

STEM CAREERS: It's not rocket science ... but it could be



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science ... but
it could be



“What do you want to be when you grow up?”



“What will be your major in college?”

“What would you like to accomplish in your career?”



“What kind of job can you get if you study that?”

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“Do you know anyone with that kind of career?”



“Are there classes you can take to get a head start?”

“What draws you to that career?”



“What skills do you already have that can help along the way?”

EMBARKING ON YOUR CAREER JOURNEY

Students face all kinds of questions about their future career paths. Even if you know the subjects or professions that interest you, planning for a future career can sometimes feel overwhelming or confusing, especially if you aren't sure what occupation you'd like to pursue.

Many students feel pressure related to career choices, and some are unsure how to even approach what feel like such big and important decisions. Whether you have a plan or not, it's important to know there are no wrong choices. Each step on your path will offer you skills and experiences that you can apply throughout your career journey. So, stay open to opportunities and options that may come along. Some career options often go unrealized, and others may not even exist yet!

When it comes to career choices, those involving science often fall into the category of “unrealized possibilities.” Indeed, science can enrich many career pathways. Often, however, misperceptions about science-based careers cause them to be dismissed without much thought. For example, some students think that a career in science is limited to a few types of jobs or that all science careers require many years of schooling. Neither is true. Another myth is that only the “smart” students can enter a scientific field. Also, not true.

This booklet will provide some information about science careers and things to consider as you embark on the exciting journey of figuring out your own career path. Hopefully, even if you do not opt for a career in science, you will find useful tips and thought-provoking ideas as you go through these pages, and by the end, maybe you'll even come to realize that a career in science can be for anyone – even YOU!

WITH SCIENCE CAREERS, OPTIONS ABOUND

Many people don't realize the wide array of professions available to those who major in the sciences or pursue science-related careers. What do you think of when you think of a career in science? Maybe you think of a science teacher, a doctor, a meteorologist, or even an astronaut. While all of these are valid examples, they are just the tip of the iceberg. (And yes, there are iceberg scientists!)

Science careers can look very different

One reason there are so many career options is because there are so many different areas of science. In school, most students have an introduction to earth sciences, life sciences, physical sciences, and perhaps, social sciences. You may have learned information related to astronomy, geology and the earth's climate. You may have learned about plants, human and animal cells, and body systems. You may have done a physics or chemistry experiment. You may have even had an introduction to psychology. But, you may not realize the wide range of subjects and specialties that exist within these scientific disciplines.

INSIGHTS FROM THE JOURNEY

"While you will have to take a variety of science and math classes during your training, your day-to-day work will not require you to understand everything about science. If you are interested in STEM, don't feel like you have to excel at all aspects of science and math."



- Charlotte Moser, Scientist
and science communicator

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Consider these examples
of scientific disciplines:

neuroscience
engineering
physiology
mechanics
computer science
astrophysics
forensics
oceanography
biochemistry
robotics
anthropology
materials science
sociology
ecology
genetics
microbiology
botany
archeology
virology
biomedical science
statistics

While this is not a complete list of fields, it helps to demonstrate the wide array of possibilities. In addition, within each field people do many kinds of jobs. Although some people focus on one scientific discipline in school, people working in science have different educational backgrounds.

Remember: *As many scientists as there are, that is how many different career paths there are. No two paths are exactly the same, so whatever you decide to pursue, embrace the opportunity to make your own path!*



TRY THIS!

In the list of scientific field examples, circle or underline any that seem interesting to you.

If there are some you haven't heard of, look them up to learn more about them.

Science intersects with many fields

Because science is part of everyday life, it is naturally connected to many other disciplines. This means you don't need to choose "only science" for your courses or your career. For example, some of the fields science careers can intersect with include: law, medicine, education, policy, art, film, writing, and marketing, among others.



INSIGHTS FROM THE JOURNEY



“People often assume that art is creative and science is rigid. Yet Einstein was one of the most creative thinkers of the 20th century, and Michelangelo carved David in marble. Throw assumptions out the window and look for the interests in your life that seem most opposed to one another, then get creative, and even scientific, about how to satisfy them.”

- Donald Rayne Mitchell, Film director and entrepreneur

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It's also true that no two STEM-related jobs are exactly the same, and many people create their own hybrid career path to support their interests and skills.

For example, a lawyer may choose to specialize in patents for medical devices. A mental health professional may choose to specialize in genetic counseling, assessing clients' risks for inherited conditions and helping them navigate treatment decisions. A journalist or filmmaker may create pieces that communicate complex scientific topics in a way that makes them accessible to the general public.



TRY THIS!

Think about other ways different fields might intersect with science.

Write down what those types of jobs might look like.

SCIENCE CAREERS – HERE, THERE, AND EVERYWHERE

People with training in science can be found in many types of work environments. Even people who train in the same area of science can end up working in very different places.

INSIGHTS FROM THE JOURNEY

“I remember once a pair of colleagues, who worked in a pilot test lab at a company that made sunscreens, brought some new sunscreen formulations they were testing, and I thought, ‘How cool is that job?’ Likewise, my niece works in materials science engineering; she tests new materials for mason jars. There are so many jobs out there that go beyond the classic textbook roles that people think of for science majors.”



- Angela Shen, Doctor of science (public health)

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Not all science jobs take place in labs. Some scientists do not work in labs at all, or they work in living labs, like zoos and aquariums.

They may even work in the ocean, a desert, or a volcano crater!

Examples of work environments where you will find scientists include:

- Companies that develop, build, or maintain science equipment
- Consumer product companies (e.g., foods, cosmetics, etc.)
- Environmental testing companies (e.g., water treatment, energy)
- Engineering & architecture firms
- Government agencies
- Hospitals
- Museums & science centers
- Pharmaceutical companies
- Schools
- Science communication & media companies
- Universities
- Zoos & aquariums



Just one place can hold many options

Even within one institution, people with STEM backgrounds can be working in different departments on different projects in different disciplines.

For example, in a museum setting, some scientists determine the origin of artifacts, while others preserve the collections. Some ensure that the building systems are working and safe for museum staff, visitors and the exhibits. Others manage the computerized data, inventory, and security systems for the institution.

Real-world example: Children's Hospital of Philadelphia (CHOP)

Let's take a closer look at another work environment example — a hospital, specifically Children's Hospital of Philadelphia (CHOP).



The Children's Hospital of Philadelphia



TRY THIS!

Make a mental list of all the careers you can think of related to working at a children's hospital. Ready?

Read on to see how your list compares.



Probably, your list included doctors and nurses, maybe X-ray technicians, physical therapists, and phlebotomists. You may have included specialists, like pediatricians focused on the heart (pediatric cardiologists) or treatment of cancer (pediatric oncologists) or infectious diseases.

But, did your list also include flight nurses? Social workers? Teachers? Computer programmers? Information security officers? Lawyers? Business administrators? Indeed, the list is endless.

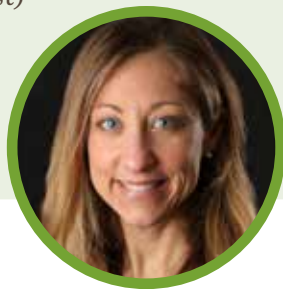
INSIGHTS FROM THE JOURNEY

“Part of [my job] is working with clinicians to help them best understand both developmental strategies and typical reactions when a child is under stress.

I also find it exciting to pair creativity with science. For example, I often use play to help a child understand and cope with medical events.”

- Allison Tappon, Clinical expert
(child life specialist)

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TRY THIS!

Go to the career listing websites of science- and health-based employers and look at the job opportunities. This will give you an idea of the diversity of positions at such places. Many have some science-related job openings that don't even require a college degree.

Examples of websites to check out include:

- Children's Hospital of Philadelphia
- Boeing
- U.S. Department of Agriculture

Use this QR code to visit the booklet companion webpage and find links to these places and others.



Repeat this activity every few months to see different opportunities.

A common misconception about science is not only that everyone works in a lab, but that all labs are the same. This could not be further from reality. Indeed, even within one institution, neighboring labs can work on distinct projects, vary in size, and have different “vibes” based on the personalities and backgrounds of the people staffing them. Let's continue with our CHOP example.

Three types of labs at CHOP

CHOP employs thousands of people. Many of them have backgrounds in science, and a large number work in labs. The types of labs fall into three categories:

CLINICAL LABS

The majority of work done in clinical labs supports patient care.



RESEARCH LABS

Research labs focus on a specific topic or area of interest.



CORE LABS

Scientists in these labs specialize in a specific test, piece of equipment, or subject area to support the work of others.



Clinical Labs

Clinical labs are those that most closely support day-to-day patient care. If you had phlebotomists or medical technicians on your list of hospital workers, they usually work in these types of labs. In smaller hospitals, “the lab” might conduct a limited number of tests that fall into the various categories listed below. However, in larger medical centers, like CHOP, the volume of samples and the diverse array of tests require many scientists working in these types of positions. Often, individuals in these labs specialize, seeking out additional training and gaining unique on-the-job experience over time. Examples of CHOP clinical labs include:

ANATOMIC PATHOLOGY

Pathologists use histology, histochemistry and microscopic examination of tissue samples obtained through surgery or autopsy to aid in diagnosis or treatment.

BLOOD BANK

Personnel in this lab specialize in delivery of and appropriate treatment with blood and blood products.

HEMATOLOGY

These scientists test blood and body fluids to help with diagnosis, treatment and care of patients.



CHEMISTRY

This lab team performs tests ordered for patient care and diagnosis, including blood gases, toxicology screenings and testing for things like glucose, drugs, proteins, enzymes and electrolytes.

IMMUNOGENETICS

Personnel in this lab perform tests associated with human leukocyte antigen (HLA) typing to increase successful outcomes following transplants and for diagnosis of diseases associated with certain HLA types.

IMMUNOLOGY

Personnel in this lab perform tests that aid in identifying and quantifying cell populations related to immune responses. Data from these analyses can be used to identify patients with autoimmune disorders, leukemias, or lymphomas, as well as to monitor transplant patients.



MICROBIOLOGY

People in this lab analyze samples for pathogens, such as bacteria, yeast and molds. They also conduct tests that help determine treatments, such as antibiotic susceptibility testing.

MOLECULAR GENETICS

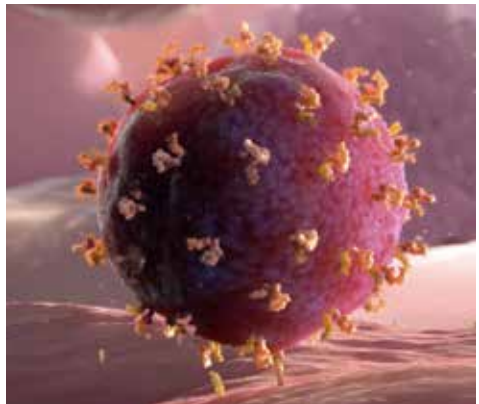
People in this lab perform tests that help with diagnosis and treatment of genetic conditions, such as clotting disorders and cancer predisposition syndromes.

STEM CELL LAB

This lab team prepares progenitor cell populations for transplantation, processes and stores donor samples, and performs tests to enrich subpopulations of cells within the sample prior to transplant.

VIROLOGY

Scientists in this lab perform tests on samples from patients suspected of having viral infections. This aids with the diagnosis and treatment of individual patients as well as public health monitoring of trends in rates of viral infections in the community.



Research Labs

Research labs study very different questions. Some have large groups of people working on related studies, whereas others have small teams. All research labs collaborate with and learn from other scientists doing similar work — whether those scientists are working in their same institution or at other universities, hospitals or institutes around the world. A few examples of CHOP research labs include:

BIOMEDICAL AND HEALTH INFORMATICS

This group explores how data, technology, and knowledge converge to improve scientific research and patient care. For example, the “Global Health Informatics” team conducts projects that support the implementation of digital health systems in low- and middle-income countries.

CENTER FOR APPLIED GENOMICS

This group of scientists focus on genomics to develop new ways to diagnose and treat children affected by rare and complex medical disorders.

CENTER FOR AUTISM RESEARCH

This team uses scientific processes and evidence to understand the causes of autism, develop treatments, and support families affected by this and related conditions.



CENTER FOR CHILDHOOD CANCER RESEARCH

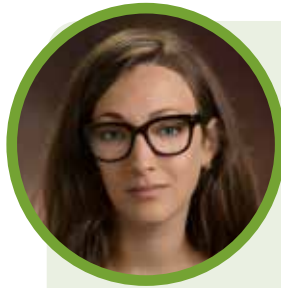
Scientists in this center conduct research aimed at improving our ability to cure childhood cancer. Some focus on developing novel treatments. Others focus on improving the results with existing treatments or decreasing their side effects.

CENTER FOR INJURY RESEARCH AND PREVENTION

This team translates research findings into actionable ways to keep young people safe from injury. For example, some of the scientists and engineers on this team use driving simulators to understand how young drivers make decisions when behind the wheel, and others analyze car crashes to improve the safety of car seats and seatbelts when children are involved in accidents.

POLICYLAB

The PolicyLab team analyzes data about topics related to childhood health and safety to inform program development and policy changes. For example, during COVID-19, some of the researchers focused on helping schools have the information needed to implement appropriate safety measures when students returned to classrooms.



INSIGHTS FROM THE JOURNEY

“Recently, scientists at CHOP have adapted a patient’s own immune system to attack a type of childhood leukemia ... This type of treatment is called chimeric antigen receptor T-cell therapy (CAR-T) ... I am currently working on applying CAR-T to a rare type of leukemia involving T cells ... I am really hopeful that this will become a new therapy option for patients with this disease.”

- Caroline Diorio, Physician-scientist (pediatric oncology)

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Core Labs

Core labs tend to be unique to larger research institutions. The people working in these labs are often very specialized. Examples of CHOP core labs include:

BIostatistics and Data Management

This group helps researchers understand large or complex data sets using computer analyses and statistics.

Flow Cytometry

Personnel in this lab are experts using a machine, and lab technique, known as flow cytometry. Cells are treated with fluorescent labels that can be distinguished by color. The flow cytometer sorts the cells based on the presence or absence of these colored labels to create distinct groups of cells that scientists can analyze or use in other experiments.



INSIGHTS FROM THE JOURNEY

“Our liquid nitrogen freezer is important to maintaining a cell line from a 53-year-old leukemia patient, and we use it in our chromium release assay to test patients’ natural killer cell function in the hospital.”

- Richard Tustin, Scientist (research technician and lab manager)

Biorepository Resource Center

The team in this lab oversees biological samples collected for various studies throughout the institution. They ensure that samples are not duplicated; are maintained safely, securely and under the appropriate storage conditions; and are organized and cataloged. At CHOP, the facility has the capacity to store up to three million samples.

Find more “STEM Career Conversations” on our webpage.



LAB ANIMAL SERVICES

Personnel in this area care for animals being used for research. They monitor for proper care and treatment, ensure that the use of animals is appropriate and based on approved protocols, and keep the facilities clean and safe for the animals and researchers. Sometimes, personnel further specialize, such as at CHOP where there is an aquatic zebrafish core and a small animal imaging facility core.

INSIGHTS FROM THE JOURNEY



“Part of my job involves caring for our mouse colony which I actually really enjoy. We have around 200 mice at any given time that are each bred to have a very specific combination of genes. I get to greet the baby mice as they come into the world and give them sunflower seeds as treats, which they absolutely love. I’ve always loved animals, and I love escaping to the ‘mouse house’ as we call it, or the room where the mice live.”

- Ali Lenard, Scientist
(research technician
and lab manager)

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PATHOLOGY

People in this lab prepare, stain and examine tissues microscopically, including using various types of microscopes, web-based data applications and 3D imaging.

PROTEOMICS

Personnel in this group are experts in techniques related to protein production, characterization and analysis.



TRY THIS!

To find out more about CHOP labs, use this QR code to visit the booklet's companion webpage.



SCIENCE CAREERS ARE ONLY AN EXPERIENCE AWAY

Hopefully, these examples have helped illustrate the variety of options when it comes to careers in science. But how do you get started? There is more than one approach, so find what works for you.



TRY THIS!

Think about these questions:

- What is a problem in the world you would love to fix?
- What is a mystery in the world that you would like to solve?
- What is something that you lose track of time doing?
- How would you approach your work if you knew it was vital to others?

Be adventurous

Get out there and try things to find out more about them. For example, if you know someone who works in a lab, ask if they can give you a tour of their workspace. If a tour is not possible, ask to interview them about their job. Other ways to explore potential careers include trying citizen science projects, joining clubs, doing internships or volunteering for an organization you want to learn more about.

Recognize your interests

Identify your interests and passions, and think creatively about the ways in which they overlap with science.



INSIGHTS FROM THE JOURNEY

"I have always been fascinated by discovering how things work. I remember one of my favorite books as a child was called, 'The Big Book of Why.'"

- Kristen Feemster, Physician-scientist
(pediatric infectious diseases)

Ask for help

Don't be afraid to speak up if you have concerns or questions about your path. Talk to teachers, family, people in your community, and people doing the job you would like to have. This is how you can get information and ideas to help you along the way.



Be curious and open to options

Many people came to their career through an unexpected experience or opportunity, including ones that they weren't sure they would enjoy. Be curious about the people you know and their career paths to get ideas and inspiration. Many people are not only happy to share their experiences but would also welcome the opportunity to help out or mentor a student on their career journey.



INSIGHTS FROM THE JOURNEY

"It was not until I started working as a research assistant in a cancer lab after college [that I truly fell] in love with doing scientific research. This experience told me that I no longer wanted to go to medical school and instead decided to go to graduate school in a biomedical science program."

- David Garbe, Doctor of science (biology)

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Avoid common pitfalls

Remember that there are no wrong career decisions, but some choices may make your journey much longer or more expensive. Try to avoid these common career path “detours:”

- *Entering a field or career path to meet someone else’s expectations.* Focus on more personally motivating factors, such as what you enjoy doing and learning about.
- *Planning a career based solely on expected future job availability.* By the time you finish your training, positions that are currently in need may no longer be so. Job supply can change due to many factors, such as the number of people graduating with a certain major or changes in technology.
- *Choosing a career based on its high salary.* A high salary might seem like it can help make your choice easier, but it will not matter how much money you are making if you don’t like what you do. You will not enjoy going to work. Seek personal satisfaction over monetary gains — it will leave you with a richness of life that money can’t buy.

Identify roadblocks

Maybe you don't have the highest grades in the class, or maybe you are concerned about the cost of college. Many schools and community centers offer tutoring, so you can get extra help with concepts or classes that don't come naturally to you. You may be able to enter an internship or training program instead of going to college. If a degree is important for getting the job you want, you may be able to do some on-the-job training while you're saving money for school, and some jobs will even pay a portion or the entirety of your college tuition as part of your employee benefits.

INSIGHTS FROM THE JOURNEY

"From my personal story, I was very interested in biology, but I did poorly in classes where I had to memorize facts (e.g., the names of species or biological pathways). On the other hand, I did well in problem-solving classes where I could work things out based on theory. Choosing an engineering major did not close any doors for me, either as a biologist or as a scientific writer."

- Kate Kadash-Edmondson, Scientist and science writer



"The easy way becomes the hard way, and the hard way becomes the easy way." Very sound advice from a colleague which sums up a career in STEM. Science can be challenging and frustrating, especially in one's early educational years. Trust that your investment to learn and master the subject matter will illuminate a path where you can explore and pursue your true passion."

- Ajit Johal, Scientist (clinical pharmacist)

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READY TO CHANGE THE WORLD?

Not only are many STEM-related careers interesting and fun, but they are also critical for improving the world. Science jobs offer the opportunity to address some of society's biggest challenges and to have a direct impact on people's lives. As you embark on your career journey, remember that you are not only in charge of your future, but you are also in charge of THE future.

Ready to change the world?

“Your work is going to fill a large part of your life, and the only way to be truly satisfied is to do what you believe is great work. And the only way to do great work is to love what you do.”

– Steve Jobs

“Don’t let anyone rob you of your imagination, creativity, or curiosity. It’s your place in the world; it’s your life. Go on and do all you can with it, and make it the life you want to live.”

– Mae Jemison

“Try to understand who you are and what you want to do, and don’t be afraid to go down that road and do whatever it takes and work as hard as you have to work to achieve that.”

– Sally Ride

“We pass through this world but once. Few tragedies can be more extensive than the stunting of life, few injustices deeper than the denial of an opportunity to strive or even to hope, by a limit imposed from without, but falsely identified as lying within.”

– Stephen Jay Gould

“What you need, above all else, is a love for your subject, whatever it is. You’ve got to be so deeply in love with your subject that when curve balls are thrown, when hurdles are put in place, you’ve got the energy to overcome them.”

– Neil deGrasse Tyson

“We must have perseverance and above all confidence in ourselves. We must believe that we are gifted for something and that this thing must be attained.”

– Marie Curie

“Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world.”

– Albert Einstein

ADDITIONAL RESOURCES

Visit the booklet companion webpage to find more resources including:

- "STEM Career Conversations" series
- Science- and health-based career listings
- Types of labs at CHOP
- Other resources

or visit
vaccinemakers.org/stem-careers-booklet



MY NOTES

Thoughts & ideas

People I
could talk to

My next step

Questions I have

This information was written and produced by the Vaccine Makers Project (VMP), the classroom program of the Vaccine Education Center at Children's Hospital of Philadelphia (VEC).

The VMP provides free school-based materials about the immune system, diseases, vaccines, STEM careers, and evaluating information.

The VEC was formed in October 2000 to provide accurate, comprehensive and up-to-date information about vaccines and the diseases they prevent. The Center is funded by endowed chairs from the Children's Hospital of Philadelphia. The VEC does not receive support from vaccine companies.

FIND MORE INFORMATION

vaccinemakers.org
hillemanfilm.com
vaccine.chop.edu

Use the QR code to check the booklet companion webpage to find more info and resources about STEM careers.

