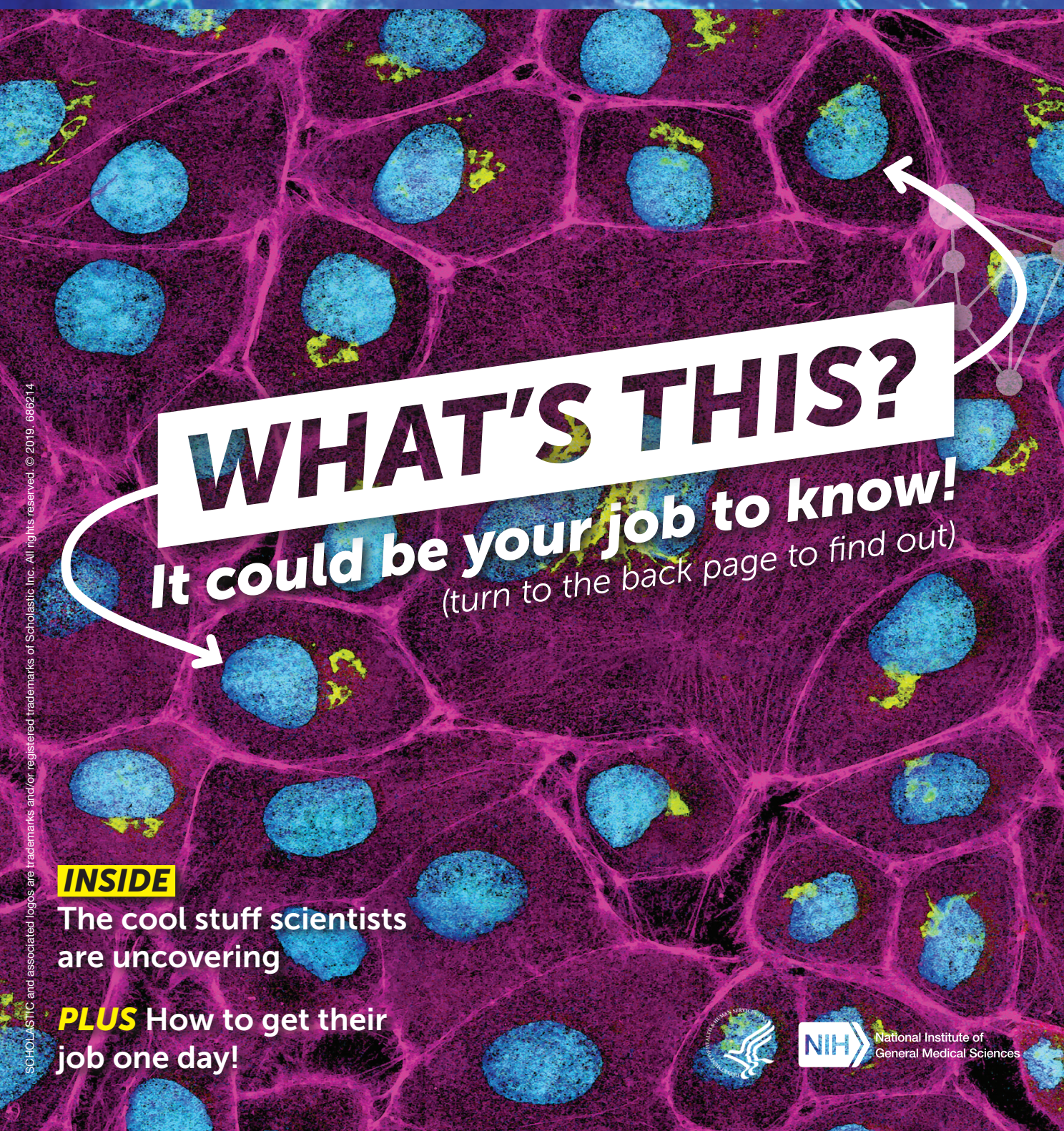
SPONSORED EDUCATIONAL MATERIALS

SCHOLASTIC

# PATHWAYS



## WHAT'S THIS?

**It could be your job to know!**

*(turn to the back page to find out)*

**INSIDE**

The cool stuff scientists are uncovering

***PLUS*** How to get their job one day!



NIH National Institute of General Medical Sciences

# How Curiosity Creates Cures

**Look around you.** From your fingernails to faraway forests, the whole world is teeming with wonder. See how these scientists are unlocking nature's secrets to improve our health.

**Ph.D.**
**A Doctor of Philosophy** is the highest academic degree awarded by universities. It means you've studied a lot!

## The Beetle Guy

**Ryan Bracewell, Ph.D.,** postdoctoral fellow, University of California, Berkeley

**What do you research?** Using bark beetles, I carry out genetics experiments to understand how chromosomes evolve and have led to diversity among living things.

**What is most exciting about being a scientist?** Some days I'm outdoors using chainsaws to collect bark samples. Other days I'm indoors writing code and analyzing data. Each day I get to do what I love.

**Were you interested in science as a kid?** I was often in a swamp digging around for creatures. And I was interested in how things worked. It wasn't until later that I realized I could turn these interests into a career.

**What would you say to a budding scientist?** Ask questions and think about what's going on around you. And always be exploring and following different paths; you may stumble upon things that are interesting and amazing.

A closer look at mountain pine beetles, a species of bark beetle that Dr. Bracewell uses in his research. Females (right) are, on average, larger than males (left).

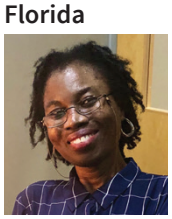
Photo courtesy of Ryan Bracewell

## What Is Basic Science?

The phrase **basic science** doesn't refer to science that's simple—it's actually a scholarly term that refers to the research of figuring out how and why things work in the world around us. Basic science in biology helps scientists understand living systems and find new ways to improve our health.

## The Viral Star

**Mavis Agbandje-McKenna, Ph.D., professor, University of Florida**



**What do you research?** Viruses. I try to understand the ones that make people sick as well as the ones that don't. I study how they can be used to make treatments or cures.

**What kinds of tools do you use?** I use a tool called a cryo-electron microscope. It creates detailed images of the three-dimensional structure of a virus.

**What's an example of a mistake that you have made?** After two weeks of preparing a virus to study, I was cleaning up my station and instead of pouring my waste down the drain, I poured out the virus! I told my boss, and he said, "Mistakes happen—and now you will never do that again." Nearly 30 years later, he was right; I never did it again. In science, failure is going to happen a *lot*. You have to learn from your mistakes.

**How would you encourage teens who are interested in science but don't have role models in the field?** Don't give up. Reach out to a teacher or a guidance counselor who can connect you with science programs outside of school.

**Did you know?** Venom from the Gila monster has been found to help treat diabetes.

## The Gene Detective

**Melissa Wilson,** Ph.D., assistant professor, Arizona State University

**What do you research?** My research focuses on the role genetics plays—and does not play—in shaping life. We're a product of our genes and our environment. It's this cool kind of interplay.

**What kinds of animals do you study?** We look at the rattlesnake, Gila monster, tortoise, and other animals. But we study humans too!

**What's the most important skill a scientist should develop?** You need to be open to being wrong. My lab and classrooms are no-judgment zones. Because if we can't ask questions and be wrong or make mistakes, then we're not going to learn.

## The Powerhouse

**Christian J. Garcia,** Ph.D. student, Columbia University

**What do you research?** Mitochondrial diseases. The mitochondria are the power plants of the cell, so these diseases affect organs that require a lot of energy.

**How did you get into this specific field?** In fifth grade I started having fainting spells. Doctors didn't know why. After a year and a half, I was diagnosed with hypoglycemia. They changed my diet and I stopped fainting. That always stuck with me, just how powerful nutrition can be.

**What are some ways you conduct your research?** I use a confocal microscope and gel electrophoresis. I look at mitochondria that aren't working in flies and mice—and research how they can be fixed.

**What is essential to your work?** Teamwork. I played team sports my whole life, and working in the lab is similar. My lab leader is like our coach—and every person in a lab has something to offer.

## The Bacteria Spy

**Alecia Dent,** Ph.D. student, University of Maryland, Baltimore School of Pharmacy

**What do you research?** I investigate how bacteria survive during infections.

**How did you get into science?** Growing up, I attended an underfunded school. We didn't have much of a science program, but once a week in third and fourth grade, a teacher would do experiments with us. It was the coolest class I had. At home, I would try to create experiments in the basement. I didn't have the correct materials, so I would just make things up and observe what happened.

**How did you make the leap to becoming a scientist?** It was very important to me to find a mentor (an experienced adviser) who was doing things that I thought were interesting and who came from my kind of background. I needed to see that someone coming from very little resources and very few opportunities could do what I dreamed of.

**What has helped you succeed?** Being open to others. Collaboration is absolutely important—there's no possible way for you to understand every single aspect of something you're doing. It's OK for you not to know things. If everyone knew everything, we wouldn't need science!

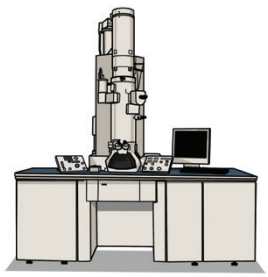
**Bacteria** are microscopic one-celled organisms that can be found everywhere. They can be dangerous, such as when they cause infection, or beneficial, such as in the process of fermentation (making cheese or vinegar) and decomposition.

# COOL TOOLS IN SCIENCE

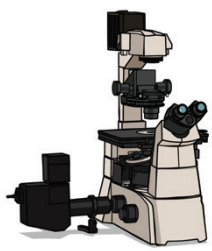
## What do you see?

You've read about some unique techniques used in basic science research. Now see some of them in action. Below each image, write the name of the instrument or method used to create the image.

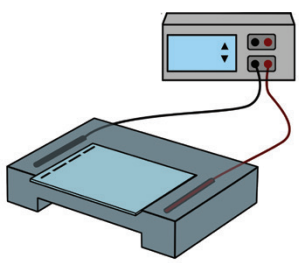
| INSTRUMENT/METHOD | IMAGE CREATED |
|---|---|



**Cryo-Electron Microscopy** Typically a transmission electron microscope is used to capture images of a rapidly frozen virus or sample, then computers create clear images of the molecular structure of the sample.



**Confocal Microscopy** Under intense light, fluorescent dyes added to a sample light up. Photos of different layers of the sample can be stacked together to create a 3D image.



**Gel Electrophoresis** When charged by an electric current, molecules separate and move through a gel. Colored stains in the gel allow the molecule to be seen.

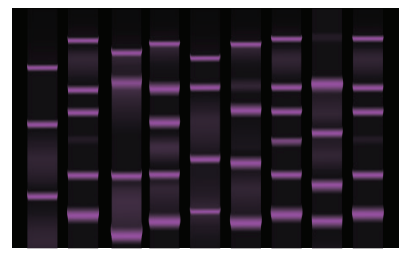


**IMAGE 1:** DNA molecule fragments

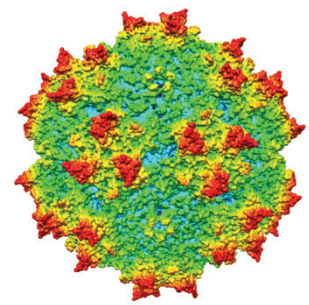


**IMAGE 2:** Computer-generated structure of a virus

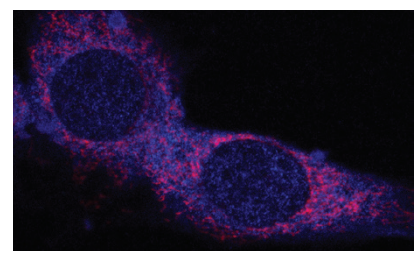
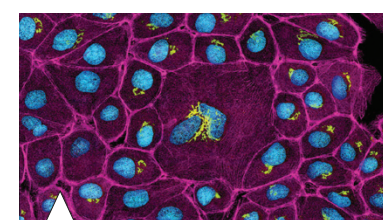


**IMAGE 3:** Mitochondria inside a cell

### Science All-Star: Dr. Michael W. Young

Sports have the Olympics, movies have the Oscars, and in science, the most prestigious award a scientist can win is the Nobel Prize. Named for Alfred Nobel, a scientist and inventor, the Nobel Prize honors men and women from around the world for outstanding achievements in physics, chemistry, physiology or medicine, literature, world peace, and more.

**Michael W. Young, Ph.D.,** a researcher, won in 2017 for his contributions to the study of the circadian rhythm that controls sleep/wake cycles, hormone release, and much more. The work was done using fruit flies. In his acceptance speech, Dr. Young called his scientific work a "remarkable journey." Just think: Some day your curiosity, passion, and collaboration with others could lead you to incredible discoveries—and maybe a few meaningful awards too.



**ON THE COVER** This image (which was created using confocal microscopy) shows human epithelial cells, a type of cell that lines and protects hollow organs, glands, and the outer surface of the body. Many epithelial cells can produce mucus or other secretions as protective features.

Photo: Tom Deerinck, National Center for Microscopy and Imaging Research

Photos (clockwise from top right) Michael W. Young © Mario Morgado/The Rockefeller University; cell mitochondria photo courtesy of Christian Garcia; structure of a virus photo courtesy of Mavis Agbandje-McKenna; DNA molecule fragments © extender_01/Shutterstock

# Exploring the Science in Our World

**Spark your students' curiosity about their world by introducing them to the science of living systems and how its study can improve our health.**

### Objective

Students will ask questions and define problems, plan a research project based on focused questions, and demonstrate an understanding of basic science.

### Time

60 minutes

### Materials

- What Is It? video at **scholastic.com/pathways**
- Go on a Science Scavenger Hunt activity sheet
- What Fascinates You? activity sheet
- Vocabulary list at **scholastic.com/pathways/vocablist**

**1** Display the following image. Find it in color here: **bit.ly/skinbow**.

After students guess what the image might be, explain that it is a zebrafish scale. Scientists have inserted genes that make cells brightly glow in different colors to highlight different types of cells. Each colored speck is an individual cell.

**2** Play the What Is It? video and have students complete the Go on a Science Scavenger Hunt activity sheet. After students share their thoughts on the video, write one of the following facts on the board.

- People who live in high altitudes have genetic adaptations that allow them to survive in thin air.
- Bacteria on your skin help heal injuries.
- You lose between 30,000–40,000 skin cells every minute.
- If you stretched out the DNA inside one human cell, it would be more than 6 feet long.

**3** Ask students what the fact you displayed makes them wonder about. As a class, compile a list of questions the fact generates. Push students to question the science behind the fact, as well as to consider how the fact could connect to another environment or organism.

**4** Explain that the brainstorm the class just completed is an example of how basic science research begins. Basic science is the practice of figuring out how and why things work (in contrast to applied science, which applies knowledge gained from basic science to make advances in fields like technology or medicine). Science researchers work to uncover the mechanisms and structures that power our world to understand life processes and treat diseases.

**5** Display the other facts from step 2 and distribute the What Fascinates You? activity sheet. Instruct students to develop a basic research plan using one of the facts as a starting place. Allow them to refer to the student magazine for guidance.

**6** Have students share their research plans and challenge their classmates to build on their ideas, generate new questions, or think of alternative applications for their investigations. Acknowledge that there are many different pathways into research questions.

### Using the *Pathways* student magazine

**Explain to students that there are many different research pathways within basic science as well as many possible pathways to a successful career. As a class, read the researcher profiles in the student magazine. Discuss the researchers' inspiration and interests, and emphasize the importance of students using their own skills and interests to find a career that is the best fit for them. Challenge students to identify quotes from the profiles that align with a growth mind-set (the belief that abilities can be developed through hard work and resilience). Discuss how a growth mind-set can serve students now. Emphasize the fact that the study, teamwork, and critical-thinking skills that students are developing right now can be the basis for a future career in STEM research.**

**Answers to "Cool Tools in Science" student magazine quiz: Image 1: Gel Electrophoresis, Image 2: Cryo-Electron Microscopy, Image 3: Confocal Microscopy.**

PHOTO: Chen-Hui Chen and Kenneth Poss, Duke University

# Exploring Research Tools

**Have your students design an experiment in their "dream" lab and explore the real-life toolsets of research scientists.**

### Objective

Students will define a scientific question that impacts people or the natural environment, identify the research tools needed to plan an experiment, and carry out an investigation.

### Time

60 minutes (plus time to complete experiments)

### Materials

- Timer
- Equip Your Science Lab activity sheet
- Vocabulary list at **scholastic.com/pathways/vocablist**
- What Is Basic Science? video at **scholastic.com/pathways**

**1** Set a timer for three minutes. Ask students to complete a quick drawing of a science lab. Have volunteers describe their pictures. What sorts of research tools have your students included in their sketches?

**2** Lead a class brainstorm to build a list of tools and supplies scientists use in their research and experiments. Capture the list on the board. Encourage students to think beyond the typical beakers, test tubes, and microscopes that often come to mind and prompt for ideas such as: pipette, telescope, notebook, graduated cylinder, camera, ruler, goggles, autoclave, burner, thermometer, tongs, vortex mixer, gloves, computer and software, electric field for gel electrophoresis, centrifuge, vacuum, and colorimeter. Hand out the vocabulary list and instruct students to complete the following task.

**a.** For middle school students: Have students work in small groups to sort or categorize the tools. Suggest categories such as: observation tools, manipulation tools (for mixing, heating, or cooling), measurement tools, recording tools, safety tools (for protection). Invite groups to add more tools to their categories as they work.

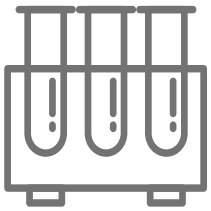
**b.** For high school students: In small groups, have students generate a list of some advantages and limitations of a few tools. Or, have students consider what substitute tools they could use if they don't have access to expensive, sophisticated tools, and how their experiment results would be similar or different (same but faster? less exact? etc.).

**3** Show the What Is Basic Science? video. Reinforce with students that basic scientists ask a lot of questions and study a range of subjects. Distribute the Equip Your Science Lab activity sheet. Ask students to select one of the scientific research questions (or another of their choosing), design an experiment to find answers, and consider the tools they would use to conduct their experiment. They should use additional sheets of paper as necessary for their work.

**4** Ask students to share their experiment designs and tool lists in small groups. Encourage them to build on each other's ideas and make suggestions for each other's experiment designs. Can groups think of possible practical applications that would arise from their experiments?

## EXTENSION

Conduct an experiment in your class. Have students take notes on the tools they used and questions that evolved during the experiment. Instruct students to write a short description assessing how well the tools functioned, what tools they would use in the future, and what questions and/or next steps that arose from the experiments.



# Small Cells, Big Findings

**Bring your students down to the molecular level and uncover cool findings and applications for emerging cellular research.**

### Objective

Students will reflect on informational text and conduct inquiry to gain a greater understanding of what can be learned from the cellular subsystems of research organisms.

### Time

60 minutes

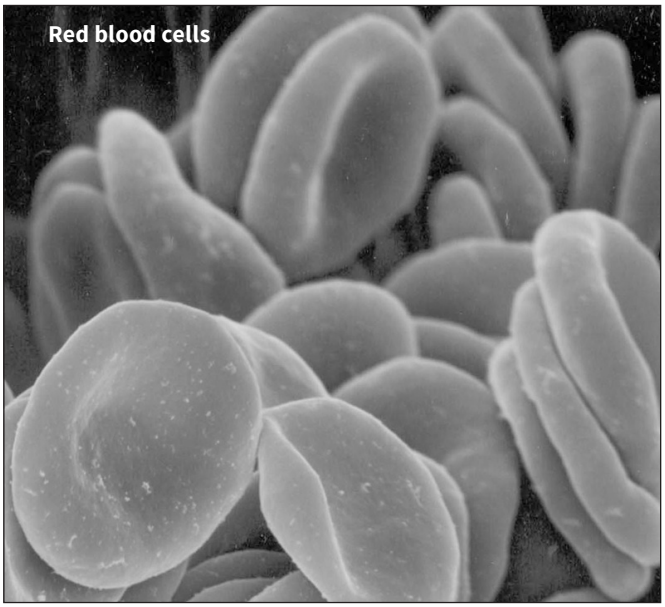
### Materials

- Uncover the Secrets of Cells activity sheet
- Vocabulary list at **scholastic.com/pathways/vocablist**
- The Fascinating Cells of Research Organisms video at **scholastic.com/pathways**

**1** Show the video and discuss research organisms. Include the following points:

**a.** Much of what we know about biology comes from studying research organisms.

**b.** A research organism can be any creature that scientists use to study life, from single-celled organisms, like bacteria, to more complex animals like mice.


Red blood cells

**c.** The most valuable research organisms have a genetic makeup that is similar to humans or behave in a manner that allows scientists to make important comparisons to the functioning of human cells.

**d.** Because of genetic, cellular, or other similarities, researchers can learn more about human function and health by studying research organisms.

**2** Distribute the Uncover the Secrets of Cells activity sheet. Ask students to read the passages and answer the focused reading question: Why do scientists study cells?

**3** Introduce the culminating challenge. Using the information from their activity sheets, students will create an infographic, a quiz, or a set of fun-fact flash cards that could be featured online to help kids learn more about cells, research organisms, and the possible human health applications of scientific research on cells. Generate a list of success criteria together on the board. Prompt for ideas such as: fun to read or use, easy for younger students to read and understand, and/or includes accompanying illustrations.

**4** Have students share their infographics, quizzes, and flash cards with one another in small groups.

**Supporting All Learners**

Have older students do additional research to profile research organisms that were not included in the reading passage. Encourage them to explore and expand on ideas such as circadian rhythm, regeneration, CRISPR, DNA chip, and gene sequence.

# Exploring the Research Path

**The field of scientific research is filled with people with varied backgrounds and skill sets. Expand student perspectives on science careers.**

### Objective

Students will conduct a short research project on a science career of their choice and consolidate their findings in writing.

### Time

60 minutes

### Materials

- Timer
- Try on a Science Career activity sheet
- Vocabulary list at **scholastic.com/pathways/vocablist**
- What's the Connection? video at **scholastic.com/pathways**

**1** Set a timer for two minutes. Ask students to quickly sketch a picture of a scientist. Ask volunteers to share and describe their drawings. Facilitate a class discussion to help debunk common stereotypes such as the "mad scientist" (older, perhaps male), that scientists are geniuses, or that they "have a gift." Other misnomers: Scientists always make "lucky" discoveries during eureka moments, or they always work long hours alone in a lab.

**2** Show the What's the Connection? video and lead a discussion about the different skill sets and careers in basic science research. Be sure to include the fact that in addition to scientists, scientific research requires people who can illustrate, organize, manage, write, and communicate effectively. These creative, logistical, and interpersonal skills are essential to successful research projects.

**3** Distribute the Try on a Science Career activity sheet and invite students to "try on" the roles of molecular animator, lab coordinator, and microbiologist. After they complete the sheet, have them reflect on the experience with a partner: What skills did they use for each job? Did any of the skills or jobs interest them? Why or why not? What kind of skills or jobs might they be interested in?

**4** To wrap up the lesson, have students conduct a short research project to find out more about a science career of their choice (See the Career Bank for ideas). During their research, students should uncover core job duties, desired skill sets, and education requirements. Students should consolidate their research into the format of a job posting.

**5** Hang completed job postings in the classroom and ask students to explore the postings their classmates have created. Ask students to jot notes as they visit the postings and be prepared to identify the careers they think they would be good at or would enjoy, as well as the careers they want to learn more about.

### Career Bank

Forensic scientist, market research analyst, meteorologist, bacteriologist, technology specialist, science writer, microbiologist, simulations designer, geneticist, science educator, chemist, chronobiologist, science liaison, research scientist, epidemiologist, scientific illustrator, cytologist, lab coordinator, science animator, data analyst/scientist

### Activity Sheet Answer Key

**Lab Coordinator** *Autoclave pressure chamber*: **AM:** A, A, A, A, A **PM:** B, B, D, B, C; *Incubator*: **AM:** C, C, C, C, D **PM:** C, C, C, C, B; ***Centrifuge***: **AM:** B, B, B, B, B **PM:** A, A, D, D, D

**Microbiologist** Irregular/coarse cell shape, multiple nuclei, nucleoli, smaller area of cytoplasm

**Supporting All Learners**

During science career research, have older students find college or post-secondary programs related to their chosen career. Encourage them to interview guidance counselors for more information on educational pathways to science careers.

Name _____

# Equip Your Science Lab

Design an experiment to answer one of the questions below. Then choose the research tools you'd need to conduct your experiment.

**Research questions**

- Which surfaces in the classroom have the most bacteria?
- Is there a way to slow the molding and decay of fruit?
- Is there a correlation between my body temperature and the time of day?

**My question**

_____

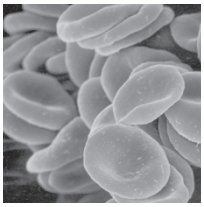
_____

| | |
|---|---|
| **Gather information** What do you already know? What don't you know? Do some research into existing experiments. | |
| **Form a hypothesis** Create an informed prediction. Use an if/then statement. Example: If I increase ambient temperature, then enzymes will work more quickly. | |
| **Design your experiment** What procedure will you follow? How do you plan to measure, observe, and analyze outcomes? | |
| **Tools at school** Which tools would you use if you were asked to conduct research at school? Example: Tools and materials that are readily available with low to no cost. How will each of the tools be used in your experiment? | |
| **Design your dream lab** Which tools would you use if you were asked to conduct research in your "dream" lab? How would each of the tools be used in your experiment? | |

# Uncover the Secrets of Cells

Read these passages below. Then answer the critical-thinking question at the end.

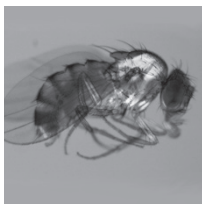
**Humans** have more than 200 types of cells.



Red blood cells carry oxygen. White blood cells defend against germs. Intestinal cells release molecules that help digest food. Nerve cells send messages that produce thoughts and movement, and heart cells contract in unison to pump blood. A person's genes help create proteins that carry out specialized tasks for each cell. But sometimes things malfunction. If the genes inside a cell change or "mutate," a cell may have difficulty dividing, making proteins, removing waste, or performing its job properly. These mutations can lead to defects and diseases.

**Fruit flies** heal wounds with supersize cells.

If a human falls and scrapes their knee, cells around the injury divide and grow until a scab forms to cover the injury. Fruit flies on the other hand, heal with the help of polyploid cells, giant cells that grow to cover the entire site of the injury. Research scientists are interested in the fruit fly's strategy for healing because it may help humans who suffer from non-healing wounds.



**Flatworm** cells have superpowers.

Humans have the capacity to repair and regenerate some parts of their bodies with the help of a few types of cells. Though we can regenerate blood and skin cells and regrow cells to repair our intestinal lining, we are not able to replace a limb or regrow an organ that has been severed. The flatworm, however, has dividing cells called neoblasts which allow it to regrow an entire body from a single cell. If a flatworm is cut in half, the tail end can grow a new head and the head end can grow a new tail! Research scientists are interested in the flatworm's regenerative powers to see if something similar might help humans recover from physical damage.

**Lamprey** cells take out the trash.

Though human cells turn genes "on" or "off" to regulate their function, every cell in the human body will maintain its particular genes from birth to death. This is not the case for the lamprey fish, which discards 20 percent of its DNA while still at the embryo stage and continues to undergo programmed genome (the complete set of genetic information in an organism) rearrangement throughout its lifetime. Research scientists are interested in the lamprey's ability to discard DNA from its cells because it may be protecting the animal from disease. Lamprey cell function may hold clues about how to cure human diseases like cancer.

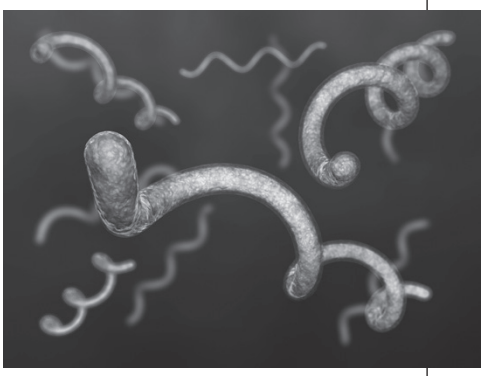
**Think It Through**

On a separate piece of paper, give a focused and detailed response to the following question: **Why do scientists study cells?** Your answer should include evidence from the text.

Name _____

# Try on a Science Career

Follow the instructions to explore the roles of three careers in science research.



**Above: Spirillum bacterium**

**1. Molecular Animator (creates animated visualizations of the inner workings of cells)** Using the description below, draw three images in sequence to create a storyboard that shows how you imagine spirillum bacterium looks and moves.

**The spirillum has a long, spiral body. It has tufts of flagellum (thread-like tails) at each end that it often uses to swim in a corkscrew-like fashion.**

**2. Lab Coordinator (responsible for coordinating activities in a science lab)**

Create a schedule to manage the equipment requirements for this week's experiments.

**Experiment A needs**: centrifuge twice a week in the afternoon; autoclave every morning

**Experiment B needs**: autoclave three times a week in the afternoon; centrifuge every morning; incubator 1/2 day a week

**Experiment C needs**: autoclave 1/2 day Fridays; incubator all day Monday to Thursday

**Experiment D needs**: autoclave 1/2 day Wednesdays; centrifuge Wednesday, Thursday, and Friday afternoons; incubator Friday morning

| | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY |
|---|---|---|---|---|---|
| Autoclave pressure chamber | AM | AM | AM | AM | AM |
| | PM | PM | PM | PM | PM |
| Incubator | AM | AM | AM | AM | AM |
| | PM | PM | PM | PM | PM |
| Centrifuge | AM | AM | AM | AM | AM |
| | PM | PM | PM | PM | PM |

**3. Microbiologist (a scientist who studies microscopic organisms including bacteria, algae, and fungi)**

Look at the illustrated sample the microscope is magnifying. Identify the irregular cell or cells. Describe the irregularities.

_____

_____

_____

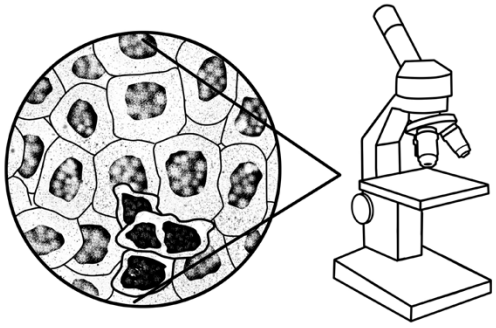


Photo: petersimoncik/iStock

# PATHWAYS

## VOCABULARY LIST

**autoclave** *(noun)*: a machine that can be set to a certain pressure and temperature for various applications.

**bacteria** *(noun)*: one-celled organisms that can be found everywhere. They can be dangerous, such as when they cause infection, or beneficial, such as in the process of fermentation (making cheese or vinegar) and decomposition.

**centrifuge** *(noun)*: a machine that spins samples at high speeds to separate fluids of different densities (e.g., cream from milk) or liquids from solids.

**chromosome** *(noun)*: a cellular structure in the nucleus containing genes. Each chromosome is made up of DNA tightly coiled many times around proteins called histones that support its structure.

**circadian rhythms** *(noun)*: the physical, mental, and behavioral changes that follow a daily cycle. They are important in determining the sleeping and feeding patterns of all animals, including humans.

**colorimeter** *(noun)*: a device that measures the absorbance of particular wavelengths of light by a specific solution.

**confocal microscopy** *(noun)*: an imaging technique that uses laser light to scan dyed samples and shows the magnified image on a computer screen. These images can be used to create two- or three-dimensional structures.

**cryo-electron microscopy** *(noun)*: an imaging technique that captures images of a rapidly frozen sample (e.g., a virus), then creates clear images of the molecular structure of the sample.

**DNA** *(noun)*: the molecule found in cells that carries instructions for cell structure and processes in the body. DNA contains genes that are passed on from parents to offspring and gives living things their inherited characteristics. The letters DNA stand for deoxyribonucleic acid.

**epithelial** *(adjective)*: relating to the thin tissue forming the outer layer of a body's surface and lining the throat, intestines, blood vessels, and all internal organs.

**gel electrophoresis** *(noun)*: a laboratory method that uses an electrical current to separate molecules of different sizes by pushing them through a gel. Colored stains in the gel allow the molecule to be seen.

**gene** *(noun)*: a small section of DNA that contains the instructions for making a specific protein. Proteins control the processes that occur in the body's cells.

**genome** *(noun)*: the complete set of genetic information in an organism. It provides all of the information the organism needs to function.

**graduated cylinder** *(noun)*: a container for measuring the volume of liquid. It has straight sides, two circular ends, and a base. Each marked line on the graduated cylinder represents the amount of liquid that has been measured.

**hypoglycemia** *(noun)*: a condition caused by an abnormally low level of blood sugar.

**incubator** *(noun)*: a device that provides a controlled environment to grow and maintain microbiological cultures or cell cultures.

**membrane** *(noun)*: a semi-fluid layer that encloses cells and organelles and controls passage of materials into and out of them.

**mitochondria** *(plural noun)*: organelles found in large numbers in most cells that convert food and oxygen into energy to fuel the cell.

**organelle** *(noun)*: a specialized, membrane-bound structure (e.g., the nucleus) that has a defined function in the cell.

**pipette** *(noun)*: a slender tube with a bulb to suction and transfer or measure out small quantities of liquid.

**spirillum** *(noun)*: a bacterium with a rigid spiral structure, found in stagnant (nonflowing) water and sometimes causing disease.

**vacuum** *(noun)*: an empty space in which there is no air or other gas.

**vortex mixer** *(noun)*: a simple device used commonly in labs to mix small vials of liquid. The mixer has a rubber cup that spins rapidly in a circle and, when the vial is pressed into the cup, the motion swirls and mixes the liquid.