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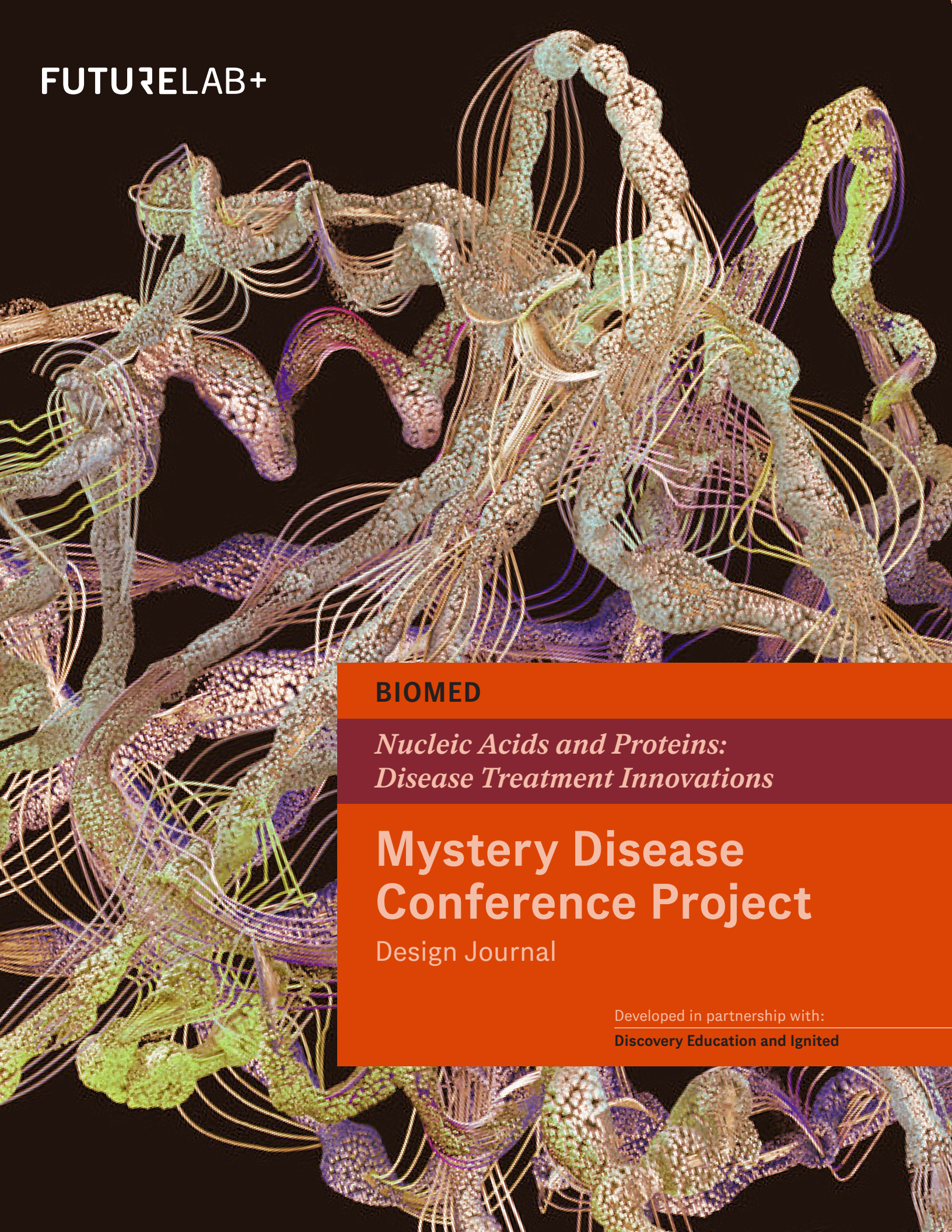
*Nucleic Acids and Proteins:
Disease Treatment Innovations*

Mystery Disease Conference Project

Design Journal

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Mystery Disease Conference Project

BACKGROUND

As advances continue to be made in the field of biotechnology, diseases that have evaded a cure, such as heart disease, HIV, and Alzheimers, may finally be meeting their match. Innovative techniques that involve nucleic acid and protein sequencing, isolation, assays, and editing have unlocked new possibilities for treatments of disease and potential cures. In this unit you have learned that an understanding of the central dogma of Biology—the transmission of information from DNA to RNA and the building of proteins—has allowed scientists to create ways to better understand the role that these molecules play in disease. It has also inspired ways to help monitor, treat, and perhaps even stop diseases by preventing them altogether, using biochemical tools such as CRISPR-Cas9.

As new biotechnological techniques and treatments are discovered and created, there are strict approval processes and guidelines to ensure that they are effective and safe for humans before they are ever available to the public. Extensive clinical trials are an important part of the drug approval process, and allow these drugs to be tested and important data to be gathered. However, there are ethical dilemmas that come with this, and ensuring that all populations and groups of people are included in these trials provides important data that can impact how the drug is used and who is treated with it.
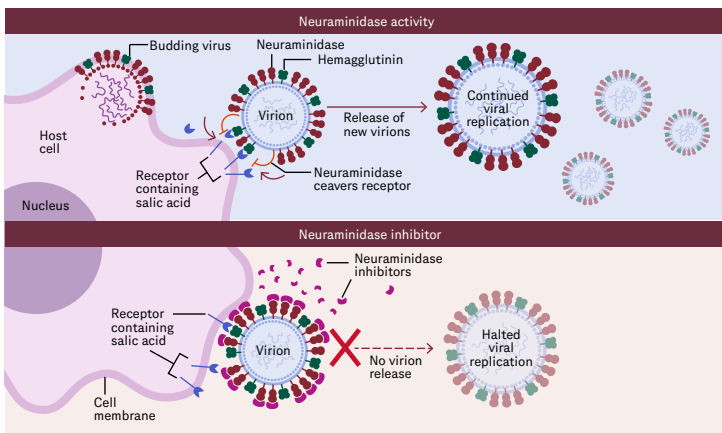
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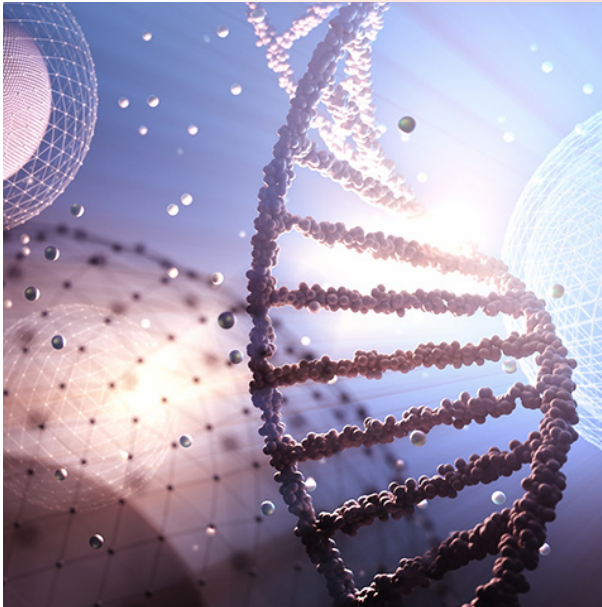
Examples of Drug Mechanism of Action Models and Animation, Clinical Trial Flowchart, and Pecha Kucha

PROJECT SUMMARY

You are part of a drug research and development team that has been given the opportunity to present at a mock Mystery Disease Conference. You will be introduced to a specific disease that has conventional treatments, but does not yet have a cure by reading the profile of a patient who suffers from the disease. Your presentation will be given in the style of a Pecha Kucha, where you will prepare 20 slides and discuss each slide for 20 seconds. Your presentation should introduce the audience to the patient and disease, and introduce an innovative drug delivery system or technology that could help to cure or prevent the disease. In your role as a project manager, biomedical technician, clinical researcher, or health information specialist, you will choose a patient profile and

work with your group to research information about the disease with which your patient is diagnosed, including the mechanism of the disease and the benefits and drawbacks of conventional treatments. Next, your group will design a potential innovative drug delivery system for the disease, using information about nucleic-acid and protein-based treatments from the lessons in this unit. This will include a sketch or animation of how the drug delivery system will work to be included in the Pecha Kucha. To end the presentation, your group will outline a detailed clinical trial plan that will give important data about the drug's effectiveness, while ensuring equity to all people to begin the pathway to the drug's approval by the FDA.

Neuraminidase (Influenza viral disruptor)
Mechanism of Action (model)

Clinical Trial Flowchart

How a Drug Moves Through Clinical Trials and Gets to People with FOP

Proton Pump Inhibitor Mechanism of Action (animation)
Link to example
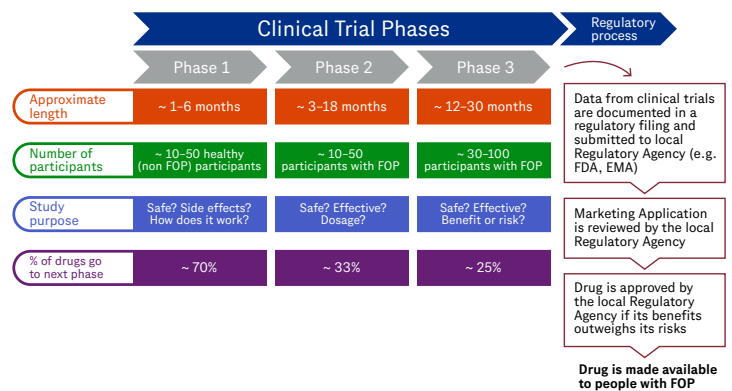
Huntington's Disease Pecha Kucha
Link to example

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Proposal Requirements

Research for the project must include:

1. Information about the disease, including the disease mechanism, symptoms, causes, and demographics using data.

2. A cost and benefits comparison with traditional treatments to manage symptoms.

3. An explanation of the potential drug's target that is related to the disease mechanism.

4. Brainstorming about how the drug innovation will work and if it will use nucleic acid or protein modification, isolation, or purification.

5. An explanation about how the innovative drug delivery system could work to cure the disease.

The Drug Mechanism of Action 2-D Model or Animation must include:

1. Images that clearly represent the disease mechanism and drug mechanism.

2. Arrows, steps, or captions to help the viewer understand how the drug will work.

3. The incorporation of color to help distinguish among objects in the model or animation more easily.

The Flowchart or Timeline must include:

1. Details on how a clinical trial would be held for the drug innovation, including specific steps or phases and the data that would be collected.

2. An explanation of how various groups would be included in the trial to ensure equity.

The Petcha Kucha Slideshow must include:

1. 20 images that relate directly to the presentation and add imagery to help convey the message.

2. One or more slides should include the 2-D model or animation of the drug innovation mechanism.

3. Slides should be set to appear for 20 seconds each for the presentation

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Engineering Design Process Journal

Name

_____

Group Members

_____

_____

Start Date

_____

_____

Due Date

_____

_____

_____

_____

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 1: Define the Problem

According to the information from the patient profile your group has chosen, what is the problem and/or the need that justifies the drug innovation for this patient?

_____

_____

_____

What evidence do you see of this problem when you think about what you have learned in the previous lessons for this unit?

_____

_____

_____

Below are the four requested products. Describe what needs to be communicated in each product.

1 ___Research Sheet :___ _____

_____

2 ___Model of Action 2-D Model or Animation:___ ____

_____

3 ___Clinical Trial Flow Chart or Timeline:___ _____

_____

4 ___Pecha Kucha Slideshow:___ _____

_____

How can a proposed design allow others to understand the need for the proposed drug innovation and its mechanism of action to potentially cure or prevent disease?

_____

_____

What are the constraints for your mock Mystery Disease Conference presentation?

_____

_____

_____

What are the critical questions that need to be answered in order to be able to produce these components?

1 _____

2 _____

3 _____

What do you already know about these questions?

_____

_____

_____

What resources will you use to find out more information about these questions?

_____

_____

_____

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 2: Brainstorm

Discuss initial ideas for your drug innovation with your group. In the space provided, create a concept map, flow chart, or other type of graphic organizer showing how you might connect information about the use of nucleic acids and proteins in biotechnology to potential cures for the disease incorporating these techniques. What will be the goal of each piece of the presentation to inform and inspire?

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Engineering Design Process Journal

Step 1:	Step 2:	Step 3:	Step 4:	Step 5:	Step 6:	Step 7:	Step 8:	Step 9:	Step 10:	Step 11:	Step 12:
Define the Problem	Brainstorm	Research and Generate Ideas	Identify Criteria and Specify Constraints	Explore Possibilities	Select an Approach	Develop the Design Proposal	Make a Model or Prototype	Test and Evaluate Design Using Specifications	Refine the Design	Modify and Present for Market	Communicate Processes and Results

Step 3: Research and Generate Ideas

In the table below, think about possible questions you need to answer to gather more information prior to committing to one of your ideas. What resources are available to assist you in answering your questions?

Resource List

_____

_____

_____

Possible Questions Generate a list of specific questions that need to be answered.	Research Results	Any Additional Design Ideas Generated During Research Notes or sketches

Question Prompts

— What are some additional demographics or background that might be helpful to know about your patient's disease?

— What are some of the available drugs or treatments for this disease? What are the benefits and limitations for these drugs or treatments?

— What will the target be for your drug delivery system?

— What data and resources might be helpful in the creation of a clinical trial for your drug delivery system?

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Lesson Connections

LESSON 1: The Central Dogma
Use the capture sheets and information learned from this lesson to answer the following questions:

How can you tell the difference between DNA and RNA?

How is the information contained in DNA used to make proteins?

What are some of the medical treatments that rely on the central dogma—DNA to RNA to Protein?

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Making Connections

What I learned from this lesson:

_____

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How this connects to the project:

_____

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Which part(s) of the project does this lesson address and how might it be used?

Disease Research and Data

Drug Mechanism of Action 2-D Model or Animation

Clinical Trial Timeline or Flowchart

FUTURELAB+

Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Lesson Connections

LESSON 2: DNA Modification
Use the capture sheets and information learned from this lesson to answer the following questions:

How do scientists use Cas9 to modify DNA?

What are the controversies surrounding genetic modification?

How can genetic modification be applied to medical science?

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Making Connections

What I learned from this lesson:

_____

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How this connects to the project:

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Which part(s) of the project does this lesson address and how might it be used?

Disease Research and Data

Drug Mechanism of Action 2-D Model or Animation

Clinical Trial Timeline or Flowchart

FUTURELAB+

Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Lesson Connections

LESSON 3: DNA Isolation and Purification
Use the capture sheets and information learned from this lesson to answer the following questions:

How is DNA extracted from the nucleus of a cell?

How can gel electrophoresis use the properties of DNA to create a DNA fingerprint?

How can DNA be used to prescribe specific medicine to patients?

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Making Connections

What I learned from this lesson:

How this connects to the project:

Which part(s) of the project does this lesson address and how might it be used?

Disease Research and Data

Drug Mechanism of Action 2-D Model or Animation

Clinical Trial Timeline or Flowchart

FUTURELAB+

Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Lesson Connections

LESSON 4: Protein Modification
*Use the capture sheets and information learned from this
lesson to answer the following questions:*

How can proteins be modified inside a cell?

What is the purpose of protein modification?

How are enzymes used as drugs?

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Making Connections

What I learned from this lesson:

How this connects to the project:

Which part(s) of the project does this lesson address and how might it be used?

Disease Research and Data

Drug Mechanism of Action 2-D Model or Animation

Clinical Trial Timeline or Flowchart

FUTURELAB+

Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Lesson Connections

LESSON 5: Protein Isolation and Purification
Use the capture sheets and information learned from this lesson to answer the following questions:

> **Why are bacterial cells used to produce some human proteins?**

> **What are the most common cell lines or types of cells used in analytical or therapeutic biochemistry and why are they used?**

> **How are proteins produced and purified as part of the drug production process?**

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Making Connections

What I learned from this lesson:

How this connects to the project:

**Which part(s) of the project does this lesson address and
how might it be used?**

Disease Research and Data

Drug Mechanism of Action 2-D Model or Animation

Clinical Trial Timeline or Flowchart

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Lesson Connections

LESSON 6: Nucleic Acid Assays
Use the capture sheets and information learned from this lesson to answer the following questions:

What types of laboratory tests utilize nucleic acids?

How do nucleic acids play a role in diagnosing disease?

How do nucleic acids play a role in treating disease?

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Engineering Design Process Journal

Step 1:	Step 2:	Step 3:	Step 4:	Step 5:	Step 6:	Step 7:	Step 8:	Step 9:	Step 10:	Step 11:	Step 12:
Define the Problem	Brainstorm	Research and Generate Ideas *Continued*	Identify Criteria and Specify Constraints	Explore Possibilities	Select an Approach	Develop the Design Proposal	Make a Model or Prototype	Test and Evaluate Design Using Specifications	Refine the Design	Modify and Present for Market	Communicate Processes and Results

Making Connections

What I learned from this lesson:

How this connects to the project:

Which part(s) of the project does this lesson address and how might it be used?

Disease Research and Data

Drug Mechanism of Action 2-D Model or Animation

Clinical Trial Timeline or Flowchart

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Lesson Connections

LESSON 7: Protein Assays
Use the capture sheets and information learned from this lesson to answer the following questions:

Why do medical professionals need to determine the quantity and identity of proteins in a sample?

How do some protein assays detect specific proteins while other assays do not?

How do Biuret protein assays and ELISAs differ?

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Making Connections

What I learned from this lesson:

How this connects to the project:

Which part(s) of the project does this lesson address and how might it be used?

Disease Research and Data

Drug Mechanism of Action 2-D Model or Animation

Clinical Trial Timeline or Flowchart

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Lesson Connections

LESSON 8: How Are Drugs Tested?
Use the capture sheets and information learned from this lesson to answer the following questions:

What part do pharmaceuticals play in modern life?

What are the many stages in the invention of new medicines?

How have new progressions in drug development affected the processes of drug testing?

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Engineering Design Process Journal

| Step 1: Define the Problem | Step 2: Brainstorm | Step 3: Research and Generate Ideas _Continued_ | Step 4: Identify Criteria and Specify Constraints | Step 5: Explore Possibilities | Step 6: Select an Approach | Step 7: Develop the Design Proposal | Step 8: Make a Model or Prototype | Step 9: Test and Evaluate Design Using Specifications | Step 10: Refine the Design | Step 11: Modify and Present for Market | Step 12: Communicate Processes and Results |

Making Connections

What I learned from this lesson:

How this connects to the project:

Which part(s) of the project does this lesson address and how might it be used?

Disease Research and Data

Drug Mechanism of Action 2-D Model or Animation

Clinical Trial Timeline or Flowchart

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Lesson Connections

LESSON 9: Mechanisms of Drug Delivery
Use the capture sheets and information learned from this lesson to answer the following questions:

How does the route of drug administration impact where the drug acts?

What are the benefits of using proteins as medicine?

What are the ethical considerations of patenting biological materials?

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas *Continued*	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Making Connections

What I learned from this lesson:

How this connects to the project:

Which part(s) of the project does this lesson address and how might it be used?

Disease Research and Data

Drug Mechanism of Action 2-D Model or Animation

Clinical Trial Timeline or Flowchart

FUTURELAB+

Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 4: Identify Criteria and Specify Constraints

What are specific criteria and constraints for your chosen innovation challenge?

Criteria

_____

_____

_____

_____

_____

_____

Constraints

_____

_____

_____

_____

_____

Potential Materials Needed

_____

_____

_____

_____

_____

_____

_____

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Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 5: Explore Possibilities

Review your ideas from Steps 2 and 3 of the design process. Explore some of your ideas in more detail. Record your results in the space provided. Possible results can reflect testing, experiments, simulations, peer review, etc. Be sure to include any data collected or group discussion and feedback.

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 6: Select an Approach

Use the following decision matrix to assist in selecting one of your ideas for further development. To use the tool, complete the following steps:

1 Enter the criteria and constraints of the project in the first column.
2 Use a numeric value to rate each solution against the criteria or constraint. (2 = totally meets the requirement, 1 = somewhat meets the requirement, 0 = does not meet the requirement)
3 Total the columns and circle the highest score.

Criteria or Constraint	Sketch/Idea 1	Sketch/Idea 2	Sketch/Idea 3

Other criteria: A single rating for your own "nice-to-have" desirable criteria and universal design criteria (such as *Robustness, Aesthetics, Skill Required, Safety*):

	Sketch/Idea 1	Sketch/Idea 2	Sketch/Idea 3
Total			

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 7: Develop the Design Proposal

Now that your group has decided on the best solution, you need to develop a plan to meet your innovation challenge. Some of these components will come in at different points during the unit. Your solution proposal must include the following components:

1   Background information on the disease that your patient faces and how it impacts your patient's daily life, along with statistics and data showing the prevalence and disparities related to those affected by the disease.
2   Incorporation of a 2-D model or animation showing the drug innovation's mechanism of action and its target to cure the disease.
3   A flowchart or timeline showing how you would conduct a clinical trial with your drug innovation.
4   A 20-slide slideshow that contains 20 images with all slides timed to last for 20 seconds each.

Your written solution proposal may be attached to this Design Journal, inserted into the space provided, or submitted digitally according to the teacher's direction.

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 8: Make a Model or Prototype

In the space below, insert or sketch pictures showing your drug innovation's proposed mechanism of action (how it will work in the body or cell and what it will target to disrupt and stop the disease).

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Engineering Design Process Journal

Step 1:	Step 2:	Step 3:	Step 4:	Step 5:	Step 6:	Step 7:	Step 8:	Step 9:	Step 10:	Step 11:	Step 12:
Define the Problem	Brainstorm	Research and Generate Ideas	Identify Criteria and Specify Constraints	Explore Possibilities	Select an Approach	Develop the Design Proposal	Make a Model or Prototype	Test and Evaluate Design Using Specifications	Refine the Design	Modify and Present for Market	Communicate Processes and Results

Step 9: Test and Evaluate Design Using Specifications

How will you test or obtain feedback about your mystery disease presentation?

_____

_____

_____

_____

_____

_____

What data will you collect during testing?

_____

_____

_____

_____

_____

_____

In the space below, document the type of test you conducted and the results.

Description of Test Performed

_____

_____

_____

_____

_____

Test Results

_____

_____

_____

_____

_____

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 10: Refine the Design

After reviewing the Test and Evaluate Design Using Specifications results in the previous step, record any new ideas to refine your design here.

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Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 11: Modify and Present for Market

What changes (if any) did you make to your presentation after considering data and feedback in the Test and Evaluate Design Using Specifications and Refine the Design steps of this project?

_____

_____

_____

_____

_____

_____

_____

Presentation of the Product

The Pecha Kucha Mystery Disease Presentation must include:

1   A slideshow (Google Slides, PowerPoint, Keynote) containing exactly 20 slides with each containing an image that is timed to be displayed for 20 seconds before automatically moving to the next slide.

2   One or more of the images in the slideshow must be a 2-D model or animation that shows your drug innovation's proposed mechanism of action.

3   A flowchart or timeline showing a proposed clinical trial for the drug innovation.

4   Features that are targeted to your specific audience. (For example, if your target audience is non-English speaking, it may be helpful to add pages that are translated in that language or record a second PSA video with a voiceover in the native language of that group.)

If this were for an actual new drug proposal (rather than a fictional one), what further work would need to be done to prepare it for actual clinical trials and the drug testing and approval process? Explain in the space below.

FUTURELAB+

Engineering Design Process Journal

Step 1: Define the Problem	Step 2: Brainstorm	Step 3: Research and Generate Ideas	Step 4: Identify Criteria and Specify Constraints	Step 5: Explore Possibilities	Step 6: Select an Approach	Step 7: Develop the Design Proposal	Step 8: Make a Model or Prototype	Step 9: Test and Evaluate Design Using Specifications	Step 10: Refine the Design	Step 11: Modify and Present for Market	Step 12: Communicate Processes and Results

Step 12: Communicate Processes and Results

Summarize your results by answering the following questions:

1   What were the best elements about your presentation?

2   What were the weaknesses of your presentation?

3   How would your presentation change if you were to share it with a community that may not have the medical knowledge or vocabulary as a group of drug researchers, such as a group of newly-diagnosed patients or people at-risk of your disease?

Explain the reasoning behind any changes or improvements you would make.