

Viral Variants

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AMGEN® Biotech Experience

Scientific Discovery for the Classroom

The curriculum projects designed by the 2020–21 ABE Master Teacher Fellows are a compilation of curricula and materials that are aligned with the Amgen Biotech Experience (ABE) and prepare students further in their biotechnology education. These projects were created over the course of a 1-year Fellowship in an area of each Fellow’s own interest. Each is unique and can be adapted to fit the needs of your individual classroom. Objectives and goals are provided, along with expected outcomes. Projects can be used in conjunction with your current ABE curriculum or as an extension.

As a condition of the Fellowship, these classroom resources may be downloaded and used by other teachers for free. The projects are not edited or revised by the ABE Program Office (for content, clarity, or language) except to ensure safety protocols have been clearly included where appropriate. We are grateful to the ABE Master Teacher Fellows for sharing their work with the ABE community.

If you have questions about any of the curriculum pieces, please reach out to us at ABEInfo@edc.org. We will be happy to connect you with the author and provide any assistance needed.

AMGEN BIOTECH EXPERIENCE

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PBL: Viral Variants

Length: 8–10 class sessions

Link to PPT: <https://bit.ly/PBLViralVariantsPPT>

What Will Students Do?

For the culminating project-based learning (PBL) activity, students will work as a CDC team to determine the origins of a viral strain that is resistant to treatment.

Overview



This lesson accesses and reinforces prior knowledge about microorganisms, includes a piece of history that celebrates the contribution of underrepresented minorities to the fields of medicine and science, allows students to create their own designer microbes, guides students through the process of vaccine development, and culminates with a PBL activity that asks students to explore mutated viral variants.



Lessons & Activities

Lesson 1: Bacteria vs. Viruses. Activating and reinforcing prior knowledge about microorganisms with an emphasis on the comparison between viruses and bacteria. Choose a video to introduce this topic, create common language, access prior knowledge, and provide a spring board for academic conversation. For this I chose Ed Puzzle, which allows for teacher-developed checking for understanding questions to be embedded into the platform: <https://edpuzzle.com/media/5f4fbc7e53f75f3f396a2361> (*Time commitment = 2–3 class sessions*)





**The resource column contains blank copies of the examples. All documents are set to “Anyone can view.” You will need to make a copy to modify them to your class needs.*

Activity	Resources	Examples
<p>Celebrate Your Journey Grounding Activity. This activity can be used with middle school or high school. This getting-to-know-you activity includes skills related to the use of Google slides. Students create their slides individually with the expectation that they will share out to the whole group after the allotted time.</p>	 https://bit.ly/AMGENCelebrateYourJourneyActivity	 http://bit.ly/MiddleSchoolGroundingActivity

Activity	Resources	Examples
<p>This activity is a virtual group activity done in groups of 3 or 4. It also includes skills related to incorporation of audio into student Google slides. Teachers can incorporate changing the color of their slides to the teacher-designated color to indicate completion. A group-roles checklist is included on each slide.</p>	 <p>https://bit.ly/AMGENBiodigitalSayMeanMatter</p>	 <p>http://bit.ly/BiodigitalSayMeanMatter</p>

Lesson 2: A Bit of History. In the lesson, we celebrate the contribution of underrepresented minorities to the fields of medicine and science. This lesson highlights the contribution of Dr. Charles R. Drew. **(Time commitment = 1 class session)**

**The resource column contains blank copies of the examples. All documents are set to “Anyone can view.” You will need to make a copy to modify them to your class needs.*

Activity	Resources	Examples
<p>Class Photo! This activity can be used with MS or HS. This getting-to-know-you activity includes skills related to the use of Google slides, including inserting photos and audio. Students work on one slide to create a virtual class photo, with the expectation that they will share out to the whole group after the allotted time.</p>	 <p>https://bit.ly/AMGENClassPhotoActivity</p>	 <p>http://bit.ly/MSClassPhoto</p>



Lesson 3: Rate Review. The objective is to have students apply their understanding of rates to population growth. If students are in middle school, focus on the trend lines (population increasing, decreasing, or staying the same). If students are in high school, use this opportunity to teach them how to use Google Sheets to create graphs that represent exponential, logistical growth and population carrying capacity. (Students later apply this to their fictitious microbes.) **(Time commitment = 1 class session)**


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Activity	Resources	Examples
<p>Rate Review This activity can be used with MS or HS. This short activity will help you to determine how much support your students need for calculating rates. Students can work in pairs to complete the rate review practice.</p>	 <p>https://bit.ly/AMGENRateReview</p>	 <p>http://bit.ly/MSRateReviewPractice</p>

Lesson 4: Microbe Fact Sheet Project. Students design a fictitious microbe (virus/bacteria) and create a fact sheet to describe its features, mode of transmission, and how someone can protect themselves from their fictitious microbe. *(Time commitment = 2 class sessions)*

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Activity	Resources	Examples
<p>Google Planning Sheet. This is a great way to help students plan out their project; it also gives you insight to student understanding. Use the scroll bar at the bottom to see all categories.</p>	<p>Blank Middle School Planning Sheet: https://bit.ly/AMGENBlankMSPlanningSheet</p> <p>Blank High School Planning Sheet: https://bit.ly/AMGENHSPlanningSheet</p>	<p>Middle School Example: https://bit.ly/MSPlanningSheet</p> <p>High School Example: https://bit.ly/HSPlanningSheet</p>
<p>Microbe Fact Sheet Project. This activity is a virtual individual activity that asks students to use the knowledge they’ve obtained throughout the lesson to create a fictitious microbe and describe its features, mode of transmission,</p>	<p>Middle School Google Slides Template</p>  <p>https://bit.ly/AMGENMicrobeFactSheet</p>	<p>Middle School:</p>  <p>https://bit.ly/MSMicrobeFactSheetExample</p>

<p>and how someone can protect themselves from their microbe.</p>	<p style="text-align: center;">High School Jamboard Template</p> <div style="text-align: center;">  </div> <p style="text-align: center;">https://bit.ly/HSJamBoardTemplate</p>	<p style="text-align: center;"><i>High School: This example was created using Jamboard</i></p> <div style="text-align: center;">  </div> <p style="text-align: center;">https://bit.ly/HSFactShetExampleJamboard</p>
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Lesson 5: Vaccine Development. Students learn the steps involved in vaccine development and the many checks and balances in place before a drug is brought to market. *(Time commitment = 1 class session)*

Accessing Prior Knowledge. Have students recreate the following chart and complete the first column only for the beginning of class.

What you already know about vaccine development	What you learned from the Jig Saw activity about vaccine development	What questions do you still have about vaccine development?
	X	X

Students participate in a video jigsaw using the videos below. Students capture the key points from their video on a Google slide (see below for one possibility). When all groups are done, have them share out to the class.

Source	Link	Possible Google Template & Student Example
Group 1: Vaccine Development (PBS)	https://www.youtube.com/watch?v=-92HQA0Gcl8	 https://bit.ly/VaccineDevelopmentJigSaw
Group 2: History of Vaccines (NBC)	https://www.youtube.com/watch?v=6iRatByNwO8	
Group 3: RNA Vaccines Explained (Vox)	https://www.youtube.com/watch?v=mvA9gs5gxNY	
Group 4: Pfizer – BioNTech Vaccine Development (60 Minutes)	https://www.youtube.com/watch?v=AM3gSgvN2Fw	
Group 5: Our Government and the Vaccine Development Process (CDC)	https://www.youtube.com/watch?v=Z06JQhyZLUl	

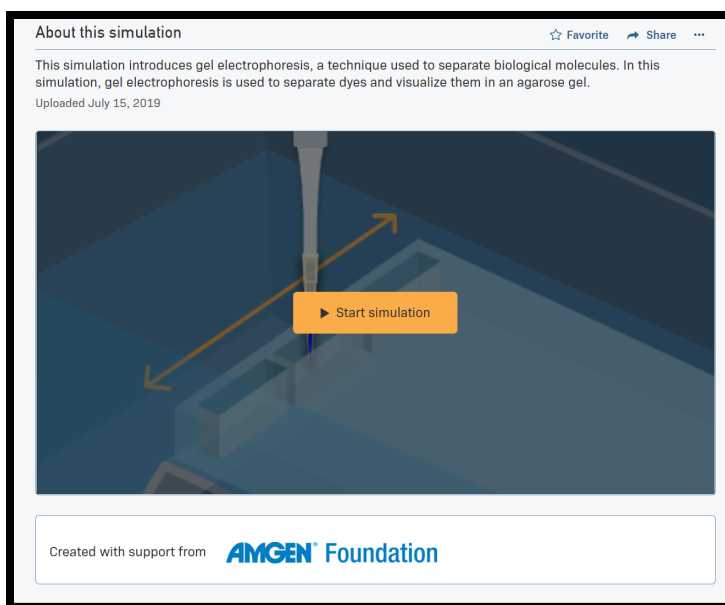
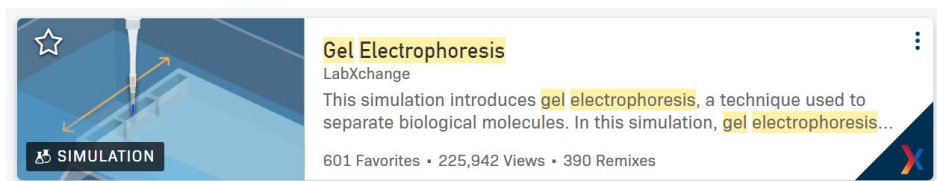
Lastly, students complete the last two columns of their charts. This will be their exit slip for the lesson.

What you already know about vaccine development	What you learned from the Jig Saw activity about vaccine development	What questions do you still have about vaccine development?
X		

Lesson 6. Amgen Lab 1 Viral Variants Edition. Students learn basic biotechnology skills, such as how to use a pipette, how to load a gel, how to run a gel, and how to read and interpret a gel. These skills are

be applied to solve the PBL mystery of viral variants. (*Hands-on or Virtual Time commitment = 1–2 class sessions/Hands-on AND Virtual Time commitment = 3–4 class sessions*)

Amgen Lab 1 Virtual Simulation



Resource	Link
Activity Write-Up & Simulation Guide	https://bit.ly/ActivityWriteUpNSimulationGuide

PBL Viral Variants Edition

Use this video to introduce the topic of viral variants: Viral Variants (*60 Minutes*)

<https://www.youtube.com/watch?v=FOK-yvXCcGo>

Introduce students to the PBL scenario. **Divide them into groups of 4, and give each group one of the U.S. strains and the three international ones.**

PBL Scenario: You work for the CDC. Your team has been tracking and monitoring the evolution of COVID in America. Your team has received recent reports of strains that are not responding to treatment and an increase in cases in select cities.

You have requested samples of these strains in order to determine their origins.

You received samples from New York, Florida, Texas, and California. You plan on comparing these strains to the local strains as well as strains from Puerto Rico, The Netherlands, and Italy, where they have seen similar symptoms and resistance to treatment. This will help us to determine if one of the viral variants is responsible.

- For this scenario, use ABE Lab 1. Decide which states and/or countries you'd like to match.
- Create different groups to study different strains.
- Have lab presentations so that students can hear about different strains.
- Students develop a conclusion based on their findings and the findings of all other groups.

If an ABE kit is not available, the University of Arizona has a similar write-up using food coloring:

https://bioprep.community.uaf.edu/wp-content/uploads/sites/339/2013/07/Foodcolor_Electrophoresis_teacher.pdf

NGSS Standards:

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. *[Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.]* *[Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]*

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. *[Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.]* *[Assessment Boundary: Assessment is limited to provided data.]*