

# F.E.M.M.E.S. Advance Career Guide

Here at F.E.M.M.E.S., we think of a career as an exploration that sustains you - both financially and intellectually. We've compiled a guide of the various career possibilities you could have in different STEM disciplines: in biology, mechanical engineering, statistics, etcetera, etcetera!

However, STEM is big and creative and constantly evolving! This career guide is far from exhaustive. Think of this guide as a launching point for your long and unique STEM journey. In whatever that journey entails, we wish you the best of luck!

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# SCIENCE

Science uses empirical investigation (like observations and experiences) to answer questions about the world around us, inside us, and even between us! Different branches of science, like ecology and nursing, can look very different from one another, but all are connected by 1) the use of the scientific method and 2) the ability to understand and impact how our universe functions.

## Academic Science

Nearly every branch of science is taught! If you want to help grow the minds of future scientists, consider being a teacher or a professor of a science subject that you love. Elementary and middle school science teachers will likely major in education while they are in college, and choose a major “speciality” or “concentration” in their preferred branch of science, i.e. biology. High school teachers will likely major in their favorite branch, then complete a teaching preparation program. You can enroll in a teaching preparation program either during the last years of undergraduate studies or after undergraduate studies. College professors definitely major in their favorite branch, so that they can become an expert in the science subject that interests them most. Professors then split their time in their career between teaching this subject and doing research on the subject.

## Anthropology

Anthropology investigates human existence from four unique perspectives: sociocultural, linguistic, anthropological, and biological. By combining these perspectives, anthropologists develop a deep understanding of what it means to be human and to live in a human society. Questions anthropologists might be interested in include: How did the values of this religion develop? What do excavations tell us about the gender norms of the tribe that lived here hundreds of years ago? How does technology influence how we communicate with one another today? How did humans evolve? Anthropologists might also focus on illness and healing in different cultures or societies, and thus be able to offer a fresh voice to conversations about medicine and public health. You can find anthropologists working in corporations, government institutions, academic settings, and non-profit organizations.

## Biology

Plant cells, blood cells, viruses, evolution, medicine, muscles, addiction, animals, anatomy, neurons...the list goes on and on! Biology studies both living and nonliving organisms, and sometimes even looks at how these organisms interact! Majoring in biology can be great preparation for a number of careers, ranging from a veterinarian to a cancer researcher to a specialist on flowers or agriculture. In the early years of college, biology classes are usually

larger lecture classes, which give you a solid biology foundation. In the later years, you get to join smaller classes that focus on your particular interests!

## **Chemistry**

One of the earliest female scientists to claim prestige was Marie Curie, a chemist. Since then, a diverse group of women (and others) have advanced the field of chemical sciences: Nancy Chang from Taiwan, Uma Chowdhry from India, and so many more! The bright individuals who study chemistry are all interested in the elements and compounds that compose our universe; they examine how substances form, combine, and change, and manipulate substances to be beneficial tools in our society, like medication. Careers in chemistry often involve a lot of time in a lab, working with beakers and burners and safety goggles. But it's also common for chemists to combine their knowledge of substances with another discipline, like biology or engineering. This interdisciplinary study can have endless impacts! Maybe you'll make makeup, develop vegan food, or cut gas emissions! Learn more about chemistry innovation [here](#).

## **“Doctor”**

This guide considers “doctor” in its own category, because there are so many different types of doctors, and so many paths to becoming a doctor! When we discuss a doctor here, we refer to a person who has gone to medical school. As such, a doctor is suited to address human medical concerns, like infectious diseases or giving birth. For nearly every system in the human body, there is a doctor that specializes in it! Gastroenterologists know about the digestive system, for example, and pulmonologists know about the organs involved in breathing. Some doctors even specialize in particular body parts, like nephrologists, who provide kidney care. Another group of doctors is psychiatrists; they treat mental health conditions through a mix of counseling and medication resources, and they often collaborate with psychologists and therapists. In addition to providing care, many doctors are involved in research related to their speciality. Others teach at hospitals, and still others provide recommendations to communities, governments, and organizations. Although a medical license in the United States is state-specific, meaning that each state you want to be a doctor in must approve you separately, doctors have the opportunity to travel the world; medical care is needed everywhere and organizations like Doctors without Borders and the American Red Cross provide opportunities to practice medicine outside of the United States.

In order to become a doctor, you do NOT need to major in a science in college. In fact, you can major in something as different as poetry or a foreign language, so long as you complete the medical school admissions requirements. A college advisor can help you organize your schedule so that you are sure you stay on-track to fulfill these “pre-med requirements”.

## **Earth and Environmental Science**

Earth scientists study the physical planet Earth environmental scientists studies changes and problems in the environment. These two disciplines are not the same, but they are very related. Academic classes as well as careers in these subjects will often involve spending time outdoors in nature – as you collect rock sediment, for example – but can also include computer work, like mapping shifting sand dunes, and policy work, such as initiatives aimed to combat climate change. Specialities within the earth an environmental science category include paleontology, geobiology, structural geology and tectonics, oceanography, and more.

If you're interested in the environment and wanting to help fight climate change, check out the podcast *How to Save a Planet*, or research a local organization near you! Every small action helps!

## **Ecology**

Ecologists examine the origins of and interactions between Earth's biodiversity on various levels: genetic, organism, population, community, and ecosystems. In other words, ecologists are all-around experts on Earth's life! Ecologists usually spend a lot of time doing research, either for an academic or government institution, or a non-profit organization. Ecology research questions sound like: What are the trends in vertebrate fossils found in the Indian subcontinent? How does algae affect a lake's ecosystem? How do peacocks choose their mates, and how is this related to how they parent their offspring? If you find questions like these exciting, then ecology may be for you!

## **Meteorology**

Meteorologists apply both math and science skills to study and predict the weather. This has enormous implications for societal safety! For instance: giving people enough time to evacuate their homes before an earthquake. Consider meteorology if you are interested in:

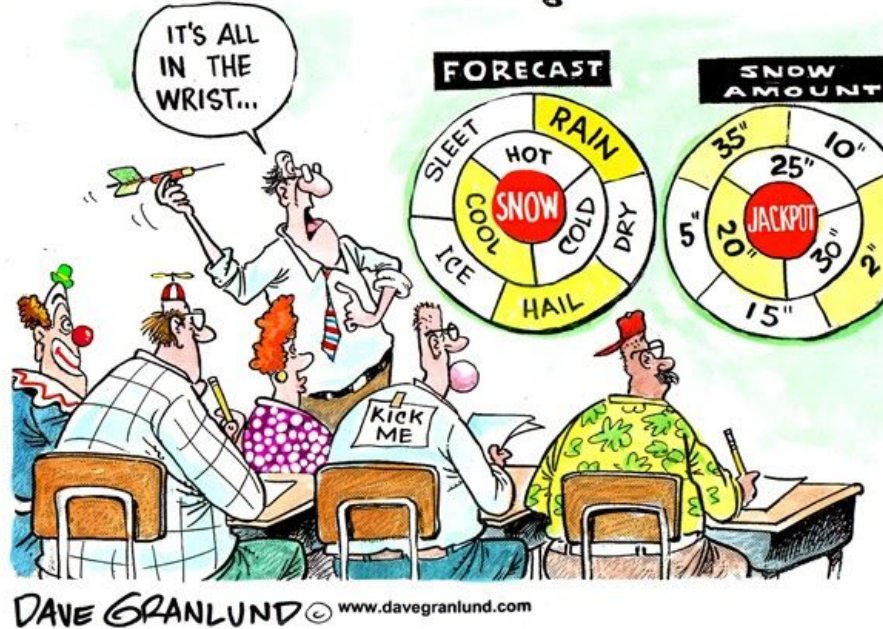
- Climate processes
- How and why storms occur
- How to predict weather patterns
- The impact of weather on societal functioning

While research jobs in meteorology require a masters or PhD, there is no shortage of jobs for meteorologists with a bachelor's degree. You can work for a private company in aviation, energy or agriculture. Or for the government's National Weather Service. Or, if you're not too camera shy, become a television weather forecaster, spreading news about weather patterns far and wide.

Not every undergraduate school offers meteorology. And meteorology is sometimes listed under other names, like "Climate and Space" in University of Michigan's engineering school,

or “atmospheric sciences” in University of Washington's College of the Environment. Get in touch with an admissions counselor or advisor at the school you’re considering and ask directly about their meteorology options.

### Refresher course for meteorologists...



## Neuroscience

Neuroscience is a field that *everyone* is talking about! Academics, doctors, and businesspeople alike are all curious: what are the most basic mechanisms of human thinking, moving, and experiencing? What is going on at that most basic level - that of neural cells - that allows us to live as full people? Neuroscience is concerned with all the parts and functions of the nervous system. Neurons, mentioned above, are the fundamental units of this system, and they communicate with one another via electrical charges and neurotransmitters. They also make up more well-known parts of our bodies like our brains and spines. Neuroscientists, who usually work in academic institutions, but can also work for companies, the government, or think-tanks, study the functions, diseases, and enhancement of this system. For example:

- Parkinson's Disease and dementia are both neurodegenerative diseases, meaning that they are caused by reduced functioning of the nervous system
- Drug use alters the nervous system, so research on drug impact and drug addiction is typically conducted by neuroscientists
- The gut is in fact the body part with the second highest number of neurons (after the brain)! What we eat might have more of an impact on how we think, learn, and feel than we ever realized! In fact, there might be something scientifically true about that saying “it’s gut instinct”

- When humans copy the expressions of others (think of a baby smiling back at you), they are engaging their mirror neuron system, which has significant implications for how we interact with one another
- If humans are “ruled” by their neuroscience, could we program robot parts to mimic neurons in order to make robots act like us?
- If humans are “ruled” by their neuroscience, do we have free will? When are we morally culpable for a crime?

Studying neuroscience in undergrad will usually require a breadth of chemistry and biology classes. Once you get a firm understanding of these topics, neuroscience classes will branch into more specific options, like ones focused on the bullets above. If you’re interested in neuroscience, try to get involved with a lab on campus! Some neuroscience labs are clinical, meaning that they work with human participants. Others work with animals, like rats, or primarily with computers. Choose the type of lab experience that is best suited to your interests!

#### 8 Geeky Neuroscience Jokes!

- 1) What does a brain do when it sees a friend across the street? **It gives a brain wave.**
- 2) What did the neuron say to the glia cell? **“Thanks for the support!”**
- 3) What do neurons use to talk to each other? **A cellular phone.**
- 4) What did the stimulus do to the neuron after they got married? **Carried it over the threshold.**
- 5) What did the angry brain say to the nociceptor? **“You’re a real pain.”**
- 6) Why does the spinal cord belong in the brass section of an orchestra? **Because it has dorsal and ventral horns.**
- 7) What did the hippocampus say during its retirement speech? **“Thanks for the memories.”**
- 8) What did parietal say to frontal? **“I lobe you.”**

## Nursing

COVID-19 has revealed the incredible power of nurses: the people who interact with patients for both small and big tasks and impact the overall “feel” and comfort of someone’s hospital visit. Thank you nurses!

There are various paths to becoming a nurse. One is to study nursing in undergrad. These programs are usually very selective and intense, but you meet a cohort of like-minded students who you become close with, and you get fantastic real-world experience. Another option is to study a science (or health-related subject) that interests you and to do a nursing program after undergrad. In this case, make sure you talk to an advisor in your undergrad so that you are on the right track for applying to a program after graduation.

Once a nursing student completes school, they take a nursing test to be licensed. Then they are off to change lives, usually in a hospital or a care center!

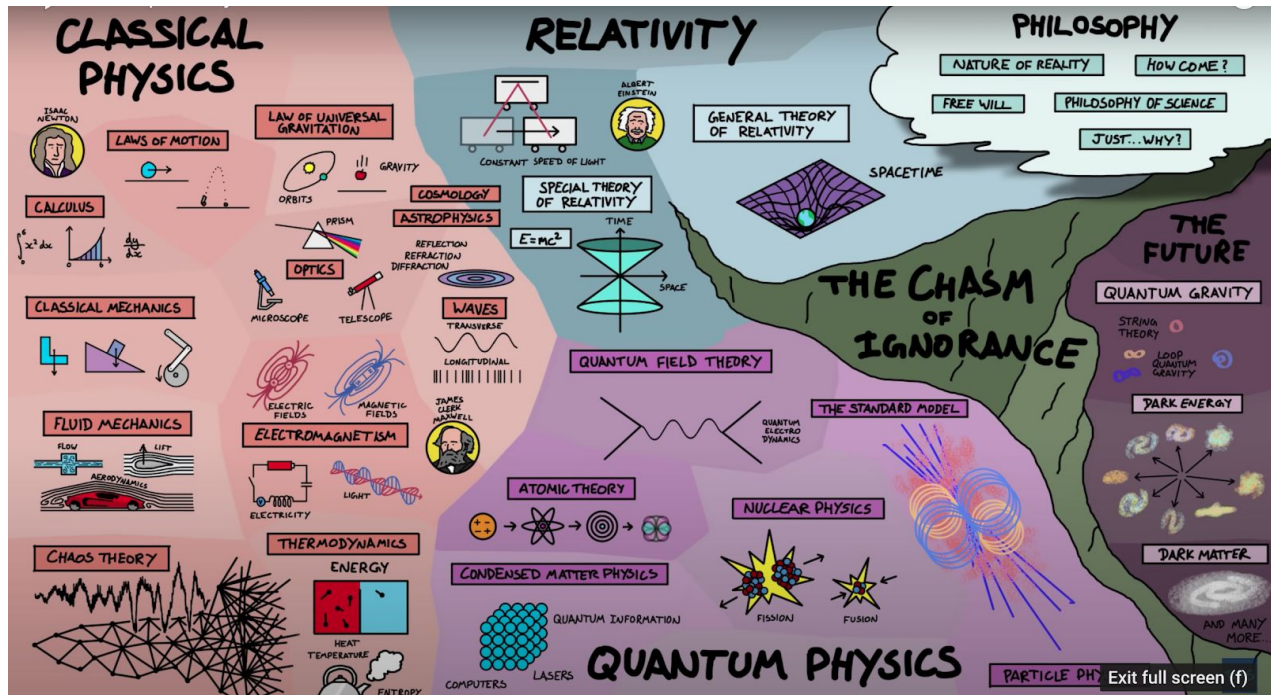
Nurses are lifelong learners and are people who like interacting with other people! Check out this Johnson & Johnson [video playlist](#) to taste “a day in the life” of nurses with different specialties!

## **Physics**

Many students enter college having already taken a physics course. Some had great experiences with this course and others had terrible ones! Let a college physics class be a fresh start with physics; the skills you learn could help you reveal new stars or make breakthrough discoveries about the movement of atoms!

At its root, physics is the investigation of matter and physical laws. The “fathers” of physics are well-known names: Galileo, who formulated the concept of inertia and posited that Earth revolves around the sun, Newton, who had an apple fall on his head and consequently developed the laws of motion, and Einstein, who wrote the equation for energy:  $E = mc^2$ . Today’s field of physics builds on the work of these early thinkers in expansive and varied ways. The map on the next page shows the major branches of modern physics, and you can watch a video with more info [here](#).





Map taken from video.

Being a physicist nearly always requires a strong foundation in math. Some physicists are also well-versed in philosophy, engineering, or astronomy, which allows them to approach physics from unique, interdisciplinary viewpoints. Since physics is relevant to so many different topics, there are SO many different jobs that studying physics prepares you for. Professor, researcher, engineer, computer system designer, and astronomer are just the tip of the iceberg!

## Psychology

Psychology can be defined as the study of mind and behavior. This broad definition means that psychologists answer *all sorts* of questions: What makes humans creative? How can we reduce aggressive behavior? What type of advertisement will consumers like most? How do we develop our sense of who we are? And, as a result, an interest in psychology can lead to all sorts of career options!

Most commonly, a psychology student pursues one of five types of careers\*:

- 1) Human services: being a counselor or therapist, managing a community non-profit, or developing programming for people with disabilities, for example. If you plan on working in human services, it might be helpful to become competent in a second language, or to spend your time outside of class doing volunteer work that's related to your interests.
- 2) Human resources: helping to manage the people who work in a corporation, institution, or other big group, like a hospital. As a specialist in human resources, your

tasks might include leading conflict resolution (i.e. when one employee makes a racist comment to another), finding mental health resources for workers, or choosing who to promote to a new position! Both leadership and communication skills are super important in human resources.

- 3) **Research:** discovering new knowledge about a topic that interests you! Some psychology research will involve testing or observing human subjects. For instance, you could compare whether a certain therapy or a certain medicine is a more effective treatment for an addiction. Other psychology research will involve animal subjects, like chimpanzees, and still other research will involve mostly computers. Since psychology research questions are endless, the research possibilities are too! If you think research is up your alley, email or talk to undergraduate professors about getting involved in their research labs. Most professors would be thrilled to accept your help! Also be sure to take a statistics or a research methods class. Then, after college, psychology researchers can be employed by universities, companies, consulting firms, governments, and more!
- 4) **Education:** create a tutoring program, become a high school advisor, run a study abroad program, or manage something that's important to you, like Greek Life or a multicultural office. Psychologists pursuing education should work on becoming confident when speaking with and in front of others, and they should familiarize themselves (through volunteer work, etc.) with the age group or types of people they plan to educate!
- 5) **Business and Industry:** Since psychology concerns how people think and behave, it's a great major for those who want to go into social careers, like business! You can use your psychology knowledge to make informed business decisions, predict how people might act, and build a cohesive team of people.

For some (but definitely not all!) psychology careers, it's common to go to graduate school - like a Masters or Phd program - after you finish your undergraduate degree. Masters degrees are often needed for counseling and educational careers, whereas doctoral programs emphasize the analytical skills needed in research careers. Sometimes these graduate programs cost money, but it will be possible to earn scholarships and financial aid.

\*These five types of careers were taken from  
<https://whatcanidowiththismajor.com/major/psychology/>

## **Public Health**

By generating research, advocating for policy change, developing grassroots solutions, and approaching health holistically, public health workers aim to improve overall societal health. They are interested in a range of topics, from disease to nutrition to environmental hazards (and to so many more!), and they approach these topics in their own distinctive way. One of the unique features of public health is its ability to cross over with and interact with other

disciplines. Public health workers are taught to consider various viewpoints and problem solve creatively in order to achieve their empirically-informed goals. In this way, public health is an inclusive health field.

Some schools offer public health as an undergraduate major, but many do not. Instead, most public health workers major in something else that interests them - maybe sociology or biology - and then get a Masters or a PhD in Public Health after their undergrad.

## Sociology

In a *Crash Course Sociology* [video](#), Nicole Sweeney describes sociology as the study of the “world of people”. *Why is there poverty?*, a sociologist might ask. Or: *How do gender roles affect our interactions?* Or: *What is the history of immigration around the world, and how should this history inform immigration policy today?*

Sociology is less direct of a science than many of the disciplines listed above, but it often still uses the scientific method to inquire about phenomena in the social world. And in addition to using the scientific method, sociology emphasizes critical-thinking, perspective-taking, and historical analyses. Sociology students are well-rounded thinkers and analyzers who pursue a variety of careers: law, policy, public health, medicine, and community development, to name a few!

Here are two quotes from sociology majors at University of Michigan:

“Sociology is related to whatever field you go into. As a student focused on the intersection of the environment and cities, sociology has provided me with a background knowledge on how people interact with one another in these spaces and the ways in which social relationships inform relationships within physical space.”

“I love talking about my Sociology major in job interviews and have seen firsthand how unique of a perspective I bring to new projects and teams. One lesson I have learned is that diversity comes in many forms, especially diversity of thought and experience. I love listening to other people’s ideas and have become more open-minded, and I know that will make me a great contributor to my future workplace and relationships.”

Some sociologists focus particularly on the sociology of health and medicine. This speciality examines the socio-demographic, cultural, political, and ethical factors pertinent to health behavior and health policy. The sociology of health and medicine uses the numerous investigation techniques of sociology - the scientific method + perspective-taking, + historical

analysis, etc. – to look at sexuality, sex, the body, global health inequalities, specific diseases, and more.

Studying sociology will change the way you look at the world around you, and it will open countless doors!

## TECHNOLOGY

Careers in technology have a wide range and include doing things like designing computer networks, coding, and developing and protecting software and websites. Technology can include computer science, data science (collecting and analyzing data to understand trends in various areas), and many types of engineering. The great thing about technology is that it is essential to almost every business today! So, you can work in the technology sector of any company (from as big as Amazon or Nike to smaller, grassroots organizations) or even start your own to fit your own interests! A foundation in technology can also be applied to other careers such as finance, marketing, customer service, and business administration. Working in technology requires a strong understanding of math and computer science, so people interested in technology tend to major in statistics, mathematics, computer science, and data science, but also other areas like engineering, business, and others. Learning different programming languages can give you a leg up when searching for internships and/or jobs, and code.org is a great place to start!

Q. What degrees can you get within technology?

- Within the University of Michigan, there are four degrees related to technology: Computer Science, Data Science, School of Information – Informational Analysis pathway, and School of Information – User Experience and Design pathway
- These degrees might have different names at other colleges, but the overall content should be similar!

Q. What can I do with a technology-related degree?

- Work in “Big Tech”
  - These are large companies whose focus is producing technology. Examples are Microsoft, Google, Facebook, and Amazon
- Work with start-up companies
  - These are newer, smaller companies that also focus on producing technology. These would provide more flexibility in your job requirements and might be more tailored to your specific interests – you could even start your own! Take a look at this link [here](#) for some examples of start-ups!
- Work in the technology sector of businesses

- Since technology is so essential in today's world, almost every business (big and small) has a technology sector to cover its websites, online presence, user interaction, etc.
- Examples of businesses that employ people with technology expertise are Nike, Meijer, CapitalOne, BP, and many more!

Q. What specific careers are popular in technology?

#### Careers in developing code/software

- Software developer: write the code for a computer that can create software for a specific task (music streaming, organizing photos, etc.)
- Web developer: write the code that creates websites
- Computer Network Architect: build and maintain a variety of data communication networks to allow different parts of the network to merge smoothly together
- Computer programmers: write the actual code included in a software program that instructs it on how to run

#### Protecting and managing code/software

- IT (information technology) Manager: manage computer systems, prevent hackers from disrupting the networks
- Database administrator: set up databases according to a company's needs and make sure they operate efficiently. Also protect data that is collected on apps, social media, etc.
- Information security analyst: Protect company's systems from hackers, malware, and cyberattacks (present in nearly every company, especially ones trusted with sensitive information)
- Computer systems analyst: Install and manage an organization's overall computer system (hardware, software, and networks) to allow the system to run more efficiently and effectively
- Computer systems administrator: sets up and maintains the organization's computer servers so that higher systems can function properly

#### User interaction

- Computer support specialist: Help users of the company's technology with figuring out how to use the software
- User Experience/Design: Focus on the parts of websites or software that users would interact with and make sure these are efficient and attractive

#### Analysis

- Data scientists: monitor data collected by the company's technology (things like user preferences, popular items, etc.) and analyze that data to show trends in activity

# ENGINEERING

Engineering is the systematic application of knowledge and experience to solve problems. Engineers design bridges, cars, and rocket ships. They make video games, develop sustainable energy solutions, and map out bus routes. They go on to found or manage companies serving society. The possibilities of the application of an engineering education are endless. Ultimately, engineers analyze and solve problems to build the world around us.

There are various disciplines of engineering. Some common ones are listed below.

## Aerospace Engineering

Aerospace engineers study and solve problems of flight both within the Earth's atmosphere - aeronautics - and in space - astronautics. They use math and science principles to solve problems of how aircrafts can move through space and air. They figure out what materials should be used for satellites, helicopters, planes, and other spacecraft. They design computer programs that guide flight operations. Aerospace engineers make sure people are safe when they fly, and they perform computations and calculations to optimize aircraft performance. They're literally rocket scientists - how cool is that?

Some concentrations within aerospace engineering include but are not limited to...

- Structures and materials - how should we build air and spacecraft?
- Aerodynamics and propulsion - how do air and spacecraft move?
- Autonomous systems and control - systems for air and spacecraft to fly themselves
- Some people study aerospace engineering as a pathway to becoming an astronaut or military pilot

Some employers of aerospace engineers include but are not limited to...

- Private companies responsible for designing and producing air and spacecraft
- Private companies responsible for producing related controls and navigation tools
- Government organizations - including NASA and the military

## Biomedical Engineering

Biomedical Engineering applies engineering principles of problem solving and design to the healthcare industry. Biomedical engineers work heavily with biology and chemistry to develop tools for healthcare providers like prosthetics, MRI machines, or methods for artificial creation of human organs. They work to apply their knowledge to advance human health and wellbeing. Biomedical Engineering is also an undergraduate educational pathway some people follow to apply to medical school.

Some concentrations within biomedical engineering include but are not limited to...

- Medical device development - design tools for medical professionals to help patients
- Biocomputation - optimizing medical devices with computations
- Biomedical imaging and bioelectrics - imaging and electric tools for healthcare services
- Biomechanics - study movement of living organisms
- Biotechnology and pharmaceutical engineering - design vaccines and pharmaceuticals
- Medical Device development
- Neuroengineering - work with technology associated with the nervous system
- Pre-health - apply to medical school later (doctor, dentist, etc.)
- Tissue engineering and regenerative medicine - work with growth of tissues and organs

Some employers of biomedical engineers include but are not limited to...

- Large medical device development companies - examples of these are Stryker and Medtronic
- Some people may also found or work for start-ups - smaller, more specialized companies developing medical technologies

## **Chemical Engineering**

Chemical engineering is the discipline of engineering focused on the large scale production of manufactured products, including chemical products. They design processes and equipment to make toothpaste, orange juice, and makeup. They refine oil for energy and figure out how to economically produce pharmaceuticals. Chemical engineers can also work in the environmental field, ensuring people dispose of production waste properly. When you think of large quantities of goods being produced, think chemical engineering.

Industries that employ chemical engineers include but are not limited to...

- Pharmaceutical (company for example: Merck, Abbott Laboratories)
- Biomedical (company for example: Medtronic)
- Electronics (companies for example: Apple, IBM)
- Food (companies for example: Kraft, Frito Lay, General Mills, Keurig Green Mountain)
- Consumer products (companies for example: Unilever, SC Johnson, L'Oreal)
- Petroleum/energy (companies for example: BP, Shell, DTE Energy)
- Chemicals (companies for example: Dow, 3M)
- Automotive (companies for example: Ford, General Motors)
- Environmental (for example: US EPA)

**COOL CURRENT PROJECT: COVID-19 VACCINE MANUFACTURING:**

Right now, many chemical engineers around the country are working hard to figure out how to most effectively, efficiently, and economically produce coronavirus vaccines for distribution. Once the scientists figure out the correct “recipe” for the vaccines, the chemical

engineers will have to figure out how to produce millions of doses so that everyone can get vaccinated.

## **Civil Engineering**

Civil engineers are responsible for designing infrastructure, the built environment. They make sure bridges, buildings, and dams stand strong by analyzing building designs and soil. They design systems to ensure stormwater and sewage is safely cleaned and discharged away from your home. Civil engineers plan out roadways, optimizing streets and traffic signals to get you to your destination safely and quickly. They can take on the job of managing construction projects, coordinating the work of architects, electricians, painters, builders, and more to construct hotels, offices, malls, and neighborhoods. Any part of your environment that isn't trees, grass, or rocks - anything unnatural - was the work of a civil engineer.

Some concentrations within civil engineering include but are not limited to...

- Structural engineering - dealing with structural components of infrastructure
- Geotechnical engineering - dealing with soil strength and stability
- Construction engineering and management - dealing with building structures
- Transportation engineering - dealing with transportation systems
- Environmental and water resources engineering - generally dealing with wastewater and drinking water systems, see also Environmental Engineering section

Some employers of civil engineers include but are not limited to...

- Large and small civil engineering consulting firms, which are hired by outside organizations on a project-by-project basis to provide civil engineering services
- Federal, state, and local government agencies
- Many large corporations (for example Delta, Target, Nike) have their own civil engineers on staff to deal with infrastructure problems

**FUN FACT:** Civil engineering was the first discipline of engineering! “Civil” implies “for civilians;” civil engineers were the first to provide engineering services outside the military.

## **Computer Science**

Computer science is often offered as a major in engineering schools. It's the technology version of engineering! If you're interested in careers related to computer science, check out our technology section.

## **Electrical Engineering**



Electrical engineering is the discipline of engineering concerned with systems, equipment, and devices which use electricity to solve problems.

“Electrical engineering is all about information and energy. Electrical engineers control things, sense things, power things, design and build electronic devices, process signals, design computers, connect things and people – and lots more. The impact of electrical engineering on our daily lives can be seen and felt most everywhere. Next-generation electronic devices, environmental and medical sensors, power systems, energy conversion systems, communication systems, satellite systems, remote sensing, nanotechnology, medical devices, information technology, big data, lighting, displays, miniature computers, automotive electronics, imaging, and even cyber security are all the work of electrical engineers.”

- University of Michigan Electrical Engineering Department

Electrical engineering can be applied to almost any industry. Some specific industries that hire many electrical engineers include but are not limited to...

- Power, energy, and sustainability
- Sensing for health and safety
- Automotive industry
- Electronics and computers development
- Information technology and data science
- Robotics and autonomous systems
- Medical technology
- Space research

Famous woman in electrical engineering: Katie Bouman



Katie Bouman is an American electrical engineer, and she developed the technology needed to take the first ever image of a black hole! In April of 2019, she used her electrical engineering education to collaborate with a team of engineers and complete a computer program which was able to process information from telescopes and develop a picture of a black hole.

## **Environmental Engineering**

Environmental engineering is a relatively new discipline of engineering focused on maintaining a clean and safe environment. Environmental engineers focus on systems that provide clean drinking water, manage stormwater, treat wastewater, deliver clean air, and

prevent or minimize pollution. They can also work on remediation projects - cleaning up contaminants from previously-polluted soil, sediments, and water. At some colleges you can earn a stand alone environmental engineering degree while at others environmental engineering is a concentration within civil engineering.

Some employers of environmental engineers include but are not limited to...

- Large and small environmental consulting firms, which are hired by outside organizations on a project-by-project basis to provide engineering services
- Federal, state, and local government agencies
- Most corporations (for example Target, General Motors, BP) have their own environmental engineers on staff to deal with problems of environmental compliance (following environmental legislation) and sustainability

## **Materials Science and Engineering**

Materials science focuses on the study and design of materials, and the materials they make are used to build the solutions created by every other engineering discipline. They innovate to make plastics more recyclable, structural members stronger, clothing more comfortable, and solar panels that better absorb sunlight. They can look at molecular structure and large-scale interactions to design better materials, which give us the ability to build better tools to use everyday.

Some concentration within materials science and engineering include but are not limited to...

- Metallic and structural materials - think car frames, building supports, airplane walls
- Polymers and biomaterials - materials like plastics and materials that interact with biological systems (i.e. the human body, often used for medical devices)
- Electronic, nano, and quantum materials - materials that will be used to build electronic devices
- Energy materials - think more efficient batteries, solar panels, nuclear waste storage
- Computational materials - work to build computer models to simulate testing materials so that they can be evaluated without extensive physical trial and error

## **Naval Architecture and Marine Engineering**

Naval Architecture and Marine Engineering is a very specialized discipline of engineering focused on maritime (via the sea/water) transportation. They focus on ship design, port design, and determining efficient routes. If you're interested in big boats and the ocean environment, this might be a great path for you!

Some concentrations within Naval Architecture and Marine Engineering include but are not limited to...

- Hydrodynamics - studying the movement of water systems

- Marine and offshore structures design
- Dynamics, control, and marine systems integration - ship technology tools
- Robotics and autonomy
- Yacht design
- Marine renewable energy - getting energy from the sea, one way is with turbines

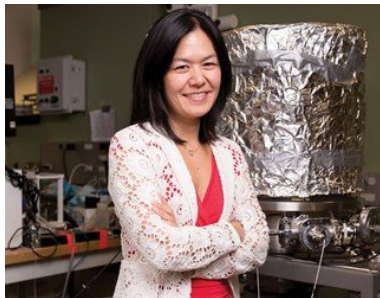
Some industries that employ Marine Engineers include but are not limited to...

- Global commerce - work with companies responsible for satisfying global shipping operations
- Public service - work for the government, especially the U.S. Navy, solving maritime challenges and developing new naval tools
- Offshore systems - work on the construction of structures in the sea like oil rigs or offshore turbines
- Automation and data - work with companies focused on building smarter ships
- Pleasure craft - yacht design, work on building boats civilian consumer will buy to have fun out on the water

## **Mechanical Engineering**

Mechanical engineering is the broadest of all engineering disciplines. Mechanical engineers touch an infinite range of topics. They apply practiced science and math principles to solve any kind of problem. They're university degree is not as specific, so they may develop expertise further as they enter their career and find an industry that interests them. The degree provides a broad starting point, and expertise is developed further outside of school. We won't even begin to list the industries and opportunities for mechanical engineers here because there are too many. If you know an industry or company that interests you, look up related jobs online - chances are someone working at the company in your search has a mechanical engineering background.

Famous woman in mechanical engineering: Evelyn Wang



Evelyn is the Head of the Department of Mechanical Engineering at Massachusetts Institute of Technology, a university widely considered the best in the world for an engineering education. Rather than take her mechanical engineering degree to industry, she researches how heat is exchanged to build highly efficient solar cells (solar panels) and leads the Mechanical Engineering Department in teaching new students how to be mechanical engineers!

## **Nuclear Engineering**

Nuclear engineering is another very specific discipline of engineering. They focus on applying nuclear physics to solve problems. Nuclear physics looks at sub-atomic processes - the absolute smallest scale of materials. They study and design processes, equipment, and systems that work to change nuclear energy and radiation into useful tools that benefit humanity. Some of these tools may be nuclear energy plants, medical machines such as MRIs, and weapons.

Nuclear engineers often work for energy providers working with nuclear power plants, larger corporations developing nuclear technology, federal government offices and the military, or continue research in a university setting.

## **MATH**

“Mathematics is the language and tool of the sciences, a cultural phenomenon with a rich historical tradition, and a model of abstract reasoning.”

- University of Michigan math department

Math is typically split into two groups: pure math and applied math. Pure math is characterized by “math rules”: the logic and aesthetics of what’s possible and not possible in mathematical problem solving. Most pure mathematicians work in academic settings and try to prove, disprove, or create math rules. Applied math, on the other hand, concerns the ways math can influence society, including in science, research, and business. There is a lot of crossover between these two groups, and studying math in undergrad will usually entail a bit of both!

### **Academic Math**

From those first days of counting all the way through college, math teachers are always around! Elementary and middle school teachers likely study education in college, with a speciality in math, whereas high school teachers and college professors major in math, maybe with a speciality in education. In addition to teaching and testing out new teaching techniques, math professors often do math research: they might determine how to model a new idea mathematically (applied math) or work on proofs (pure math). Based on this research, they might give economic advice to businesses or the government, or help psychology researchers complete statistical data analyses in the most efficient way possible. Academic mathematicians also have the opportunity to collaborate with people in other disciplines: physicists, computer scientists, or engineers. As some of the highest performers in the math field, academic mathematicians might even check the work of other thinkers; for example, check NASA calculations to be sure that rockets launch into space correctly (if you haven’t seen the movie *Hidden Figures* yet, we highly recommend it!)

### **Computer Science**

Computer science relies heavily on math: binary math (0s and 1s), algebra, calculus, statistics, and discrete math (how mathematical ideas are represented). If you're interested in math and technology, computer science might be for you! For more information, check out our technology section.

## Data Science

Data scientists capture large amounts of information (about any topic) and use that information to answer questions as efficiently and accurately as possible. They create and use mathematical algorithms to look at this data, and they often rely on computers and coding to carry out these algorithms. You can think of data scientists as the people who make real-world sense of numbers and other information.

If you're interested in data science, watch [this video](#) to learn more. It goes through the five steps of a data scientist's job: 1) determining a problem, 2) acquiring data, 3) preparing data for analysis, 4) exploring data, and 5) modeling data.

We also suggest checking out coding tutorial videos in your free time. Coding programs each have their own "language"; try them out and see if learning these languages is fun for you!

## Economics

Economics is the study of how limited resources are apportioned and utilized in society. *Macroeconomics* looks at economic decisions and planning on a global scale, i.e. concerning countries and big companies, whereas *microeconomics* looks at smaller-scale economic questions, like how a small business can smartly invest its money. Economics students gain a firm understanding of the mathematics behind economic decision making, of how market systems work, and of how non-mathematical factors (mostly social science factors) can affect market positions.

Economists can work in banks, corporations, consulting firms, international organizations, government agencies, policy positions, and teaching positions. For entry level economist positions, an undergraduate degree is all you need. For most high level economist positions, graduate school is necessary. Sometimes a company that you work at as an entry level economist will pay for you to get a graduate degree that would enhance your work ability.

*Some women economists to know!*

**Deirdre McCloskey**: an economist in her own right AND a historian of economics who studied the beginnings of industrialization.



**Dambisa Moyo:** a student of chemistry in undergrad, then of business in graduate school. Dambisa has worked for a number of top companies and has won various awards! Her best known work is a book called “Dead Aid: Why Aid Is Not Working and How There is a Better Way for Africa”. Dambisa is pictured to the left.

**Elinor Ostrom:** winner of a Nobel Prize in economics, for discussing the influence of formal and informal political institutions on the economy.

## Finance

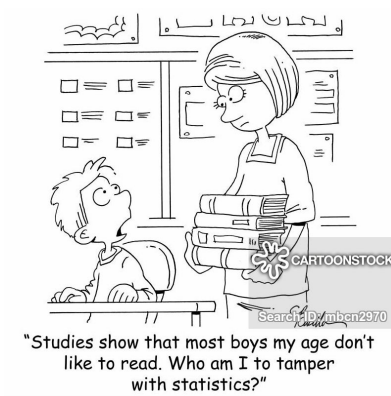
Finance can be broken down into several categories:

1. Providing financial assistance (to individuals, businesses, or companies)
2. Conducting financial analysis (creating reports and streamlining financial processes for businesses, organizations, and government agencies)
3. Managing taxes (collecting taxes, reducing tax risk, and ensuring that businesses and individuals comply with regulations when submitting taxes)
4. Working in a treasurer's office (managing financial records and making financial decisions for a large group of sorts, i.e. a business, university, or government agency)

For each of these job types, one must understand theoretical financial concepts and be able to perform the relevant mathematical calculations. For a finance career, it is important to be organized and clear, comfortable working with numbers and computers, and thoughtful about how today's decisions impact long-term realities.

## Statistics

What is the probability you are sitting at a desk as you read this? The probability you have a warm coffee or tea next to you? Statisticians collect, visualize, model, and analyze data, including probabilities! And as they do so, they make a big impact on marketing, public policy, social sciences, and health sciences. Statisticians might even partner with doctors and engineers, putting data to work to uncover truth. Like math more generally, statistics has both theoretical and applied sides to it. This means that some jobs explore the nature of statistics itself: how does statistics work? What are the rules of statistics? Other jobs answer questions about statistics in everyday practice; for example: how can we model the potential future death rate of a disease? Statisticians work at universities, for government, for research centers, and in companies!



## What to Ask?

Sometimes the hardest part of picking a career is asking the right questions. Below are some questions to guide you as you consider career paths.

**What are the parts of me that I'm most excited to "grow into"?** Maybe you want to develop your creative side, for example, or strengthen your political voice. How might the careers you're considering support your growth in these areas?

**What type of daily atmosphere do I like best?** Do I prefer working alongside people or on my own? Am I comfortable speaking in front of others? Would I rather spend my days on my feet or at a desk?

**What type of daily schedule do I like best?** Do I like waking up early? Working on weekends? Building my own schedule or having structure established for me?

**What stabilizes me?** If the answer is being part of a team, you might choose a career, like a research lab, wherein you're surrounded by others in a non-competitive atmosphere. If the answer is nature, you might choose a career that involves being outdoors.

**What stresses me out?** Just as important as knowing what calms us is having awareness of what overwhelms us. If you can, choose a career that limits your individual stressors.

**What type of environment do I want to live in?** Some careers (like a financial advisor) will likely land you in a city; others (like a professor) might offer you jobs in a smaller town. Still others, like a doctor or nurse, will be more flexible, and are not fixed to particular environments.

**Which aspects of this career would genuinely interest me: engage and stimulate me?** Which aspects would not? Are there sides of you that this career won't fulfill? Can you fulfill the "missing parts" in other ways?

Careers will mold and shift through time, and your end goal is always flexible - no matter the age. Enjoy the journey!