An Ask A Biologist Activity for at Home or in the Classroom

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Contents

About the Author

When this activity was first designed, **Emma Gerrard** was a Barrett Honors undergraduate student at Arizona State University, where they were studying genetics. They designed the activity as part of their student thesis.

DNA Discovery Awards

askabiologist.asu.edu/experiments/DNA-Discovery-Awards

Lesson Overview

Genetics–it's the study of inheritance and DNA. It's what makes it possible for us to be here, and why we are similar in many ways to our relatives. We've learned so much about genetics over the past 200 years... How did the study of genetics get to where it is today? Even 40 years ago, saying you could figure out exactly what DNA a person has in their genome was a dream. Now it can be done by nearly any doctor, and for less than an Xbox costs!

This lesson will teach you about genetics and the scientists who have grown the field. You'll also learn about how science research builds on itself. A strong base of work is needed to build more detailed studies on top of.

It's for this reason that you are going to help us start an award show for the scientists that got us here...
The DNA Discovery award! The award is given only to the most important scientists in genetics. The judges change every year though, and this year your class is set to vote on who is the winner. So it's time to learn about the nominees and other scientists who allowed them to shine!

What you need

- PowerPoint presentation (your teacher has this)
- Timeline items
- Access to a computer, library, or other way to look up information
- Pencils and colored pencils, markers, or crayons
- Access to a printer (optional)

Procedure

Engage

Step 1 Watch the genome sequencing video that your teacher plays for the class. While you watch, think about the following: Who studies science and makes discoveries? How is research done?

Step 2 Discuss with your class. What did you learn from the discussion?

Explore

Step 3 Your teacher will pass out a list of discoveries in genetics. Work with your group to research when these events occurred and put them into a timeline. You can also find the list here.

Explain

Step 4 Compare your timeline with another group's. Do your timelines match?

Step 5 With that new group, talk about the timeline items. Are there any surprising things on the list? Did anything happen earlier or later than you expected? What did you learn?

Elaborate

Step 6 Your teacher will explain the DNA Discovery award to you, and present the nominees. Pick a nominee from the list below and research them:

- Charles Darwin
- Rosalind Franklin
- Barbara McClintock
- Gregor Mendel

Step 7 Research your chosen scientist, including the following. Don't forget to note your sources.

- Their background
- Key achievements
- Why that achievement is important
- A fun fact
- Why they should win the award

Explain

Step 8 Create a poster with your findings using the supplies your teacher provides. Your teacher will instruct you if you should do it digitally or on paper.

Make a separate page with your sources. Make sure to follow your teacher's instructions on how these should be formatted.

Evaluate

Step 9 Your teacher will provide a judging form and give you time to go around and look at your peers' projects. Do your best to vote on who should win the DNA Discovery award, and who made the best poster.

Teaching Tips

While we often talk to students about science discoveries, learning about the researchers responsible is often neglected. Our activity, The DNA Discovery Award is designed to get students to think about how science builds on itself, and that real people are behind all of our greatest (and smallest) discoveries.

For just a quick refresher on the basics of DNA, visit DNA ABCs (**askabiologist.asu.edu/explore/dna-abcs**).

Time required

120-180 minutes over 3 days. Roughly 30-60 minutes on day one, 60 to 90 minutes on day two and 20 to 30 minutes on day 3. If you don't have this much time, you can do a few things to reduce the time for this lesson, such as providing students with the online resources they need for each scientist, or having students read just one poster about each scientist for their judging form.

Classroom set-up

- Make sure you've downloaded and reviewed the PowerPoint presentation. You can download this from the History of DNA Research Lesson: Teacher Page (**askabiologist.asu.edu/experiments/teaching-genetics-history**).
- A link to the intro video, How to sequence the human genome, can be found on the History of DNA Research Lesson: Teacher Page too.
- Printable timeline items are included on page 6. Only one is needed per group.
- You may also want to print out an example poster (page 7) and the rubric (page 8) for your students.
- This project is fairly reliant on access to a computer, but if you have a well-stocked library (or can bring in outside books for references) you can probably do it based on books alone. Access to the internet is highly recommended.

Poster making

For poster making, you can either have students do it digitally via tools listed below. Regardless of method, allow time for creation and for printing as necessary.

- Google drawings
- Google slides
- Various free art programs
- By hand

Voting

Posters can be made anonymously to attempt to preserve fairness. If you'd like to do that, have each poster be numbered so that students can vote. Do note that having students hang it up themselves helps reduce the setup time.

To facilitate student peer evaluation, a google form or some other voting method is recommended. An example poster judging form is included on page 9. If you'd like to make your own, here are the recommended questions:

- Student name
- Which poster was yours (if you made them anonymous)
- Which scientist should win the prize?
- Which poster on [EACH SCIENTIST] was the best?

This form should not be used to actually grade the students' performance. It is designed more so that students have a reason to go read other student's posters and learn about other scientists.

Objectives

After completing the lesson, students should be able to:

- Determine the chronological order of specific achievements in genetics research.
- Research a chosen scientist to learn about biographical and subject related information.
- Construct a poster to quickly convey researched information to other students.

Timeline Answers

- Charles Darwin proposes the Theory of Evolution (Paper published November 1859).
- Gregor Mendel discovers that traits don't blend, but pass on in discrete bits called alleles (paper published 1866).
- The Avery-MacLeod-McCarty experiment discovers DNA is what carries genetic information (1944).
- Barbara McClintock discovers transposons, parts of DNA that move (1948).
- Rosalind Franklin takes an X-ray diffraction image of DNA, helping to discover it has a double helix shape (1952).
- Walter Fiers and his team "transcribe" the first gene, which codes for a viral coat protein (1972).
- Dolly the sheep is cloned (1997).
- The Public Project publishes the first version of the Human Genome Project (2001).

Standards

Arizona science standards

Grade 5

5.SP1.1	Create and use a chronological sequence of related events to compare developments that happened at the same time.
5.SP1.2	Explain how events of the past affect students' lives and society
5.SP3.7	Construct and present explanations using reasoning, correct sequence, examples and details with relevant information and data.

Timeline Printable

The Public Project publishes the first version of the Human Genome Project.	Barbara McClintock discovers transposons, parts of DNA that move.
Charles Darwin proposes the Theory of Evolution.	Dolly the sheep is cloned.
Walter Fiers and his team “transcribe” the first gene, which codes for a viral coat protein.	Gregor Mendel discovers that traits don’t blend, but pass on in discrete bits called alleles.
Rosalind Franklin takes an X-ray diffraction image of DNA, helping to discover it has a double helix shape.	The Avery-MacLeod-McCarty experiment discovers DNA is what carries genetic information.

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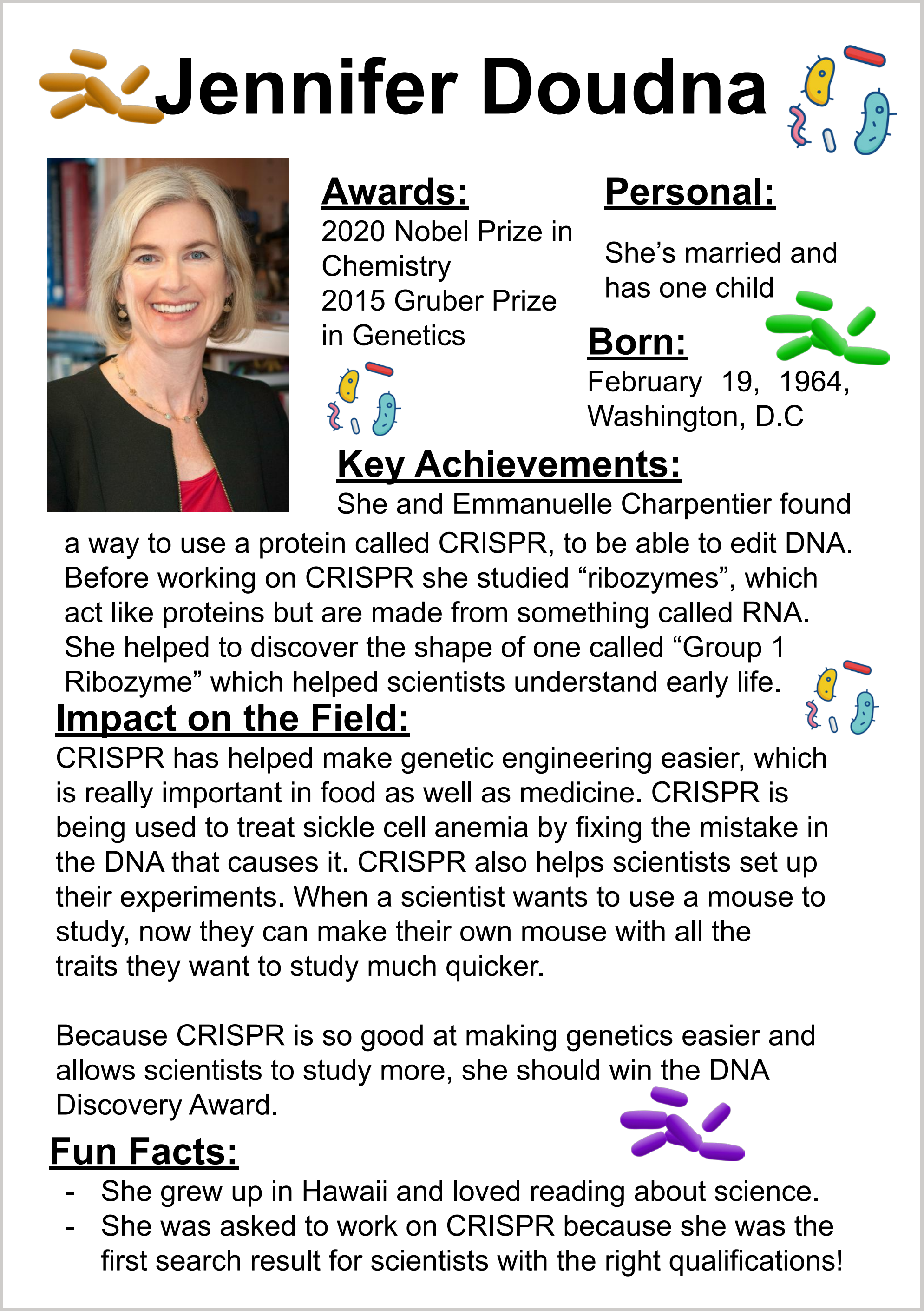

Jennifer Doudna

Awards:

2020 Nobel Prize in Chemistry
2015 Gruber Prize in Genetics

Personal:

She's married and has one child

Born:

February 19, 1964, Washington, D.C

Key Achievements:

She and Emmanuelle Charpentier found a way to use a protein called CRISPR, to be able to edit DNA. Before working on CRISPR she studied "ribozymes", which act like proteins but are made from something called RNA. She helped to discover the shape of one called "Group 1 Ribozyme" which helped scientists understand early life.

Impact on the Field:

CRISPR has helped make genetic engineering easier, which is really important in food as well as medicine. CRISPR is being used to treat sickle cell anemia by fixing the mistake in the DNA that causes it. CRISPR also helps scientists set up their experiments. When a scientist wants to use a mouse to study, now they can make their own mouse with all the traits they want to study much quicker.

Because CRISPR is so good at making genetics easier and allows scientists to study more, she should win the DNA Discovery Award.

Fun Facts:

- She grew up in Hawaii and loved reading about science.
- She was asked to work on CRISPR because she was the first search result for scientists with the right qualifications!

Poster Example

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Nominee Poster Rubric

Category	4 - Awesome!	3 - Good Job!	2 - Keep Trying!	1 - Needs More Work
Basic Info	You clearly include the nominee's full name, background, and interesting facts about their life.	You include the nominee's name and some background, but it could be clearer or have more details.	You include a little information, but it's missing important details or is unclear.	The nominee's basic information is missing or incorrect.
Key Achievements **(What)**	You list multiple important achievements and explain why they matter.	You list several achievements, but the details aren't very strong or clear.	You list only a few achievements, and they are not well explained.	There are no achievements listed or they are incorrect.
Impact on the Field **(Why it's important)**	You clearly explain how the nominee changed or helped their area of science.	You explain how the nominee made a difference, but it could use more details.	You try to explain the nominee's impact, but it is hard to understand or unclear.	There is no explanation of how the nominee helped their area of science.
Fun Fact	You include one fun and interesting fact that makes the poster exciting to read!	You include one fun and interesting fact that makes the poster exciting to read!	You include a fact, but it's more like a basic detail than a fun fact.	There is no fun fact, or the fact is just about their research/discovery.
Persuasive Argument	You give a strong and clear reason why your nominee should win, using great evidence.	You give a good reason why your nominee should win, but it could be more convincing.	You try to explain why your nominee should win, but your argument is weak or not well organized.	You don't give a reason why your nominee should win.
Visual Layout & Design	Your poster is easy to read, with all the important information in the right place.	Your poster is mostly organized but could be easier to follow.	Your poster has some organization, but it's a little hard to read or find information.	Your poster is messy or hard to read. The information is not in the right place.
Citations (Sources)	You include multiple sources and list them in an organized way.	You include only one source, or the source is not very strong (like a blog).	You include a source, but it is unclear where the information came from.	You don't list any sources.

Judging Form

Name: ___________________________

Which poster was yours?

Which poster on CHARLES DARWIN was the best?

Which poster on ROSALIND FRANKLIN was the best?

Which poster on BARBARA MCCLINTOCK was the best?

Which poster on GREGOR MENDEL was the best?

Which scientist should win the DNA Discovery Award? (Circle One)

Charles Darwin Rosalind Franklin Barbara McClintock Gregor Mendel

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