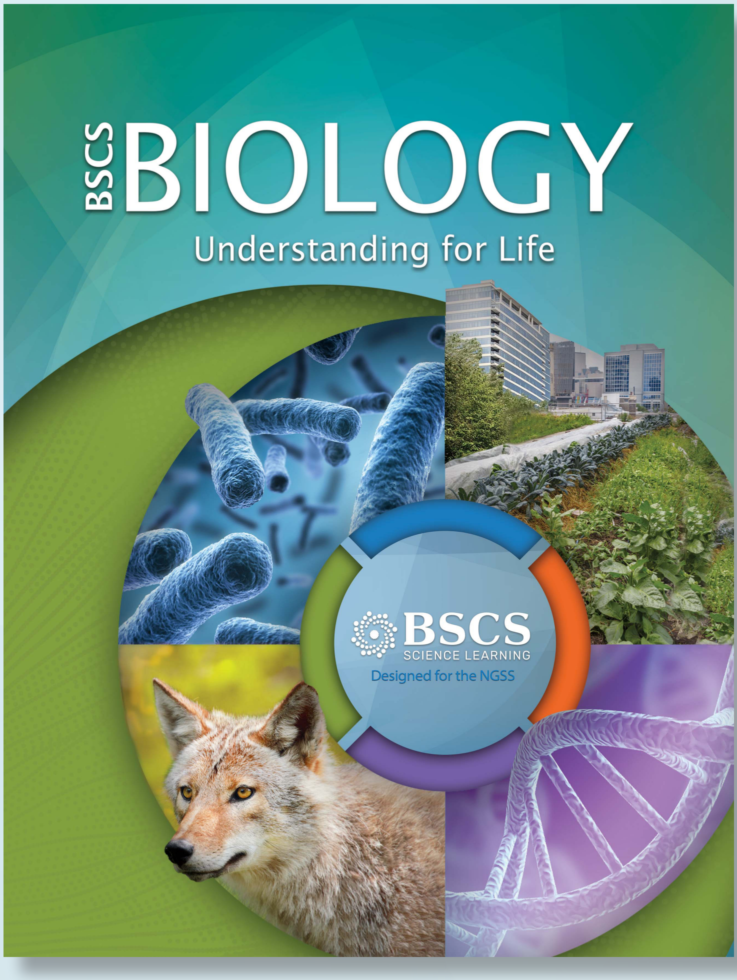
BSCS BIOLOGY

Understanding for Life



BSCS BIOLOGY SAMPLER

Kendall Hunt

SAMPLER CONTENTS

BSCS BIOLOGY
Understanding for Life

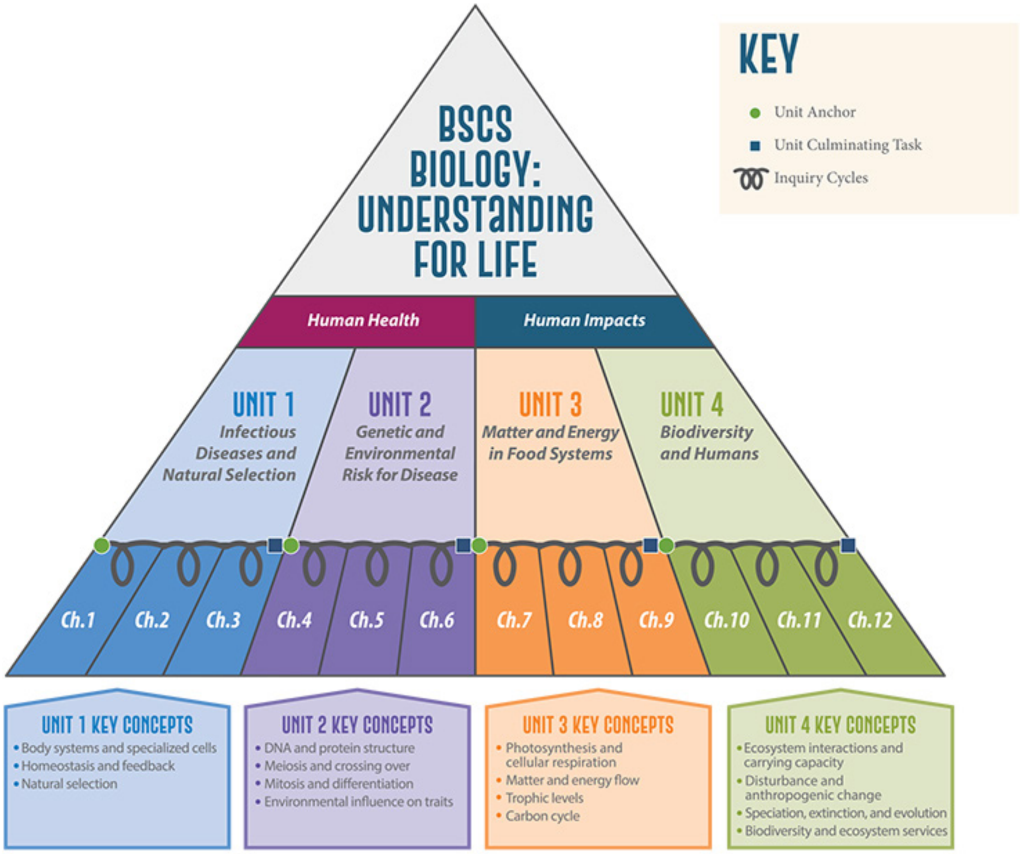
This sampler is intended to be used as a brief introduction and preview of the full BSCS Biology Understanding for Life curriculum.

What Is BSCS Biology Understanding for Life?

BSCS Biology: Understanding for Life strongly emphasizes the development of students' problem-solving, critical-thinking, and inquiry skills. The curriculum allows learners to conduct investigations that are meaningful to them and that highlight the analysis of data, the construction of models and explanations, and the communication of scientific information.

Real-world phenomena and challenges motivate learning of scientific concepts and practices, enabling students to build a deep understanding of life science that will serve them for life. Designed to achieve all of the performance expectations in the Next Generation Science Standards (NGSS) for life science at the high school level, this program's approach matches the vision of three-dimensional learning in the NGSS.

How Are The Units Broken Down?



CHAPTER

1

How can bacteria cause infections?

Artist's depiction of *E. coli* bacteria.

CHAPTER LEARNING GOALS

Ask questions to develop a model of how differences in resources in different systems affect bacterial division and population growth.

Obtain and evaluate information to develop a model of how specialized systems within the human body can be affected by changes in bacterial populations.

CHAPTER 1	CHAPTER 2	CHAPTER 3
We figure out how bacteria live and grow, and how this growth can cause infections.	We figure out how the human body can (and can't) maintain homeostasis to defend itself against infections.	We figure out how antibiotics can help fight infections, and how over time natural selection can lead to resistance.

ALIGNMENT TO NGSS

Chapter 1 builds toward the bolded parts of the following Disciplinary Core Ideas (DCIs):

(HS-LS1-1) Systems of specialized **cells within organisms help them perform the essential functions of life.**

(HS-LS1-2) **Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.**

(HS-LS2-1), (HS-LS2-2) Ecosystems have carrying capacities, which are **limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources** and from such challenges as predation, competition, and disease. **Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite.** This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.

(HS-LS4-2) Evolution is a consequence of the interaction of four factors: (1) **the potential for a species to increase in number**, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment.

Chapter 1 Focal Science and Engineering Practices (SEPs):

SEP 1: Asking questions
SEP 2: Developing and using models
SEP 8: Obtaining, evaluating, and communicating information

Chapter 1 Focal Crosscutting Concepts (CCCs):

CCC 2: Cause and effect
CCC 4: Systems and system models

CHAPTER 1 • WORDS WE "EARN"

BSCS Biology does not advocate "pre-teaching" key vocabulary. We are confident that initially, students can communicate their ideas without scientific terms. Once they have started to develop a new conceptual understanding, they may start to feel a genuine need for terms as a shorthand for their ideas. At this point in their learning, it makes sense to introduce an official scientific term for the idea they have been trying to describe. These are words students have "earned" by doing the work of figuring out the concept behind them. Use this list as a reference for intended conceptual progress in this chapter, rather than a list to have students memorize ahead of time.

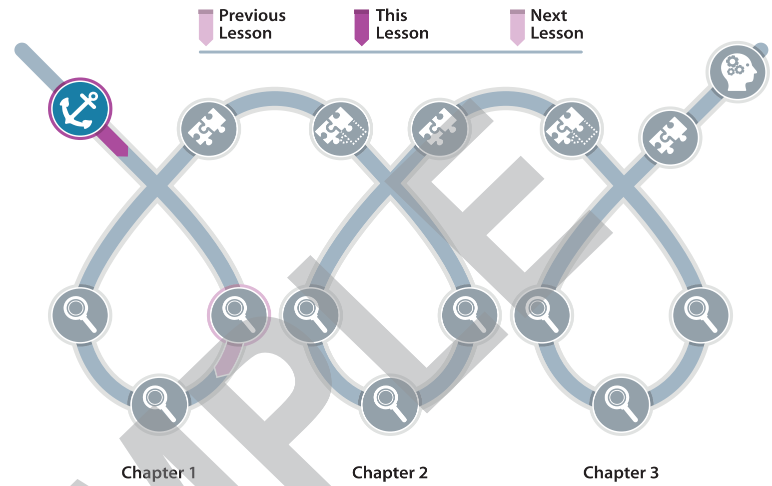
Lesson	Word(s) we "earn"
Lesson 1 (Anchor)	
Lesson 2 (Investigate)	bacteria, virus
Lesson 3 (Investigate)	population, population growth, resources, limits
Lesson 4 (Investigate)	pathogenic, nonpathogenic, symptom, infection, infectious disease
Lesson 5 (Synthesize)	

PURPOSE | Introduce a puzzling phenomenon or problem and motivate further investigation.

How can bacteria make us so sick?

THIS LESSON | After examining a case of an 11-year-old boy with a severe, life-threatening infection, we explore initial ideas about how and why we get infections. We set our unit Driving Question: *How can bacterial infections make us so sick, and why are they getting harder to treat?* Before we can make progress, we realize we need to know more about bacteria.

NEXT LESSON | We will figure out what bacteria are and where we find them. This will leave us wondering what bacteria need to survive and how they grow.



Lesson question

How can bacterial infections make us so sick, and why are they getting harder to treat?

What students figure out

While the Anchor Lesson is mostly about exploring what we don't yet know and what we want to investigate, students should come away with the following ideas:

- A scientific model is a representation that is used as a tool to explain how or why something in the world works the way it does.
- There are similarities across cases of severe bacterial infection—symptoms worsen and the infections are often difficult to treat with antibiotics.
- Bacterial infections can be life-threatening.
- They can strike seemingly anyone.
- They can be caused by a variety of bacteria, including MRSA, *E. coli*, and *Salmonella*.
- It sometimes seems hard to find antibiotics that will work for these infections.
- We are questioning and wondering how and why bacteria can make us so sick and why bacterial infections are getting harder to treat.
- We are starting to consider that science is a human endeavor, and that science, culture, and society are interrelated.

LESSON LEARNING GOAL

Develop an initial model to ask questions about what could cause people to get seriously sick from bacterial infections and what could cause antibiotics to not work as well as they used to.

TIME
Four 50-minute class periods

What we are *not* expecting

Where we are not going *yet*

- We are not yet trying to answer our unit question (how and why bacteria make us so sick and why bacterial infections are getting harder to treat); rather, we are surfacing initial ideas and questions about the phenomenon.
- We are also not trying to explain or understand the concept of antibiotic resistance; rather, students should simply notice that in many of the cases the antibiotics don't seem to be working as well as they used to.

Boundaries

- We do *not* expect students to memorize which types of bacteria cause various diseases and how.

Relevant common student ideas

- Antibiotics can cure viral diseases. (Antibiotics are effective treatments for bacterial diseases only.)
- Antibiotics are always effective. (Antibiotics are effective treatments only for infections caused by bacteria. Furthermore, many bacteria are resistant to one or more antibiotics; in these cases, antibiotics are ineffective.)
- If your immune system is healthy, you don't need medicine when you get sick. (People with suppressed immune systems are not the only ones who need antibiotics to support fighting an infection. People with healthy and responsive immune systems are at risk for bacterial infection and will sometimes need antibiotics to help the body recognize and defend itself from damage-causing bacteria.)

Key literacy and sensemaking strategies

- **Science Notebooks**
  Students are oriented to the purpose of keeping a science notebook; do some initial setup and start using it to capture their ideas.
- **Turn and Talk**
  Turn and Talk is a simple discussion strategy introduced in this lesson that will be used frequently throughout this course. The purpose is for students to have a safe place to share and practice articulating initial ideas before sharing them more publicly in a whole-class discussion.
- **Notice and Wonder chart**
  Students are introduced to the Notice and Wonder format for capturing initial ideas about a phenomenon.
- **Scientists Circle**
  Scientists Circle is a protocol for getting the whole class into a circle where they can see and hear everyone at once for certain key discussions. The purpose is to support students in expressing themselves and listening to peers during key discussions.
- **Initial Models and Initial Consensus Model**
  Students make their first attempt in the course at sketching an explanatory model; they also work together to decide what they do and don't

know so far by constructing an initial consensus model. The initial models will be collected and turned back in the Synthesize Lesson for this chapter as a way for students to reflect on how their ideas have changed.

- **Driving Question Board**
  The class constructs the Driving Question Board for this unit. This publicly posted artifact will be a key touchpoint to track our progress and add new questions throughout the unit.
- **Ideas for Investigation chart**
  Students build a list of ideas for data or information they could collect to help them make progress on their unit Driving Question. As this is the first unit of the year, their ideas may not yet be sophisticated; they will evolve as they get experience with the kinds of investigations we do in this course.

ASSESSMENT

Pre-assessment: initial models
Students create initial models to show their understanding of how and why Zach (an 11-year-old boy with a severe infection) got so sick. (See the Assessment callout within the lesson for more detail on what to look for.)

ANCHOR LESSON SNAPSHOT

Lesson 1: How can bacteria make us so sick?

BIG IDEA | Sometimes, bacterial infections make us very sick with potentially fatal infections.

Routine	Part	Time	Summary	Slide	Materials
Course launch	1	35 min*	**Course Launch** Students introduce themselves to peers and share their ideas about science class. The teacher shares how in this course we will work together to figure things out and supports students to see connections between science, their daily lives, and larger societal issues. ***Purpose:*** *to orient students to each other, the goals of the course, and the approach of* BSCS Biology. *15 minutes are left to attend to other administrative needs.	A–G	Student Sheet 1.1.A: *Students, Teachers, and Scientists* 4 pieces of chart paper
Suggested class period break			*End of Day 1*		
Explore a phenomenon or problem	2	10 min	**Personal experiences: a time we got sick** Students think back to a time they got sick and write or draw a brief description of their experience. They talk with a partner and compare similarities and differences. ***Purpose:*** *to orient students to the central phenomenon for the unit by asking them to recall personal experiences about a time they got sick.*	H–J	Science notebooks

Routine	Part	Time	Summary	Slide	Materials
	3	40 min	**Zach's story: MRSA** Students watch a video and hear from Zach Doubek, a teen who experienced a life-threatening MRSA infection when he was 11 years old. Using a class version of a timeline that highlights the important parts of Zach's story, they record noticings and wonderings. ***Purpose:*** *to encounter the central phenomenon for the unit—antibiotic resistance and stewardship—and begin to consider and question the details of Zach's case.*	K–O	Science notebooks Student Sheet 1.1.B: *Zach's Timeline* Student Sheet 1.1.K: *Transcript of Zach's Case* Zach's Story Video Black pens Red pens 1 piece of chart paper
Suggested class period break *End of Day 2*					
Share initial ideas	4	20 min	**Creating initial models** Teacher explains why scientists use models and then students sketch models to show their thinking about the "how" and "why" of Zach's case to try to explain: *Why and how did Zach get so sick that he almost died?* ***Purpose:*** *to support student understanding of the purpose of scientific models and to create individual models to share initial ideas/what we already know about how and why Zach got so sick.*	P–V	Science notebooks Student Sheet 1.1.C: *Initial Models*
	5	20 min	**Initial class consensus model** In pairs, students compare similarities and differences between initial models. Then, as a class, students look across all models and decide what the class consensus model needs to include. The teacher supports students to decide how they will collectively represent certain aspects of their models. ***Purpose:*** *to come to a consensus about what to include in the class model to describe how and why Zach got so sick and why it was difficult for the doctors to treat his infection.*	W	Science notebooks 3 pieces of chart paper
Define gaps	6	10 min	**Identify gaps—what can we still not explain?** Looking at the class consensus model, students identify gaps and questions their modeling exposed. The class compares these gaps and remaining questions to the questions that came up in their notice/wonder chart and realize they have even more questions and their questions are becoming more specific. ***Purpose:*** *to motivate students to go deeper into their inquiry about Zach's case, to consider different perspectives, and to question if Zach's case is unique or if there are other similar cases they can use for comparison.*	X–Z	Science notebooks
Suggested class period break *End of Day 3*					

(*Continued*)

Routine	Part	Time	Summary	Slide	Materials
Broaden	7	20 min	**Is Zach's case unique? Six case investigations** Students engage in a jigsaw activity to gather information from different perspectives about six additional cases of people from a variety of demographics who got serious antibiotic-resistant bacterial infections (including *MRSA, E. coli, Salmonella infections*). ***Purpose:*** *to expand student thinking beyond Zach's case and to start to notice patterns across different cases of people who also had difficult-to-treat bacterial infections and across different perspectives to determine that these types of bacterial infections are concerning and connect to a broader societal issue that doctors are concerned about.*	AA–DD	Science notebooks Student Sheet 1.1.D: *Compare the Cases* Student Sheet 1.1.E: *Jigsaw Case 1* Student Sheet 1.1.F: *Jigsaw Case 2* Student Sheet 1.1.G: *Jigsaw Case 3* Student Sheet 1.1.H: *Jigsaw Case 4* Student Sheet 1.1.I: *Jigsaw Case 5* Student Sheet 1.1.J: *Jigsaw Case 6*
Ask and organize questions	8	20 min	**Building our Driving Question Board (DQB)** Students review their notebooks, the class notice and wonder chart, and initial models and add questions on sticky notes (one per note). As a class, they add their questions to the Driving Question Board and consider which questions could be answered by science and which questions science might not be able to answer. ***Purpose:*** *to brainstorm and list specific questions the class will work to answer together to gain a better understanding of the overall unit question and societal issue and to give the students agency in deciding which questions seem the most important to try to answer first.*	EE–HH	Science notebooks 1 piece of chart paper Sticky notes Fine-point markers
Navigate	9	10 min	**Planning our next step: What and where are these bacteria?** The class looks back at the questions on the Driving Question Board. Students notice many of their questions are about bacteria, and determine their next steps should focus on answering a fundamental question: What are bacteria and where are they found? ***Purpose:*** *to support students to prioritize the most basic questions on their Driving Question Board (What are bacteria and where are they found?) in the next lesson.*	II	

STANDARDS ALIGNMENT

Target Disciplinary Core Ideas (DCIs)

Students demonstrate their initial ideas and prior knowledge related to the unit's target DCIs by developing models and asking questions. We are not expecting students to have built any new understandings by the end of this Anchor Lesson; rather, we expect them to have more specific questions and ideas for investigations that would lead them toward these understandings.

Target Science and Engineering Practices (SEPs)

- <u>SEP 2: Developing and using models:</u> **Use a model to provide mechanistic accounts of phenomena.**

  Students engage in the bolded parts of this SEP as they develop individual and then whole-class initial models to show their current understanding of the mechanisms that explain how Zach got so sick and why his infection was hard to treat.

- <u>SEP 2: Asking questions:</u> **Ask questions that arise from careful observations of phenomena, or unexpected results, to clarify and/or seek additional information.**

  Students engage in the bolded parts of this SEP throughout this lesson as they observe the details of Zach's case and other related cases, culminating in the collaborative development of a unit Driving Question Board.

Target Crosscutting Concepts (CCCs)

- <u>CCC 2: Cause and effect:</u> **Cause and effect relationships can be suggested** and predicted **for complex natural** and human designed systems **by examining what is known about smaller scale mechanisms within the system.**

Students use the bolded parts of this CCC as they attempt to explain what happened to Zach in their initial models by considering what smaller-scale processes might be happening inside his body.

Connections to Common Core State Standards

<u>Reading in Science and Technical Subjects</u>

Key Ideas and Details:

- CCSS.ELA-LITERACY.RST.9-10.2: Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- CCSS.ELA-LITERACY.SL.9-10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
- CCSS.ELA-LITERACY.SL.9-10.4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

LESSON MATERIALS

Per student

- Science notebook
- Sticky notes
- Fine-point markers
- 1 black pen
- 1 red pen
- Student Sheet 1.1.A: *Students, Teachers, and Scientists*
- Student Sheet 1.1.B: *Zach's Timeline*
- Student Sheet 1.1.C: *Initial Models*
- Student Sheet 1.1.D: *Comparing the Cases*
- Student Sheet: 1.1.K: *Transcript of Zach's Story*

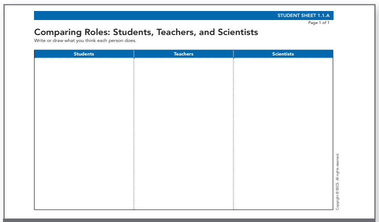
Per class

- Computer with projector
- Markers
- Tape
- 12 pads of sticky notes (any color)
- 10 sheets of chart paper
- "Zach's Story" video clip

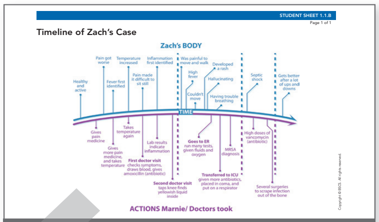
For jigsaw*

- 6 copies of Student Sheet 1.1.E: *Jigsaw Case 1*
- 6 copies of Student Sheet 1.1.F: *Jigsaw Case 2*
- 6 copies of Student Sheet 1.1.G: *Jigsaw Case 3*
- 6 copies of Student Sheet 1.1.H: *Jigsaw Case 4*
- 6 copies of Student Sheet 1.1.I: *Jigsaw Case 5*
- 6 copies of Student Sheet 1.1.J: *Jigsaw Case 6*

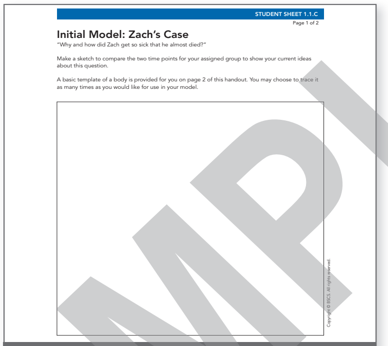
**Assuming a class size of 32.*



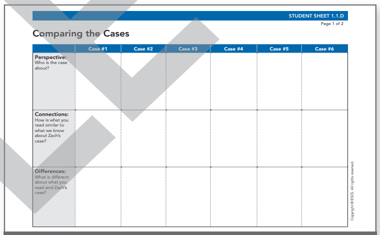
Student Sheet 1.1.A



Student Sheet 1.1.B

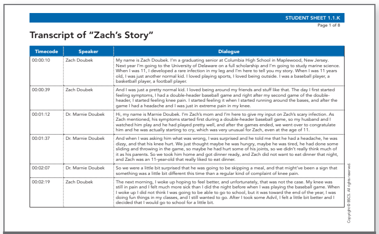


Student Sheet 1.1.C



Student Sheet 1.1.D

Student Sheet 1.1.E–J



Student Sheet 1.1.K

Preparation

- Test your video and audio equipment for playing the "Zach's Story" video clip.
- Consider how you will establish norms for a collaborative classroom culture with your students (refer to the Teacher Handbook for more on this topic).
- Identify a location in the room where the class charts can be displayed. Ideally, students are able to see and stand around the charts and refer to and interact with their content if needed.
- Consider how you will group students into six groups.
- Make copies of student sheets.

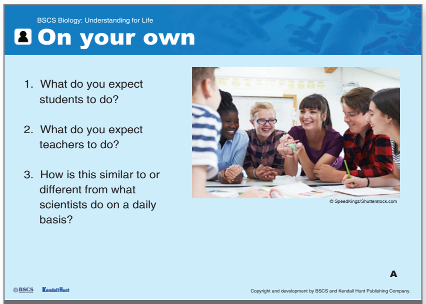
ADDITIONAL CONTENT BACKGROUND FOR THE TEACHER

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a bacteria that can cause an infection that is difficult to treat because of resistance to some antibiotics. Anyone can get MRSA and most often MRSA causes infections in the skin. The symptoms of the MRSA infection depend on the part of the body that is infected. For example, people with a MRSA infection in their skin have swelling, warmth, and redness in the area. Because the symptoms of a MRSA infection are often very similar to symptoms of less serious bacterial or viral infection or insect bite, infections can progress because of misdiagnosis or delayed treatment. In most cases, it is difficult to tell if an infection is due to MRSA or another bacteria without ordering laboratory tests to identify the type of bacteria.

NOTES

COURSE LAUNCH

PURPOSE | To orient students to the goals and approach of *BSCS Biology*



Lesson 1 Slide A

Powerpoint Slide

Students consider expectations for "science class."

This unit ideally would be taught at the beginning of the school year. Consider incorporating the following sequence to support your launch of the year and start of this unit.

In addition to framing the course and the unit, the suggested sequence will provide context about your students' prior experiences in science classrooms and will allow them to practice discussion routines that will be used across this first lesson.

Display **Slide A**. Hand out one copy of **Student Sheet 1.1.A: *Students, Teachers, and Scientists.*** Ask students to take a moment to consider the following prompts:

- In a science class
  - What do you expect students to do?
  - What do you expect teachers to do?
  - How is this similar to or different from what scientists do on a daily basis?

Give students a minute or two to think individually. You might invite students to optionally write or sketch their ideas if it helps them organize their thinking.

Lesson 1 Slide B

Powerpoint Slide

Students share their experience with an elbow partner.

Display **Slide B**. Ask students to **turn and talk** with an elbow partner. Let students know that they will be listening closely and taking notes about what their partner says, and that they will be asked to share out with the class afterward. Give students several minutes to discuss the following prompts:

- Introduce yourself to your partner: share your name and one thing you like to do outside school.
- Share your ideas about what you expect students and teachers to do in science classes and how that might be similar to or different from what scientists do on a daily basis.

You might choose to display a countdown timer for students and/or give students verbal cues to remind them to switch speakers about halfway through.

As students are sharing, you might look and listen for students' comfort talking with new peers, as well as their familiarity and skill at managing short paired-group work.

When students have had time to share with their partners, ask students to get ready to share out the following:

- Their partner's name and one personal detail their partner shared
- Something similar or different between one another's ideas about what to expect in science class and how that is similar to or different from what scientists do on a daily basis

Literacy and Multilingual Learner Support

Turn and Talk is a simple discussion strategy introduced in this lesson that will be used frequently throughout this course. The purpose is for students to have a safe place to share and practice articulating initial ideas before sharing them more publicly in a whole-class discussion. Use of this strategy during the first few days of the course will also provide opportunities for students to meet one another and help to establish relationships among students.

Students identify patterns in expectations of students, teachers, and scientists.

Put up three pieces of chart paper, labeled "students", "teachers", and "scientists." (If no chart paper is available, create three columns on the board with the same labels.) Ask each student to introduce their partner and then share one idea for each role. Write down all students' ideas. If students have similar ideas, you might choose to signal that by writing a star or plus sign next to the idea.

Suggested prompts	Listen for student responses such as
In science class, what do you expect students to do?	• As students we sit and learn interesting facts about nature. • As students we do experiments and then fill out worksheets about what we saw.
In science class, what do you expect teachers to do?	• Teachers tell us what we need to memorize for the tests. • Teachers tell us stories and show videos.
How is what students and teachers do similar to or different from what scientists do?	It's different. Scientists ask questions and run experiments to figure out the answers. Students just memorize what scientists figure out and take tests.

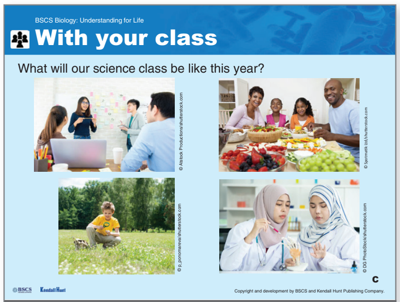
From this conversation, you may begin to gauge students' prior experiences and feelings about science class, which you could use to anticipate student needs to build comfort and skill with ways of working together that may feel new or different in this course.

Attending to Equity

During this discussion emphasize the use of students' names both by the students and also in your teaching practice. Pronouncing students' names correctly conveys important messages: I care about you, I accept you, and you are important to me. By modeling this behavior, teachers can cultivate a classroom climate that is equitable and fair to students. By asking students to use each other's names, this will also begin to build relationships between students who are meeting each other for the first time.

Common Student Ideas

Students may have incomplete or alternative ideas about what scientists do. Rather than using this conversation to try to change those ideas, allow the ideas to surface. There will be opportunities to return to this conversation throughout the course.



Lesson 1 Slide C

Powerpoint Slide

Share some initial framing of the course.

At this point, take a moment to formally welcome students to their new biology class and thank them for sharing their ideas with one another.

Display **Slide C**. Let students know that in this course, we will frequently share our ideas with one another, and draw on our experiences, both in and outside class, to help us *figure things out together*. You might note that this might feel different from what some of us have experienced in the past.

Emphasize that when we talk together in this class, it isn't about labeling ideas as right or wrong. Instead, we want to work as scientists do. Scientists wouldn't have jobs if all they did was check a book or the internet for a "right answer"—they work in groups to try to figure things out! That means putting out a lot of different ideas and experiences at the start that we will build from and revise as we figure out new ideas. In this class, we will come back to our initial ideas and experiences, and revise them together as we figure new things out and our ideas change.

You may choose to briefly introduce yourself to the class if you have not done so already, using the same structure that students used and offering a detail about your interests outside class. You might even include whether there are parts of this course that feel similar to or different from your own science learning experiences. This can be an opportunity to model sharing vulnerability and to position yourself as a learner/participant in classroom discussions, which can set a tone for students' engagement in discussions going forward.

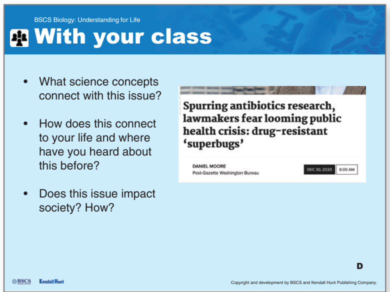
Students consider and/or help to establish the norms of the classroom.

Emphasize that because doing science in this collaborative requires everyone to participate and consider hard topics, it will require an environment where everyone feels comfortable, safe, and valued.

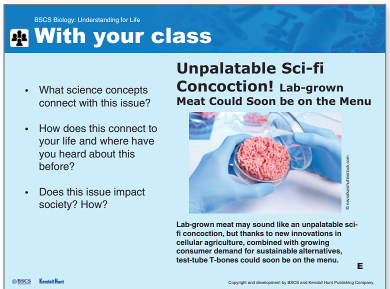
Ask students to consider what that looks like in their role as a student, what they would hope for from you as a teacher, and what the classroom environment would look like, sound like, and feel like. After this discussion, you might choose to create a classroom chart with agreed-upon norms to establish and maintain a supportive and collaborative classroom culture. Examples of how these norms could be phrased are below:

- We make sure that everyone feels safe, seen, and valued.
- We provide each other with support and encouragement.
- We place ideas on the table—even if we are not certain we are correct—to help us all learn.

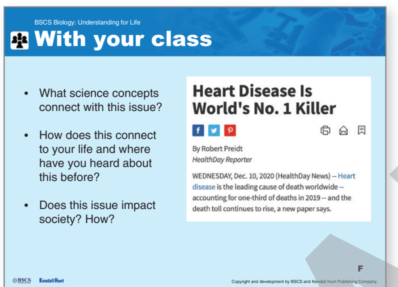
Tell students this shared record of classroom norms can be expanded and revised throughout the course.



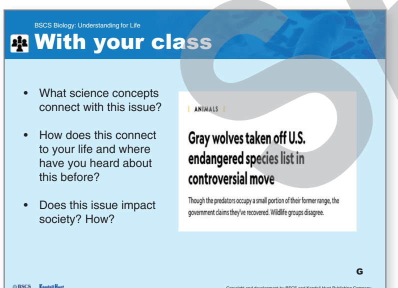
Lesson 1 Slide D



Lesson 1 Slide E



Lesson 1 Slide F



Lesson 1 Slide G

Powerpoint Slides

Attending to Equity

Creating a classroom culture where all students feel they are safe to share and revise their ideas and engage in productive struggle is central to Anchored Inquiry Learning. The establishment and ongoing use of norms can help to create a culture that values diversity of experiences, perspectives, and ways of knowing. Norms differ from "rules" in that they are established and revisited with student input. Student input can range from considering and revising a starting set of norms to co-construction of norms.

Consider connections between science, everyday lives, and larger societal issues.

Display **Slides D–G**. As you show students the article headlines, ask them to consider how each connects to science, their lives, and other larger societal issues they may have heard about or have experience with. Facilitate a class discussion using the following prompts:

Suggested prompts	Listen for student responses such as (organized within each cell in slide order)
What science concepts seem connected with this issue?	• Antibiotic research, finding out how they work • Labs growing meat • Heart disease and how we make medicines to stop it from killing people • Endangered species and predators and prey
How does this connect to your life and where have you heard about this before?	• My aunt had a bad infection and had to take antibiotics for it. • My parents and I talked about eating less meat because we want to make sure our food choices are sustainable. • My grandpa died from a heart attack. • I heard they were having a wolf hunt in our town.
Does this issue impact society? How?	• The creation of "superbugs" is making more people sick. • We need to be making more foods available that are sustainable. • Heart disease is the number one killer in the United States. We need to figure out how to save those people. • Endangered species are dying and when they do it causes problems for their food chain and other animals.

Note: Each headline shown in Slides D–G connects in some way to the concepts and societal issues raised in each one of the units in this course.

Making connections between science, society, and big societal issues.

After students share their ideas about the four headlines, tell students that throughout this year they will investigate issues similar to those you have just highlighted. Each has connections to science, but beyond that, they have implications for their lives and also for society as a whole. The class will work together to understand the science and then use that understanding to consider solutions to several issues challenging society today that draw on scientific understandings.

Connections to the Nature of Science: Science Is a Human Endeavor

Science and engineering are influenced by society, and society is influenced by science and engineering. A major goal of this course is to support students to consider larger societal issues and their connections to science. For example, in unit 1 we are asking students to consider antibiotic stewardship in light of antibiotic resistance. Though we don't try to solve the larger societal issue at the very start of unit 1, students will build understanding of the science concepts and consider them in connection to why bacterial infections are becoming more difficult to treat.

SUGGESTED CLASS PERIOD BREAK
End of Day 1

EXPLORE A PHENOMENON OR PROBLEM

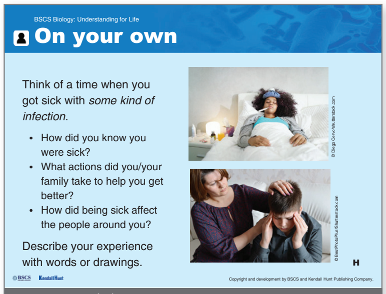
PURPOSE | To engage with the central phenomenon or problem for the unit

Introduce the science notebook.

Let students know that we will be using our science notebooks all year as a place to collect our ideas and reflect on our thinking over time. Emphasize that the notebook will be a thinking tool for them—it does not need to look "perfect" and will not be graded. However, keeping it organized will make it much more useful as they collect more and more information in this unit and course. Direct students to leave at least 10 pages blank in the front of their notebooks. Then, on the next new page, have them write the date and Lesson 1.

Literacy and Multilingual Learner Support

The science notebook will be used throughout this course. The first 10 pages are reserved for adding a Model Tracker, which will be started in the next lesson, that students will come back and add to throughout unit 1. To facilitate this, you may choose to have students number the pages on their science notebooks; this will also help in cases of absence when students need to leave pages blank to go back and fill in.



Lesson 1 Slide H

Students inventory personal experiences with feeling sick and treating an infection.

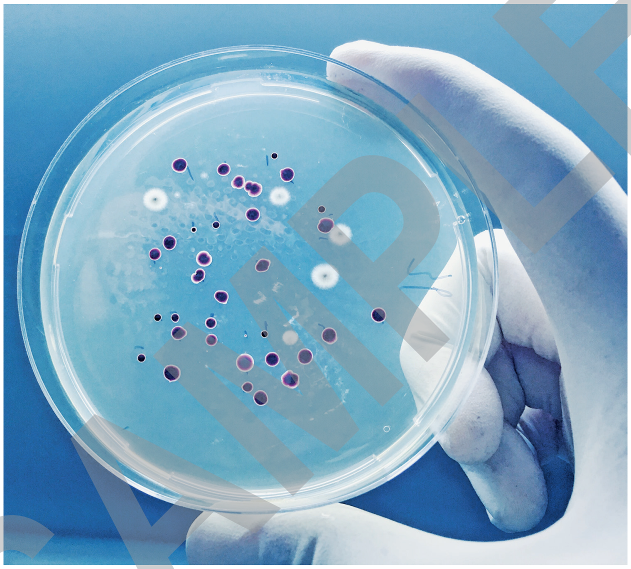
Display **Slide H**. Ask students to think back to a time when they got sick and think that it was caused by an ***infection***. (You might alternatively phrase this as "a time you *caught something* and got sick" or "a time you got sick with what people might call a *'germ'* or *'bug.'*")

Name: ______________________ **Date:** ______________

Chapter 1 Assessment

ITEM 1

1a. A scientist wants to grow some bacteria cells on agar in a petri dish. She transfers a sample of the cells to the agar and counts the number of cells in the dish over time.



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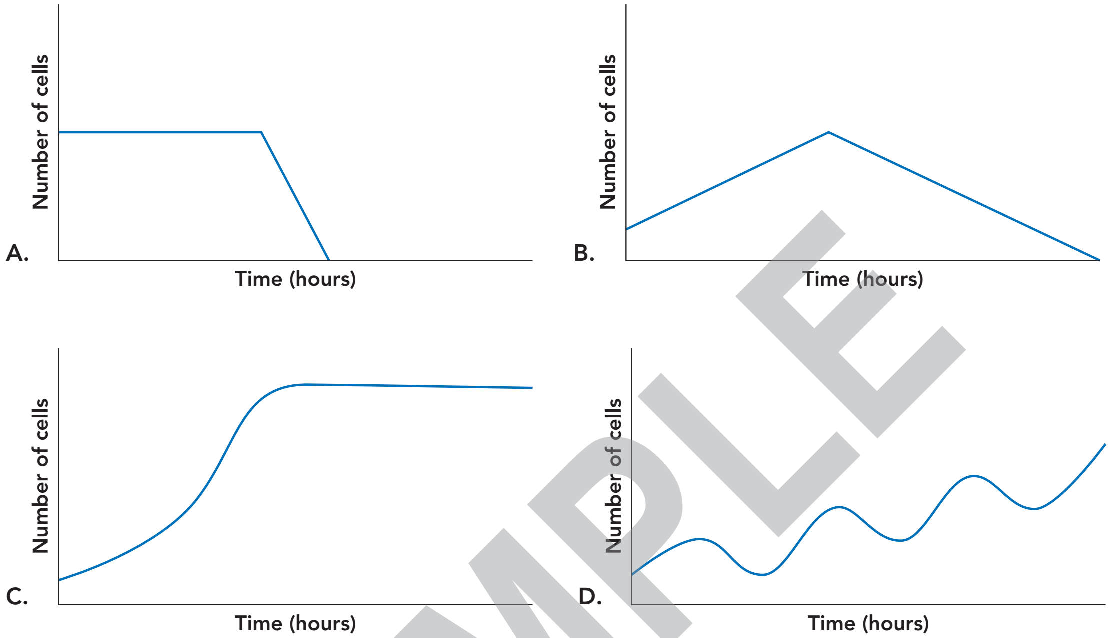
A petri dish with bacteria growing on agar.

Which graph is the best model of how the cell population will grow over time given the limited supply of food and space? Circle the letter for the graph you choose.



1b. Redraw a larger copy of the graph you selected and annotate it (you may choose to use the I^2 strategy if it helps) to communicate what is happening to the cells over time. Be sure to indicate what is happening at least two different times.

- Reminder: the I^2 strategy involves writing "what I see/what it means" statements.

ITEM 2

2a. One day, an 18-year-old male was mountain climbing on a very tall mountain.

A mountain climber at the top of a mountain.

He started to experience severe pain in the left side of his stomach and a fever. He descended the mountain and went to the emergency room because he had not experienced pain like this before. The doctors scanned his abdomen and found that part of his spleen was dying. The doctors thought that it was likely that the man had the sickle cell trait. They performed a test that confirmed this diagnosis. The doctors treated him with nasal oxygen and kept him hydrated. Gradually his spleen recovered without any specific treatment or surgery.

After the man recovered, he did more research on why having the sickle cell trait caused him to have problems after mountain climbing.

Before reading his summary of what he found, set a Scientific Purpose for reading the text. Write your purpose below.

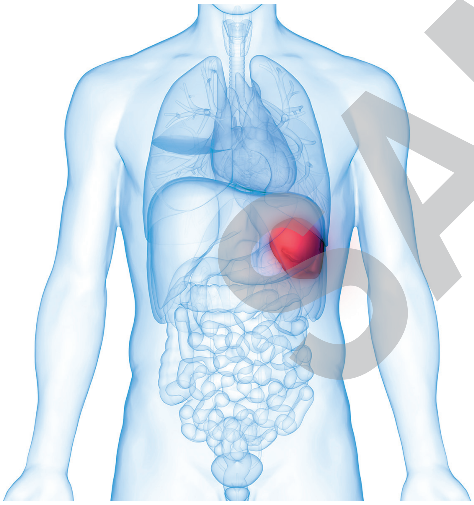


Illustration of abdominal organs showing the location of the spleen.

2b. Below is a summary of what he found. As you read, you can use the following Science Reading Annotation Stems to make annotations on the text to help you make sense of it: "What's important here is ..." "This reminds me of ..." "I wonder about ..." and "What might be true is ...."

Red blood cells serve a very important function in the human body. They are responsible for carrying oxygen throughout the body. Approximately 99% of the oxygen transported in blood is bound to the hemoglobin protein found inside the red blood cells. Normal red blood cells have a round shape. However, some of the red blood cells in people with sickle cell trait have an abnormal shape. The image below compares a normal red blood cell (right) to an abnormal red blood cell (left). The abnormal red blood cells do not work in the same way as the normal red blood cells. At low altitudes, where most people spend the majority of their time, this is not a problem because people with sickle cell trait have enough normally shaped red blood cells to transport oxygen throughout the body.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An abnormal red blood cell (left) and a normal red blood cell (right).

When mountain climbing, people can find themselves at very high altitudes of 11,000 feet above sea level or more. At around 7,000 feet above sea level, the percentage of oxygen in the air starts to decrease rapidly. This makes it difficult for a person to breathe at high altitudes and reduces the amount of oxygen the body has available to transport oxygen to the organs.

Based on the reading above, what information can the man use to explain why it is more dangerous for him to go mountain climbing than it is for a person with all normal red blood cells to go mountain climbing?

2c. If you were going to make a model to describe what happened to the man when mountain climbing, what components would you include? List the components below.

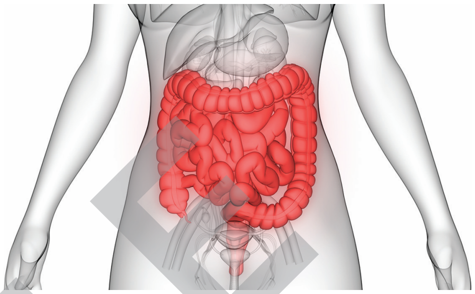
2d. What interactions between components would you include in the model? List the interactions below.

2e. What other questions would you ask to help you figure out why this man's spleen started dying after mountain climbing? List three or more questions.

ITEM 3

3. The small intestine is an organ that is part of the digestive system. It is where most of the digestion and absorption of food takes place.

All humans have bacteria cells in their small intestine to perform important functions, like helping to digest vitamins and protecting the intestine from being invaded by harmful bacteria. However, if the normal function of the intestine is compromised, potentially harmful bacteria may grow to outnumber the other types of bacteria. When this happens people tend to experience symptoms like chronic diarrhea or weight loss.



A drawing of the large and small intestines.

Based on your Class Consensus Model, draw a more specific model that could be used to explain why a person with an imbalance of bacteria in their small intestine may experience these symptoms. If it's helpful, you may build a Gotta-Have-It Checklist to ensure you are including the necessary components and interactions in your model.

Use this space for a Gotta-Have-It checklist if needed. (There is space for your model on the next page).

Use this space to draw your model.

ITEM 4

4a. Elands are a type of antelope that are found in East and Southern Africa. Elands are herbivores and eat mainly grasses. They live primarily in open plains, grasslands, and foothills. They tend to form herds in groups of up to 60 elands.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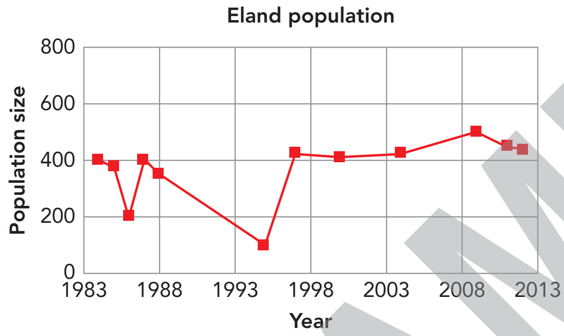
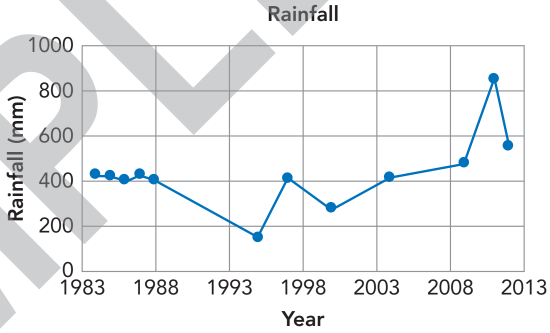
Eland.

Below is a graph of the population of elands in Waterberg Plateau National Park and a graph of the precipitation in the park from 1984 to 2012. Scientists think there is a possibility that the changes in the amount of rainfall caused changes in the size of the eland population.





Make observations about the data in the graphs and annotate the graphs (you may choose to use the I^2 strategy if it helps) to help you think about what questions you would ask to gather more information about whether the changes in rainfall could be a possible cause for the changes in the eland population.

- Reminder: the I^2 strategy involves writing "what I see/what it means" statements.

4b. List three or more questions that you would ask to gather more information about whether the changes in rainfall could be a possible cause for the changes in the eland population.