Scaffolded Final Project – Biotechnology (AGRI 115)

The final project in AGRI 115 was scaffolded into five smaller assignments that culminated in a final product for the online course. Below are the pages available to students to learn about (and complete) their fully online final project and the scaffolded work leading into the final project. You are encouraged to explore the student pages in the dropdown menus below and take note of the following features:

* The five smaller assignments are the “scaffolded” assignments. They are worth fewer points than the final project itself because intent is to give students a non-threatening opportunity to try skills for the first time ever – from creating citations to making a video using VidGrid to articulating science information. Take note of how many of the requirements have links to information about the task (for instance, there are links to wrapping text around image, captioning images, and similar tasks that aren’t taught in class, but are still expected skills).
* Each assignment contains a rubric. The rubric on the scaffolded assignments provides students with formative feedback (where “formative” means that it is actionable feedback that the students can use to improve their skills and target their learning/efforts on components that they most need to work on). The rubric on the final project is summative meaning that the rubric is for assessment of their skill & knowledge levels at the completion of the course. In this particular course, the rubric contained criteria that aligned with course learning objectives.
* The directions are very thorough. In part, it is because this course was an online course, but the intent was to clarify expectations to students. The assignment directions and the grading rubrics were intended to be well aligned.

# Project Instructions - Big Picture Overview

There are problems and things we can improve all around us. Your task in your final project is to:

* document a problem in food production, the environment, human health, etc.
* create justification for why it is important to solve the problem
* use classical biotechnology, modern biotechnology, and molecular diagnostics on an organism (or organisms) to address/solve your problem
  + propose whether the classical biotechnology or modern biotechnology solution is a better mode to address your problem based on data-based information on stakeholder acceptance of similar projects/solutions

The best types of problems to choose for this project include those that:

* + Have a negative impact a group of stakeholders (producers and consumers, the public, etc.) that you can find numbers/statistics for
  + Have not yet been solved in the ways that you hope to solve it
  + You can readily think of ways to apply classical biotechnology (fermentation, classical breeding, or making medication from medicines) and modern biotechnology (gene discovery, genomics, GMOs, gene editing, designer vaccines, etc.) to solve the problem
  + You can readily think of a way to use DNA detection or protein detection to help either understand/document the problem or to come to a solution
  + Watch this video from McKinzie (former instructor) on [what kind of problem is good for this project](https://use.vg/6PGjfX).

Examples:

* **Problem:** People are dying from west nile (which you would document with numbers).   
  **Classical biotechnology solution:** You want to create a breeding program to create a population of west nile resistant mosquitoes.  **Modern biotechnology solution:** you'd like to create a designer vaccine to help people build immunity to west nile  
  **Molecular diagnostics role:** you want to use genetic testing to track the effectiveness of your vaccine
* **Problem:**There is eutrophication of lakes happening due to agricultural runoff (which you would document with numbers).  
  **Classical biotechnology solution:**You find a soil bacteria that can digest the nutrients that are flowing into the lakes and you breed those soil bacterium to work more quickly than they do naturally. You reintroduce them to the spaces around lakes to help prevent the entry of nutrients to the lake.   
  **Modern biotechnology solution:** You can genetically engineer bacteria that make use of a gene from another organism that breaks down nutrients faster/better than normal soil bacteria do.
* **Problem**: Goats and sheep are dying from scrapie.  
  **Classical biotechnology solution:**The [USDA already found a potential solution](https://tellus.ars.usda.gov/stories/articles/wiping-out-scrapie-in-goats-the-genetic-way/?utm_medium=email&utm_source=govdelivery) through selective breeding for 3 genes.  
  **Modern biotechnology solution**: use genetic engineering to create a virus that can infect and treat goats & sheep for scrapie. This virus needs to be able to infect brain tissue and the virus would have to carry a gene that can identify and destroy mutated prions.
* **Problem**: World hunger. Your "problem" in this situation is essentially that production for a specific type of plant too low and needs increased. You **need** to pick a specific crop to improve.  
  **Classical biotechnology solution:**Pick one crop (like soybeans, corn, rice, black beans, etc.) that you think can help solve the world hunger situation. You will need to breed that one crop to either produce more or better food to help solve world hunger.   
  **Modern biotechnology solution**: use genetic engineering to help your chosen crop to either produce more or better food to help solve world hunger.

**Project Components**

This project is broken into several assignments.  This will guide you toward your final project which will incorporate all the individual assignments into one comprehensive summary of how you can solve a problem using biotechnology.

15 points - Final Project - Part 1 - Identifying the problem

15 points - Final Project - Part 2 - Classical Biotechnology Approach

15 points – Final Project - Part 3 - Modern Biotechnology Approach

15 points - Final Project - Part 4 - Diagnostic Techniques

40 points - Final Project - Part 5 - Feedback through Peer-Review  (\*NOT a part of the assignment\*)

100 points - Final Project - Part 6 - Presenting your Solutions

= 200 points total (minus 40 points with eliminating Part 5) = **160 total points**

**Overall Requirements**

Your project will include the following:

* 1. **Convincing documentation of the problem.** This includes:
     1. A **description**of the problem.
     2. **Resources** that help **document the issue** (i.e. numbers that document the negative impacts of the problem).
     3. What you anticipate is the value of solving the problem (think about things like revenue, improved human health, better quality of life, healthier ecosystems, etc.).
  2. Provide **details about the classical biotechnology** approach to solving the problem including:
     + Detailed **steps** for how you will modify an organism or improve the use of an organism to solve your problem.
     + A **timeline** for the project that takes the reproductive biology of your organism into consideration.
     + Clear ideas for how the end product of your project will **solve the problem.**
     + Clear ideas about the value of a classical biotechnology solution compared to a modern biotechnology solution. What does your classical biotechnology solution offer to stakeholders that your modern biotechnology solution does not provide?
     + A **graphic**that outlines the steps of the classical biotechnology process for your organism to solve your problem.
  3. Provide **details about the genetic engineering** project including:
     + Detailed **steps** for how scientists in laboratories will create the product that will solve your problem.
     + A **timeline** for the project that includes all the steps of genetic engineering, vaccine design, or gene editing that you are using to solve your problem.
     + **What methods** scientists will use to complete transformation of your organism and ***why***those methods are better than other methods.
     + Clear ideas for how your project will **solve the problem.**
     + Clear ideas about the value of a genetic engineering solution compared to a classical biotechnology solution. What does your genetic engineering solution offer to stakeholders that your classical biotechnology solution does not provide? Use **resource-backed** information to indicate whether you think stakeholders will have an interest in a product that has been modified through modern biotechnology.
     + A **graphic** that outlines the steps of the modern biotechnology process for your organism to solve your problem.
  4. Identify and explain a **diagnostic test** that can help you address your chosen problem. For instance, the diagnostic test can help document the problem or can help with verifying your classical or modern biotechnology methods are helping you address the problem.
     + You must include a **graphic** that depicts what **parts of your organism** you can **meaningfully test**.

**Choose your formatting**

**Written Formatting**

* **File type submitted -**.docx, .doc, .pdf
* **Length -** 3 - 4 single-spaced pages. The margins should be no greater than 1 inch and text should be size 11 or 12 font. The length requirement does not include headings. Images should not be unreasonably large given the content. Any obvious signs of circumventing the length requirements through excessive text size or spacing between content will result in a loss of points for formatting.
* **Text-based resource use -**In-text and full citations are provided in APA.
* **Image-based resource use -**Images contain succinct captions/typed information to describe what is important about the image. The source of the image is credited within the caption. The captions have a label (figure 1, figure 2, etc.) and are referenced within the text.

### Video Formatting

* **Screencast video -**Videos must be recorded in VidGrid (Academic Video) or with another screencast program. PowerPoint files with audio are not acceptable.
* **Length -**The presentation should be only a couple minutes long for this assignment. The final project videos are usually 10 - 15 minutes long.
* **PowerPoint slide style -** The use of bullet points should be minimal (or non-existent). The PowerPoint should be image-based as best as possible. The heading for the slides should be a sentence. See examples of this format and read more about the science that supports this style in the article:  
  ["A case for sentence headlines and visual evidence"](http://libproxy.unl.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ufh&AN=18798074&site=ehost-live)
* **Text-based resource use -**In-text and full citations are provided in APA.
* **Image-based resource use -**Images contain succinct captions/typed information to describe what is important about the image. The source of the image is layered on top of or just below the image.

### How to create a screencast presentation (if you are not writing)

Before creating your slides, skim the [this research article](http://writing.engr.psu.edu/2005_alley_neeley.pdf) for the slide formatting requirements for effective slide design.  Summary - You will be required to: 1) Use sentence statement headlines and 2) Use carefully chosen images rather than bulleted lists.

* 1. Go to <https://app.vidgrid.com/login>
  2. Click the blue '**Enterprise Login**' button near the bottom of the page.  Login with your **UNL credentials**. This means you should use your @huskers.unl.edu e-mail.  The website is looking for the "UNL" portion of the e-mail address so that it knows where to direct you.
  3. **Download the software** (Once you've logged in, click the red "Record" button and it will prompt you to download the software.)
  4. Open the program and **record your presentation**.  VidGrid will record your screen and audio.  It might be good to start with a test run.
  5. There is no specific length requirement, but please only make it as long as you need.  5 minutes should be plenty long.  Please do not exceed 10 minutes.

### Directions for getting the video link to submit your video:

* 1. Login to your [VidGrid account](https://app.vidgrid.com/login" \t "_blank)
  2. Find the thumbnail for your video and hover over it
  3. Click the 3 dots in the top right of your video thumbnail to expand the menu. Click the 'Copy link' button
  4. Paste your link into the assignment in Canvas and submit

# Solving a Problem with Biotechnology – Part 1 (Identifying the problem and organism(s))

For this assignment, you will identify a problem you are passionate about solving and can solve with biotechnology. This is the first of several assignments that help you complete your final project. I encourage you to read the overview of the final project as you choose your project topic, which you will stick with the whole semester. A fundamental part of the definition for biotechnology is that you use technology to make use of biological functions to solve problems. As such, you will solve a problem by using technology centered around the biology of organisms to solve your problems. When you look for ways to solve the problem, you may come to the conclusion that you can change just one organism (i.e. one species) or you may find that it's most helpful to change one organism for one part of your project and another organism (i.e. a species) for another part of your project in order to solve the problem through classical biotechnology and later through modern biotechnology.

As you pick your problem and organism(s), keep in mind that later you will propose 3 methods for genetic-level improvements:

1. Genetic-level changes using **classical biotechnology**
2. Genetic-level changes using **modern biotechnology** (genetic engineering or gene editing)
3. A **molecular diagnostics test** for safety/quality checks or documentation of the problem or solution.

## Graded presentation/written product to introduce your plan

In a screencast presentation or written project, you will provide a convincing case about the existence of a problem that can be solved through biotechnology.  Include the following:

1. **Identify the problem you want to solve.**
   * Describe your **classical** biotechnology solution.
   * Describe your **modern** biotechnology solution. (Note that we haven't covered this unit yet, but it's good to think ahead about ways you can solve the problem with genetic engineering or gene editing)
   * Provide a **picture** of the organism(s) you want to change or that you will use in your project (don't forget to follow formatting guidelines for pictures below!)
2. Defend **why** it is important to solve the problem you have by **documenting the negative impact with numbers that come from reliable resources** (use [in-text citations](https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/in_text_citations_author_authors.html) within your work and [full-text citations](https://use.vg/8Jfyvp) at the end of your work). If the problem is a well-known problem that already has solutions, talk about your novel plans to solve the problem.
   * Identify **stakeholders (i.e. people who care about the solution to the problem or people who are impacted by the problem)** that could generally **benefit** from your proposed genetic improvements.
   * Throughout your project, you will need to use information from reliable resources. In this assignment, describe how you know your resources are reliable and reasonable for the information you presented. It may be helpful to [watch this video](https://use.vg/fKYBsf) that is from a later lesson in this course.
     + For instance, a reliable and credible resource for GMO acceptance statistics could be the Pew Research Institute. The Pew Research Institute specializes in conducting surveys that researchers widely accept as being able to produce statistics that are representative of the whole country. The report likely undergoes review from many statisticians, which means it's unlikely to have statistical errors and is less likely to reflect the bias of a single individual.
3. Follow **formatting** guidelines (below). **You can choose to write OR do a screencast.** The reason you are completing a more formal item for this part of the project is so you get practice and feedback on creating a professional document or presentation. If you choose to create a screencast, I think you'll be pleased about how easy it is. The directions for downloading the software, using it, and submitting the link are below. You will also practice presenting or writing in persuasive ways and using evidence to back your statements. Once your project is graded, you should use the instructor feedback on your formatting to improve your presentation or writing skills.
4. **Read the rubric** on this assignment to **compare your submission to what you are graded on**. The rubric for this assignment includes a requirement to talk about the **credibility of your resources**. In your rubrics for this class, please ignore any items with the funny bullseye/target symbol with the arrow pointing into it. I use those bullseye/target items to help me document this course as an ACE 4 course, but it does not affect your grade on any of your assignments.

\*Check out the rubric below to see how you will be graded for this assignment.

## Choose your formatting method

### **Written Formatting**

* **File type submitted -**.docx, .doc, .pdf
* **Length -**1/2 of a single-spaced page with margins that are no greater than 1 inch and text that is size 11 or 12 font. The length requirement does not include headings. Images should not be unreasonably large given the content. Any obvious signs of circumventing the length requirements through excessive text size or spacing between content will result in a loss of points for formatting. Final project written work is generally 3 - 4 pages in length.
* **Text-based resource use -**[In-text](https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/in_text_citations_author_authors.html) and [full citations](https://use.vg/8Jfyvp) are provided in APA.
* **Image-based resource use -**Images contain succinct captions/typed information to describe what is important about the image. The source of the image is credited within the caption. The captions have a label (figure 1, figure 2, etc.) and are referenced within the text. Need a guide on how to do this? Learn [how to add captions](https://support.office.com/en-us/article/insert-a-caption-for-a-picture-bb74994c-7f8b-457c-be85-92233177a356) and how you can [wrap text around your images](https://support.office.com/en-us/article/wrap-text-around-a-picture-in-word-bdbbe1fe-c089-4b5c-b85c-43997da64a12).

### **Video Formatting**

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* **Length -**The presentation should be only a couple minutes long for this assignment. The final project videos are usually 10 - 15 minutes long.
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  "["A case for sentence headlines and visual evidence"](http://libproxy.unl.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ufh&AN=18798074&site=ehost-live)
* **Text-based resource use -** [In-text](https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/in_text_citations_author_authors.html) and [full citations](https://use.vg/8Jfyvp) are provided in APA.
* **Image-based resource use -**Images contain succinct captions/typed information to describe what is important about the image. The source of the image is layered on top of or just below the image.

### **How to create a screencast presentation (if you are not writing)**

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3. **Download the software** (Once you've logged in, click the red "Record" button and it will prompt you to download the software.)
4. Open the program and **record your presentation**.  VidGrid will record your screen and audio.  It might be good to start with a test run.
5. There is no specific length requirement, but please only make it as long as you need.  5 minutes should be plenty long.  Please do not exceed 10 minutes.

Retrieving your link to submit your work:

1. Login to your [VidGrid account](https://app.vidgrid.com/login" \t "_blank)
2. Find the thumbnail for your video and hover over it
3. Click the 3 dots in the top right of your video thumbnail to expand the menu. Click the 'Copy link' button
4. Paste your link into the assignment in Canvas and submit

## Rubric

**Final Project - Part 1**

| Final Project - Part 1 | | |
| --- | --- | --- |
| **Criteria** | **Ratings** | **Pts** |
| Problem | |  |  | | --- | --- | | **1 pts**  **Identified** | **0 pts**  **Not identified** | | 1 pts |
| Potential traits | |  |  |  | | --- | --- | --- | | **2 pts**  **Identified a classical and a modern biotechnology improvement** | **1.2 pts**  **Identified traits, but either lacks specificity or both traits would be improved through the same methods** | **0 pts**  **None identified** | | 2 pts |
| Importance of improvement | |  |  | | --- | --- | | **2 pts**  **Good reasoning with thoughts about consumers and producers** | **0 pts**  **No reasoning or insufficient reasoning** | | 2 pts |
| Resource-based support for the importance | |  |  | | --- | --- | | **1 pts**  **Included and appropriate** | **0 pts**  **Not included** | | 1 pts |
| Citations | |  |  |  | | --- | --- | --- | | **2 pts**  **APA in-text and full citations are accurate and complete** | **1.2 pts**  **In-text and full citations were attempted, but are either not in APA style or are not complete** | **0 pts**  **None were provided** | | 2 pts |
| Appropriateness of resource | |  |  |  | | --- | --- | --- | | **2 pts**  **Good justification for credibility and reliability of resources based on type of information** | **1.2 pts**  **Poor justification** | **0 pts**  **Not provided** | | 2 pts |
| Formatting - file type | |  |  | | --- | --- | | **2 pts**  **File was one of the accepted types and could readily be opened** | **0 pts**  **File type was not an acceptable type or did not open readily** | | 2 pts |
| Formatting - style | |  |  | | --- | --- | | **2 pts**  **Written files follow the margin and spacing requirements. PowerPoint slides have minimal bullet point use, have good image use, sentence headlines, and good audio.** | **0 pts**  **A major issue exists in the formatting** | | 2 pts |
| Formatting - Image | |  |  |  |  | | --- | --- | --- | --- | | **1 pts**  **Images provided with correct captions** | **0.6 pts**  **Images provided with incorrect captions** | **0.2 pts**  **Images provided with no captions** | **0 pts**  **Images not provided** | | 1 pts |
| Total Points: 15 | | |

# Solving a Problem with Biotechnology – Part 2 (Classical Biotechnology)

**Before you start, read your instructor's feedback on part 1 to make sure there are no immediate concerns about your project.**Not sure how to find your feedback? Read [the Canvas Guide on viewing comments](https://community.canvaslms.com/docs/DOC-10666-how-do-i-view-assignment-comments-from-my-instructor)and [the guide on viewing rubric feedback](https://community.canvaslms.com/docs/DOC-10491-421267891)

## This assignment has 2 components:

In this part of the project, you need to develop the background information to solve your problem using **classical processes**. You must create a **diagram** of the science-based steps to implement your solution AND answer the **questions below**. In this assignment, do **not**format it into your final project styling. This assignment is graded on information only and not formatting.

### 1. Graded questions

[Download this document](https://unl.box.com/s/ln4uyvieagbzfn12510wf9ga5uekg4lf), answer the questions, and re-upload the document for grading.  You will use your answers along with the instructor's feedback to begin your final project for this course, which is a proposal to solve a problem with biotechnology.

### 2. Graded diagram for the final project

**Create a diagram** of the steps needed to complete the **laboratory/field processes required to solve your problem** with classical biotechnology. You should outline processes and steps with sufficient scientific detail that an average person would understand the steps you would use to solve the problem. If you use images, please plan to cite them, but feel free to simplify the citation as much as possible within the graphic to make the citations unobtrusive. For instance, number the images and provide a full citation list outside the graphic.

\*Tip\* If you have chosen selective breeding as your classical biotechnology process, your graphic will be show the breeding process for your organism of choice. During the step of “select offspring”, you must describe how you will control the breeding process (what will you use to prevent unwanted breeding?), what it means to "select," and how you determine which offspring you will select.

\*Tip\* If you are making a medicine, you will need to show things like harvesting the organism, extracting the medicine, making the medicine in a form that it will be used, and testing it for effectiveness. In the step of testing for effectiveness, be sure to indicate what signs you will look for that it is effective and what decisions you would make based on those results.

\*Tip\* If you are fermenting a food or drink, you should show the process you would use (including what things you add or take out) of your fermented food/drink as you are making it. When you have your product, how will you assess its quality? If it's quality is not good enough, what will you do?

## Rubric

**Final Project - Part 2**

| Final Project - Part 2 | |
| --- | --- |
| **Criteria** | **Ratings** | **Pts** |
| Problem & Improvement | |  |  | | --- | --- | | **1 pts**  **Problem is stated and a novel improvement is provided** | **0 pts**  **Not provided or not unique enough** | | 1 pts |
| Advantage of Classical Biotechnology | |  |  |  | | --- | --- | --- | | **3 pts**  **The value of classical biotechnology over modern biotechnology is discussed and backed with resources** | **1 pts**  **The value of classical biotechnology over modern biotechnology is discussed but lacks resources** | **0 pts**  **Not discussed or illogical** | | 3 pts |
| Steps | |  |  |  | | --- | --- | --- | | **3 pts**  **Good connection between the problem, the trait, the process, and assessment of the process** | **1 pts**  **Needs some clarification** | **0 pts**  **No clear steps provided** | | 3 pts |
| Timeline | |  |  | | --- | --- | | **1 pts**  **Timeline is accurate and shows evidence of being biologically-based** | **0 pts**  **Timeline is wildly inaccurate or lacks explanation** | | 1 pts |
| Diagram details | |  |  |  | | --- | --- | --- | | **4 pts**  **The diagram contains enough detail** | **2.4 pts**  **The diagram is missing some necessary details** | **0 pts**  **The diagram is majorly lacking in detail** | | 4 pts |
| Diagram accuracy | |  |  |  | | --- | --- | --- | | **3 pts**  **The steps in the diagram are accurate** | **1.8 pts**  **The steps in the diagram are mostly accurate** | **0 pts**  **The steps in the diagram are wildly inaccurate or so under-detailed that accuracy cannot be assessed** | | 3 pts |
| Use Scientific Knowledge  threshold: 3.0 pts | |  |  |  |  | | --- | --- | --- | --- | | **4 pts**  **Demonstrate knowledge of appropriate background information from texts and incorporates relevant information from primary literature.** | **3 pts**  **Demonstrates knowledge of appropriate background information from texts.** | **2 pts**  **Demonstrates familiarity with background knowledge, but with gaps that limit ability to ask appropriate questions.** | **1 pts**  **Lacks the background knowledge and context to ask appropriate questions.** | | -- |
| Pose Questions  threshold: 3.0 pts | |  |  |  |  | | --- | --- | --- | --- | | **4 pts**  **Poses questions that can be investigated and that are within the context of existing knowledge. In addition these questions are differentiated into hierarchical levels.** | **3 pts**  **Poses questions that can be investigated and that are in the context of existing knowledge.** | **2 pts**  **Poses questions that can be investigated, but lack connections to existing knowledge.** | **1 pts**  **Cannot frame appropriate questions that can be investigated using scientific methods.** | | -- |
| Total Points: 15 | |

# Solving a Problem with Biotechnology – Part 3 (Modern Biotechnology)

In this part of the project, you need to develop the precise steps for how you can conduct a modern biotechnology (genetic engineering, gene editing, gene discovery, genome creation, designer vaccines, etc.) process to solve your problem. You will create a stand-alone graphic to detail the science steps required to solve your problem AND you will answer the questions below.

## This assignment has 2 components:

### 1. Graded questions

Download the Final Project - Modern Biotechnology Worksheet and fill out your answers. When you are done, upload it to Canvas for grading and feedback.

### 2. Graded diagram for the final project

Now, create a diagram of the steps using one of the two templates provided – one for genetic engineering and one for gene editing. You can deviate from the templates, but be sure to include the same level of detail as you see in the templates. No matter what you do, you will need to modify the template to be specific to your organism or your project. Please plan to cite your images, but feel free to simplify the citation as much as possible within the graphic to make the citations unobtrusive. For instance, number the images and provide a full citation list outside the graphic.

## Rubric

**Final Project - Part 3**

| Final Project - Part 3 | | |
| --- | --- | --- |
| **Criteria** | **Ratings** | **Pts** |
| Problem/solution | |  |  |  | | --- | --- | --- | | **1 pts**  **The problem is provided with a logical solution that tells what organisms are needed to create the solution** | **0 pts**  **Not provided or not unique enough** | **0 pts**  **Some information is missing** | | 1 pts |
| Advantages/disadvantages of modern biotechnology | |  |  |  | | --- | --- | --- | | **2 pts**  **Several advantages or disadvantages of modern biotechnology solutions are shared and supported with resources** | **1 pts**  **Few advantages/disadvantages are shared or there are not resources to support the statements** | **0 pts**  **Not present or illogical** | | 2 pts |
| Steps | |  |  |  | | --- | --- | --- | | **2 pts**  **The steps to create the modern biotechnology solution are covered.** | **1 pts**  **Some information is missing** | **0 pts**  **Not completed** | | 2 pts |
| Timeline - single organism/initial start | |  |  | | --- | --- | | **1 pts**  **Timeline is accurate and shows evidence of being biologically-based** | **0 pts**  **Timeline is wildly inaccurate or lacks explanation** | | 1 pts |
| Timeline - whole "line" (the entire solution) | |  |  | | --- | --- | | **1 pts**  **Timeline is accurate and shows evidence of being biologically-based** | **0 pts**  **Timeline is wildly inaccurate or lacks explanation** | | 1 pts |
| Diagram accuracy | |  |  |  | | --- | --- | --- | | **3 pts**  **The steps in the diagram are accurate** | **1.8 pts**  **The steps in the diagram are mostly accurate** | **0 pts**  **The steps in the diagram are wildly inaccurate or so under-detailed that accuracy cannot be assessed** | | 3 pts |
| Diagram details | |  |  | | --- | --- | | **3 pts**  **An appropriate level of detail is included** | **0 pts**  **Details have not been filled out entirely** | | 3 pts |
| Resources | |  |  |  | | --- | --- | --- | | **2 pts**  **Resources are cited in-text and as full citations** | **1.2 pts**  **Resources are cited, but not correctly** | **0 pts**  **No resources cited** | | 2 pts |
| Pose Questions  threshold: 3.0 pts | |  |  |  |  | | --- | --- | --- | --- | | **4 pts**  **Poses questions that can be investigated and that are within the context of existing knowledge. In addition these questions are differentiated into hierarchical levels.** | **3 pts**  **Poses questions that can be investigated and that are in the context of existing knowledge.** | **2 pts**  **Poses questions that can be investigated, but lack connections to existing knowledge.** | **1 pts**  **Cannot frame appropriate questions that can be investigated using scientific methods.** | | -- |
| Use Scientific Knowledge  threshold: 3.0 pts | |  |  |  |  | | --- | --- | --- | --- | | **4 pts**  **Demonstrate knowledge of appropriate background information from texts and incorporates relevant information from primary literature.** | **3 pts**  **Demonstrates knowledge of appropriate background information from texts.** | **2 pts**  **Demonstrates familiarity with background knowledge, but with gaps that limit ability to ask appropriate questions.** | **1 pts**  **Lacks the background knowledge and context to ask appropriate questions.** | | -- |
| Total Points: 15 | | |

# Solving a Problem with Biotechnology – Part 4 (Diagnostic Techniques)

In this part of the project, you need to develop a plan for a **molecular diagnostic technique** that can be used in conjunction with your classical biotechnology solution, your modern biotechnology solution, or as a way to help document/track your problem. I have listed some ideas below, but you need to use your discretion on which ideas make sense for your given problems and solutions. If you need help, contact your instructor or ask other students for help.

* If you're solving a problem related to food or beverages, you could:
  + Speed up the selection process of selective breeding with the help of a diagnostic technique
  + Test for allergens in a genetically engineered product
  + Test for allergens in a classical process product
  + Identify or verify what is in a medicine product
* For a health-based problem, you might be able to use diagnostics to:
  + Track disease spread
  + Diagnose disease
* For an environmental problem, you could:
  + Maybe do an item in the food/beverages idea list if you're genetically engineering an organism
  + Document the spread of a species or types of species in an ecosystem

## This assignment has 2 components:

### 1. Graded questions

Download the Final Project - Diagnostic Test Worksheet and answer the questions. When you are done answering the questions, upload your answers to Canvas for grading and feedback.

### 2. Graded visuals for your final project

You must submit at least two images.

**Image 1** - an images (or images) of your diagnostic technique that helps someone see what your diagnostic technique is.

**Image 2**- a picture of your organism with a **label** (or labels) to indicate where you can **meaningfully sample/test**your organism.

## Rubric

**Final Project - Part 4**

| Final Project - Part 4 | | |
| --- | --- | --- |
| **Criteria** | **Ratings** | **Pts** |
| Test name | |  |  | | --- | --- | | **1 pts**  **Provided** | **0 pts**  **Not provided** | | 1 pts |
| Molecule detected | |  |  | | --- | --- | | **1 pts**  **Accurate** | **0 pts**  **Inaccurate/not completed** | | 1 pts |
| Result type | |  |  | | --- | --- | | **1 pts**  **Accurate** | **0 pts**  **Inaccurate/not completed** | | 1 pts |
| How the test works | |  |  |  | | --- | --- | --- | | **1 pts**  **Accurate science information** | **0.6 pts**  **Accurate with unsound/no explanation** | **0 pts**  **Inaccurate/not completed** | | 1 pts |
| Test location | |  |  |  | | --- | --- | --- | | **1 pts**  **Accurate with sound explanation** | **0.6 pts**  **Accurate with unsound/no explanation** | **0 pts**  **Inaccurate/not completed** | | 1 pts |
| Parts to test | |  |  |  | | --- | --- | --- | | **2 pts**  **Accurate with sound explanation using information about the molecule tested for** | **1.2 pts**  **Accurate, but lacking sound explanation** | **0 pts**  **Inaccurate/not completed** | | 2 pts |
| Explanation of the value | |  |  |  | | --- | --- | --- | | **1 pts**  **Included and convincing** | **0.6 pts**  **Included, but not convincing** | **0 pts**  **Inaccurate or not included** | | 1 pts |
| Organism image with label | |  |  |  | | --- | --- | --- | | **2 pts**  **Organism image is provided and the labels are accurate** | **1.2 pts**  **Organism image is provided, but the labels are inaccurate. The labels are based on prior inaccurate information** | **0 pts**  **Inaccurate or not provided** | | 2 pts |
| Technique image | |  |  | | --- | --- | | **2 pts**  **Provided and accurate** | **0 pts**  **Not provided or incorrect** | | 2 pts |
| Image resources | |  |  | | --- | --- | | **1 pts**  **Image source is provided** | **0 pts**  **Not cited** | | 1 pts |
| Appropriateness of technique | |  |  |  | | --- | --- | --- | | **2 pts**  **The technique used is appropriate/logical** | **1.2 pts**  **The technique lacks justification, but it is logical** | **0 pts**  **The technique proposed is illogical** | | 2 pts |
| Pose Questions  threshold: 3.0 pts | |  |  |  |  | | --- | --- | --- | --- | | **4 pts**  **Poses questions that can be investigated and that are within the context of existing knowledge. In addition these questions are differentiated into hierarchical levels.** | **3 pts**  **Poses questions that can be investigated and that are in the context of existing knowledge.** | **2 pts**  **Poses questions that can be investigated, but lack connections to existing knowledge.** | **1 pts**  **Cannot frame appropriate questions that can be investigated using scientific methods.** | | -- |
| Use Scientific Knowledge  threshold: 3.0 pts | |  |  |  |  | | --- | --- | --- | --- | | **4 pts**  **Demonstrate knowledge of appropriate background information from texts and incorporates relevant information from primary literature.** | **3 pts**  **Demonstrates knowledge of appropriate background information from texts.** | **2 pts**  **Demonstrates familiarity with background knowledge, but with gaps that limit ability to ask appropriate questions.** | **1 pts**  **Lacks the background knowledge and context to ask appropriate questions.** | | -- |
| Total Points: 15 | | |

# Solving a Problem with Biotechnology – Part 5 (Peer Review)

You have been placed on a small team that you will present your project to (whether written or recorded) for feedback\*.  Your instructor has the ability to give extra credit points to individuals or teams as they see fit. Most often, the rewards go to those who have a positive attitude, produce high-quality work, and who work with their team in a way that is mutually beneficial.

\*The work you turn in will receive feedback from your peers.

## To submit your work to the peer-review process

1. Familiarize yourself the final project directions. You aren't submitting your assignment to part 6 yet, but the details you need to complete part 5 are in part 6. Solving a Problem with Biotechnology - Part 6
2. Create a completed draft of your final project.
3. Submit your work to this peer-review portal BEFORE the due date. Missing the due date will result in full loss of points for peer-review participation.

## To give feedback to your peers

1. Wait for the peer-review process to become available. It becomes available at the moment this assignment is due and it is auto-generated by Canvas.
2. [Locate your peer-review assignments](https://community.canvaslms.com/docs/DOC-10651-421254363).
3. Fill out the rubric for each of your peers (you can read more about this from the information link provided above. This content is under the heading "complete rubric"). You will need to fill in some comments for certain questions. Look for spots in the rubric where you are prompted to add more detail/information with an ellipsis (a dot-dot-dot [...]) that means a statement needs continued or a colon (:) that indicates you need to list something.

## Waiting for what's next

* You'll need to wait to see your feedback. Sometimes all of your peers will complete their peer-review assignment and sometimes they won't. Either way, the due date for peer reviews is one week after the due date of this assignment. [Try checking for peer review feedback](https://community.canvaslms.com/docs/DOC-10552-4212103952) one week after this assignment closed.
* You will see that you earn these points when your instructor has time to grade your completed peer-reviews. You are graded on the quality of your reviews.

## How your peer reviews are graded

Your peer reviews will be graded by an instructor for their quality. Peer review points will NOT be given for correcting grammar and spelling nor for simple feedback such as “good job”. You MUST focus on content and provide thoughtful/insightful feedback for all the questions with the intent to help your peer improve their funding proposal to earn points for your peer reviews. Here is how a single peer-review is graded:

* All peer-review questions were addressed (regardless of quality). (Yes = 5 points, No = 0 points)
* The answers to the questions were insightful/thoughtful and/or provided help with ways for their peer to improve their project (Yes = 15, No = 0)

**Final Project - Peer-review**

| Final Project - Peer-review | |
| --- | --- |
| **Criteria** | **Ratings** |
| Did your peer make the problem clear? | |  |  | | --- | --- | | **Yes, The problem is clear. I interpreted the problem as...** | **No. The problem is unclear. What confused me is...** | |
| Were the solutions are logically connected to the problem? | |  |  | | --- | --- | | **Yes. The two solutions are clearly connected to the problem. The two solutions are...** | **No. The solutions were not clearly connected to the problem. The connection was unclear because...** | |
| Was the science information and steps used in the classical biotechnology process clear?  Look at their graphic and read their description. Do you understand how they were able to solve the problem? | |  |  | | --- | --- | | **Yes. The classical biotechnology steps were clear. The steps to complete their project include:** | **No. The steps of their classical biotechnology process were not complete. The steps they forgot or otherwise got wrong were...** | |
| Was the science information and steps used in the modern biotechnology process clear?  Look at their graphic and read their description. Do you understand how they were able to solve the problem? | |  |  | | --- | --- | | **Yes. The modern biotechnology steps were clear. The steps to complete their project include:** | **No. The steps of their modern biotechnology process were not complete. The steps they forgot or otherwise got wrong were...** | |
| Diagnostic Testing - Information | |  |  | | --- | --- | | **The details are accurate and complete**  Required details are: -Test name -Molecule type that is detected -Where the test can be conducted at -What tissue(s) can meaningfully be tested and WHY -What value it adds to safety/quality testing | **Not all the details are present. The details that were missing were....** | |
| Resource use | |  |  |  | | --- | --- | --- | | **4 resources used and cited correctly** | **Resources are underutilized** | **Resources not present** | |
| Professional Formatting - Resources | |  |  | | --- | --- | | **Resources are correctly formatted in APA** | **Resources were not cited** | |
| Professional Formatting - Slides/pages | |  |  | | --- | --- | | **For pages, spacing/sizing directions were followed. For slides, sentence headlines, many images, and few bullet points were used.** | **There were formatting errors. Those errors are...** | |

# Solving a Problem with Biotechnology – Part 6 (Final Project)

## Instructions

Revisit the Project Instructions – Big Picture Overview for full details on what must be included in your final project. You should also take time to read through the grading rubric to see how your final project is graded.

## Leveraging your feedback

Be sure to review all the types of feedback you have received on this project. Guides to each type of feedback are linked to the feedback type:

* Instructor feedback located within the [rubrics](https://community.canvaslms.com/docs/DOC-10491-421267891) for each part of the project
* Some semesters, there might be general instructor feedback provided through the announcements
* [Peer feedback](https://community.canvaslms.com/docs/DOC-10552-4212103952)within the [rubrics](https://community.canvaslms.com/docs/DOC-10491-421267891) on your peer-review assignment
* Make sure you look over the final rubric below to see how all the points will be awarded for the final project.

## Resource use

Throughout the various parts of your project, you should have collected quite a few resources. The expectation is that you have gathered information from at least 4 resources. You should plan to cite your images, but NOT have them included as part of your resource count. Here are some examples of reasons you may have used a resource:

* describe the reproductive biology of your organism
* to get the background information you need to create a timeline for producing solution
* discuss the success rates of your transformation type (if you created a GMO or gene edited an organism)
* cite numbers in relation to how your project appeals to stakeholder
* information about how your diagnostic test functions or the information you get from the diagnostic test
* cite numbers in relation to the problem you are addressing (for instance, you're documenting how big of a problem exists)

## Rubric

**Final Project - Instructor Graded**

| Final Project - Instructor Graded | | |
| --- | --- | --- |
| **Criteria** | **Ratings** | **Pts** |
| Convincing value of the problem and good comparison of the classical and modern biotechnology solution tradeoffs. | |  |  |  | | --- | --- | --- | | **15 pts**  **Convincing with evidence to support the argument** | **9 pts**  **Slightly convincing, but lacking evidence** | **0 pts**  **Not present or severely lacking** | | 15 pts |
| Classical Biotechnology - Steps | |  |  |  | | --- | --- | --- | | **7 pts**  **The steps are discussed with sufficient detail and are accurate** | **4.2 pts**  **The steps are present, but with little or no detail** | **0 pts**  **The steps were not provided** | | 7 pts |
| Classical Biotechnology - Timeline | |  |  |  | | --- | --- | --- | | **6 pts**  **A timeline is shared and it is accurate** | **3.6 pts**  **An inaccurate timeline is shared or an underdeveloped timeline is shared** | **0 pts**  **No timeline is shared** | | 6 pts |
| Classic Biotechnology - Graphic | |  |  |  | | --- | --- | --- | | **5 pts**  **A complete, accurate graphic is included and explained within the text or presentation** | **3 pts**  **An underdeveloped graphic is included and explained** | **0 pts**  **No graphic is included or the graphic included is not meaningfully integrated in the project (there is no explanation of what is in the graphic)** | | 5 pts |
| Modern Biotechnology - Steps | |  |  |  | | --- | --- | --- | | **7 pts**  **The steps are discussed with sufficient detail and are accurate** | **4.2 pts**  **The steps are present, but with little or no detail** | **0 pts**  **The steps were not provided** | | 7 pts |
| Modern Biotechnology - Timeline | |  |  |  | | --- | --- | --- | | **6 pts**  **A timeline is shared and it is accurate** | **3.6 pts**  **An inaccurate timeline is shared or an underdeveloped timeline is shared** | **0 pts**  **No timeline is shared** | | 6 pts |
| Modern Biotechnology - Transformation (or equivalent process) | |  |  | | --- | --- | | **5 pts**  **Transformation is correctly chosen** | **0 pts**  **Transformation method is incorrect or not addressed** | | 5 pts |
| Modern Biotechnology - Gene Design (or basics about the "anatomy" of genes, when appropriate) | |  |  |  | | --- | --- | --- | | **5 pts**  **The gene design is fully described, including the promoter (what organism it is from and where it will express at) and what organism the gene region is from** | **3 pts**  **Partially correct information** | **0 pts**  **Incorrect or not addressed** | | 5 pts |
| Modern Biotechnology - Graphic | |  |  |  | | --- | --- | --- | | **5 pts**  **A complete, accurate graphic is included and explained within the text or presentation** | **3 pts**  **An underdeveloped graphic is included and explained** | **0 pts**  **No graphic is included or the graphic included is not meaningfully integrated in the project (there is no explanation of what is in the graphic)** | | 5 pts |
| Diagnostic Testing - Information | |  |  |  | | --- | --- | --- | | **6 pts**  **The details are accurate and complete**  Required details are: -Test name -Molecule type that is detected -Where the test can be conducted at -What tissue(s) can meaningfully be tested and WHY -What value it adds to safety/quality testing | **3.6 pts**  **The details are partly fulfilled** | **0 pts**  **Not present or severely lacking** | | 6 pts |
| Diagnostic Testing - graphic | |  |  | | --- | --- | | **5 pts**  **An accurate depiction of possible sampling locations is provided** | **0 pts**  **An accurate depiction of possible sampling locations is provided or nothing is provided** | | 5 pts |
| Uniqueness of both classical and modern biotechnology projects | |  |  | | --- | --- | | **5 pts**  **Unique from any changes currently available on the market** | **0 pts**  **One or both are not unique**  Copying pre-existing changes is not acceptable. Things like Bt corn or Flavr Savr tomatoes will receive a zero for the whole modern biotechnology section of your project in addition to a zero in this category. | | 5 pts |
| Resource use | |  |  |  |  | | --- | --- | --- | --- | | **10 pts**  **4 resources used and cited correctly** | **6 pts**  **4 resources used, but not cited correctly** | **4 pts**  **Resources are underutilized** | **0 pts**  **Resources not present** | | 10 pts |
| Professional Formatting - Slides/pages | |  |  |  | | --- | --- | --- | | **8 pts**  **For pages, spacing/sizing directions were followed. For slides, sentence headlines, many images, and few bullet points were used.** | **4.8 pts**  **A good faith attempt to follow the guidelines** | **0 pts**  **There were several formatting errors** | | 8 pts |
| Professional Formatting - Grammar/spelling | |  |  | | --- | --- | | **5 pts**  **For written work, there are few grammar/spelling errors. For presentations, the audio is clear and engaging** | **0 pts**  **For written work, the grammar/spelling issues were distracting or for presentations, the audio was not present.** | | 5 pts |
| Reward from "supervisor" for great work  If you greatly exceed expectations in a workplace, you can sometimes earn a reward. In this situation, you can earn extra credit in the class by exceeding expectations. | |  |  |  | | --- | --- | --- | | **10 pts**  **Your teamwork or individual project greatly exceeded expectations** | **3 pts**  **Your work was good, but not outstanding** | **0 pts**  **N/A** | | 10 pts |
| Use Scientific Knowledge  threshold: 3.0 pts | |  |  |  |  | | --- | --- | --- | --- | | **4 pts**  **Demonstrate knowledge of appropriate background information from texts and incorporates relevant information from primary literature.** | **3 pts**  **Demonstrates knowledge of appropriate background information from texts.** | **2 pts**  **Demonstrates familiarity with background knowledge, but with gaps that limit ability to ask appropriate questions.** | **1 pts**  **Lacks the background knowledge and context to ask appropriate questions.** | | -- |
| Pose Questions  threshold: 3.0 pts | |  |  |  |  | | --- | --- | --- | --- | | **4 pts**  **Poses questions that can be investigated and that are within the context of existing knowledge. In addition these questions are differentiated into hierarchical levels.** | **3 pts**  **Poses questions that can be investigated and that are in the context of existing knowledge.** | **2 pts**  **Poses questions that can be investigated, but lack connections to existing knowledge.** | **1 pts**  **Cannot frame appropriate questions that can be investigated using scientific methods.** | | -- |
| Total Points: 110 | | |