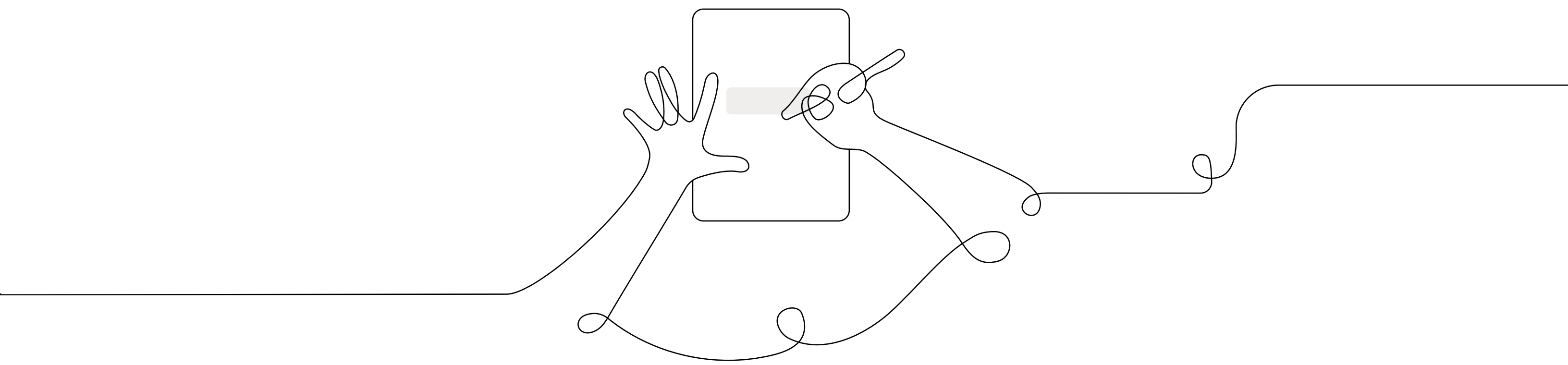
AmplifyScience

Participant Notebook

Unit Internalization and Guided Planning

Grade 8, Natural Selection Engineering Internship



Unit Map

How can we design treatments for malaria that don't lead to drug resistance?

Students act as biomedical engineering interns to design a malaria treatment plan. These treatment plans must reduce the population of *malaria plasmodia* while meeting three design criteria: 1) limiting the amount of the drug-resistance trait that develops in the population; 2) minimizing the side-effects caused by the treatment; and 3) minimizing the treatment costs as much as possible, so as many patients can be treated as possible. Students focus on the practice of analyzing data to deepen their understanding of natural selection; students also learn about the cause-and-effect mechanisms involved as rates of death and reproduction can lead to increased drug-resistance in the *plasmodia* population.

Research Phase:

They review information from the *Natural Selection* unit, and learn new related content by reading detailed supporting articles in the project Dossier. They use a physical model to explore how natural selection can lead to increased drug-resistance. They work with the digital Design Tool, MalariaMed, to conduct iterative tests and better understand how each drug affects the model population of malaria parasites and the project criteria.

Design Phase:

They use the MalariaMed Design Tool as a part of the Design Cycle. They design malaria treatments by planning and testing a sequence of drugs, analyzing the results, and conducting further iterations. Students learn the value of iterative tests, how to balance trade-offs, and how to make sense of the results in order to inform their next decisions. They submit an early version of their malaria treatment plan to the project director for feedback. They then have a chance to refine these designs in order to create an optimal design that addresses all the project criteria.

Proposal Phase:

They gather evidence and write proposals, supporting their claim about an optimal solution. They focus on the types of evidence for the design decisions that helped them address each criterion. They submit an outline of the proposal to their project director for feedback. They use the feedback letter, proposal rubric, review of the Dossier, and peer discussion to improve their proposals so it is clear how and why each decision led to the proposed optimal design. They brainstorm other problems that contribute to the spread of malaria and develop design criteria for solving one of those problems.

Students apply science content:

To design successful treatment plans, students apply their understanding of traits, variation in populations, selection pressure, reproduction, death, and mutation from the *Natural Selection* unit. They also learn about a new context in which to apply these ideas: how medicines affect the environment, and act as a selection pressure for microorganisms that cause disease.

Guided Engineering Internship Unit Internalization Planner

Part 1: Unit-level internalization

Unit title:

What is the phenomenon students are investigating in your unit?

Unit Question:

Student role:

What do students figure out in each phase of the Engineering Internship?

Research Phase:	Design Phase:	Proposal Phase:

What science ideas do students apply from the core unit to solve the engineering problem?

Guided Engineering Internship Unit Internalization Planner

Part 1: Unit-level internalization

Unit title: Natural Selection Internship

What is the phenomenon students are investigating in your unit?

Design a malaria treatment plan with 3 criteria: limit amount of drug resistant traits, minimize side effects, minimize cost

Unit Question:	**Student role:**
How can we design treatments for malaria that don't lead to drug resistance?	Biomedical engineers

What do students figure out in each phase of the Engineering Internship?

Research Phase:	**Design Phase:**	**Proposal Phase:**
They work with the digital Design Tool, MalariaMed, to conduct iterative tests and better understand how each drug affects the model population of malaria parasites and the project criteria	design malaria treatments by planning and testing a sequence of drugs, learn the value of iterative tests, how to balance trade-offs, and how to make sense of the results in order to inform their next decisions.	gather evidence and write proposals, supporting their claim about an optimal solution.

What science ideas do students apply from the core unit to solve the engineering problem?

Students apply their understanding of traits, variation in populations, selection pressure, reproduction, death, and mutation from the *Natural Selection* unit.

Multi-day planning, including planning for differentiation and evidence of student work

Day 1: Lesson 1.1

Minutes for science: 30 min.	**Minutes for science:** 30 min.
Instructional format: ☒ Asynchronous ☒ Synchronous	**Instructional format:** ☐ Asynchronous ☒ Synchronous
Lesson or part of lesson: Warm up, Introducing Futura, slides 1-29	**Lesson or part of lesson:** Slides 30-47
Mode of instruction: ❏ Preview ❏ Review ☒ Teach live ❏ Students work independently	**Mode of instruction:** ❏ Preview ❏ Review ☒ Teach live ❏ Students work independently

Students will...	**Teacher will...**	**Students will...**	**Teacher will...**
Get connected to Futura workspace, share ideas about engineering, watch and discuss video. Assign reading: Chapter 2 Basic Facts about Malaria	Lead activities using Classroom Slides. Preview independent work: Active Reading.	Discuss annotations of Basic Facts about Malaria, Explore Malaria Med.. (After Hours Work- Read and annotate Chapter 1 "Request for Proposals in Dossier)	Lead discussion of annotations, introduce Malaria Med, Review After Hours work

Look at the *Students will* columns. What are students working in the lesson(s) that you could collect, review, or provide feedback on?
See Some Types of Written Work in Amplify Science to the right for guidance.

If there isn't a work product listed above, do you want to add one? Make notes below.

Synchronous: Discussion Board (Shared Document using schoology or Jamboard)

Asynchronous: Read and annotate "Basic Facts About Malaria"

Some Types of Written Work in Amplify Science

- Daily written reflections
- Homework tasks
- Investigation notebook pages
- Written explanations (typically at the end of Chapter)
- Diagrams
- Recording pages for Sim uses, investigations, etc

How will students submit this work product to you?
See the Completing and Submitting Written Work tables to the right for guidance on how students can complete and submit work.

Synchronous Discussion Board

Asynchronous: Submit annotations through Amplify Science platform.

Completing Written Work	Submitting Written Work
• Plain paper and pencil (videos include prompts for setup) • (6-8) Student platform • Investigation Notebook • Record video or audio file describing work/answering prompt • Teacher-created digital format (Google Classroom, etc)	• Take a picture with a smartphone and email or text to teacher • Through teacher-created digital format • During in-school time (hybrid model) or lunch/materials pick-up times • (6-8) Hand-in button on student platform

How will you differentiate this lesson for diverse learners? (Navigate to the lesson level on the standard Amplify Science platform and click on differentiation in the left menu.)

Supports:
- Partner or small group reading
- Multi-language glossary
- Reveal tool in Amplify Library to click difficult words for definition

Extension:
- Write down what ideas and questions they have about malaria

Part 2: Lesson-level internalization

Multi-day planning, including planning for differentiation and evidence of student work

Day 1:____________

Minutes for science: ____________ **Instructional format:** ☐ Asynchronous ☐ Synchronous	**Minutes for science:** _____________ **Instructional format:** ☐ Asynchronous ☐ Synchronous
Lesson or part of lesson: **Mode of instruction:** ❏ Preview ❏ Review ❏ Teach live ❏ Students work independently	**Lesson or part of lesson:** **Mode of instruction:** ❏ Preview ❏ Review ❏ Teach live ❏ Students work independently

Students will…	**Teacher will…**	**Students will…**	**Teacher will…**

<table>
<tr>
<td rowspan="2">Look at the Students will columns from Part C. What are students working in the lesson(s) above that you could collect, review, or provide feedback on?
See Some Types of Written Work in Amplify Science to the right for guidance.

If there isn't a work product listed above, do you want to add one? Make notes below.</td>
<td colspan="2">Some Types of Written Work in Amplify Science</td>
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<td>● Take a picture with a smartphone and email or text to teacher
● Through teacher-created digital format
● During in-school time (hybrid model) or lunch/materials pick-up times
● (6-8) Hand-in button on student platform</td>
</tr>
<tr>
<td colspan="3">How will you differentiate this lesson for diverse learners? (Navigate to the lesson level on the standard Amplify Science platform and click on differentiation in the left menu.)</td>
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Multi-day planning, including planning for differentiation and evidence of student work

Day 1:____________			
Minutes for science: ____________ **Instructional format:** ☐ Asynchronous ☐ Synchronous		**Minutes for science:** _____________ **Instructional format:** ☐ Asynchronous ☐ Synchronous	
Lesson or part of lesson: **Mode of instruction:** ❑ Preview ❑ Review ❑ Teach live ❑ Students work independently		**Lesson or part of lesson:** **Mode of instruction:** ❑ Preview ❑ Review ❑ Teach live ❑ Students work independently	
Students will…	**Teacher will…**	**Students will…**	**Teacher will…**

Look at the Students will columns from Part C. What are students working in the lesson(s) above that you could collect, review, or provide feedback on? See Some Types of Written Work in Amplify Science to the right for guidance. If there isn't a work product listed above, do you want to add one? Make notes below.	**Some Types of Written Work in Amplify Science** • Daily written reflections • (6-8) Homework tasks • (K-5) Investigation notebook pages • Written explanations (typically at the end of Chapter) • Diagrams • Recording pages for Sim uses, investigations, etc

How will students submit this work product to you? See the Completing and Submitting Written Work tables to the right for guidance on how students can complete and submit work.	**Completing Written Work** • Plain paper and pencil (videos include prompts for setup) • (6-8) Student platform • Investigation Notebook • Record video or audio file describing work/answering prompt • Teacher-created digital format (Google Classroom, etc)	**Submitting Written Work** • Take a picture with a smartphone and email or text to teacher • Through teacher-created digital format • During in-school time (hybrid model) or lunch/materials pick-up times • (6-8) Hand-in button on student platform

How will you differentiate this lesson for diverse learners? (Navigate to the lesson level on the standard Amplify Science platform and click on differentiation in the left menu.)

Remote and hybrid instruction note catcher

	Ideas for synchronous instruction	Ideas for asynchronous instruction
Research phase		
Design phase		
Proposal phase		

Name: ______________________________ Date: ____________________

Day 1: Welcome to Futura!

Hello interns,

Welcome to your new engineering internship! I'm Ken Tapaha, your project director.

You'll be working with me to design treatments that help people infected with a disease called malaria. There are three criteria to consider when designing malaria treatments. We want to:

1. minimize the percentage of the malaria population with high drug resistance;
2. minimize patient side effects; and
3. keep costs low.

We want to accomplish all of this, while still making sure the malaria parasite population doesn't increase. In this project, you will apply what you know about natural selection and mutations to figure out ways to stop these tiny malaria parasites. You will also learn more about ways to make sure malaria treatments will be able to help sick people now and in the future.

Today you'll learn more about malaria by using the Futura Biomedical Engineer's Dossier and the MalariaMed Design Tool. Note: *Dossier* (DAW-see-ay) is a term professional engineers sometimes use for a set of related documents.

Deliverables

- Annotations for Chapter 2: "Basic Facts About Malaria"
- After-Hours: Read and annotate Chapter 1: "Request for Proposals"

I am looking forward to working with you,

Ken

Ken Tapaha, Project Director
Futura | Biomedical Engineering Division

Name: ______________________________ Date: ______________________

After-Hours Work

Return to Message 1 on page 3 from Ken Tapaha and be sure you've completed all internship tasks for the day.

1. Read and annotate Chapter 1 in the Dossier: "Request for Proposals" (RFP).
   - Answer the reflection question below when you are done reading the RFP.

     How well did this reading help you understand your internship project?

     The reading was . . . (check one)

     ☐ very helpful

     ☐ somewhat helpful

     ☐ not helpful

     ☐ confusing

2. Your internship coordinator may have asked you to complete additional tasks.
   - If you are required to read the Safety Guidelines and read and complete the Safety Agreement form, find those on page 2 of your Engineering Notebook.
   - Double-check the Daily Message to see if there are other deliverables that need to be completed after hours.

Chapter 1:

Request for Proposals

Malaria is a disease that kills more than one million people every year. It is caused by malaria parasites. Malaria can be treated with antimalarial drugs. However, the population of malaria parasites changes due to natural selection. Many malaria parasite populations adapt to past malaria treatments and become resistant to certain drugs. Once those populations adapt, those drugs may no longer work on them.

Malaria is a disease caused by a parasite that is passed between humans by certain mosquitoes.

The Global Health Organization (GHO) seeks proposals for new malaria treatments. Successful proposals will address three criteria:

1. Minimize drug resistance

All drug treatments for malaria eventually stop working as drug resistance becomes more common in the population of malaria parasites. Once a population of malaria becomes resistant, scientists need to find new drugs to treat the disease. New drugs can be expensive and difficult to create. Keeping drug resistance low means the drug is more likely to continue to cure patients and save lives.

2. Minimize patient side effects

There are several drugs that kill malaria parasites, but each has different side effects. Some drugs work well, but have severe side effects that make patients feel bad. These side effects may make patients less likely to follow their malaria treatments correctly. Other drugs may not work as well, but have milder side effects, so patients are more likely to finish their malaria treatments.

3. Keep costs low

In regions where malaria is common, many people live in poverty. The more each treatment costs, the fewer people can receive the drug treatment. It's important to keep costs low so the GHO can help treat as many patients, especially children, as possible.

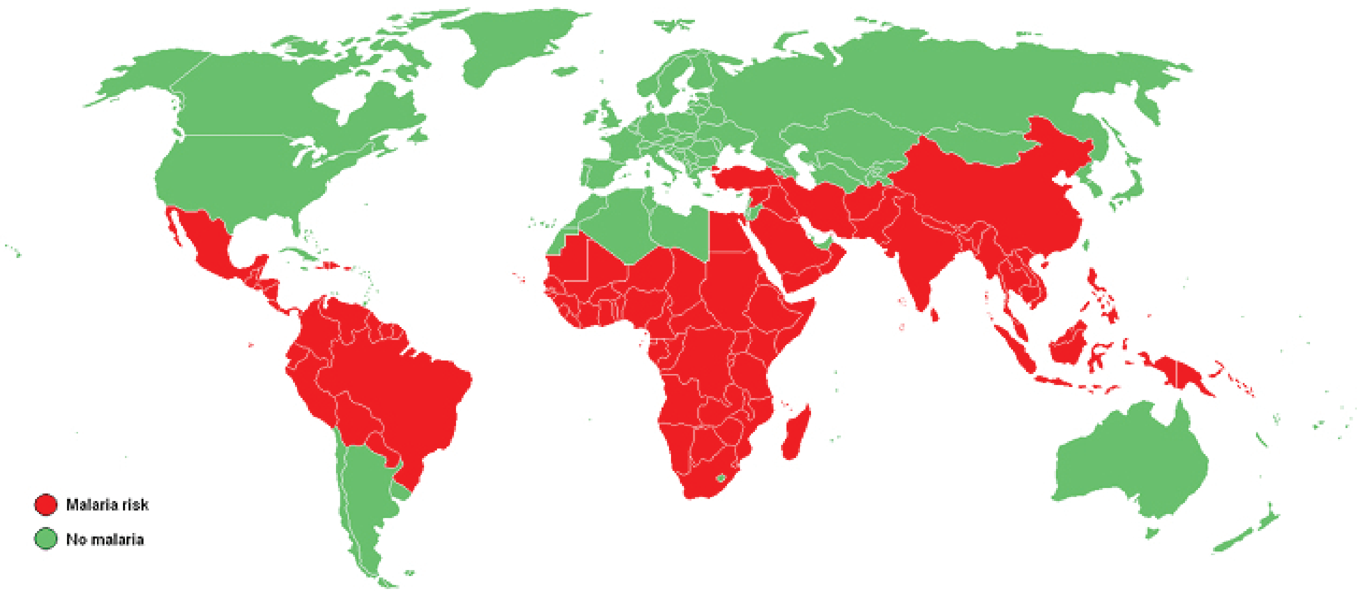
In addition to meeting the above criteria, the new malaria treatments need to take into account the constraints, or limits to the possible solutions. These constraints include:

- The proposed malaria treatment must not cause an increase in the malaria population.
- The proposed malaria treatment must last between one and seven days.

Chapter 2:

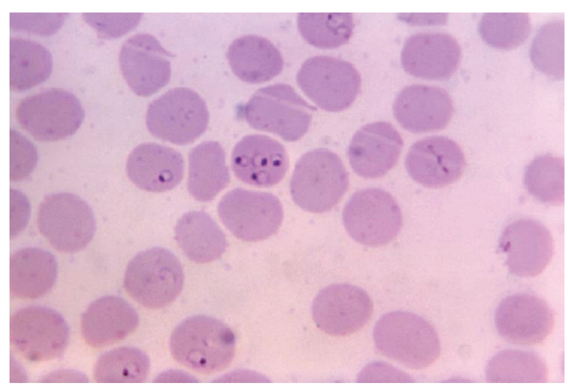
Basic Facts About Malaria

Malaria is a serious disease that kills more than one million people every year in certain regions of the world. The majority (over 70%) of those infected with malaria are children under the age of 5. The symptoms of malaria include fever, chills, headache, body aches, and vomiting.



Malaria is found in many tropical and subtropical areas of the world. Malaria is a serious problem in Africa, Southeast Asia, and South America.

Malaria is caused by a tiny parasite called Plasmodium. These parasites live inside humans and certain types of mosquito. When a person with malaria parasites in his or her blood is bitten by a mosquito, those parasites are picked up by the mosquito and can be passed on to other people it bites. Sometimes people can have malaria parasites and not show any signs of being sick. Their parasites can still be passed on to infect other people. Once inside the human body, Plasmodium parasites reproduce in the liver and infect red blood cells. If malaria is not treated, it can quickly become life-threatening by preventing blood flow to important organs.



This microscope image shows malaria parasites inside an infected person's red blood cells. Since malaria parasites are too small to see with the naked eye, this photograph has been magnified 1,125 times to make it easier to see.

To fight malaria, researchers and governments are exploring many different ideas. Some focus on using insect repellents and putting mosquito nets over people's beds to prevent the mosquito bites that spread malaria parasites. Others are working on vaccines that protect people from contracting malaria even if they are bitten by an infected mosquito. Another way to fight the disease involves designing new treatments that will cure those who already have malaria and keep populations of malaria parasites from developing resistance to drugs.

Once people are infected with malaria, they can be treated using antimalarial drugs. Scientists have developed several different drugs that are effective at killing the malaria parasites in a patient's body. However, the population of malaria parasites, like all organisms, changes due to natural selection and some populations of malaria parasites are becoming resistant to these antimalarial drugs. When parasites have resistance to a drug, the drug no longer kills the parasites. The parasites survive and reproduce, and can be transferred to more humans through new mosquito bites.

One of the simplest measures against malaria is the use of mosquito nets. Sleeping under a mosquito net prevents the bites that spread malaria parasites.

Adapting the Amplify Science Approach for Remote Learning

In Amplify Science units, students figure out phenomena by using science and engineering practices. They gather evidence from multiple sources and make explanations and arguments through multiple modalities: doing, talking, reading, writing, and visualizing. They also make their learning visible by posting key concepts on the classroom wall. While we have retained this core approach in the @Home Lessons, enacting it at home will require adaptations.

The @Home Lessons provide general guidance for these adaptations, but you may need to set up expectations for specific routines or provide additional support to your students. Below are ideas for how different aspects of the Amplify Science approach might be adapted for your learners' particular contexts.

Student talk options

- Talk to a member of their household about their ideas.
- Call a friend or classmate and discuss their ideas.
- Talk in breakout groups in a video class meeting.
- Use asynchronous discussion options on technology platforms.

Student writing options

- Write in a designated science notebook.
- Photograph writing and submit digitally.
- Complete prompts in another format. (Teachers can convert prompts so they are completed in an on-line survey or an editable document so students can submit digitally.)
- Submit audio or video responses digitally, rather than submit a written response.
- Share a response orally with a family member or friend with no submission required.
- For students with technology access, complete written work in the students' Amplify accounts (links to corresponding student activities are provided in the @Home Slides).

Student reading options

- Read printed version of article, included with @Home Packets. (Note: although the articles are originally in color, they are provided in the @Home Packets in grayscale for ease of copying. Most articles translate well into grayscale but there will be some exceptions).

- Read printed or PDF version of article, included with @Home Student Sheets.
- Listen to the article being read aloud using the audio feature in the Amplify Science Library or read articles in digital format via the Amplify Science Library (links are provided in the @Home Slides).
- Read with a partner, classmate, or someone from their home.

Hands-on activity options

- Do the activity with simple materials students are likely to have at home. (For activities where this is feasible, instructions are provided.)
- Watch a video. (For some hands-on activities in the @Home Units, a video / images of the investigation are provided.)
- Do the activity using kit materials if available. For example,
    - If possible, send home materials to students who need them.
    - If you have access to your Amplify Science kit, and have opportunities to teach synchronously, demonstrate some hands-on activities with student input.

Classroom wall options

The classroom wall, which provides an important reference for students to track and reflect on their developing understanding of the unit's anchor phenomenon and content, has been reimagined as an @Home Science Wall. A complete list of Chapter Questions, key concepts, and vocabulary that have been introduced so far are provided in the last lesson of each chapter. To enhance students' experience of the @Home Science Wall, you could have students:

- Draw a picture or write their ideas on their @Home Science Wall pages.
- Highlight each question, key concept, or word that is introduced.
- Cut out each question, key concept, or word. These can be then posted on a wall, large sheet of paper, or refrigerator at home.

Additionally, if you are meeting with your class remotely, you could create a virtual @Home Science Wall.

Adaptations of other Amplify Science routines

- **Reading support.** In Amplify Science 6–8, support for student reading includes: teacher modeling; structured paired and whole group discussion of texts; multiple readings of text; an audio feature in the Amplify Library; as well as suggestions for additional strategies for students who need more reading support. Some suggestions to offer similar supports with the @Home Lessons are:

  - Meet virtually as a class or in small groups and read the first part of the article with students, modeling how you would read the text.
  - Ask student pairs to meet after reading to discuss their annotations.
  - Have each student meet with someone in their home to read at least some of the text together and/or discuss their annotations after reading.

- **Talk routines.** In Amplify Science units students periodically talk in small groups using routines such as Word Relationships and Write and Share. You may consider including and adapting these routines by having students meet and talk to their peers in small groups or asking each student to conduct the routine with someone in their home.

- **Science Seminar.** Each core unit in Amplify Science 6–8 culminates with a Science Seminar, which is a whole-class, student-led argumentation routine. An adapted version of the Science Seminar has been included in the @Home Units. Some suggestions for implementing this are:
  - Hold your Science Seminar in class, if you are meeting in person some of the time.
  - Hold Seminars with your whole class, remotely. Students can participate all at the same time, or you might break the group up in thirds or in half and have the students who are not talking take notes using the Science Seminar Observations sheet.
  - Hold Seminars with pairs or small groups meeting on the phone, on video calls, or in virtual breakout rooms.
  - Have students talk to someone in their household about the Science Seminar evidence and claims.

@Home Units assessment considerations

Each Chapter Outline contains considerations for assessment and feedback in the Amplify Science units, and in some cases, the pre-unit and end-of-unit assessments. Generally, we recommend the following:

- You may need to adapt the format in which you collect student work. See the “Student writing options” above.

- When providing feedback to students, you may wish to focus on how students are attending to the Investigation and/or the Chapter Questions, if they are using evidence they have gathered to support their responses to questions, and if they are using appropriate unit vocabulary in their responses.

@Home Units guidance for synchronous and in-person learning

Each @Home Lesson contains suggestions for using these asynchronous resources in conjunction with virtual or in-person class sessions. If you are able to choose particular lessons to conduct together with students, we recommend:

- Holding discussions to engage students in figuring out the unit phenomenon.
    - At the beginning of each chapter so students can share their initial ideas or evolving ideas about the unit phenomenon.
    - At the end of the chapter so students can talk as they make sense of evidence, and/or synthesize various sources of information, and make an explanation or argument about the phenomenon.
- If you have access to kit materials, you can conduct hands-on demonstrations when hands-on materials are unavailable to students. Solicit student input as you demonstrate.
- If students do not have access to technology at home, when in-person, you can provide time for them to make observations and discuss ideas related to the simulations and digital tools.

Suggestions for synchronous time

The following are some ideas for making the most of synchronous time with your students. As a general rule, the best way to use your synchronous time is to provide students opportunities to talk to one another, or to observe or visualize things they could not do independently.

Online synchronous time	Notes
Online discussions: It's worthwhile to establish norms and routines for online discussions in science to ensure equity of voice, turn-taking, etc. **Digital tool demonstrations:** You can share your screen and demonstrate, or invite your students to share their screen and think-aloud as they use a Simulation or other digital tool. **Interactive read-alouds**: Screen share a digital book or article, and pause to ask questions and invite discussion as you would in the classroom. **Shared Writing:** This is a great opportunity for a collaborative document that all your students can contribute to. **Co-constructed class charts:** You can create digital charts, or create physical charts in your home with student input.	

Questioning Strategies for Grades 6–8

Overview of the Role of Open-Ended Questioning

Repeated opportunities for students to listen to and speak with others are essential for promoting deep thinking and learning in science. Meaningful teacher-initiated questions create a rich context for promoting open-ended student dialogue and discussion. The *Science Framework for California Public Schools* explains that "Simply providing opportunities to talk is not enough. Effective questioning can scaffold student thinking" (*California Science Framework*, 2016, Chapter 11, p. 21). The Framework suggests that "Teacher-initiated questions are key to helping students expand their communication, reasoning, arguments, and representation of ideas in science" (*California Science Framework*, 2016, Chapter 11, p. 21). The types of questions that teachers pose are instrumental in supporting student understanding. The Framework calls for more open-ended teacher questioning that "prompts and facilitates students' discourse and thinking" and less teacher questioning that prompts "students to seek a confirmatory right answer" (*California Science Framework*, 2016, Chapter 11, p. 6).

The Amplify Science Teacher's Guide is infused with opportunities for students to discuss their developing ideas in response to open-ended prompts. Questions to promote student thinking and discussion are purposefully built into the Teacher's Guide instructional steps and Teacher Support notes that surround all our hands-on and reading activities. In addition, all units include discourse routines (e.g., Shared Listening, Think-Draw-Pair-Share, Write and Share, Word Relationships) that provide opportunities for students to use focal unit vocabulary as they think and talk with partners and the class about their understanding of key science content and practices. Many of the On-the-Fly Assessment suggestions provided throughout each unit offer open-ended follow-up questions that can be used to probe student thinking and formatively assess student understanding of the content. In addition, each unit includes multiple opportunities for students to respond to open-ended questions through additional modalities (e.g., in writing, with diagrams, through a kinesthetic model).

While the prompts embedded in each of the opportunities mentioned above provide fertile ground for student discussion, continued use of flexible, open-ended questions is invaluable for assessing students' knowledge and skills, promoting student-to-student discourse, and guiding student learning. A collection of grade-appropriate questions follows that can be used for these purposes. You will also find a list of activity types included within the Amplify Science curriculum that are particularly conducive to the use of these questions. You may choose to print out these questions and activity types for reference throughout your instruction.

Open-Ended Questions to Facilitate Student Thinking and Discourse

Questions to assess students' knowledge and skills:

- Can you explain how you decided that this claim is the best one?
- Can you explain why X happened?
- Would you (and your partner) explain the steps you went through (to create the model you made)?
- How do you know X?
- If XXX were changed, how would that change YYY?

Questions to promote student-to-student discourse:

- Do you agree or disagree with (that idea)? Why?
- Can you add evidence to support (student name)'s thinking?
- Do you have evidence to go against (refute) (that idea)?
- Does anyone else have something to add to the conversation?
- We are working together right now to figure out/better understand X. Can anyone start us off with some thinking about this (question, problem, idea)?
- Can you explain X, using science vocabulary words XX and YY (from the unit)?
- What claim does this evidence support? How do you know?
- Can you explain why this evidence is important?
- Can you explain why this evidence does not support Claim Y?
- How does your idea relate to what others have said today?

Questions to guide student learning:

- I hear what you are saying (or I read your question/response). Can you explain your thinking to me a bit more so I can understand your idea?
- Some students have said that they think X happened. Can those students work together to find more evidence to support this idea?
- You are claiming that Y happened/explains this phenomenon.
    - Can you find more evidence to support your claim? Please go back to these resources (e.g., simulation, article) and see if you can find more evidence.
    - Which evidence can you use to make a stronger argument?
- How can we investigate why this happened?
- What did you notice? What else do we need to figure out?

Activity Types Within the Amplify Science Curriculum That Are Especially Suited for Additional Teacher Questioning

The activity types listed below are student-centered and often contain prompts for pairs or small groups of students to use to discuss content or to vet evidence together. As you circulate through the classroom during these activities, you can use the open-ended questions to assess students' knowledge and skills, promote student-to-student discourse, and guide student learning.

- Hands-on activities
- Discourse routines (e.g., Write and Share, Word Relationships)
- Discussion after reading
- Paired Modeling Tool activities
- Paired Reasoning Tool activities
- Paired Simulation activities
- Evidence Card sorts
- Evidence Gradient card sorts
- Discussion of evidence in preparation for a Science Seminar (discussing which claim the evidence supports and why, sorting evidence in pairs)
- Science Seminar

Natural Selection Engineering Internship

Overview of Days 2-5

Day 2: GROUP 1

- Interns continue the Research phase and are introduced to the practice of taking Daily Message Notes to identify the key ta
- sks and any important concepts.
- they actively read and discuss background information and engage in a hands-on activity that simulates mutations in a malaria parasite population when an antimalarial drug is introduced to the environment.

Day 3: GROUP 2

- Interns focus more on how drug resistance occurs in parasite populations and how the choices biomedical engineers make for drugs used in malaria treatments affect the overall distribution of traits for drug resistance in these populations.
- Interns use Malaria Med Design Tool in order to investigate the effect of using one drug on long-term drug resistance, and then discuss the pros and cons of each drug type.

Natural Selection Engineering Internship

Overview of Days 2-5

Day 4: GROUP 3

- Interns read about the different antimalarial drugs available for their treatments in this Malaria Med model.
- Interns then run additional isolated tests to better understand the effects of different antimalarial drugs, doses, and days of treatment on the project criteria and complete the project summary

Day 5: GROUP 4

- Interns are introduced to The Design Cycle and iterative testing through a brief video that explains the process: Plan, Build, Test, Analyze.
- Interns begin to apply the practices of iterative testing to their designs, using MalariaMed to test different sequences and doses of antimalarial drugs.
- Finally, the internship coordinator guides the team through a data evaluation activity by color-coding a data set.

Notes