EQuIP Rubric for Science Unit
Peer Review Panel Feedback

Overall Rating:

E/I

Example of High-Quality NGSS Design if Improved

Unit Name: Why Don't Antibiotics Work like They Used to?
Grade Level: 9, 10, 11, & 12

Category I. NGSS 3D Design

		Evidence of Quality?			
		None	Inadequate	Adequate	Extensive
Unit Criteria	A. **Explaining Phenomena/Designing Solutions**: Making sense of phenomena and/or designing solutions to a problem drive student learning.				X
	B. **Three Dimensions**: Builds understanding of multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) *that are deliberately selected to aid student sense-making of phenomena and/or designing of solutions*.				X
	i. *Provides opportunities to develop and use specific elements of the SEP(s).*				*X*
	ii. *Provides opportunities to develop and use specific elements of the DCI(s).*				*X*
	iii. *Provides opportunities to develop and use specific elements of the CCC(s).*				*X*
	C. **Integrating the Three Dimensions:** Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs.				X
	D. **Unit Coherence**: Lessons fit together to target a set of performance expectations.				X
	E. **Multiple Science Domains**: *When appropriate*, links are made across the science domains of life science, physical science and Earth and space science.			X	
	F. **Math and ELA:** Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.				X

Category I Rating: **3**

At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C

Criterion A.

Specific evidence from materials and review team consensus reasoning:

Student questions and prior experiences related to the problems motivate sense making. In Bend 1, lesson 1, students are introduced, through a video, to a young girl named Addie who has an antibiotic-resistant pathogen. This young person's inability to get well through traditional measures serves as a driving question throughout the unit. Prior to watching the video, students are asked to reflect on their own past experiences with illness or the experiences of their family members with illness. Students are asked to generate questions "that arise from careful observation of phenomena…to…seek additional information" from Lesson 1. Students' prior experiences related to the phenomenon are elicited through discussion of illnesses (their own or someone in their family) and their use of medicine. Questions, such as, "Can this happen to me?" arise. Lesson 3a asks students to gather data about use of antibiotics in the family.

The focus of the lessons within the unit supports sense making of phenomena. Throughout Bend 1 and 2, students engage in a series of experiments with bacteria. These occur in lessons 5a – 5e. Throughout these experiments, the results of previous experiments act as the phenomena for the next investigation. Another case study (Bend 2 – Juncos) is used to test out ideas with other populations and to figure out additional mechanisms that might be responsible

	for Addie's dilemma and the change in Juncos. Many of the suggested prompts included in the Teacher's Manual promote sense-making by the students. Addie's sickness and more importantly the inability of antibiotics to help her is a driving phenomenon in Bend 1 and is a strong enough phenomenon to be referenced throughout the entire unit where appropriate. Engineering is not a learning focus in this unit.
	Suggestions for improvement: It might be useful for teachers who are new to a sense-making approach to instruction to overtly identify the case study of Addie as the overarching phenomenon for the unit, and at the lesson level, the smaller grain size phenomena provide lesson level focus.
Criterion B.	**Specific evidence from materials and review team consensus reasoning:** Throughout the unit, students are provided opportunities to develop and use specific elements of the Science and Engineering Practices. For example, during lesson 5a, students design and carry out experiments to test the effects of antibiotics on bacterial growth. Engagement in this science and engineering practice is deliberately selected to aid students in sense making of disease-resistant antibiotics. Ultimately, the experiment the students conduct helps them understand how antibiotics move through the body and the effects of different concentrations of antibiotics on bacteria. Students are provided repeated opportunities to use specific elements of all eight Practices as well as being given opportunities for developing specific elements of the Practices. For example, in Lesson 4, students develop a model of a simple system. In Lesson 3b, students develop and use a model to generate data to support explanations and to predict phenomena. Then, in Lesson 6, students develop and use a model based on evidence to illustrate the relationships between components in their explanations. Lesson 7 has students develop a model to illustrate and predict the relationships between variables to provide mechanistic accounts and/or predict phenomena. Lessons in Bend 1 also develop students' ability to plan and conduct investigations. Modeling, planning, and conducting investigations continue to be developed in Bend 2 and 3, while arguing from evidence and obtaining, evaluating, and communicating information are purposefully being developed in Bends 2 and 3. Students are provided multiple opportunities to develop and use specific elements of the DCIs. For example, as students move through a progression of experiments in lessons 5a – 5e, they are working with an element of DCI LS4.B, "The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population." Students begin to develop understanding of inherited traits vs. learned behavior in Bend 2 with the Juncos (LS4.C) and evidence of common ancestry (LS4.A) in Bend 3. Lesson 11b provides an opportunity to understand how scientists determine if a behavior is inherited or learned by reading journal articles about bee studies and applying that thinking to Juncos. Lessons in Bend 3 deliberately develop students' understanding of how genetic information provides evidence of evolution by examining karyotypes then adding variation in the expression of genetic information of traits like wing length and tail length in Lesson 16. By Lesson 20, students were revising their common ancestry models to explore other factors that might account for speciation in Junco populations. Students are provided multiple opportunities to develop and use specific elements of the CCCs throughout the unit. The CCCs of Patterns and Cause and Effect are emphasized throughout the unit. These are the CCCs in the five performance expectations identified in the unit. "Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena" was used to try to answer questions

	about Addie. A timeline of events was created to examine any large-scale patterns, then bacteria were cultured to examine patterns at a microbial scale. Variations in expressed traits were examined in Junco populations including mapping populations in different environments, and variations in genotypes were explored through karyotype analysis. These investigations led to "classification or explanations used at one scale may fail or need revision when information from smaller or larger scales is introduced, thus requiring improved investigations and experiments." "Mathematical representations" and "empirical evidence" were used in lessons 3b, 5b, 10, 13, 5e, 17b, 18, and 22. "Cause and effect relationships can be suggested and predicted for complex natural systems… by examining what is known about smaller scale mechanisms within the system." For example, in lesson 13, students are encouraged to recognize the relationship between alleles and behavior as one of cause and effect. Students were provided opportunities to develop understanding that "[e]mpirical evidence is required to differentiate between cause and correlation and make claims about specific cause and effects" in Lessons 7, 11a, 11b, 15, 20, 22, and 23. Additional crosscutting concepts (systems, structure and function, scale) were used as well.
	Suggestions for improvement: Indicate to instructors when the SEP's targeted in the lesson are the same as those in the five performance expectations the unit is building toward. This will result in more purposeful development of those practices in students. In the Teacher Guide, DCIs addressed in each lesson are sometimes indicated in the Teacher Preparation section. These DCIs are appropriately labeled as "From the Framework." Some of them appear in the Framework and not in the standards themselves. It should be noted within the lessons which DCIs are from the Framework but not the standards. For example, in Lessons 1 and 2, the DCI indicated is LS 4.C, but the text accompanying is not the DCI in the standards. This may help alleviate confusion for many teachers. Using specific elements of the practices and crosscutting concepts in the relevant suggested prompts in the teacher's manual and on the student materials might make the use of them explicit and intentional by teachers and students.
Criterion C.	**Specific evidence from materials and review team consensus reasoning:** Student sense-making of phenomena requires performances that integrate elements of the three dimensions. For example, in lessons 5a and 5b, students design and carry out an investigation that develops and uses an element of LS 4.B and encourages them to identify patterns, make predictions about patterns they might see in the future, and to recognize how cause and effect apply to their data. Each lesson organically uses the three dimensions to make sense of phenomenon driven by student questions. The Mission Board and Driving Question Board are public evidence of the resulting thinking and learning.
	Suggestions for improvement:
Criterion D.	**Specific evidence from materials and review team consensus reasoning:** Each lesson builds on prior lessons by addressing questions raised and cultivating new questions. Each of the lessons presented in the Teacher Guide provides, at the top of the document, a section titled "Previous Lesson… Where we've been." This provides a very succinct synopsis of what has come before and is linked via an arrow to what students will be doing and what questions will be addressed in the current lesson.

	Each experience promotes questions from the students and those questions drive subsequent learning. Suggested prompts in the teacher's guide provide assistance to teachers that help focus student thinking and assist in maintaining a logical conceptual flow. There are multiple mechanisms embedded in the unit that explain how prior learning will be built upon. One such mechanism exists at the end of each lesson synopsis in the Evolution Storyline and is titled "Next Steps." For example, in lesson 5a, at the bottom of the box titled "What We Figure Out" the lesson states "We are excited to check on our future results, but know that it will take a couple of days to see the effects (just like it did in lesson 3a to 3b). We think we have figured out some pieces to help us answer some of the questions on our Driving Question Board, 'Why did antibiotics stop working for Addie?' So we want to take stock of the questions we answered and what we figured out so far in the next class and regroup." Many of the student worksheets included first ask students to revisit ideas arrived at during the previous lesson. For example, the lesson 18 student activity sheet starts with the following "18.1 - Connecting to the Previous Lesson - Q1: What did we decide we could figure out by comparing the relationship between the alleles found in the mountain population males, and the alleles in the UCSD offspring?" This reinforces unit coherence and helps students move toward proficiency in the identified performance expectations. The Teacher's Manual provides "Alignment to the Standards" with each lesson that includes the targeted PE as well as CCSS Math and ELA where appropriate. The overview page includes the targeted PEs that are being built toward with that lesson. Some of the "Getting Ready: Teacher Preparation" sections for a new lesson include connections to DCIs from the middle school, which could be useful to teachers for determining gaps in understanding. Each lesson performance expectation includes the targeted component of the targeted DCIs (and SEP and CCC).
	Suggestions for improvement:
Criterion E.	**Specific evidence from materials and review team consensus reasoning:** The performance expectations that students are building toward throughout this unit all come from the Life Science domain. In Bend 2, Lesson 10, geographical factors are considered with respect to understanding changes in Junco populations. This provides an opportunity to use concepts in HS.ESS1.C, HS.ESS2.E, and HS.ESS3.A. Because only Life Science concepts were being developed, there was no opportunity to use the CCCs across science domains.
	Suggestions for improvement: Work through the high school performance expectations for the Earth and Space Science domain, identifying those that show significant overlap or applicability. Identifying these within the lessons will assist educators in making connections across domains. Connections to other performance expectations within the Life Science domain could also be identified. Educators will make different connections depending on where this unit falls in students' coursework. Because this is such an extensive and rigorous unit, it may not be advantageous to incorporate other science domains, especially if they do not facilitate sense-making. However, depending upon where this unit fell within the curriculum sequence, using the appropriate ESS DCIs might

	be more application of prior learning than new learning. Therefore, if the connections were included, teachers could decide to use them or not, accordingly.
Criterion F.	**Specific evidence from materials and review team consensus reasoning:** The unit provides grade appropriate connections to the Common Core State Standards in English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects for many lessons. At the end of each lesson in the Teacher Guide, there is a section entitled "Alignment with Standards." Almost all of lessons 1 – 12 include a section within this in which they indicate the CCSS math and ELA connections. There are numerous lessons that have students reading multiple texts on the same subject, using complex texts, and communicating in authentic forms. For example, in Lesson 4, students use information from the CDC. In Lesson 10, climate data are used and additional data are included in Lesson 11a to use as possible evidence. Students use information from scientific journal sources in Lesson 11b, and excerpts from a primary source are used in Lesson 12. Students use aerial photographs and methodology and results from a scientific journal article in Lesson16 to determine how to develop a model of population migration patterns. A technical article on karyotyping was used to determine how to make sense of Junco blood data. Three different articles were used in Lesson 20 to provide methodology and results for analyzing breeding patterns. Students were also required to gather information from a range of media sources – videos, Google Earth, and simulations. As a possible summative opportunity, students synthesized information and created an infographic about antibiotic use for the general public.
	Suggestions for improvement: Continue work on identifying connections to the Common Core State Standards.

Category II. NGSS Instructional Supports:

		Evidence of Quality?			
		None	Inadequate	Adequate	Extensive
Unit Criteria	A. **Relevance and Authenticity**: Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.				X
	B. **Student Ideas:** Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate.			X	
	C. **Building Progressions**: Identifies and builds on students' prior learning in all three dimensions, including providing support to teachers.			X	
	D. **Scientific Accuracy**: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.				X
	E. **Differentiated Instruction**: Provides guidance for teachers to support differentiated instruction.		X		
	F. **Teacher Support for Unit Coherence:** Supports teachers in facilitating coherent student learning experiences over time.				X
	G. **Scaffolded differentiation over time:** Provides supports to help students engage in the practices as needed and gradually adjusts supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems.			X	

Category II Rating: **3**

At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C

Criterion A.

Specific evidence from materials and review team consensus reasoning:

Students engage in meaningful scenarios that reflect the practice of science as experienced in the real world throughout the unit. In Bend 1, students are working with the case study of a young person who has a drug-resistant disease. Throughout Bend 1 and Bend 2, students are engaged in authentic experimentation working with bacteria in lessons 5a – 5e. In Bend 2, students work with relatively recent data from scientific journals and use this data in their sense making of phenomena.

A Mission Board is displayed that helps to make the connection between what is being studied and its applicability to their own families, neighborhood, and communities. Students are expected to communicate their learning about antibiotic abuse to their larger community in order to educate them about the importance of taking their entire course of antibiotics.

While there are many opportunities for students to make connections between the central phenomena of the unit, there are few opportunities for students to connect their explanation of a phenomenon to questions from their own experience. There are limited opportunities for students to experiment in order to answer their own questions, unless their questions were a part of an upcoming lesson.

Suggestions for improvement:

Before engaging students in lesson nine, incorporate a lesson investigating birds in the students' local ecosystems. Include student ideas about why those particular birds exist in their specific ecosystem. Introduce students to techniques that field biologist use to study organisms in their own environment.

Incorporate opportunities for students to identify how what they've learned could apply to questions in their own lives. Students could apply what they've learned about Junco evolution to birds in their own environment, asking questions about their origins.

	Another strategy that might be suggested would be to categorize the questions they generate for the DQB and "flag" them as they relate to different investigations. Perhaps the simulation could be used as a vehicle for students to test their own questions that might not fall as neatly into the storyline. The use of the simulation could be used as additional support for students who are struggling with experimental design and/or data analysis or as a resource for students who need to be challenged with respect to planning and conducting an investigation, data analysis, and/or constructing explanations with respect to cause and effect relationships.
Criterion B.	**Specific evidence from materials and review team consensus reasoning:** Students are provided multiple opportunities to express, clarify, justify, interpret, and represent their ideas multiple times, however they are not provided ample opportunities to respond to peer and teacher feedback. For example, during lesson 13 students are asked to, in pairs, draw a model of how Juncos in San Diego changed over time. Following this, students engage in a gallery walk and identify commonalities and differences across the models. A class model is then created on chart paper from a consensus building discussion. Many of the strategies in the Teacher's Manual provide excellent Suggested Prompts for probing questions and for "listen fors" as students discuss, but there are few opportunities explicitly designated for individual peer and teacher feedback.
	Suggestions for improvement: Make explicit in the lessons more opportunities for individual students to receive and respond to specific feedback from teachers and peers. Often in the lessons, students work independently and then group discussions bring student ideas to a consensus. Including a step in between in which students receive feedback and revise their work before arriving at a group consensus would further student learning. It would also provide many opportunities for formative assessment, both self and teacher driven.
Criterion C.	**Specific evidence from materials and review team consensus reasoning:** The unit sometimes explicitly identifies prior student learning expected for DCIs. For example, in lesson 11 a, in the Teacher Guide in the section entitled Getting Ready: Teacher Preparation, there is reference to specific DCIs students are expected to understand by the end of grade 8 that are relevant to the learning students will do in lesson 11 a. In some lessons, middle school DCIs are identified while in the majority they are not. In some lessons, middle school DCIs are identified using appropriate annotation (i.e. MS-LS1-4) while in others, they are not (i.e. lesson 11a). The unit does not explicitly identify prior student learning expected for the science and engineering practices or crosscutting concepts focused on in the five performance expectations that this unit is building toward. However, the lessons do identify and build upon student learning from prior lessons within the sequence. Even the student handouts referenced prior learning. This is most pronounced with the DCIs, and somewhat evident with the SEPs. This is weakly evident with the CCCs.
	Suggestions for improvement: Continue to work through lessons, identifying relevant middle school DCIs and indicate these in a consistent manner throughout the unit. Build upon the CCCs throughout the lesson in a more coherent manner.

Criterion D.	**Specific evidence from materials and review team consensus reasoning:** The unit challenges students with scientifically accurate and grade appropriate information and representations to support three-dimensional learning. In lesson 13, students read an abstract from a paper published in Behavioral Ecology. Additionally, they work with data from the Journal, which presents plasma levels of corticosterone (CORT) in two populations of juncos to draw conclusions and develop further questions. Identified elements of the Practices were at the high school level. The use of mathematical modeling, technology, and the simulation were appropriate for high school. The phenomenon used to anchor the learning (Addie case study) as well as the Juncos in Bend 2 and 3 were accessible yet sophisticated, which would appeal to high school students. Furthermore, the students are required to access information from authoritative scientific sources.
	Suggestions for improvement:
Criterion E.	**Specific evidence from materials and review team consensus reasoning:** Throughout the unit lessons, instructors are presented with Differentiation Strategies and Alternative Activities boxes accompanying lesson directions. Often these boxes also include differentiation strategies for students who struggle with reading complex text, writing etc. For example, in lesson 11b on page 178 of the Teacher's Guide, there are specific suggestions for instructors who may be working with students who find scientific text particularly challenging. The lesson provides three different strategies to assist the instructor including pairing, whole class reading, and small group strategies. Aside from what is referenced above, extra support for students who are struggling to meet the targeted expectations is not included in the unit. Although there were ideas labeled in the Teacher Supports and Notes section of the Teacher's Manual, we did not find any designated as Differentiation or Alternative Activities that provided suggested next steps for instruction. Extensions for students with higher interest or who have already met performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts is not included in the unit.
	Suggestions for improvement: The Alternative Activities and Additional Guidance sections presented are wide-ranging and thoughtful and will help educators be more flexible with their lessons in lesson planning. Including a greater number and scope of differentiated activities, which include next steps for instruction, is recommended.

Criterion F.	**Specific evidence from materials and review team consensus reasoning:** The unit supports teachers in facilitating coherent student learning experiences over time. For example, throughout the unit they work with a "Driving Question Board." This mechanism help students remember the larger questions they are trying to answer as they engage in lesson – level activities to support their understanding. The Addie case study is revisited in Bend 2 as bacterial growth is analyzed and again to wrap up the unit. Another example is the "Next steps" sections at the end of each lesson synopsis in the "What We Figure Out" sections in the Storyline document. Including information about previous learning on student handouts is another example of connecting learning experiences over time. For each lesson, lesson performance expectations crafted by the authors are included. These reinforce the three-dimensional nature of the NGSS for the instructor and are often at the element level of the dimension.
	Suggestions for improvement: Throughout the unit, explicitly identify activities that include learning in all three dimensions. Including formative and/or summative assessments that assess in all three dimensions will help ensure three-dimensional learning in classrooms.
Criterion G.	**Specific evidence from materials and review team consensus reasoning:** This is a large and comprehensive unit. Over the course of the unit students are asked to make connections between bacterial culture experiments, speciation of Juncos and the case study of Addie who is infected with a drug-resistant pathogen. They are also applying new information and concepts learned through experimentation, research, and modeling in each of these to novel information and phenomena. Students are provided support to engage in the practices as needed throughout this progression of learning. While the level of rigor of the work increases throughout the unit, clear evidence that each individual is increasingly responsible for making sense of phenomena is not evident.
	Suggestions for improvement: As students move through the unit, rely less on group discussions, group models etc. to allow students to independently arrive at important understandings they need to see the larger picture. It is not clear how the teacher could decide where each student is with respect to the targeted dimensions. Although the pair shares, group discussions, guided discourse, and consensus building are essential for helping students make sense of information, models, data, etc., the Teacher's Guide does not specify critical places in the learning for determining where each student's understanding is and there are no suggestions for next steps in instruction if a student(s) are not progressing.

Category III. Monitoring NGSS Student Progress

		Evidence of Quality?			
		None	Inadequate	Adequate	Extensive
Unit Criteria	A. **Monitoring 3D student performances**: Elicits direct, observable evidence of three-dimensional learning; students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions.				X
	B. **Formative:** Embeds formative assessment processes throughout that evaluate student learning to inform instruction.		X		
	C. **Scoring guidance**: Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.	X			
	D. **Unbiased tasks/items**: Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.			X	
	E. **Coherent Assessment system:** Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.		X		
	F. **Opportunity to learn**: Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback			X	

Category III Rating: **1** Adequate evidence for at least three criteria in the category

Criterion A.

Specific evidence from materials and review team consensus reasoning:

The unit elicits direct, observable evidence of three-dimensional learning. For example, in Bend 2, lesson 13, students develop and revise a model. In part, the model reflects the cause and effect relationship between CORT and bird behavior. Students are working with elements of LS 4.B "natural selection only occurs if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information – that is, trait variation – that leads to differences in performance among individuals."

Suggestions for improvement:

Many of the artifacts produced are group-generated artifacts. Provide more opportunities for students to produce evidence of three-dimensional learning independently.

Explicitly identify moments throughout the unit during which students are engaging in three-dimensional learning and the artifacts that evidence these moments would facilitate teaching and learning.

Criterion B.

Specific evidence from materials and review team consensus reasoning:

In some, but not all lessons, good opportunities for formative assessment are indicated clearly. For example, in Lesson 5e on page 202 of the Teacher Guide in box C, teachers are prompted to use student generated answers to lesson questions in order to assess understanding. Possible student alternative conceptions are provided with most lessons on the Getting Ready: Teacher Preparation pages. Teachers are provided guidance in most lessons regarding what specifically to look/listen for but not what to do with the information.

Suggestions for improvement:

In addition to providing guidance regarding evidence of acquisition of knowledge and skills, provide guidance to teachers including possible steps to take/strategies to employ if students are not displaying adequate skills and/or knowledge.

Present formative assessment opportunities consistently throughout the unit and use the same symbol for clarity.

Criterion C.	**Specific evidence from materials and review team consensus reasoning:** Aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers are not included. Extensive work has been done to present possible student interpretations, understandings/misunderstandings, student responses, and to present sample artifacts. These will undoubtedly be beneficial for educators.
	Suggestions for improvement: Identify appropriate moments throughout each Bend to include rubrics and scoring guidelines.
Criterion D.	**Specific evidence from materials and review team consensus reasoning:** Formative assessment is based primarily on student work during class (i.e. response to questions in writing, models, etc.). These methods are accessible and unbiased.
	Suggestions for improvement: Consider potential bias when developing summative assessments.
Criterion E.	**Specific evidence from materials and review team consensus reasoning:** The unit does not include adequate pre, summative, or self-assessment measures assessing three-dimensional learning. Most lessons include at least one suggestion for educators to formatively assess students, however these are often not assessing three-dimensional learning. There was no pre-assessment that elicited information about student understanding of the targeted Practices, CCCs, or DCIs. Prior knowledge was elicited. There were very few places where students were provided an opportunity to self-assess. Since there were no rubrics or scoring guidelines provided or critical junctures in the learning indicated, teachers would most likely not provide self-assessment opportunities. The information for the infographic in Lesson 24 has been built through a range of experiences, and the Teacher's Guide provides suggestions that it could be used summatively. Although different organisms, a range of techniques for gathering evidence, and consensus building were used in this unit, there were limited opportunities for students to apply their models or generalize from their evidence to a new phenomenon.
	Suggestions for improvement: Identify appropriate moments within the unit at which these assessments would be of most value to students and educators and incorporate them into lessons. Provide specific opportunities that would allow students to self-assess where they are in their understanding of natural selection and evolution and targeted Practices and CCCs at the element level.
Criterion F.	**Specific evidence from materials and review team consensus reasoning:** Students are engaging in three-dimensional learning in many of the lessons. Students are making sense of disciplinary core ideas or supporting ideas that will facilitate understanding of phenomena. Crosscutting concepts are identified at the beginning of each lesson. Crosscutting concepts are incorporated into student handouts and discussion prompts. For example, during lesson 5C, students are asked to identify patterns in data from experiments with bacteria and antibiotics and as well to make predictions about what patterns they will see in future data sets. Explicit opportunities for each student to receive feedback on their performance of a Practice(s) connected with their understanding of DCIs and CCCs are not provided.

	Suggestions for improvement: For each lesson, explicitly identify DCIs, CCCs, and SEPs associated with the five performance expectations the unit is building toward and provide opportunities for each student to receive feedback with respect to their performance of a Practice(s) connected with understanding of DCIs and CCCs. Because of the extensive use of group work, there are opportunities for individual students not to engage in the learning. Consider providing more individual accountability for demonstrating understanding.

Summary Comments

This unit is ambitious, comprehensive, and purposefully designed. Students are repeatedly challenged with rigorous content and expected to make important connections between and across storylines. Students also are exposed to and engage in authentic scientific research.

Due to the size and scope of this unit, as reviewers it was impossible to fully engage with every lesson and resource. Understand that some comments may apply to some lessons more than others and there are undoubtedly aspects included which were missed by the reviewers.

This is a large document compiled by different individuals. It is not surprising that there is a need for consistency. Additionally, also not surprisingly for a unit of this scope, there are many simple grammatical errors. If possible, find objective editors to edit the lessons for these types of errors.

Authors should coordinate in order to standardize the Background Knowledge section at the beginning of each lesson. Some contain resources, some contain applicable previously learned middle school DCIs, and others indicate framework DCIs that will be addressed in the lesson. It appears there are lessons that address DCIs not indicated in any of the Background Knowledge sections. While it is expected that not all lessons will address a DCI, CCC, SEP, and have necessary background knowledge, it would be helpful to indicate that in the Getting Ready: Teacher Information boxes. For example, have a section for crosscutting concepts in each one of these information boxes, and if there is no focus on a crosscutting concept for a particular lesson simply state “none.”

Lessons often indicate opportunities to incorporate crosscutting concepts into the lessons in boxes to the right in the Teacher’s Guide. Different lessons, however, use different boxes with different titles to include this information. The same is true of formative assessment opportunities.

Overall, more assessments are necessary throughout the Bends. These include formative (both self and instructor) and summative assessments and should include assessments that ensure learning is occurring in all three dimensions. This unit is purposefully constructed, and as such, learning builds meaningfully over time. The identification of appropriate moments at which to check for individual student understanding should be identified and necessary assessments should be incorporated throughout the unit.

For each lesson, identifying elements of the Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas from the five performance expectations that this unit is building toward would be invaluable to educators and facilitate development toward mastery of those dimensions.

Educators may question what has come before in the high school learning progression. Are we to understand that this lesson could be taught anywhere in that progression?

This unit is expansive and may be overwhelming for some educators. Consider assisting the schools adopting this program by providing trainers who could provide them with an overview, orient them to the document's format, and how it aligned to the NGSS.

Notes:
The synopsis for Bend 1 in the Evolution Storyline document is actually the synopsis for Bend 2.

In the Evolution Storyline document outlining the lessons for each of the Bends, the NGSS performance expectation bundles are presented at the beginning of each Bend in a box in the top right corner. While this is wonderfully helpful, the system for identifying which performance expectations are in which Bends is a bit misleading and could use clarification. For example, in Bend 1, the note underneath the five performance expectations reads that "bolded PEs are targeted in this band (1) italicized PEs are targeted in Bend 2 & 3." This leads the reader to believe that the bolded performance expectations addressed in Bend 1 are not addressed in Bend 2 or 3, which the lesson indicates later is not the case.

Unit Rating Scale for Category I (Criteria A–F):

3: At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C
2: At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C
1: Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C
0: Inadequate (or no) evidence to meet any criteria in Category I (A–F)

***Unit* rating scale for Category II (Criteria A-G):**

3: At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria
2: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A
1: Adequate evidence for at least three criteria in the category
0: Adequate evidence for no more than two criteria in the category

Unit Rating scale for Category III (Criteria A–F):

3: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion
2: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A
1: Adequate evidence for at least three criteria in the category
0: Adequate evidence for no more than two criteria in the category

Overall Rating:

E: Example of high quality NGSS design—High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9)

E/I: Example of high quality NGSS design if Improved—Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7)

R: Revision needed—Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5)

N: Not ready to review—Not designed for the NGSS; does not meet criteria (total 0–2)