ScienceNews

IN HIGH SCHOOLS | EDUCATOR GUIDE

CLOCKWISE FROM TOP LEFT: BRYCE VICKMARK; BRYCE VICKMARK; DEPT. OF CHEMISTRY/UIUC; CENTER FOR ADVANCED STUDY IN THE BEHAVIORAL SCIENCES AT STANFORD UNIV.; INSTITUTE FOR ADVANCED STUDY; AMY MANLEY/SYRACUSE UNIV.; C. HAMILTON; MARÍA CECILIA ABARCA/UNIVERSIDAD DIEGO PORTALES; A. SHRIVASTAVA; MEGAN MENDENHALL/DUKE UNIV.

October 13, 2018

SN 10: Scientists to Watch

SOCIETY FOR SCIENCE & THE PUBLIC

SN EDUCATOR GUIDE

October 13, 2018

SN 10: Scientists to Watch

About this Guide

Use this Guide to teach the SN 10: Scientists to watch, a special issue featuring 10 early- and mid-career scientists who are borrowing tools and inspiration from other fields to solve pressing questions facing science and society. Two of the scientists are Joaquín Rodríguez-López and Paula Jofré. "Flowing toward a sustainable future" describes how Rodríguez-López is developing batteries that could be useful for storing energy from wind farms and solar panels. "Mapping stars across generations" describes how Jofré constructed an evolutionary family tree for stars within the Milky Way that could help us better understand the origins of our galaxy.

Readability scores
"Flowing toward a sustainable future": 11.7
"Mapping stars across generations": 10.1

Also see the ***Science News for Students*** article version of "Mapping stars across generations":
"Cool Jobs: Making stellar connections": 7.6

This Guide includes:

Article-based observations Q&A — Reading comprehension questions and answers on "Flowing toward a sustainable future" and "Mapping stars across generations."

> **Key topics covered:** electrochemistry, renewable energy, batteries, astronomy and evolutionary trees

Article-based observations, questions only — These questions are formatted so it's easy for you to print them out and give them to students without answers.

Cross-curricular connections Q&A:

> **Word bank and definitions by science subtopic —** Define key science terms relating to biology, chemistry, physics, Earth science and math using contextual clues from all of the SN 10 profiles.

Cross-curricular connections, questions only — These questions are formatted so it's easy for you to print them out and give them to students without answers.

Activity: Who are the SN 10 scientists?

> **Purpose:** To gain a better understanding of the character traits, personal qualities, career paths, science, technology, engineering and mathematics (STEM) fields and the science behind the SN 10 scientists' research.

Procedural overview: Students can work in groups of two or three to come up with Jeopardy!-like answers and questions about the 10 young scientists covered in this issue. Once students submit questions and answers, a game can be prepared for the next class. Or you could choose to instead use the pre-made game that's provided with this Guide.

Approximate class time: Two classes, or approximately 60–90 minutes total, depending on the activity chosen.

Other related articles and media — *Science News* and *Science News for Students* articles and videos on similar topics that you can use in your teaching.

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Standards

Next Generation Science DCI	Common Core ELA
Matter and Its Interactions: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-8	Reading Informational Text (RI): 1, 2, 4, 5, 7
Motion and Stability: Forces and Interactions: HS-PS2-4, HS-PS2-6	Writing (W): 1, 2, 3, 4, 6, 7, 8, 9
Energy: HS-PS3-1, HS-PS3-2	Speaking and Listening (SL): 1, 2, 4, 5, 6
Waves and Their Applications in Technologies for Information Transfer: HS-PS4-1, HS-PS4-3, HS-PS4-4	Reading for Literacy in Science and Technical Subjects (RST): 1, 2, 3, 4, 5, 7, 8, 9
From Molecules to Organisms: Structures and Processes: HS-LS1-1, HS-LS1-2, HS-LS1-3	Writing Literacy in History/Social Studies and Science and Technical Subjects (WHST): 1, 2, 4, 7, 8, 9
Ecosystems: Interactions, Energy, and Dynamics: HS-LS2-7	
Biological Evolution: Unity and Diversity: HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4	
Earth's Place in the Universe: HS-ESS1-1, HS-ESS1-3, HS-ESS1-6	
Earth's Systems: HS-ESS2-1, HS-ESS2-3, HS-ESS2-5	
Earth and Human Activity: HS-ESS3-2, HS-ESS3-4	
Engineering Design: HS-ETS1-1, HS-ETS1-2, HS-ETS1-3	

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Article-Based Observation: Q&A

These questions are based on the *Science News* (*SN*) article about Joaquín Rodríguez-López: "Flowing toward a sustainable future."

1. What personal characteristics helped make Rodríguez-López a successful scientist?

Possible student response: Other scientists said that Rodríguez-López has deep knowledge and is willing to share it, and that he is good at getting a team of people to work together toward a common goal.

2. What inspired Rodríguez-López to become a scientist?

Possible student response: When he was growing up in Mexico, Rodríguez-López spent hours at home reading *Encyclopedia Britannica*, and then helped other students at school. In college, he was inspired by learning that chemicals can react to produce energy.

3. What type of battery does Rodríguez-López work on, and how does it work?

Possible student response: Rodríguez-López works on flow batteries. These batteries have two tanks of liquid (one positively charged and one negatively charged) that are separated by a membrane. When the liquids meet, they exchange ions across the membrane and generate electric current.

4. What helped inspire Rodríguez-López's research?

Possible student response: Lithium batteries power a wide range of devices, yet they can only provide a certain amount of energy before having to be recharged. Scaling up lithium batteries to store large amounts of energy from wind farms or solar panel arrays is expensive. Flow batteries are a better choice to store large amounts of renewable energy because their tanks can be easily scaled up relatively cheaply.

5. What was the objective of Rodríguez-López's research that was reported in *Journal of the American Chemical Society* in 2014? What is the objective of the research he is currently conducting in his lab at the University of Illinois at Urbana-Champaign?

Possible student response: In collaboration with his colleagues, Rodríguez-López created a new type of polymer that stores electrical energy in a flow battery. The polymer does this through a series of chemical reactions among molecules within the polymer. The polymers are bulky so they are less likely to leak across a flow battery's membrane, increasing the battery's energy storage and efficiency. In his lab at the University of Illinois at Urbana-Champaign, Rodríguez-López continues to search for new materials and new techniques to improve battery performance, especially for storing energy produced from renewable resources like wind and solar.

6. Why is Rodríguez-López's research important for the real world?

Possible student response: Battery storage is essential for making renewable energy affordable and reliable. If flow batteries' storage capabilities could significantly improve, the batteries could more efficiently store electricity from wind farms and solar panels.

7. What STEM field(s) does this research belong to? What other types of research might scientists in these fields work on?

Possible student response: The research covers the fields of chemistry, electrical engineering and materials science. Together, these fields make up an intersectional field called electrochemistry. Electrochemists can work on batteries, fuel cells, electroplating, corrosion and corrosion resistance, and electrolysis, among other things.

8. Search the *SN* or *Science News for Students* archives to find and summarize another article about improving batteries.

Possible student response: The *Science News for Students* article, "Building a better battery," published April 8, 2013, describes how researchers are developing batteries that can hold more charge and do not weaken with age. These batteries use sulfur, which is inexpensive and can store large amounts of energy. To overcome problems with sulfur making unwanted chemical byproducts or even exploding, the researchers surrounded the sulfur particles in the battery with a thin titanium dioxide coating.

These questions are based on the *SN* article about Paula Jofré: "Mapping stars across generations."

1. What personal characteristics helped make Jofré a successful scientist?

Possible student response: Jofré combined methods from astronomy and biology in ways that no one had before. Other researchers say that she is very innovative, brave and confident, and that she sees things that other researchers do not see.

2. What inspired Jofré to become a scientist?

Possible student response: Jofré has been interested in astronomy since childhood. When a guidance counselor said that it was important for women to choose careers that would leave time for family instead of pursuing demanding careers in science fields, Jofré became even more determined to become an astronomer.

3. What was the inspiration that helped define Jofré's research topic?

Possible student response: Jofré, who is an astrophysicist, met anthropologist Robert Foley at the University of Cambridge in England. They talked about how evolutionary trees can trace relationships between members of a species over time. She decided to apply that method to stars, since stars have a finite lifespan and pass on their matter, including traceable heavy elements such as carbon and iron, to new generations of stars.

4. What was Jofré's objective of her research?

Possible student response: Jofré wanted to construct an evolutionary family tree of every star in the Milky Way, showing the relationships between stars and revealing more about stars' lifecycles.

5. What methods did she use for her research?

Possible student response: Jofré measured the wavelengths of light emitted by different stars in order to figure out what chemical elements were in those stars, and in what proportions. By examining similarities and differences of the stars' elemental compositions, she was able to construct a family tree for the stars.

6. What overall STEM field(s) does this research belong to? What other types of research might scientists in these fields work on?

Possible student response: The research covers astrophysics and topics in biology, such as evolution and family trees. Astrophysicists can pursue a wide range of careers, studying everything from the Big Bang to solar storms. Evolutionary family trees are usually constructed to identify relationships between different living and extinct species, or to trace relationships between members within the same species. Jofré's research shows that evolutionary family trees can be applied to other scientific areas as well.

7. Search the *SN* or *Science News for Students* archives to find and summarize another article about tracing the relationships between stars.

Possible student response: The *Science News* article, "Chemical signature of first-generation star found," published August 21, 2014, describes how a star located in the direction of the constellation Cetus, about 1,000 light-years from Earth, appears to contain matter inherited from one of the first stars in the universe. That first-generation star was more than 100 times as massive as the sun, and it produced a unique signature of elements including carbon, magnesium and iron.

8. How are Jofré and Rodríguez-López similar?

Possible student response: Both scientists have found new results by exploring the boundaries between different research fields and by combining different tools and techniques from those fields. The scientists are also similar in that they are self-motivated and driven by new challenges.

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Article-Based Observation: Q

Directions: Read the articles "Flowing toward a sustainable future" and "Mapping stars across generations" then answer the questions.

1. What personal characteristics helped make Rodríguez-López a successful scientist?

2. What inspired Rodríguez-López to become a scientist?

3. What type of battery does Rodríguez-López work on, and how does it work?

4. What helped inspire Rodríguez-López's research?

5. What was the objective of Rodríguez-López's research that was reported in *Journal of the American Chemical Society* in 2014? What is the objective of the research he is currently conducting in his lab at the University of Illinois at Urbana-Champaign?

6. Why is Rodríguez-López's research important for the real world?

7. What STEM field(s) does this research belong to? What other types of research might scientists in these fields work on?

8. Search the *SN* or *Science News for Students* archives to find and summarize another article about improving batteries.

These questions are based on the *SN* article about Paula Jofré: "Mapping stars across generations."

1. What personal characteristics helped make Jofré a successful scientist?

2. What inspired Jofré to become a scientist?

3. What was the inspiration that helped define Jofré's research topic?

4. What was Jofré's objective of her research?

5. What methods did she use for her research?

6. What overall STEM field(s) does this research belong to? What other types of research might scientists in these fields work on?

7. Search the *SN* or *Science News for Students* archives to find and summarize another article about tracing the relationships between stars.

8. How are Jofré and Rodríguez-López similar?

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SN 10: Scientists to Watch

Cross-Curricular Connections: Q&A

Directions: Define key science terms relating to the SN 10: Scientists to watch using contextual clues from the articles. Consult an outside resource if necessary.

Word bank and definitions by science subtopic:

Biology

What is RNA?
RNA is ribonucleic acid. It is a molecule in cells that is used to copy the instructions in DNA and direct the creation of proteins essential to the cell's function.

What is a polymerase?
A polymerase is an enzyme that takes smaller chemical molecule subunits called monomers and joins them together to make a long molecule called a polymer. A DNA polymerase joins together nucleotides to make a new DNA strand, generally copying from an existing DNA strand. An RNA polymerase joins together RNA nucleotides to make a new RNA strand, either copying from an existing DNA strand (in normal cells) or sometimes from an RNA strand (in some virus-infected cells).

What is transcription?
Transcription is the process of making an RNA copy of DNA. In normal cells, enzymes open the DNA strands of a gene. Then RNA polymerase forms on one of the DNA strands and makes an RNA copy of it.

What is the human microbiome?
The human microbiome is the collection of microorganisms — bacteria, viruses, fungi and more — that live on a person's skin and inside the gastrointestinal tract and other areas of the body. The microorganisms of the human microbiome are generally harmless, but can cause illness under certain circumstances. Microbes living in and on the human body can even perform useful services, ranging from helping to digest food to preventing harmful microorganisms from invading the same space.

What is chronic inflammation?
Chronic inflammation occurs when the body's immune system mistakenly signals cells to attack invaders when there are no invaders to be found. The resulting ongoing overreaction by cells can cause a variety of problems, damaging tissue in the gastrointestinal tract, respiratory system, joints, nerves or other regions of the body.

What is asthma?
Asthma is chronic inflammation of the airways of the lungs, which causes swelling. As a result, the body can expand to breathe in air, but loses the ability to exhale appropriately. Muscles lining the airways can contract or spasm, constricting the airways and making it harder to breathe. Asthma

can be triggered or worsened by allergens or other substances that the immune system recognizes and tries to attack.

Chemistry

What is choline?

Choline is a vitamin; the human body can make some choline, but not as much as it needs, so it is necessary to obtain choline from foods or vitamin supplements. In the body, choline is a chemical signal that relays messages between nerve cells and other types of cells.

What is TMAO?

Trimethylamine N-oxide (TMAO) is a chemical molecule, $(CH_3)_3NO$. It is produced in response to certain foods by some bacteria in the human gastrointestinal tract, where it can then enter the bloodstream. High levels of TMAO in the blood may be associated with cardiovascular disease.

What is a lithium ion battery?

Lithium ion batteries have a graphite anode containing loose lithium atoms, a liquid electrolyte (typically an organic solvent) and a cathode (typically a metal oxide). Electrons leave the anode, travel through an electric circuit and return to the cathode. Lithium ion batteries have become widely used in modern devices such as cell phones, laptops and smartwatches.

What is a flow battery?

Flow batteries have two tanks of liquid (one positively charged and one negatively charged) that are separated by a membrane. Where the liquids meet, their ions exchange and generate electric current. Flow batteries can store large amounts of energy, which could make them useful for electric cars and the U.S. power grid.

What is electroplating?

Electroplating is a process used to coat one metal with a thin layer of another metal. The process involves placing a metal object in a solution containing ions of another metal and then passing an electric current through the system. That causes the ions to adhere to the metal object. Electroplating can be used to deposit thin layers of silver or gold on jewelry, coat electrical connectors with gold and coat iron or steel hardware with zinc.

What is corrosion?

Corrosion is the reaction between oxygen and a metal, usually forming a metal oxide, such as iron oxide.

What is spectroscopy?

Spectroscopy is a tool that uses light to determine characteristics of an object. By analyzing how an object scatters light into various wavelengths, scientists can infer physical properties of the object including its temperature, mass, luminosity and chemical makeup.

Physics and astronomy

What is a jamming transition?

In a jamming transition, the components of a material change from flowing freely by each other to sticking together. Jamming transitions can happen with anything from sand to human cells to herds of students eager to leave school.

What is a phase transition?

A phase transition is a change in how the atoms, molecules, or other components of a material are organized. The best-known phase transitions are from solid to liquid, liquid to gas, and gas to

plasma. Some materials such as liquid crystals can have additional phase transitions in which their properties change in more subtle ways.

What is condensation?
Condensation is a phase transition from a gas or vapor into a liquid. The best-known example of condensation is when water molecules in the air join together to become droplets of water that form clouds or rain.

What is a scanning electron microscope?
A scanning electron microscope uses a beam of electrons to create an image of an object. Because electrons can act like waves, and because those electron waves can be much smaller than light waves, an electron microscope can visualize much smaller features than an ordinary light microscope.

What is a black hole?
A region of space having a gravitational field so intense that no matter or radiation (including light) can escape. Most black holes form when very large stars run out of fuel and collapse.

What is Hawking radiation?
Hawking radiation is the theoretical faint glow of particles emitted by black holes. According to quantum mechanics, pairs of particles and antiparticles pervade all of space. Each particle and its antiparticle partner annihilate one another almost as soon as the pair appears. However, if a particle-antiparticle pair appears just outside of a black hole and one of the particles falls into the black hole, the surviving member of the pair can escape. Hawking radiation has never been directly observed.

What is quantum gravity?
A theory of quantum gravity would unite quantum physics — which describes the behavior of very small things including electrons, protons, neutrons and photons — with Albert Einstein's general theory of relativity, which describes the different but equally strange behavior of space and time in regions with gravitational fields. We do not currently have a good theory of quantum gravity.

What is stellar evolution?
Stellar evolution usually refers to how one star changes over the course of its lifetime, although evolution can be applied to trace the relationships among multiple stars. Stars are born from fusion reactions that occur when massive clouds of mostly hydrogen heat up and collapse. Toward the end of a star's life, it experiences a series of reactions that result in the collapse of its core. Depending on the star's mass, the stellar core can form one of three objects: a white dwarf, a neutron star or a black hole.

Earth and environmental science

What is climate change?
Climate change is long-term, significant change in Earth's climate. It can happen naturally and in response to human activities such as the burning of fossil fuels, which produces carbon dioxide and other greenhouse gases. As those gases accumulate in the atmosphere, they trap longer-wavelength solar radiation reflected as heat by Earth. As a result, Earth is warming at an accelerated rate.

What is energy conservation?

Energy conservation is any behavior that results in the use of less energy. Important methods of energy conservation include improving the efficiency of devices such as light bulbs, refrigerators and other household appliances, increasing recycling and producing less goods from new materials, and traveling less on airplanes or other vehicles that require a lot of energy.

What is water treatment?

Water treatment is the process of making water drawn from lakes, rivers, reservoirs and underground wells safe for people to drink, cook and bathe with. The complex, multi-step process involves removing potentially harmful substances — including microbes, minerals and certain chemicals — and adding beneficial substances such as fluoride.

What is a volcano?

A volcano is a place on Earth's crust that opens, allowing hot molten rock called magma and gases to spew out from underground. The magma rises through a system of pipes or channels, sometimes spending time in chambers where it bubbles with gas and undergoes chemical transformations. Once the magma spews onto Earth's surface, it's called lava. The surface around a volcano's opening can grow into a mound or cone shape as successive eruptions send more lava onto the surface, where it cools into hard rock.

Mathematics

What is chaos?

Chaos occurs when a small change in the input conditions of a system can cause a very large change in the output. The most famous example of chaos is the butterfly effect: a hypothetical scenario in which a butterfly flaps its wings, and the tiny change in airflow affects when and where a storm appears. Some systems are less chaotic than others and can be easily predicted, such as the motion of two objects orbiting each other in space. The more objects that are added to such a system, the more chaotic the system becomes. Recently, black holes have been found to reach the peak of chaos — nothing can be more chaotic than a black hole.

What is Big Data?

Big Data is a term that refers to the accumulation of data sets that are too large and complex for processing by traditional database management tools. A few examples of Big Data include the online behavior of everyone using the internet worldwide or health records of millions of people. Researchers are designing and testing new techniques to extract useful information from such data sets.

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Cross-Curricular Connections: Q

Directions: Define key science terms relating to the SN 10: Scientists to watch using contextual clues from the articles. Consult an outside resource if necessary.

Word bank and definitions by science subtopic:

Biology

What is RNA?

What is a polymerase?

What is transcription?

What is the human microbiome?

What is chronic inflammation?

What is asthma?

Chemistry

What is choline?

What is TMAO?

What is a lithium ion battery?

What is a flow battery?

What is electroplating?

What is corrosion?

What is spectroscopy?

Physics and astronomy

What is a jamming transition?

What is a phase transition?

What is condensation?

What is a scanning electron microscope?

What is a black hole?

What is Hawking radiation?

What is quantum gravity?

What is stellar evolution?

Earth and environmental science

What is climate change?

What is energy conservation?

What is water treatment?

What is a volcano?

Mathematics

What is chaos?

What is Big Data?

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Activity Guide for Teachers: Who are the SN 10 Scientists?

Purpose: To gain a better understanding of the character traits, personal qualities, career paths, STEM-related fields and science behind the SN 10 scientists' research.

Procedural overview: Students can work in groups of two or three to come up with Jeopardy!-like answers and questions about the SN 10 scientists, or you can use the prepared game provided. Once answers and questions are submitted, a game can be prepared for the next class. Approximately one class period is required to allow students to read the articles and prepare the game, and one class period is required to play the game. Or, allow students time to read the articles, then use the pre-made game that's provided with this Guide. Approximately one class period is required when the pre-made Jeopardy!-like board is used.

Approximate class time: Two class periods or approximately 60–90 minutes total, depending on the activity chosen.

Materials:

- Activity Guide for Students: Who are the SN 10 scientists?
- *Science News* articles on the SN 10 scientists
- Pre-made game board provided

Pre-made Jeopardy!-like board:

Personal Traits	Inspiration to be a Scientist	Research Objectives	Fun Research Fact	Name that STEM Field	What Else Could You Do?
"Can do chemistry that very few people in the world can do"	Built a lab in the family house while growing up	Studies the enzymes that copy DNA to RNA	Found how bacteria may contribute to heart disease	Is an electrochemist	Might have advice if you wanted to study the clumping of Alzheimer's proteins
Has a "deep knowledge" and "willingness to share it"	Loved to read *Encyclopedia Britannica* as a child	Studies the effects of individual particles on black holes	Found that 1/3 of college students did not know about water treatment	Combines environmental science and psychology	Might have advice if you wanted to study how to create a wormhole
Described as a holistic thinker	First learned about physics from sailing	Studies volcanoes throughout the solar system	Found further proof that Mars once had a lot of water	Is a theoretical physicist	Might have advice if you wanted to study the effects of acceleration on cells
Thinks "that feeling of discovery is incredibly addictive"	Was encouraged to do biology by a high school physics teacher	Wanted to create a family tree of stars	Studies the "light fingerprint" from different elements	Is a planetary geologist	Might have advice if you were trying to develop autonomous drones
Thinks about hard problems for a long time then suddenly finds a solution	Was motivated to combine computer, animal, and bench work	Wanted make neural networks more efficient	Measures the health of monkeys under different conditions	Combines evolutionary anthropology and genomics	Might have advice if you were studying genetic predisposition to becoming a science nerd

Pre-made Jeopardy!-like board answers:

Answers	Personal Traits	Inspiration To Be a Scientist	Research Objectives	Fun Research Fact	Name that STEM Field	What Else Could You Do?
Who is Ibrahim Cissé?		Built a lab in the family house while growing up	Studies the enzymes that copy DNA to RNA			Might have advice if you wanted to study the clumping of Alzheimer's proteins
Who is Emily Balskus?	"Can do chemistry that very few people in the world can do"			Found how bacteria may contribute to heart disease		
Who is Joquin Rodriguez-López?	Has a "deep knowledge" and "willingness to share it"	Loved to read *Encyclopedia Britannica* as a child			Is an electrochemist	
Who is Shahzeen Attari?	Described as a holistic thinker			Found that 1/3 of college students did not know about water treatment	Combines environmental science and psychology	
Who is Douglas Stanford?		First learned about physics from sailing	Studies the effects of individual particles on black holes		Is a theoretical physicist	Might have advice if you wanted to study how to create a wormhole
Who is Lisa Manning?	Thinks "that feeling of discovery is incredibly addictive"	Was encouraged to do biology by a high school physics teacher				Might have advice if you wanted to study the effects of acceleration on cells
Who is Chris Hamilton?			Studies volcanoes throughout the solar system	Found further proof that Mars once had a lot of water	Is a planetary geologist	
Who is Paula Jofré?			Wanted to create a family tree of stars	Studies the "light fingerprint" from different elements		
Who is Anshumali Shrivastava?	Thinks about hard problems for a long time then suddenly finds a solution		Wanted make neural networks more efficient			Might have advice if you were trying to develop autonomous drones
Who is Jenny Tung?		Was motivated to combine computer, animal, and bench work		Measures the health of monkeys under different conditions	Combines evolutionary anthropology and genomics	Might have advice if you were studying genetic predisposition to becoming a science nerd

Notes to the teacher: Each group is assigned a different scientist from the 10 scientists profiled in this issue of *Science News*. Students in each group come up with Jeopardy!-style answers and questions for their assigned scientist, based on information in the *Science News* article. Each student in a group come up with one answer and its corresponding question for each of these six categories:

1. Personal traits: things that helped the scientist succeed.

2. Inspiration to be a scientist: things that inspired this person to become a scientist.

3. Research objectives: question(s) that the scientist is trying to answer.

4. Fun research fact: something unique or surprising about the scientist's research.

5. Name that STEM field: questions and answers should relate to the scientist's field(s) of study.

6. What else could you do?: other types of STEM careers that one could pursue in the scientist's field(s).

Students can spend up to one class period (or approximately 40–45 minutes) working in groups to write their answers and questions, and then they can submit them to the teacher. The teacher can assemble those answers and questions into a Jeopardy!-style board under the six categories listed above. Easier pairs of answers/questions can be assigned lower point values, and harder pairs can be assigned higher point values:

- 200 vibranium coins
- 400 vibranium coins
- 600 vibranium coins
- 800 vibranium coins
- 1,000 vibranium coins

Before the next class, the homework for the teacher is to assemble the students' answers and questions into a Jeopardy!-style board:

Personal Traits	Inspiration To Be a Scientist	Research Objectives	Fun Research Fact	Name that STEM Field	What Else Could You Do?
200	200	200	200	200	200
400	400	400	400	400	400
600	600	600	600	600	600
800	800	800	800	800	800
1000	1000	1000	1000	1000	1000

Note for teachers: You only need 30 pairs of answers and questions for the game. The pairs chosen should cover the scientists and the student teams in a fair and representative fashion. The students' sheets are designed to be cut apart by the teacher in preparation for the game. Students are not allowed to answer a question that their team submitted, which is why it is important for the students to write their names on every answer/question pair that they submit. You might want to start off the class with your favorite Jeopardy! clip, or at least the theme song! Also, feel free to create a final Jeopardy!-like answer and question for the game, so student groups can wager their points.

Before the next class, the students' homework is to read the articles about all of the scientists and take notes.

After the game, you can wrap up the activity by asking the class some unifying questions, such as:

1. What personal characteristics are shared by many or all of the scientists? Why might that be?

2. What are some common sources of inspiration to become a scientist? For students in the class who would like to go into STEM careers, what has inspired them? What has inspired students to want to pursue careers outside of STEM?

3. How do (or should) scientists choose their research objectives?

4. What are the various methods that scientists use to solve different problems?

5. How many different STEM fields are represented by these scientists? What important STEM fields are not included in this small sample of scientists?

6. What have you learned about scientific careers from these articles and this activity?

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Activity Guide for Students: Who are the SN 10 Scientists?

Purpose: To gain a better understanding of the character traits, personal qualities, career paths, STEM-related research fields and the science behind the SN 10 scientists' research.

Procedural overview: Work in groups of two or three to come up with Jeopardy!-like answers and questions about the SN 10 scientists. Once answers are submitted, your teacher will prepare a game for the next class.

Instructions: Each group is assigned a different scientist from the 10 scientists profiled in this issue of *Science News*. After reading the article and taking notes, work with your group to come up with Jeopardy!-style answers and questions for your assigned scientist, based on information in the *Science News* article. Don't forget to word your Jeopardy!-style clues as answers, so that the audience will answer the clues with a question. Groups should come up with one answer and its corresponding question for each of six categories. Your teacher will cut this handout apart and mix your answer/question pairs with those of other groups. When playing the game, you will not be allowed to answer a question that your group submitted, so it is important to write the names of your group members on each answer/question pair:

1. Personal traits: things that helped the scientist succeed

Jeopardy!-style answer:

Jeopardy!-style question:

Names of your group members:

2. Inspiration to be a scientist: things that inspired this person to become a scientist

Jeopardy!-style answer:

Jeopardy!-style question:

Names of your group members:

3. Research objectives: What question is this scientist trying to answer?

Jeopardy!-style answer:

Jeopardy!-style question:

Names of your group members:

4. Fun fact: Something unique or surprising about this scientist's research

Jeopardy!-style answer:

Jeopardy!-style question:

Names of your group members:

5. Name that STEM field: Can contestants guess the researcher's field based on your question?

Jeopardy!-style answer:

Jeopardy!-style question:

Names of your group members:

6. What else could you do?: other types of STEM jobs in the scientist's field(s)

Jeopardy!-style answer:

Jeopardy!-style question:

Names of your group members:

After the game is over, spend time answering the following questions:

1. What personality traits are shared by many or all of the scientists? Why might that be?

2. What are some common sources of inspiration to become a scientist? For students in the class who would like to go into STEM careers, what has inspired you? If you want to pursue careers outside of STEM, what has inspired you?

3. How do (or should) scientists choose their research objectives?

4. What are the methods that scientists use to solve different problems?

5. How many different STEM fields are represented by these scientists? What important STEM fields are not included in this small sample of scientists?

6. What have you learned about scientific careers from these articles and this activity?

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SN 10: Scientists to Watch

Other Related Articles and Media

***Science News*:**

Article: "Better batteries charge forward"

Article: "Lithium-oxygen batteries are getting an energy boost"

Article: "The ecosystem that controls a galaxy's future is coming into focus"

***Science News for Students*:**

Article: "Germs power new paper batteries"
Readability score: 8.3

Article: "Half the Milky Way may be stolen material"
Readability score: 8.2

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