Biology Resource
Phenomenon: Disease Outbreak

3 Dimensional Science Learning Standard Connection driven by Phenomena

Science and Engineering Practices	Content	Crosscutting Concept
Develop and use models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others. **Construct explanations of phenomena** using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams. **Obtain and evaluate scientific information** to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of student experimental investigations.	**H.B.2B.1 Develop and use models to explain how specialized structures within cells (including the nucleus, chromosomes, cytoskeleton, endoplasmic reticulum, ribosomes and Golgi complex) interact to produce, modify, and transport proteins. Models should compare and contrast how prokaryotic cells meet the same life needs as eukaryotic cells without similar structures.** **H.B.2B.2 Collect and interpret descriptive data on cell structure to compare and contrast different types of cells (including prokaryotic versus eukaryotic, *and animal versus plant versus fungal-italics not covered in this learning sequence*).** **H.B.2B.3 Obtain information to contrast the structure of viruses with that of cells and to explain, in general, why viruses must use living cells to reproduce.**	**4. Systems and systems models: The National Research Council (2012) states that "Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p. 84). *Models could be created to show the structures inside of a prokaryotic and eukaryotic cell and what their functions are in relation to the cell.*** **6. Structure and Function: The National Research Council (2012) states that "The way in which an object or living thing is shaped and its substructure determine many of its properties and functions" (p. 84). *Each organelle has a function inside a Eukaryotic cell without that organelle functioning properly the cell is affected in some way.***

Resources and scaffold of learning	Standard Connection
Phase 1: Students journal their current thoughts, feelings, understandings, and wonders/questions about the disease about the coronavirus in a "Disease Outbreak Phenomena" journal or on a teacher selected platform if available (ex: google classroom). From this link https://www.sciencenews.org/snhs/guide/why-bat-viruses-are-so-dangerous, Scroll down and click on the second link titled: The path from outbreak to pandemic **Phase 2:** Students read, "We may be on the brink of a coronavirus pandemic. Here's what that means," originally published on the *Science News* website in late February, for the purpose of thinking about how the article affects their current perspective (their thoughts, feelings, understandings, and wonders/questions from above). Students engage with the text by making annotations on their journal entry where they cite from the text while showing how the text affirms, extends, and/or changes their thinking about the coronavirus. Note the PDF version of the article can possibly be uploaded in google classroom if available for students to annotate the above directly on the text. **Phase 3:** Students engage in a second read of the text: **The path from outbreak to pandemic** for the purpose of engaging in questions 1-5 listed via the link above. **Phase 4:** Students can connect with a classmate via google classroom, by phone, or work through next steps individually if needed. The student(s) will think through their past learning and needed extensions to their learning around the following 3 tasks. Links to resources and articles are provided to get students started in connecting to their background knowledge/extended research supports. *Students should consider their previous learning that organisms and their parts are made of cells. Cells are the structural units of life and have specialized substructures that carry out the essential functions of life. Viruses lack cellular organization and therefore cannot independently carry out all of the essential functions of life.* Task 1: Students should collect and interpret descriptive data and obtain information on cell structure to compare and contrast different types of cells (prokaryotic versus eukaryotic). Student(s) should note their interpretations of descriptive data and information in their journals or google classroom post if available. *https://www.khanacademy.org/test-prep/mcat/cells/viruses/a/are-viruses-dead-or-alive*	**Standard** H.B.2: The student will demonstrate the understanding that the essential functions of life take place within cells or systems of cells. **Conceptual Understanding** H.B.2B.: Organisms and their parts are made of cells. Cells are the structural units of life and have specialized substructures that carry out the essential functions of life. Viruses lack cellular organization and therefore cannot independently carry out all of the essential functions of life. **Performance Indicators:** Students who demonstrate this understanding can: H.B.2B.1 Develop and use models to explain how specialized structures within cells (including the nucleus, chromosomes, cytoskeleton, endoplasmic reticulum, ribosomes and Golgi complex) interact to produce, modify, and transport proteins. Models should compare and contrast how prokaryotic cells meet the same life needs as eukaryotic cells without similar structures.

https://www.khanacademy.org/science/high-school-biology/hs-cells/hs-prokaryotes-and-eukaryotes/v/prokaryotic-and-eukaryotic-cells *https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems/hs-the-immune-system/a/intro-to-viruses* Task 2: Student will develop (co-develop if partner is available) and use a model to explain how specialized structures within cells (including the nucleus, chromosomes, cytoskeleton, endoplasmic reticulum, ribosomes and Golgi complex) interact to produce, modify, and transport proteins. The model should compare and contrast how prokaryotic cells meet the same life needs as eukaryotic cells without similar structures. Student(s) should show their model and thinking in their journals or on google classroom if available. Task 3: Based on the information gathered (Task 1) and model constructed above (Task 2), the student(s) should contrast the structure of viruses (prokaryotic example) with that of human cells (eukaryotic example) to construct an explanation of why viruses must use living cells to reproduce. Students should share their constructed explanation in their journal or on google classroom if available. **Phase 5:** Independently or with partner above, have students link back to **The path from outbreak to pandemic** and work through the section titled, "Partner Work" and complete inquiry questions 1-3. Have student(s) share their paired response and work in their journal or on Google classroom if available. **Phase 6:** Students can connect and set up a time to engage further with other classmates who researched other diseases via google classroom, by phone, or work through next steps individually if needed. Independently or with larger group, have students link back to **The path from outbreak to pandemic** and engage in the last portion titled, "Class Discussion." Note in the resource that students are to first share their key points about their research with the larger group and it is suggested that time be allotted for other listening student(s) to share responses through the format of questions for clarity or interest in further warranted research based on questions. It is suggested that students break back into partners/individual work if needed before moving in question 1 (See Phase 7 below). **Phase 7:** Prior to student's time to engage in a larger discussion over question 1 in the last portion titled, "Class Discussion", the partner groups should read the article linked in question 1. The article is	H.B.2B.2 Collect and interpret descriptive data on cell structure to compare and contrast different types of cells (including prokaryotic versus eukaryotic, and animal versus plant versus fungal). H.B.2B.3 Obtain information to contrast the structure of viruses with that of cells and to explain, in general, why viruses must use living cells to reproduce. Science and Engineering Practice support can found in the Science and Engineering Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf). It is important we realize that the nine science and engineering practices are not intended to be used in isolation. Even if a performance indicator for a given standard only lists one of the practices as a performance expectation, scientists and engineers do not use these practices in isolation, but rather as part of an overall sequence of practice. When students engage in learning, it is important that they see how a given

written by researchers at the University College London and London School of Hygiene and Tropical Medicine. The researchers note that the frequency of reported infectious disease outbreaks has increased in the past three decades and is predicted to continue increasing in the future. Read and discuss/note with your partner/independently if needed the following questions: What factors might be contributing to the increase in the number of outbreaks reported? Does an increase in the number of reported outbreaks necessarily mean that there are more outbreaks? Talk through your thinking with your partner and note key points/understandings you want to share with the larger group and possible clarifying questions about the text. **Phase 8:** Engage in a larger group discussion over your understandings to question 1 in the last portion titled, "Class Discussion" and share your key points and any questions about the text you have with the larger group. Then discussion can then move into question 2 in the last portion titled, "Class Discussion." **Phase 9:** Students should return to their journal or independent google classroom post and share their responses to the following 4 questions: 1. Who (audience) would you want to know more about the coronavirus and why? 2. What would you share and how would you share your thinking? 3. What is your intended outcome in informing others (your audience)? 4. Do the questions and wonders shared overtime (by you as an individual, shared during partner work, discussed in larger group discussions) lead you to gather more information through research? What are those questions and wonders and why are they important to you?	performance expectation fits into the broader context of the other science and engineering practices. In addition to the explicitly noted SEP connections of developing and using models, obtaining, evaluating and communicating information, and constructing explanations found directly in this learning, other SEPS are used by students including asking questions, analyzing and interpreting data, constructing and analyzing scientific arguments. *Cross Cutting Concepts support can be found in Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012) (http://www.nap.edu/read/13165/chapter/8)

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