Model Tracker Formative Assessment Tool

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.

Purpose

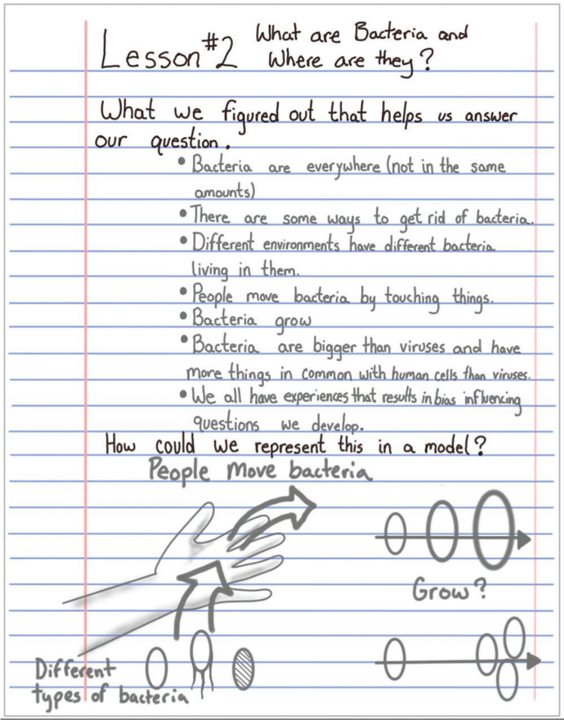
In the next lesson (Synthesize), students will use the three models they developed so far to help them contribute ideas to create a Class Consensus Model. Students will then expand on the consensus model and use it to construct an explanation for the success of behavioral modification at reducing the probability of contracting (and/or transmitting) an infection using the cause-and-effect relationships they have uncovered in their investigations.

Look across the student entries in the Model Tracker, then use the rubric below to assess individual students' progress over time and their overall readiness to engage with the Synthesize Lesson and, by the end of it, to meet the Chapter Learning Goals.

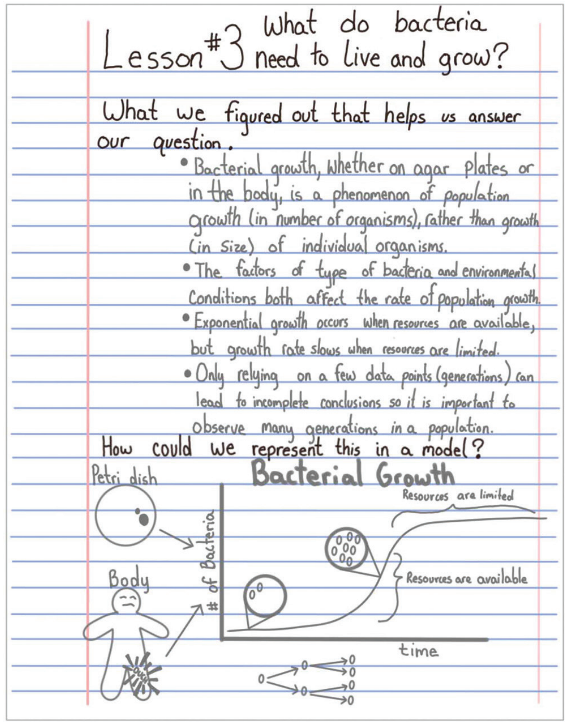
Model Tracker: Sample Entries

The following table shows the intended list of ideas that students should have figured out in each Investigate Lesson, and one possible way they may choose to represent those ideas. There should be plenty of natural variability in what students write and draw—the Model Trackers are intended to be a record of students' own thinking—not an "ideal" they should memorize or copy down.

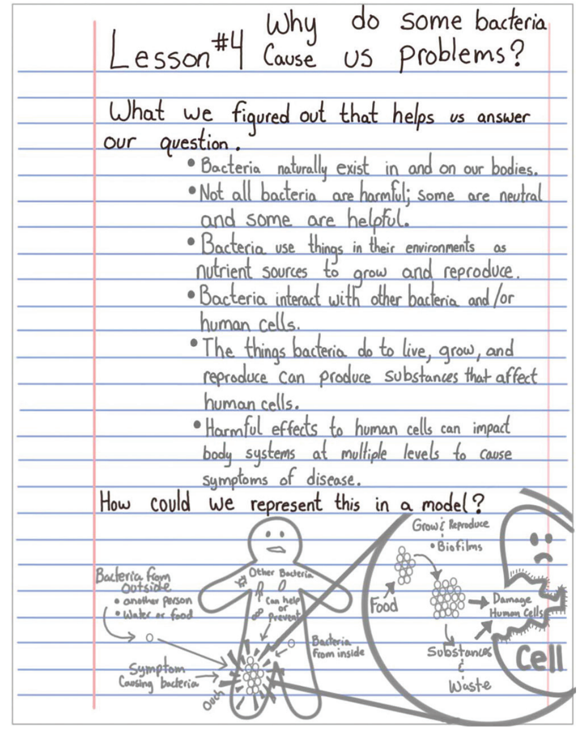
Unit 1 Chapter 1 Lesson 2



Unit 1 Chapter 1 Lesson 3



Unit 1 Chapter 1 Lesson 4



Formative Assessment and Implications Tracker

The following table is intended to help you identify areas of strength, potential areas for improvement, and any progress over time in the focal DCIs, SEPs, and CCCs. As a formative assessment, it is not intended to be used for scores or grades, but to provide individual students with feedback and to provide you with information about students' readiness for the Synthesize Lesson of this chapter. Remember to look across all the models and consider them together.

Modeling, systems, and DCI criteria	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32
a. Included the components of a model to explain growth of bacteria:																																
a.1 Bacteria																																
a.2 Environment																																
a.3 Bacterial input and outputs																																
a.4 Human cells																																

<u>**Implications**</u>

If students struggle to identify the key components to explain bacterial growth, consider revisiting the following learning opportunities:

- Bacteria are introduced in Lesson 1 and characterized in more detail in short readings in Lesson 2.
- Bacterial inputs and outputs in the form of food and waste are investigated on day 2 of Lesson 3 and are explicitly delineated in the Recording Key Ideas graphic organizer in Lesson 4.
- The environment that bacteria grow in is introduced and explored throughout Lesson 3 and is expanded to the human body in the readings in Lesson 4.
- Human cells are introduced in the readings about four different scenarios of infection in Lesson 4.

Modeling, systems, and DCI criteria																
b. Showed the interactions between components in the models, which include the initial conditions, inputs, outputs, and boundaries of systems:																
b.1 Bacteria need food and space to grow.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32
b.2 The space where bacteria can grow has boundaries that depend on the system/where the population growing is located.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32
b.3 Bacteria themselves are a system and their inputs are food and outputs are wastes and other substances.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32
b.4 Bacteria interact with human cells when they enter or come in contact with the human body and take up space, and the substances bacteria output become an input to human cells.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32

<u>Implications and Feedback</u>

If students struggle to show the key interactions to explain bacterial growth, consider revisiting the following learning opportunities:

- Bacterial inputs and outputs in the form of food and waste are investigated on day 2 of Lesson 3 and are explicitly delineated in the Recording Key Ideas graphic organizer in Lesson 4.
- The concept of boundaries for the bacterial environment is introduced when students observe growth on petri dishes (either their own or pre-collected) in Lesson 2, and the effect of limited space (as one resource) is further explored when modeling limitations on population growth in Lesson 3.
- Negative interactions between bacterial and human cells are explored in the readings about four different scenarios of infection in Lesson 4.

Modeling, systems, and DCI criteria																
c. Used the models to provide a description of **how the phenomenon works:**																
c.1 Bacteria grow by dividing in half; this mechanism causes bacteria to grow quickly (cause-and-effect relationship).	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
	S17	**S18**	**S19**	**S20**	**S21**	**S22**	**S23**	**S24**	**S25**	**S26**	**S27**	**S28**	**S29**	**S30**	**S31**	**S32**
c.2 Bacteria need food and space to grow; if food and space are limited, there are limits to how much they can grow (cause-and-effect relationship).	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
	S17	**S18**	**S19**	**S20**	**S21**	**S22**	**S23**	**S24**	**S25**	**S26**	**S27**	**S28**	**S29**	**S30**	**S31**	**S32**
c.3 When bacteria grow and produce substances, these processes can affect human cells, causing symptoms of infection (cause-and-effect relationship).	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
	S17	**S18**	**S19**	**S20**	**S21**	**S22**	**S23**	**S24**	**S25**	**S26**	**S27**	**S28**	**S29**	**S30**	**S31**	**S32**

Implications and Feedback

If students struggle to show the key mechanisms to explain bacterial growth, consider revisiting the following learning opportunities:

- In Lesson 1, the idea that models should show how and why (not just what and when) is introduced when students receive a definition of models and consider examples and nonexamples of scientific models.
- In Lesson 4, students are also asked to attempt to generalize from the specific information in each reading to focus their models on common mechanisms across infections for how bacteria cause symptoms.

Modeling, systems, and DCI criteria																
Progress Over Time Put a check for progress over time (*or* mastery at the level intended) for this chapter.																
d. The Model Tracker shows **progress in ideas over time** (e.g., initially showed bacteria growing larger and then showed bacteria growing by cell division).	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32
e. The Model Tracker shows **progress in the practice of modeling** over time (e.g., at first, including irrelevant components or a misplaced focus on making the model look exactly like the system being modeled; later showing more focus on mechanism and only the components necessary to explain the mechanism).	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32
f. The Model Tracker shows **progress in use of the crosscutting concept of systems and system models** over time (e.g., at first described everything in the model as one big system; later demonstrated understanding that a system can be made up of many systems and that outputs from one system can be inputs to another system).	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32
<u>**Implications and Feedback**</u> You may see progress over time or you may see students who had key pieces from the beginning. Either is OK! The point of this section is to see assets in student models and how they are growing.																
Overall Understanding																
g. Based on the presence of the criteria in the rubric, does the student demonstrate understanding of the core ideas, practices, and crosscutting concepts in this chapter so far?	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32