Louisiana Believes

Distance Learning Support for inquiryHub Biology

Unit 2 Bend 2: CRISPR – How can science make our lives better?

This resource is designed to support teachers in implementing distance learning for inquiryHub Biology Unit 2 Bend 2. It is intended as a supporting document and should be used in conjunction with the Inquiry Hub High School Biology Curriculum Resources. The resources contained in this document have been adapted from inquiryHub Biology with permission under Creative Commons 4.0 licensing.

The Remote Learning Resources linked below contain detailed information about adapting specific routines to a remote learning environment and a wide variety of options including those for students who do not have internet access:

- Fostering Productive Norms
- Anchor Phenomenon Routine
- Navigation Routine
- Supporting Discourse
- Problematizing Routine

This guidance document is considered a "living" document as we believe that teachers and other educators will find ways to improve the document as they use it. Please send feedback to STEM@la.gov so that we may use your input when updating this guide.

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DEPARTMENT of EDUCATION
Louisiana Believes

Norming Language	
Term	**Description**
Virtual Class Pre-Work	Assignments that students should do prior to virtual class meetings in order to be prepared to engage in discussions, there may be multiple assignments throughout a given lesson
Virtual Class Post-Work	Assignments designed for students to apply learning from virtual class meetings, there may be multiple assignments throughout a given lesson
Virtual Class	Live sessions with students through any digital conferencing platform, teachers may choose to allow students without internet to call in during these sessions and record virtual class sessions to share with those who cannot join. Sample Virtual Class Norms
Lesson Slideshows	Lesson progression specific to each lesson that can be shared with students in their entirety at the beginning of the lesson or broken into small portions and shared as needed. They will contain assignments for students to complete before, during, and after virtual classes, discussion boards, and home investigations. They are intended to replace the SAS documents from iHUB. These can be copied and delivered directly to students using google classroom or another platform, modified for use in your platform of choice, or printed and delivered to students without internet access.
Assignment	An assignment should be posted on a virtual platform (Google Classroom, Schoology) that can be accessed and edited by students. Assignments should have the option to “make a copy” for each student so that students can individually complete work and turn in that individual work to the teacher for review, feedback, and assessment.
Discussion Boards	Assignments designed for students to share ideas and engage in discussion with one another over time rather than a live environment. Students should use documents from individual work to plan their public discussion. Usually students will post some original comments into a group discussion and respond to a specified number of others. Ensure that norms are established for appropriate posting behavior, just like you would set norms for your classroom discussion. Teachers may choose to allow students without internet access to text in responses and may screenshot/download and share portions of or full discussions via text (ex. through apps like Remind)
Home Investigations	Investigations with readily available materials designed for students to perform at home; teachers may choose to substitute videos or photos of data collection for students who cannot complete investigations at home

Unit 1 Bend 1	
Resources Students Will Need	**Additional Materials for Students Without Internet Access**
Lesson Slideshows for each lesson: Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15 **Additional Materials Lesson 10:** • 10.1 The Biotech death of Jesse Gelsinger • 10.2 The Eugenics Movement • 10.3 The Ashanti DeSilva case • 10.4 DTC (Direct to Consumer) genetic testing • 10.5 Gene therapy against brain cancer • 10.6 Making insulin • 10.7 Amniocentesis • Notes Template & A copy of this google form **Additional Materials Lesson 11:** • Lesson 11 form **Additional Materials Lesson 12:** • Combined Reading and SAS Questions **Additional Materials Lesson 14:** • Case Study Template • Proposal Evaluation Template • Evaluation Form • Optional articles - links within lesson **Optional Alternate Delivery for Lesson 15:** • Form Assessment • Doc form Assessment	**Prior to Lessons** (videos and documents): ***Print Copies of All Slideshows and SEETs*** • L 10 Principle-Based Ethics Video, TedEd Video, Student reading from Science • L 11 Science article • L12 Alternate Article and SAS o Videos: Doudna TED Talk, What is CRISPR?, Genetic Engineering Will Change Everything Forever-CRISPR, Bozeman Science: What is CRISPR • L13 Print out of BBC Article o Print Copy of Infographic • L14: 3 articles per student o Wired Article: A Crispr calf is born. It's definitely a boy. o Wired Article: A more Humane Livestock Industry, Brought to You by Crispr o Science News Article: With a litter of tactics, scientists work to tame cat allergies o Science News Article: CRISPR-edited immune cells for fighting cancer passed a safety test o Science News Article: The first U.S. trials in people put CRISPR to the test in 2019 o SingularityHub Article: A Year After Gene Therapy, Boys With Muscular Dystrophy Are Healthier and Stronger o NPR Article: A Boy with Muscular Dystrophy Was Headed For A Wheelchair. Then Gene Therapy Arrived o Healthline Article: First Person Treated for Sickle Cell Disease Using CRISPR Is Doing Well o Genetic and Society Article: Russia's CRISPR "Deaf Babies": The Next Genome Editing Frontier o Genetics and Society Article: Why Deaf People Oppose Using Gene Editing to "Cure" Deafness **After Lesson Completion:** Recordings of Virtual Classes, Results of collaborations

Students should plan to join Virtual Class meetings for the following lessons: 10, 11, 13
Formative and Summative Assessment Opportunities: Lesson Slideshows can be used for formative assessment in all lessons Lesson 10: Google Form (GMO Video) and Note Template Lesson 11: Google Form (Understandings after Discussion) Lesson 12: Combined Reading and SAS Questions Lesson 13: Consensus Building Discussion in Virtual Class Lesson 14: Proposal Evaluation and Evaluation Form Lesson 15: What have we found out about CRISPR so far? Assessment

Lesson List

Lesson 10 - Can genetic disorders be cured?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- Lesson Slideshow
- Readings - 1 per student
    - 10.1 The Biotech death of Jesse Gelsinger
    - 10.2 The Eugenics Movement
    - 10.3 The Ashanti DeSilva case
    - 10.4 DTC (Direct to Consumer) genetic testing
    - 10.5 Gene therapy against brain cancer
    - 10.6 Making insulin
    - 10.7 Amniocentesis
- Notes Template
- A copy of this google form

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- Lesson Slideshow
- Principle-Based Ethics Video
- TedEd Video from Slide 19 if students are unable to attend Virtual Class and are completing the slides independently
- Student reading from Science
- One of the readings above
- Notes Template
- Virtual Class recording - *after completion of virtual class, or prepare a video to support students in completing the slides independently*

This lesson is slotted for 125 minutes in the iHub guidance. Differentiated instruction should be added to assist struggling readers.

Lesson 10 - Can genetic disorders be cured?

Lesson Components	Distance Learning Plan	
	Teacher	**Student**
VIRTUAL CLASS PREWORK (Slides 1-13) Parts 1-3 (part of 4)	1. Make a copy of this google form and insert it into your slideshow on Slide 12. 2. Adjust Slide 4 as needed. (see speaker notes) 3. Assign "copy for each student" Lesson Slideshow. 4. Assign one Article and Notes template to each student.	1. Complete Slides 1-13 2. Read Article. 3. Take notes. 4. Complete Google Form.
VIRTUAL CLASS (Slides: 14-18) Part 4-5	1. Facilitate Building Understandings Discussion on GETs from readings and ethics. 2. Watch 2 minutes of Ted-Ed video. If time permits, discuss the need for discussion skills in today's world. Use discussion strategies detailed in part 4 of the iHub lesson. (2 videos are shown in the pre-work form). 3. Explain Discussion Board Assignment (teacher choice whether to include "World Cafe" ideas or just use general discussion board).	
VIRTUAL CLASS POST-WORK DISCUSSION BOARD (Slides: 19-20) Part 6	1. Post Discussion Questions (Part 6) to your discussion board. a. "What did the article discuss? What was the topic?" b. "What ethical questions does this technology raise? Justify your answers with principle-based ethical reasoning." c. "How does CRISPR compare to the other technologies we learned about earlier in this lesson?"	1. Read Student reading from Science. 2. Engage in the discussion board.

	2. Guide postwork discussion board as needed (may need to modify directions on slide 21 based on your discussion board platform). 3. Assess slides, form, and discussion.	

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Lesson 11 - What evidence do scientists have that CRISPR works?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- Lesson Slideshow
- Copy of Lesson 11 form

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- Lesson Slideshow
- Science article
- Print version of Lesson 11 form
- Virtual Class recording - *after completion of virtual class, or prepare a video to support students in completing the slides independently*

Lesson 11 - What evidence do scientists have that CRISPR works?

Lesson Components	Distance Learning Plan	
	Teacher	**Student**
VIRTUAL CLASS PREWORK (Slides: 1-7) Part 1,2	1. Assign slideshow or student copy of Science article . 2. Be available (office hours or on-line chat room) to help with this reading. 3. If not using the slides, provide a Jamboard or shared space to track new vocabulary.	1. Read the article. 2. Keep track of the words that need to be defined.
VIRTUAL CLASS (Slides: 8-9) Part 2-3	1. Visit student generated word lists - define and discuss terms. 2. Hold a building understandings discussion to make sense of the Journal article (be sure to include the 5 questions from the slides/SAS. 3. Ask students what they need to know now.	
VIRTUAL CLASS POST-WORK Wrap Up/Exit Ticket (Slides: 10-11) Part 4	1. Distribute your copy of the Lesson 11 form. 2. Provide feedback as needed.	1. Complete 5 questions based on discussion and/or reading. 2. Turn in work.

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Lesson 12 - Where did CRISPR come from and how does it work?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- Lesson Slideshow
- Combined Reading and SAS Questions

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- Lesson Slideshow
- Alternate Article and SAS
- Videos:
    - Doudna TED Talk
    - What is CRISPR?
    - Genetic Engineering Will Change Everything Forever-CRISPR
    - Bozeman Science: What is CRISPR

Lesson 12 - Where did CRISPR come from and how does it work?

Lesson Components	Distance Learning Plan	
	Teacher	**Student**
VIRTUAL CLASS PRE-WORK (Slides: 1-11) Parts 1-6, alt 7	1. Assign the Lesson Slideshow and Combined Reading and SAS Questions via your chosen platform. 2. Collect assignments and give feedback as needed. 3. Collect and compile students' responses to create a document with anonymous work samples - add to next lesson prework.	1. Complete the slideshow and Combined Reading and SAS Questions

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Lesson 13 - What are the ethical considerations of using this technology?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- Lesson Slideshow

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- Lesson Slideshow
- Print out of BBC Article
- Video: Doudna TED Talk
- Print Copy of Infographic
- Virtual Class recording - *after completion of virtual class, or prepare a video to support students in completing the slides independently*

Lesson 13 - What are the ethical considerations of using this technology?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (Slides: 1-10) Parts 1-4	1. Add link (to slide 4) for students to view anonymized student summaries from L12. 2. Add link to Jamboard or shared workspace to slide 13 (option - share link during class in chat). 3. Assign Lesson Slideshow.	1. Pull common ideas from classmate's summaries. 2. Read the article and complete the venn diagram. 3. Watch Doudna video and generate ideas about rules for this tech.
VIRTUAL CLASS (Slides:11-15) Part 1, 4, 5	1. Hold Consensus building discussions using the teacher guide from iHUB. Students should figure out: • How CRISPR genes are passed down through generations • Types of cells that CRISPR Cas system can work on, specifically the difference between somatic and gametic cells 2. Discuss Infographic to learn: • the current ethical criteria being used to govern the use of CRISPR Cas9 in humans. • Compare these criteria to student generated ideas	

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Lesson 14 - What are some current uses of CRISPR?

note This lesson involves a unique event requiring an atypical lesson format. The WORLD CAFE event will be placed within the "postwork" section of the lesson. If time constraints are an issue, you could move this project to post end-of-course exam. **

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- Lesson Slideshow
- Case Study Template
- Proposal Evaluation Template - to be edited and assigned as a shared document
- Evaluation Form
- If you are assigning articles, suggestions are provided below

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- Lesson Slideshow
- Case Study Template
- Proposal Evaluation Template - to be edited and assigned as a shared document
- Evaluation Form
- Print copies of CRISPR news article(s) - Suggestions provided below
    - Wired Article: A Crispr calf is born. It's definitely a boy.
    - Wired Article: A more Humane Livestock Industry, Brought to You by Crispr
    - Science News Article: With a litter of tactics, scientists work to tame cat allergies
    - Science News Article: CRISPR-edited immune cells for fighting cancer passed a safety test
    - Science News Article: The first U.S. trials in people put CRISPR to the test in 2019
    - SingularityHub Article: A Year After Gene Therapy, Boys With Muscular Dystrophy Are Healthier and Stronger
    - NPR Article: A Boy with Muscular Dystrophy Was Headed For A Wheelchair. Then Gene Therapy Arrived
    - Healthline Article: First Person Treated for Sickle Cell Disease Using CRISPR Is Doing Well
    - Genetic and Society Article: Russia's CRISPR "Deaf Babies": The Next Genome Editing Frontier
    - Genetics and Society Article: Why Deaf People Oppose Using Gene Editing to "Cure" Deafness
- Print copy of 3 assigned student proposals

Lesson 14 - What are some current uses of CRISPR?

Lesson Components	Distance Learning Plan	
	Teacher	Student
PREWORK Part 1-3	1. Use iHUB World Cafe planner to decide how to implement this project a. Community Night (virtual or live) where students present b. Present to School board or select invited members c. Team up with another teacher to present ideas virtually to another class d. Present to invited scientist e. Create slides or infographic 2. Allow students to choose their proposal topic (additional more recent news articles are suggested above) 3. Share Lesson Slideshow.	1. Choose topic. 2. Research. 3. Write and turn in proposal.
ASSIGNMENT Part 4	1. Deliver anonymized proposals as a shared document to students along with evaluation rubric. Ensure each proposal has at least 3 evaluators. Make your copy and assign Evaluation Form. 2. Use response results from evaluation form to determine the "best" proposals (# to be determined depending on chosen event) (teacher can also evaluate proposals as a summative assessment for this Bend)	1. Use form to evaluate proposals. 2. Practice for Event: students who did not write winning proposals can team up with "winners" to improve presentation using individual strengths such as public speaking, video production, graphic design, etc.)

POST-WORK EVENT	1. Setup and hold Event - the event does not need to be held before Lesson 15 Thank donors and attendees formally (assign this task to student groups)	1. Participate in Event 2. Thank donors and or attendees

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Lesson 15 - What have we found out about CRISPR so far?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- Choose one of the assessment formats
  - Lesson Slideshow
  - Form Assessment
  - Doc form Assessment

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- Print or off-line copy of either assessment version

Lesson 15 - What have we found out about CRISPR so far?

Lesson Components	Distance Learning Plan	
	Teacher	**Student**
POSTWORK (Slides: 1-15) ASSESSMENT	1. Assign Lesson Slideshow, Form Assessment, or Doc form Assessment. *You may want to edit the slides with Nearpod or Pear deck to allow for ease of grading and data collection*	1. Complete Assessment as assigned.

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