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BIOMED

Crowdsourcing Innovations in Biotechnology

Biotech Careers in Longevity Project

Design Journal

Developed in partnership with:

Discovery Education and Ignited

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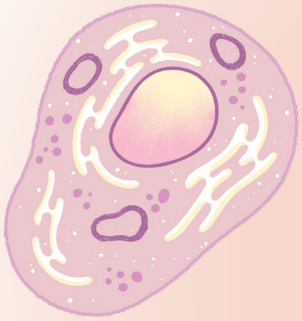
Biotech Careers in Longevity Project



BACKGROUND

Although people are living longer now than any other time on Earth, aging is one aspect of life that no person can escape… perhaps until the very near future. Biological aging is caused by the accumulation of molecular and cellular damage over a person's lifetime, and can lead to disease and ultimately to death. While there are many choices we can make in our lives, such as diet, exercise, and abstaining from dangerous behaviors that will help us to maximize our normal human lifespan, which was 73.4 years in 2019 according to the World Health Organization, scientists studying aging and longevity say that it is only a matter of time until innovations in biotechnology can extend the human lifespan well beyond 120 years.

As new biotechnological breakthroughs are reported in research being conducted on cell senescence, telomeres, and rejuvenative properties in the blood of young animals, there are many different components and stages for a scientific breakthrough to result in the development of a treatment or drug that will extend the human lifespan. There are many careers involved in this process, rooted not only in science and discovery, but also in areas such as evaluation and research, statistics, and regulatory affairs. While the pathway to approval for a breakthrough treatment or drug has many steps to ensure safety and effectiveness, they have the potential to change lives for the better, or in this case, to extend the human lifespan to allow us to live longer and healthier.

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Examples of Scientific Breakthrough Videos, Career Snapshots, and How to Create an Emaze Presentation

PROJECT SUMMARY

You are part of a team that has just made a scientific breakthrough in the field of aging and longevity. Your team of scientists is looking to hire people that will help you take your breakthrough through the drug and treatment development pathway so that people may be able to benefit from your discovery and live a longer and healthier life. In your role as a project manager, biotechnology researcher, biotech recruiter, and design specialist, your team will choose one of the scientific breakthroughs in longevity briefings that will become the focus of your project. You will conduct research to learn more about your scientific breakthrough, and create a short video that informs the viewer about it. Next, your team will determine the jobs that are needed to move your breakthrough through the development and implementation pathway and create career snapshots that explain the job duties and roles. Finally, the team will create an interactive job board using the digital presentation platform Emaze (*www.emaze.com*) that will include your introductory video, job snapshots, and interactive components that seek to attract diverse members to your team to complete the pathway to the use of your breakthrough to extend the human lifespan.

Examples of Scientific Breakthrough Videos:

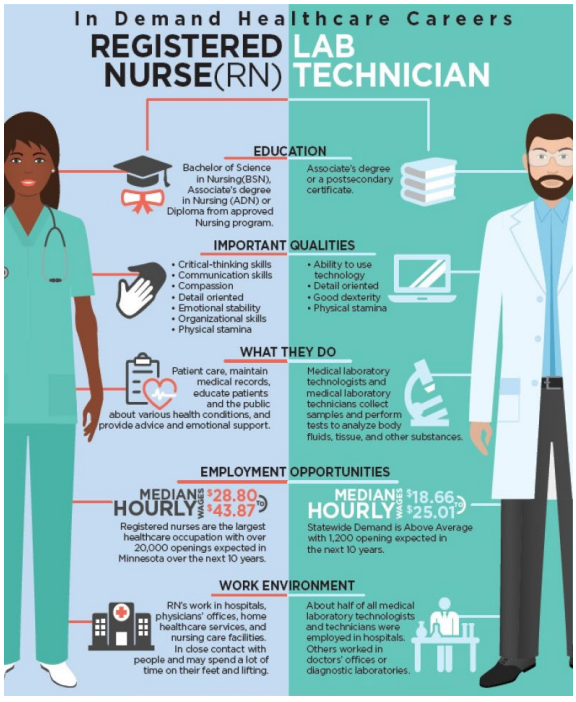
Breakthrough stem cell platform could shed light on mysteries of early human development

Potential Diabetes Breakthrough

How to Create an Emaze Presentation:

Welcome to Emaze

Emaze Demonstration



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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 of the disease using data
2. A cost and benefits comparison of 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 of how the innovative drug delivery system could work to cure the disease

The Longevity Scientific Breakthrough Introductory Video must include:

1. Definition of the problem that the breakthrough is helping to solve or the goal of the breakthrough
2. Summary of the scientific breakthrough, defining any new medical or biological terminology
3. Incorporation of images or video clips that help to explain your scientific breakthrough

The Career Snapshots must include:

1. Brief information about the job duties of the career and interests that a person in the field may have
2. Explanation of how and where the career fits into the line of research and process of testing and approval for the scientific breakthrough

The Interactive Job Board must include:

1. The introductory video your group created for your scientific breakthrough
2. The five or more career snapshots your group created
3. Interactive features to engage the viewer that may include links, video, audio, and social media components

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Name

Group Members

Start Date

Due Date

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Step 1: Define the Problem

According to the information from the longevity innovation profile your group has chosen, what is the problem that the innovation is working to solve?

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

What are the four requested products?

1 Research Sheet:

2 Breakthrough Introduction Video:

3 Career Snapshots:

4 Interactive Job Board:

Describe what needs to be communicated in each product?

1

2

3

4

How can a proposed design allow others to understand the need for your longevity breakthrough and its mechanism of action to potentially extend the lifespan of humans?

What are the constraints for the products involved in the creation of your interactive job board?

What are the critical questions needed 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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Step 2: Brainstorm

Discuss initial ideas for your interactive job board with your group. In the space provided, create an initial sketch of the user interface (UI), or layout and design, for your interactive job board that models what will be seen when a potential candidate interacts with your job board. What will the goal of each piece of the design be to inform, inspire, and attract viewers?

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Step 3: Research and Generate Ideas

In the table below, record 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 chosen longevity scientific breakthrough?
- What are some of the jobs that are a part of this line of research?
- What are the steps in bringing this product or innovation to market for use by humans?
- What data and resources might be helpful in the creation of a clinical trial for your innovation that would ensure equity for all demographics and populations?

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Lesson Connections

LESSON 1: Cellular Aging
Use the capture sheets and information learned from this lesson to answer the following questions:

What are the consequences to the body as cells age?

How does the body recognize and eliminate cells that have aged and now behave abnormally?

Can cells become immortal?

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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?

Longevity Breakthrough Research and Data

Breakthrough Introduction Video

Career Snapshots

Interactive Job Board

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Lesson Connections

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

How is an individual's genome sequenced?

What advances in the genetic sequencing of human DNA have been made?

What are the advantages and disadvantages of genome sequencing?

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Lesson Connections

LESSON 3: The Human Genome Project
Use the capture sheets and information learned from this lesson to answer the following questions:

Could we replace our old cells and live a thousand years?

Could we make genetic diseases completely disappear from Earth?

How can environmental factors affect our epigenome?

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Lesson Connections

LESSON 4: Can an Organism Have No Parents?
Use the capture sheets and information learned from this lesson to answer the following questions:

Will technology enable us to produce a whole synthetic organism?

What could be the consequences if synthesis biology was used for malicious purposes, such as artificially synthesized viruses?

Could synthetic DNA possibly wipe out genetic diseases?

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Lesson Connections

LESSON 5: Bioengineering of Organisms
Use the capture sheets and information learned from this lesson to answer the following questions:

How can we increase human lifespans using bioengineering?

How ethical is bioengineering for genetic modification?

Who may benefit from bioengineered organisms?

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Lesson Connections

LESSON 6: Bioengineering of Plants
Use the capture sheets and information learned from this lesson to answer the following questions:

What impact may genetically modified crops have in global communities?

How have methods to genetically modify crops evolved?

Why might someone be opposed to using genetically modified plants?

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Lesson Connections

LESSON 7: Therapeutic Cloning and Embryonic Stem Cells
Use the capture sheets and information learned from this lesson to answer the following questions:

What may be some of the ethical considerations when discussing cloning?

How might cloning and stem cell research be interrelated?

How might cloning extend the human lifespan?

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Lesson Connections

LESSON 8: Senolytics: Our War Against Aging!
Use the capture sheets and information learned from this lesson to answer the following questions:

In which part of the cell cycle are aged cells?

Are senescent cells harmful to the body?

Why do cells become senescent?

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Lesson Connections

LESSON 9: Ethical Considerations
Use the capture sheets and information learned from this lesson to answer the following questions:

How has the need for ethical reasoning been increased in science and medicine over the past two centuries?

What careers are involved in the development and regulations surrounding breakthroughs in biotechnology?

Should the use of biomedical testing be restricted or regulated?

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Step 4: Identify Criteria and Specify Constraints

What are specific criteria and constraints for your chosen longevity scientific breakthrough?

Criteria

Criteria

Potential Materials Needed

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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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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):*

Total			

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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 scientific breakthrough in longevity along with statistics and data that support the innovation's effectiveness and show the prevalence and disparities related to extending the human lifespan
2. Creation of a video that will introduce potential employees to the scientific breakthrough in longevity that your group has chosen in a creative and entertaining way and includes elements from research
3. Five or more snapshots of careers involved in the development and testing of your longevity scientific breakthrough that give information about how the jobs fit into the overall line of research
4. An interactive job board that incorporates your introductory video, data, and statistics to ensure equity in your breakthrough and its pathway to approval, the career snapshots, and elements that provide the viewer interaction and information about your scientific breakthrough in longevity

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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Step 8: Make a Model or Prototype

In the space below, insert the components (video, data/ statistics, information, career snapshots, pictures) that will be included in your interactive job board.

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Step 9: Test and Evaluate Design Using Specifications

How will you test or obtain feedback about your interactive job board?

What data or feedback 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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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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Step 11: Modify and Present for Market

What changes (if any) did you make to your product 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 Interactive Job Board for your longevity scientific breakthrough must include:

1. The introductory video that informs the viewer of your scientific breakthrough in extension of the human lifespan that includes information from the research and background component of the project and information collected from previous lessons in the unit.
2. Five or more career snapshots that give quick and concise information about jobs that are involved in the research, design, implementation, and data collection, and approval of a new biotechnology innovation related to your scientific breakthrough.
3. The use of interactive elements, such as links, video, audio, and social media components to engage the job board viewer and information about the timeline or plan for the future of this breakthrough in longevity.

Explain in the space below, if this were for an actual new scientific breakthrough what would be additional factors that you would take into consideration while designing your job board and how would your team ensure that it would be accessed by a diverse spectrum of people and populations as potential job candidates?

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Step 12: Communicate Processes and Results

In addition to your interactive job board format outlined in the guidelines in the journal, answer the following questions about your solution.

1 What were the best elements about your interactive job board?

2 What were the weaknesses of your interactive job board?

3 How would your job board change if you were to share it with a community that may not have the same biology or biotechnology knowledge or vocabulary as people in the scientific field, such as job candidates from related fields who are looking to join your team?

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