

UPDATED DECEMBER 2019



CAREERS IN BIOLOGY

CONTENTS

OVERVIEW

SAMPLE BIOLOGY INDUSTRIES

MOLECULAR BIOLOGY/BIOCHEMISTRY

At a Glance

Skills required

Labor Market

Common Occupations

Cytotechnologist

Job Descriptions

Attributes and Abilities

Earnings

Education and Training

Interviews with Professionals

Microbiologists

Job Descriptions

Attributes and Abilities

Earnings

Education and Training

Interviews with Professionals

BIOINFORMATICS

At a Glance

Skills Required

Labor Market

Common Occupations

Operations Research Analyst

Job Descriptions

[Attributes and Abilities](#)

[Earnings](#)

[Education and Training](#)

[Interviews with Professionals](#)

[Bioinformatics Specialist](#)

[Job description](#)

[Attributes and Abilities](#)

[Earnings](#)

[Education and Training](#)

[Interviews with Professionals](#)

[ECOLOGY AND EVOLUTIONARY BIOLOGY](#)

[At a Glance](#)

[Skills Required](#)

[Labor Market](#)

[Common Occupation](#)

[Ecologist](#)

[Job Description](#)

[Attributes and abilities](#)

[Earnings](#)

[Education and Training](#)

[Interview with Professionals](#)

[BIOTECHNOLOGY](#)

[At a Glance](#)

[Skills Required](#)

[Labor Market](#)

[Common Occupation](#)

[Biotechnologist](#)

[Job Description](#)

[Attributes and abilities](#)

[Earnings](#)

[Education and Training](#)

[Interview with Professionals](#)

[PHYSIOLOGY](#)

[At a Glance](#)

[Skills Required](#)

[Labor Market](#)

[Common Occupation](#)

[Exercise Physiologist](#)

[Job Description](#)

[Attributes and Abilities](#)

[Earnings](#)

[Education and Training](#)

[TOXICOLOGY](#)

[At a Glance](#)

[Skills Required](#)

[Labor Market](#)

[Common Occupation](#)

[Toxicologist](#)

[Job Description](#)

[Attributes and Abilities](#)

[Earnings](#)

[Education and Training](#)

[Interview with Professionals](#)

[PHARMACOLOGY](#)

UPDATED DECEMBER 2019

[At a Glance](#)

[Skills Required](#)

[Labor Market](#)

[Common Occupations](#)

[Pharmacologist](#)

[Job Description](#)

[Attributes and Abilities](#)

[Earnings](#)

[Education and Training](#)

[Interview with Professional](#)

[MARINE BIOLOGY](#)

[At a Glance](#)

[Skills Required](#)

[Labor Market](#)

[Common Occupations](#)

[Marine Biologist](#)

[Job Description](#)

[Attributes and Abilities](#)

[Earnings](#)

[Education and Training](#)

[Interview with Professional](#)

[WHO EMPLOYS BIOLOGY GRADUATES](#)

[POSSIBLE CAREER PATHS](#)

[HOW TO GAIN EXPERIENCE](#)

[Internal Research Opportunities](#)

[External Research Opportunities](#)

[Additional Student Related Organizations](#)

UPDATED DECEMBER 2019

[Create a LinkedIn Profile](#)

[Join a Professional Association](#)

[SAMPLE JOB POSTINGS FOR GRADUATING STUDENTS/RECENT GRADUATES](#)

[HOW CAN THE CAREER CENTRE HELP](#)

[Library Resources](#)

[Appointments](#)

[Career Planning by Year](#)

[The National Occupational Binder](#)

[Tip Sheets](#)

[Events](#)

[Extern Job Shadowing](#)

[Talk to Professors](#)

[Career Counseling](#)

[Job Postings](#)

[ALUMNI PROFILE](#)

[ADDITIONAL WEB RESOURCES](#)

[REFERENCES](#)

OVERVIEW

Medical school isn't the only option for graduates with a bachelor's degree in biology – although you may still have to invest in additional education beyond a four year degree to get started. A biology degree opens the door to many career possibilities. If you are a student who loves science and is intrigued by the study of living things, a biology degree might be a perfect choice to launch your career path. Jobs in this area of science are appealing to all kinds of people. So you're not alone in wanting to pursue a career in it. But unlike other areas of study with well-defined career paths, biology's professional outcomes can sometimes be trickier to figure out, mostly because the possibilities are so wide-ranging.

SAMPLE BIOLOGY INDUSTRIES

Molecular Biology/ Biochemistry

AT A GLANCE

A major in biochemistry or molecular biology would focus on studies of life at the cellular level. You would learn about the chemical reactions inside living cells and the roles they play for the organism's overall functioning. This major can be a good choice if you are interested in research. You will need an advanced degree to work as a scientist, but a bachelor's degree could lead to sales or administrative positions in the pharmaceutical industry. Molecular biology chiefly concerns itself with understanding the interactions between the various systems of a cell, including the interrelationship of DNA, RNA and proteins synthesis and learning how these interactions are regulated.

SKILLS REQUIRED

Molecular biologists work with advanced lab equipment, like cloning kits, DNA synthesizers, electron guns and temperature cyclers. They regularly emphasize deductive reasoning and critical thinking in their

tasks, as they attempt to enact change to processes and reinforce new methodology in solving problems. For instance, molecular biologists might be focused on how to change genetic properties in order to assist in curing or slowing diseases infestations.

- Analytical
- Communication and interpersonal: write scientific reports; present research findings; interact professionally with a multidisciplinary team of researchers, technicians, student and professors; and literacy writing
- Problem solving
- Critical thinking: analyze and logically interpret trends and results
- Technical skills: use specialized computer programs; perform laboratory procedures; maintain laboratory equipment and instrumental; and comply with quality control procedures
- Research: Collect and preserve field organisms; dissect preserved or euthanized specimen; inspect specimens; and analyze and evaluate information

LABOR MARKET

The employment outlook will be fair for Biologists and related scientists (NOC 2121) in Ontario for the 2019-2021 period.

The following factors contributed to this outlook:

- Employment growth will lead to several new positions.
- A moderate number of positions will become available due to retirements.
- There are a moderate number of unemployed workers with recent experience in this occupation.

COMMON OCCUPATIONS

CYTOTECHNOLOGIST

Job Description

- Examine cells for abnormalities or changes that indicate the presence of diseases or infections in human bodies
- They spend a lot of time looking at cell size, shape, and color through microscopes.

- They mount specimens on slides and stain them with dye so that cell size and shape are more visible
- Enter results into a computer tracking system and writing reports
- Report abnormal results to a pathologist
- Employed by hospitals, private labs, health clinics, cancer detection centers, research facilities, and universities
- Usually work 35-40 hours a week
- Spend much of their time sitting at microscopes

Attributes and Abilities

- Able to concentrate for long periods of time
- Detail-oriented
- Decisive
- Able to work independently
- Communication skills

Earnings

Most cytotechnologists work full time and earn an annual salary. They can make from about \$40,000 to \$70,000 a year. Some senior techs can make more. The highest salaries often go to those who rise in the field to become supervisors. Earnings in this career depend on a few factors. These include experience, employer, and location. For example, large labs in urban areas tend to pay more than smaller labs. Cytotechnologists who work full time often get benefits as well as a salary. These may include dental coverage, paid sick days, and vacation time. Many also get a pension plan. Many people in this career belong to unions. These unions represent a range of health science experts. Union reps negotiate wages and benefits on behalf of their members.

Education and Training

To become a cytotechnologist, start by getting a high school diploma. You will then need to do post-secondary training in the field. A small universities offer cytotechnology programs. A few technical institutes and health authorities also offer these programs. Programs vary in length from about 15 months to 4 years. You finish with either a diploma or a bachelor's degree. You will learn in the classroom and get a hands on experience in a lab

Some programs ask that you apply after doing first-year courses at a university. Others call for a bachelor's degree. These programs often accept you if you have the right experience. Some people who apply are already certified as medical lab techs.

You may need to get certified before you begin to work. The Canadian Society for Medical Laboratory Science (CSMLS) offers this option. You will need to pass an exam. You do not need to be certified to work in some provinces. But, most employers prefer you to be certified.

Each province has a regulatory body for medical lab techs. You will likely need to register with or get a license from this body.

[Interviews with Professionals](#)

Tell me about your job. Is what you do different in any way from what others in your occupation do?

My job is to examine cells under a microscope and report my findings to a pathologist. Some of the things I examine include Pap smears (cells from the uterine cervix) and clinical specimens (including fungus, Candida, and viral secretions). I screen more than 50 Pap smears and look at millions of cells, every day. My work helps pathologists diagnose cancers and other viral and bacterial infections.

I evaluate cell samples that have been shed normally, scraped from the body, or aspirated with a fine needle. I am trained to notice subtle changes in cells so I can accurately identify precancerous, malignant, and infectious conditions.

As far as my job duties are concerned, there is no difference between my responsibilities and those of my cytotechnologist colleagues.

Can you tell me about your background and how you got into this field?

I grew up in China and moved to Canada as an adult. I was born to be a health care professional in some capacity or another, as both of my parents are doctors. I aim to help relieve people's pain and suffering, and I'm happy to be a cytotechnologist because I detect cell changes, which helps make the right diagnosis to help patients. I studied and worked in the health care field for more than 10 years in China before I immigrated to Canada. My previous experience includes working for 2 years as a physician for infectious diseases, and for 3 years teaching microbiology at a medical university. This background helped me to become a cytotechnologist.

I studied cytology in Canada and was attracted to this field because of the job security and challenges in my work.

I enjoy being a cytotechnologist because the work load is intensive and the responsibility is high. I enjoy making my own decisions and the responsibility placed on me.

What personal characteristics are required for someone to be successful in your job?

Cytotechnologists must be independent, precise, and equipped with the ability to concentrate for long periods of time.

You need to have excellent visual skills and attention to detail, because you will spend countless hours looking through a microscope.

Good communication skills are essential because cytotechnologists need to make decisions and take primary responsibility. As the first person to examine a slide, your findings will directly affect a pathology report and a patient's treatment.

How much job security is there for people in your field?

In the United States, cytotechnologists are increasingly being hired by private diagnostic companies. In Canada, the majority are hired by hospitals and are unionized. The job security in Canada is very good. The majority of new graduates can find a job in less than a year.

In Canada, a cytotechnologist is certified by the Canadian Society for Medical Laboratory Science (CSMLS), and this certificate is accepted in every province.

What other jobs could you do with the skills you have gained in this field?

A cytotechnologist's job duties include cytology preparation, which means preparing specimens including bodily fluids and fine needle aspirations for microscopic examination. With cyto-preparation skills, a cytotechnologist could work as a technician in hematology, microbiology, immunology, or histology, or even work in a genetic diagnosis lab.

What do you think the future holds for people in your occupation?

Cytotechnology is definitely changing. Liquid-based specimen processing methods, massive automatic machine screening programs, and the emergence of an effective human papillomavirus (HPV) vaccine are causing Pap smear screening to be a less important part of the job.

However, the high health care cost to employ pathologists, and the new techniques of image-guided fine needle aspiration make the role cytotechnologists play more important in the non-gynecologic cytology diagnosis area.

What are the biggest challenges in your job?

It can be a challenge to spend such long periods of time concentrating. I sometimes face bitter fights with fatigue, yet I have to ensure I maintain a high screening speed and high accuracy. Precise diagnosis is the most important and challenging aspect of this job.

Are there many opportunities in your field? What should people do to get started?

Cytotechnology is a small specialty of medical lab science and the supply and demand are pretty steady. If you are accepted by an accredited Canadian school, you have a pretty good chance of finding a job after graduation.

A hard-working manner, precise and accurate performance, and excellent visual and communication skills are essential to securing an entry-level position in this occupation.

MICROBIOLOGISTS

Job Description

- Microbiologists study the biology and chemistry of the earth's tiniest organisms: microbes.
- They use microscopes to examine the characteristics of microbes in order to identify and classify them
- They work with all types of microbes, including fungi, algae, viruses and parasites
- Work in controlled environments where it is vital to maintain aseptic (sterile) conditions
- Some help develop new food or drug products or processes, such as waste treatment and some write reports describing their findings
- Employed by governments, colleges and universities, research labs, and companies in the drug, mining and agriculture industries
- Work indoors in labs and offices, and outdoors in the field
- Workweeks vary from 40-50 hours or more depending on responsibilities

Attributes and Abilities

- Curious
- Work well with your hands

- An aptitude for science
- Organized
- Research skills

Earnings

Most microbiologists earn between \$30,000 and \$100,000 a year. The median income for all biologists is around \$67,000 a year. Those who rise to a senior level can earn over \$200,000 a year. Earnings depend on many factors. One factor is the type of employment. Those working in the industry sector earn more than those in academics. Education and experience also affect income. Those with graduate degrees tend to make the most. Many microbiologists who work full time get benefits as well as a salary. These can include dental coverage, paid sick days, and a pension plan.

Education and Training

To get into this field, you need at least a bachelor's degree in microbiology. A degree in a related field is also suitable, such as biology or biochemistry. It's a good idea to take courses in physics, chemistry, math, statistics, and computer science.

A bachelor's program lasts 4 years. Some programs include a co-op. This is a great chance to get hands-on experience while you're in school. With a bachelor's degree, you can work as a lab tech or assistant.

You need a master's degree to move into a research position. These programs take 1 to 2 years to complete. This is where you start to specialize in one area of microbiology. For example, you may want to focus on immunology or virology.

You need a PhD to advance further in the field. You also need one to teach at a college or university. In a PhD program, you continue to focus on your area of interest. It takes 4 years to complete a PhD.

To be a medical microbiologist, you typically need a medical degree (MD). You also need to specialize in microbiology or pathology.

Certification isn't required, but it can help you advance in your career. The Canadian College of Microbiologists (CCM) offers this option. You can choose to be certified as a Registered Microbiologist (RMCCM). You must meet training and experience criteria. You also need to pass an exam.

Interview with Professionals

Tell me about your job. Is what you do different in any way from what others in your occupation do?

I am the president of a company that does environmental testing and consulting for the government and private companies. We bring soil, sewage, water, and air samples to the lab for analysis and examine them for microbe content.

After analyzing the results, we can give our clients useful info and advice. For example, if a car manufacturer has a biofouling problem and it's contaminating a nearby water supply, my company will suggest ways to prevent this.

Can you tell me about your background and how you got into this field?

I completed two degrees in microbiology (clinical and environmental), and worked for the Ministry of the Environment for 23 years. I was attracted to this field because I really enjoyed grade 9 biology and decided to follow up on it.

I've always been an outdoor person and I have great respect for the natural world. I felt that a career in microbiology was a good way to combine my concerns about the environment with my academic skills.

What personal characteristics are required for someone to be successful in your job?

Microbiology in the private sector is quite demanding. Clients demand test results quickly, and there are also potential health risks involved. Bacteria do not take weekends and holidays off, so neither can we?

Microbiologists must be dedicated and organized to design and conduct experiments properly and to meet staffing conditions and client demands.

How much job security is there for people in your field?

I believe that most microbiologists can count on keeping their jobs for life. The need for microbiologists exists worldwide, and people who are well-trained will not have problems remaining employed.

What other jobs could you do with the skills you have gained in this field?

Microbiologists can become clinical technicians in health care facilities, quality control officers in the food, cosmetic, and pharmaceutical industries, or bioremediation specialists. This last group works with engineers to help fix soil, water, and air contamination with special chemicals.

What do you think the future holds for people in your occupation?

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I believe the demand for microbiologists will increase. As the world's population grows, more public health issues relating to environmental microbiology are coming up on a regular basis. The demand for clean water and treatment processes for sewage and agricultural wastes is growing.

The privatization of environmental testing facilities has led to changes in the industry. This will continue. I consider these changes to be positive, since the system has become less bureaucratic. Unfortunately, there has also been a decrease in funding. In some areas, environmental problems are going to become much more serious in the future.

What are the biggest challenges in your job?

The most challenging part of my job is problem solving, but it is also the most rewarding aspect of what I do. Coming up with solutions for environmental problems is a demanding but worthwhile endeavor.

Are there many opportunities in your field? What should people do to get started?

Yes, I believe there are many opportunities in microbiology. If you are interested in the area I work in, then a degree in environmental microbiology is essential.

BIOINFORMATICS

AT A GLANCE

This major is about managing of large amounts of biological information generated from research using advanced computational methods and programs. IT is considered to an interdisciplinary science that combines Biology, Computer Science, Statistics, Mathematics and Chemistry. This can be used in research that looks at the genetic makeup of an entire organism and some of its many applications are in medicine or biology. It entails the creation and advancement of databases, algorithms, computational and statistical techniques, and theory to solve formal and practical problems arising from the management and analysis of biological data.

SKILLS REQUIRED

Bioinformatics is an interdisciplinary approach using data collection and modeling to analyze biological data. They create mathematical models, develop dynamic simulations, and perform pattern analyses of biological systems. They are also known as biostatisticians, biometricians, and computational biologists.

- Construct a survey methodology, designing a clinical trial for a new medication and programming a statistical model
- Develop databases to compile vast amounts for information from activities
- Create data algorithms and specialized computer software to identify and classify components of a biological system
- Maintain leadership positions oversee other scientists and laboratory technicians, maintain laboratory documents and keep current with relevant scientific or medical journals

LABOUR MARKET

The employment outlook will be fair for Biologists and related scientists (NOC 2121) in Ontario for the 2019-2021 period.

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COMMON OCCUPATIONS

OPERATION RESEARCH ANALYST

Job Description

An operations research analyst helps an organization make better decisions based on relevant, available data. Using advanced analytics and mathematics, operations research analysts identify and solve problems through investigations of complex challenges and obstacles. Many employees in this type of position work in teams with other analysts and organizational leaders. Operations research analysts typically communicate directly with high-level decision makers and focus primarily on optimizing work flow and simplifying organizational procedures. They undertake research and studies that give them the information they need to provide guidance for decision makers. Day-to-day duties often revolve around generating reports, memos and other documents based on their research. The reports reflect the results of information gathered from databases, sales histories,

customer feedback and other sources and are presented to executives, managers and other organizational stakeholders.

Attributes and Abilities

An operations research analyst's first responsibility is to identify potential problems that require solutions, or processes that must be made more efficient. The U.S. Bureau of Labor Statistics (BLS) lists the following daily responsibilities for the typical operations research analyst:

- Identify and solve real-world problems
- Collect, organize and analyze data from a variety of sources
- Interview and survey worker involved with the process or problem under review
- Determine best practices for the method of analysis based on the problem at hand
- Develop practical solution using statistical analysis, simulations, predictive modeling
- Advise managers and executives on best practices

Earnings

Most microbiologists earn between \$49,000 and \$118,000 a year. The median income for all biologists is around \$76,000 a year. Earnings depend on many factors. One factor is the type of employment. Those working in the industry sector earn more than those in academics. Education and experience also affect income. Those with graduate degrees tend to make the most. Many research analysts who work full time get benefits as well as a salary. These can include dental coverage, paid sick days, and a pension plan.

Education and Training

The BLS recommends candidates for most operations research analyst positions pursue advanced degrees, such as an MBA or a Master of Science in Applied Business Analytics. However, a bachelor's in business, research, engineering, computer science or another related major might be adequate for some entry-level positions.

No matter how well-positioned a candidate might be based on past academic performance, the BLS also recommends that operations research analysts take part in regular continuing education. This is because of the rapid changes in the field of analytics, advances in software development and improved technology.

Skill sets that should be developed by aspiring operations research analysts include analytical skills, communication skills, critical-thinking skills, interpersonal skills, math skills, problem-solving skills and writing skills.

Interview with Professionals

1. Tell me about your job. Is what you do different in any way from what others in your occupation do?

I am the president of an operations research company and am also a full-time university professor.

Our company has about 1,200 clients and I provide consulting services on the modelling of transportation systems. I am also one of the authors of our transportation planning software. This software is used in 64 countries.

2. Can you tell me about your background and how you got into this field?

I have a bachelor's degree in mechanical engineering. After I graduated, I did operations research for a railway company for 2 years. I decided I liked it, so I went back to school and got a master's and PhD in operations research.

I worked as a senior analyst at a paper company and then as a university professor. The company I founded was based on research my students and I created: a software program that we now market around the world.

3. What personal characteristics are required for someone to be successful in your job?

To model operations systems, you must have good math skills. Computer literacy is important, too, as there is a lot of computer programming in this job.

An inquisitive mind will help you critically evaluate operations systems. You will doubtless work on many different assignments (often in different countries), so you should also be adaptable.

4. How much job security is there for people in your field?

There is high job security in this field. Operations research skills are in demand and analysts can count on having their jobs for at least 5 to 10 years.

5. What other jobs could you do with the skills you have gained in this field?

Operations research analysts often move into management because they have studied and analyzed the way companies work. This makes operations research a good stepping stone. For example, a former president of Air Canada has an operations research background.

6. What do you think the future holds for people in your occupation?

As a result of continually advancing technology, I think the demand for operations research analysts will increase. For example, when a firm begins an e-commerce venture, operations research analysts are often required to plan a different way for the company to do business.

The impact of technology will continue and operations research analysts will keep using more advanced

computer-based models. I'm a prime example—I'm an operations research analyst, but I'm also selling our modelling software.

7. What are the biggest challenges in your job?

On the technical side, the most challenging part of my job is finding the right mathematical model to apply to the problem.

From an administrative point of view, the most challenging thing is convincing clients and other people that changing the way they do things would be better and more efficient.

8. Are there many opportunities in your field? What should people do to get started?

Get a degree in operations research or computer science. Then get on the Internet and look for the job you want. Many companies, including mine, advertise for employees this way.

BIOINFORMATICS SPECIALIST

Job Description

Bioinformatics is the application of computers to the management of biological data. Bioinformatics uses computers to store, process, analyze, manage, and retrieve large amounts of biologic and genomic data. When applied to humans, bioinformatics is used to support gene-based drug discovery. When applied to wildlife and conservation biology, it may refer to managing data about blood and tissue samples taken by toxicologists, genetic information about particular wildlife communities, conservation genetics, or related biodiversity data. Bioinformatics specialists are computer scientists who apply their knowledge to the management of biological and genomic data. They build databases to contain the information, write scripts to analyze it, and queries to retrieve it. Bioinformatics specialists help scientists manage, process, and analyze genomic and molecular data. They build and maintain databases to contain the information, and create or select algorithms to process, analyze, visualize, and interpret it. They may also use data mining techniques or statistical software. They may use their computer programming skills to extend the capabilities of software packages, Web tools, databases, and database queries.

Attributes and Abilities

Bioinformatics specialists collect and analyze biological research data sets. At a quick glance, large-scale data management tasks might look like they belong in the IT profession, but a specialist background in biology is required for this role. Biotechnology firms seeking new treatments, genes, and proteins look for Bioinformatics Specialists with the following types of qualifications:

- Expert knowledge of statistics, mathematics and computer science to analyze large data sets
- Engage in data extraction, storage, initial analysis and delivery to users

- Maintain current knowledge of sequencing techniques, instrumentation and methodology
- Ability to create a theoretical framework to manipulate large amounts of data into theories
- Prepare, oversee and comply with operating and capital budgets
- Interact with stakeholders on issues of common interests

Earnings

An entry-level Bioinformatician with less than 1 year experience can expect to earn an average total compensation (includes tips, bonus, and overtime pay) of \$59,280 based on 50 salaries. An early career Bioinformatician with 1-4 years of experience earns an average total compensation of \$69,743 based on 187 salaries. A mid-career Bioinformatician with 5-9 years of experience earns an average total compensation of \$82,696 based on 68 salaries. An experienced Bioinformatician with 10-19 years of experience earns an average total compensation of \$88,945 based on 23 salaries. In their late career (20 years and higher), employees earn an average total compensation of \$96,266.

Education and Training

If you want to become a bioinformatics specialist, you need at least a bachelor's degree. It's a good idea to get a master's degree as well. This will help you get higher paying jobs that are more advanced in the field. What you need to study depends on the kind of job you want. Bioinformatics specialists must be knowledgeable in at least two fields. They need to be well-versed in computer science and biology. A background in statistics is also an asset for many jobs. Some universities offer bachelor's degrees in bioinformatics. This degree can launch you directly into the field. In these programs, you'll study computer science and biology. Chemistry, math, and statistics are covered, too.

You can also enter this career with a bachelor's degree in a related subject. Computer science, math, or biological sciences are all suitable choices. No matter which one you choose, be sure to take courses in the other fields related to this career. When you have a bachelor's degree, you can apply to a master's program. Ultimately, you might want to go on to get a PhD. You can study bioinformatics or a related subject. In this competitive field, a PhD can give you an edge when you apply for jobs. You may also need to get some experience in another field. Some jobs require you to have a background in statistics. Others ask you to have a lot of experience in computer programming.

Interview with Professionals

- 1. Tell me about your job. Is what you do different in any way from what others in your occupation do?**

For the past 15 years, I've worked as a biostatistician. My work consists of applying and developing statistical methods for various biological problems.

My particular expertise, compared to other biostatisticians, is that the applications are more related to genetic problems and are often performed in the context of research projects for which no classical methods can be applied. Therefore, the research aspect is very important.

2. Can you tell me about your background and how you got into this field?

I completed my master's degree and PhD in the biostatistics department at the University of Paris. After a few years, I moved to a large Canadian city to pursue a job at a major hospital/research centre.

By chance, I had met someone previously who was working in this field and it sparked my interest in the subject. Biostatistics interests me because it allows me to apply my knowledge in a medical research environment.

3. What personal characteristics are required for someone to be successful in your job?

As the name indicates, biostatistics is composed of two main components: biology and statistics. Therefore, this work requires a multi-disciplinary approach and the capacity to collaborate with people from very different fields. So, you need to be adaptable to different environments and to different people.

A willingness to learn and to update one's knowledge on a regular basis is also a key to success.

4. How much job security is there for people in your field?

Job security in this field depends on which level you're employed at. In the research field, a research assistant to a biostatistician is generally limited to a 2 to 3-year term which can be renewed. As a principal research investigator, the job is very secure.

Nowadays, I would say it's very easy to work within this field even if you change employers.

5. What other jobs could you do with the skills you have gained in this field?

There are many other fields of applications for statisticians. Specifically, someone with these skills could work in a pharmaceutical company, at a financial institution, within industry, at a marketing company, or in the field of meteorology.

6. What do you think the future holds for people in your occupation?

Because my work is more related to a research environment, by definition, it is constantly changing and we always need to adapt ourselves to a different research question or hypothesis. This depends on which project we're working on.

7. What are the biggest challenges in your job?

The most challenging aspect for me is the multi-disciplinary aspect of the work—having to work with a variety of professionals from many different fields.

8. Are there many opportunities in your field? What should people do to get started?

Yes, there are many opportunities. The field of genetics is evolving very fast; the data generated by the new biotechnologies is extremely complex and is generated in high volume. Therefore, a lot of manpower is required in order to analyze the data.

The best way to enter this profession is via a master's degree or PhD in biostatistics.

ECOLOGY AND EVOLUTION

AT A GLANCE

Ecology and evolutionary biology seeks to understand the origins, diversity and distribution of organisms. All life sciences, along with evidence-based stewardship of life on planet Earth, depend on understanding the factors that influence the origin and maintenance of biology diversity- from genomes to ecosystems. Students exposed to these subjects come to realize that the ecological and evolutionary underpinnings of life pose a constellation of engaging scientific problems that are both intellectually challenging and critical to humanity's future.

SKILLS REQUIRED

Ecologists contribute to the preservation of the natural world. They specialize in one of the many ecosystems of the planet (oceans, forests, urban environments, deserts, mountains, etc.) or in different types of fauna and flora. Ecologists are employed by a wide array of public and private bodies and can occupy very different positions, from a technical job in a laboratory to an advisory role on environmental policy issues.

- Monitor air, water and soil quality
- Carry out field surveys using a range of specialist techniques including Geographical Information Systems (GIS) and satellite photography
- Analyze collected data with the help of industry standard technology
- Provide advice as to how a natural habitat can be affected by building, farming or mining plants
- Designate and manage natural sites and legally protected sites
- Educate the general public on the importance of preserving ecosystems

LABOUR MARKET

An entry-level Ecologist with less than 1 year experience can expect to earn an average total compensation (includes tips, bonus, and overtime pay) of \$42,724 based on 9 salaries. An early career Ecologist with 1-4 years of experience earns an average total compensation of \$47,169 based on 110 salaries. A mid-career Ecologist with 5-9 years of experience earns an average total compensation of \$52,417 based on 67 salaries. An experienced Ecologist with 10-19 years of experience earns an average total compensation of \$60,899 based on 48 salaries. In their late career (20 years and higher), employees earn an average total compensation of \$95,473.

COMMON OCCUPATIONS

ECOLOGIST

Job Description

Ecologists study how living things interact with each other and their environments. For instance, they may look at how a forest recovers from a fire. Other factors impact ecosystems too. How does warm water from a power plant affect fish in a nearby lake? How do toxins move through the food chain from algae to fish to us? Ecologists answer these questions. Ecologists plan and conduct field studies to help them gather data. Their fieldwork varies with the area of research. They may observe monkeys in the jungle. They could record the growth patterns of seaweed underwater. Or they may collect different species of bugs in the desert.

In the lab, ecologists analyze the data and samples collected in the field. They use the results to write papers and reports. Many ecologists are professors. They conduct research and teach classes. They meet with students, mark papers and exams, and oversee students' research. Others do research for governments and private companies. They provide advice on environmental policies. They also report on the potential impact of land development projects. Ecologists who work for non-profits create programs to inform the public about key issues. They teach us how to keep nature's interlocking pieces from falling apart.

Attributes and abilities

- Focus on an area of study, such as how toxins affect fish or the impact of forest fires
- Gather data in the field, such as measurements of plant growth or samples of bugs
- Study data and samples in labs
- Draw conclusions based on the findings
- May advise governments or companies on environmental issues, or teach at universities
- Requires physical stamina and strength for some fieldwork and an interest in plant and animal science
- Research and communication skills

Earnings

In general, ecologists can earn between \$25,000 and \$150,000 a year. Income depends largely on level of education and experience.

Entry-level positions include technicians and lab assistants. Starting salaries for these jobs range from about \$25,000 to \$35,000 a year. These ecologists usually enter the field with a bachelor's degree. More experienced ecologists, such as program managers, earn more. Salaries range from about \$36,000 to \$85,000 a year. People in these jobs have at least a master's degree. Professors also need a PhD. Starting salaries range from about \$45,000 to \$75,000 a year. Established professors make between \$75,000 and \$130,000 a year. Senior professors at large universities can make up to \$150,000 a year.

Education and Training

You need a science degree to become an ecologist. Relevant programs include ecology, environmental science, and biology. People just getting into this field usually work as technicians or field researchers. To get one of these jobs, you need a bachelor's degree. Programs are available at universities across the country. It takes 4 years to earn a bachelor's degree. For most jobs, you need a master's degree. It takes about 2 years to earn a master's degree. To teach at a university, you must have a PhD. PhD programs take 4 to 5 years to complete. A PhD can also help you advance to more senior research positions.

Interview with Professionals

1. Tell me about your job. Is what you do different in any way from what others in your occupation do?

I work as a professor in the biology department of a large university. During the winter months, I spend most of my time teaching, marking, and supervising graduate and undergraduate students. I also have a lot of administrative duties, like sitting on university committees.

During the summer months, when school is out, most of my time is spent working at an outdoor laboratory. Like many other biology professors, I have a small plot of land where I plant things and conduct experiments.

My main area of expertise is metal toxicity in plants—that is, how metals in a plant's environment can induce biochemical reactions in the plant's cells. One of the applications of my research is that it helps people to understand the effects of industrial pollutants on ecosystems.

2. Can you tell me about your background and how you got into this field?

At university, I studied behavioral ecology, soil/plant ecology, and eventually earned my PhD in plant ecophysiology. Since then, I have done contract work at several different universities, as well as some private consulting jobs (if you want to work as an academic, you have to be willing to travel to where the jobs are). I am still hoping to get a more stable long-term position at a university, but such jobs are very tough to get.

Over the years, I have worked on many different types of projects. I have studied the impact of snow geese on grass, parental feeding patterns in songbirds, and predator and prey relationships among

snowshoe hares and wolves. I also did a statistical analysis of water quality for a municipality. In every project, I learned many new and interesting things.

I was attracted to this job because I like teaching at the university level and doing independent research on topics that interest me.

3. What personal characteristics are required for someone to be successful in your job?

Because they are asked to give lectures and educate the public, ecologists should be good public speakers. They should also be creative—you won't be able to get funding unless you are able to do original and interesting research.

You really never stop learning in this job, and you have to learn at an extremely high academic level, so ecologists must be dedicated to their work. You also need to be highly organized. As a senior ecologist, you will be responsible for supervising students and other ecologists.

4. How much job security is there for people in your field?

Unfortunately, there is very little security. Most ecologists in government, academics, and the private sector work on a contract basis. Once they finish any given project, they must be ready and willing to find another. Contracts usually last from several months to a year.

5. What other jobs could you do with the skills you have gained in this field?

Many academic ecologists get jobs as environmental consultants with the government or with the research departments of private companies. In such jobs they might study, for example, the effects of a proposed highway on plant and animal life in the area around it.

Research jobs with the government and in the private sector are similar to academic positions, but they don't require teaching.

6. What do you think the future holds for people in your occupation?

Improvements in technology have made it easier for ecologists to monitor and evaluate environmental conditions. For example, remote sensing satellites now allow us to see the ratio of concrete to plants to trees to farmland in any given area. This is a lot easier and more accurate than having to map it all out on foot.

7. What are the biggest challenges in your job?

Scientific knowledge and technology are expanding and developing very rapidly. As a scientist, you are expected to keep up-to-date on everything related to your field. This can be very difficult. You are always learning, but it never seems like enough.

8. Are there many opportunities in your field? What should people do to get started?

It is very tough to get a job in this field. If you want to research and teach at a university, you have to complete a PhD. While you are studying, apply for as many scholarships, contracts, and summer jobs as possible. Being well-read and having a broad knowledge of science will also give you an edge in the competitive job market.

BIOTECHNOLOGY

AT A GLANCE

This major is the “application of scientific and technical advances in life science to develop commercial products”. This discipline combines biological sciences with other science disciplines. Advancement in biotechnology sees direct application in agriculture (e.g. genetic modification of food, environmental products), medicine (e.g. drug production, gene therapy), and industry (e.g. “white biotechnology”). With such rapid growth in the area, biotechnologists will play a vital role in shaping the future.

SKILLS REQUIRED

Biotechnologists seek to understand and manipulate the basic building blocks of living things, and they use the techniques of molecular biology to do so. They study the genetic, chemical and physical attributes of cells, tissues and organisms, and identify practical uses for this knowledge. The job of a biotechnologist involves:

- Designing and implementing research studies
- Developing new research procedures
- Working with lab technicians on research
- Setting up laboratory equipment to conduct and monitor experiments
- Collecting, studying and testing samples such as food, cells, tissues etc.
- Recording findings and analyzing the results
- Identifying how the research can be applied to improving human life

LABOUR MARKET

An entry-level Biotechnologist with less than 1 year experience can expect to earn an average total compensation (includes tips, bonus, and overtime pay) of \$51,698 based on 23 salaries. An early career Biotechnologist with 1-4 years of experience earns an average total compensation of \$52,052 based on 62 salaries. A mid-career Biotechnologist with 5-9 years of experience earns an average total compensation of \$73,205 based on 10 salaries. An experienced Biotechnologist with 10-19 years of experience earns an average total compensation of \$90,000 based on 6 salaries.

COMMON OCCUPATION

BIOTECHNOLOGIST

Job Description

Biotechnologists work in many different fields. But their goal is mostly the same: to make something new or to make something better. Some biotechnologists develop products that are safer for people and the environment. Plastic made from corn or soybeans instead of oil is one such product. Pesticides that control pests but are not toxic to pets and humans are another. Other biotechs work in medicine to learn more about cancer and other diseases. To do this, they do genetic studies on plants, people, viruses, and bacteria. Some make new drugs or diagnostic tests. Some people in this career work in agriculture. Their work involves adapting crops to make them less prone to disease. This lessens the need to use pesticides. Others try to make farm animal feed that isn't as bad for the environment once it becomes waste. Their exact work varies. It depends on the field they work in. But there are tasks that most of them do. They look at and study micro-organisms like fungi, bacteria, and their enzymes. They design and do experiments to learn more about them and how to use them. They develop and test ways to make new products. Some even manipulate the genetic makeup of organisms to do this. This involves taking DNA from living matter and changing it. Biotechs collect and process the data their tests produce.

Attributes and Abilities

- Design and conduct experiments
- Study microbes such as yeast, fungi and bacteria
- Collect, process, and interpret data
- Maintain logs and records; prepare and present reports
- Develop or improve foods, drugs or other products and ways to make them
- Require communication and computer skills
- Need to work well as a part of a team
- Organized and detail oriented with analytical skills

Earnings

The top respondents for the job title Senior Research Scientist, Biotechnology are from the companies Merck & Co., Inc., Pfizer, Inc. and Abbvie, Inc. Reported salaries are highest at Johnson & Johnson where the average pay is \$124,770. Other companies that offer high salaries for this role include Bristol-Myers Squibb Company and Abbvie, Inc, earning around \$119,921 and \$115,685, respectively. GlaxoSmithKline pays the lowest at around \$98,208. Abbott Laboratories and Pfizer, Inc. also pay on the lower end of the scale, paying \$100,776 and \$104,480, respectively.

Education and Training

Many universities across the country offer bachelor's degrees in biotechnology. Some schools combine this program with another, such as biochemistry or biology. A degree in a related field, such as genetics or microbiology, may also be suitable. It takes about 4 years to get a bachelor's degree. To get a job with more responsibilities and higher pay, you need a master's degree or PhD. This can be in biotechnology or a related field like biochemistry. In graduate school, you can focus on one area within the field. Options include bioinformatics and agricultural biotechnology. To get into a master's program, you need a bachelor's degree. Master's programs usually take 1 to 2 years.

You need a PhD to teach at a university or manage a research facility. A PhD takes about 4 or 5 years to earn. You need to have a master's degree before you enter a PhD program. You can also do postdoctoral research before you join the workforce. This allows you to expand your expertise in your field. Employers consider your research when they decide whether or not to hire you.

Interview with Professionals

1. Tell me about your job. Is what you do different in any way from what others in your occupation do?

I lead a team of four laboratory workers. Our main job is to provide services in genomics or gene expression for other faculty members of the university. Sometimes we are collaborators on these projects.

We look at the expression response of different genes, like what's their function. Or we ask, "How does a cell respond to its changing environment?"

Because I run the lab, I have a lot of additional responsibilities, such as overseeing projects, budgeting, billing, grant writing, experimental designing, troubleshooting, and consulting. I also work with professors, analyze samples, and create data for researchers.

2. Can you tell me about your background and how you got into this field?

I was working in a kibbutz in Israel where I was in charge of the field crops. I took a correspondence course in biology and got hooked. From there, I furthered my education and did graduate work in genetic cattle breeding.

After getting my PhD, a job opened up and I've been at it ever since. I was at the right place at the right time.

3. What personal characteristics are required for someone to be successful in your job?

You need excellent organizational skills and the ability to maintain a broad knowledge of biology by keeping updated through scientific literature. Also, writing skills are essential in order to develop grant proposals and submit manuscripts. To work well with others in your lab, you need good interpersonal skills and patience.

4. How much job security is there for people in your field?

Job security depends upon where one works. If you are in academia or at a university, there tends to be a fair amount of job security; more so if you excel at your job. If you work for a company, be prepared to change locations and companies every few years. The upside is that you will likely make more money than at a university.

5. What other jobs could you do with the skills you have gained in this field?

If you can adapt to various work environments you could do most types of research jobs in academic or biotech industry settings.

6. What do you think the future holds for people in your occupation?

There will always be integration of new technologies that will further automate some of our job duties, making the job easier. There is always the uncertainty of which technologies will actually help and last over time.

7. What are the biggest challenges in your job?

The biggest challenge is keeping up-to-date with the newest technologies and scientific research.

8. Are there many opportunities in your field? What should people do to get started?

Getting into the field largely depends upon your level of education. Generally, you'll need a PhD or master's degree in biology or a related field, and some research experience. This requires a number of years of preparation for jobs in this field.

PHYSIOLOGY

AT A GLANCE

This major is the study of normal function within living things. It is a sub-section of biology, covering a range of topics that include organs, anatomy, cells, biological compounds and how they all interact to make life possible. The study of physiology prepares students for a wide range of careers! However, sometimes students hold the belief that an undergraduate science background can only be applied to conventional career paths such as going to medical school, becoming a pharmacist, or working in the biotechnology industry etc.

SKILLS REQUIRED

Physiology careers demand students to have a wide range of skills. Different occupations require individuals to have certain skill sets over others. However, most physiology careers require students to have many of the skills listed below. Worried that you may not have all the skills below to start a successful career in physiology? Don't sweat it! Many of the skills listed below are developed throughout your time here at university. If you feel like you are lacking the skills credentials then gaining relevant

work experience during university can help diversify your skill set and reduce your worries. It is important to keep in mind that employers do not necessarily expect you to possess all the skills listed below; rather, employers are looking to see if you have dedicated the time to build some of these skills. Employers want students who have built transferable skills, and shown a keen interest in personal development.

- Working with culturally diverse people
- Demonstrating sensitivity to confidential information
- Ability to work independently and in teams
- Motivation to keep up with current information and technology
- Interacting with professional societies and be able to network

LABOUR MARKET

The top respondents for the job title Exercise Physiologist are from the companies Intermountain Health Care, Peninsula Regional Medical Center (PRMC) and Providence Hospital. Reported salaries are highest at Dignity Health where the average pay is \$30.25. Other companies that offer high salaries for this role include Intermountain Health Care and Columbia Heart Clinic, earning around \$23.97 and \$23.67, respectively. South Denver Cardiology Associates pays the lowest at around \$15.00. Providence Hospital and Peninsula Regional Medical Center (PRMC) also pay on the lower end of the scale, paying \$20.94 and \$23.01, respectively.

COMMON OCCUPATION

EXERCISE PHYSIOLOGIST

Job Description

Exercise physiologists focus on how exercise affects the body, often according to various health conditions, and are often tasked with restoring health to conditions prior to medical problems or simply improving basic functioning of the body. These physiologists may be present at gyms, hospitals, wellness centers, research centers, and even athletic settings, and are often in charge of overseeing exercise programs for individual clients or groups. Prior to administering exercise programs, they may perform evaluations of clients' abilities and goals. As time goes on, they will help clients progress and maintain healthier lifestyles, and administer health education such as home exercise assignments and dietary guidelines. Exercise physiologists often help clients understand what effects particular actions may have on the body. When working with patients who have medical conditions, the physiologist must pay special

attention to ensure that the client has not surpassed capacity; this may involve using machinery such as electrocardiogram equipment, blood pressure cuffs, oxygen monitors, and exercise ergometers.

Attributes and abilities

- Administer exercise stress tests in healthy and unhealthy populations
- Evaluate a person's overall health, with special attention to cardiovascular function and metabolism
- Develop individualized exercise prescriptions to increase physical fitness, strength, endurance and flexibility
- Design customized exercise programs to meet health care needs and athletic performance goals

Earnings

An early career Exercise Physiologist with 1-4 years of experience earns an average total compensation (includes tips, bonus, and overtime pay) of C\$42,500 based on 15 salaries. A mid-career Exercise Physiologist with 5-9 years of experience earns an average total compensation of C\$55,982 based on 8 salaries.

Education and training

Exercise physiologists typically need at least a bachelor's degree. Exercise physiologists typically need at least a bachelor's degree. Degree programs include science and health-related courses, such as biology, anatomy, kinesiology, and nutrition, as well as clinical work. A bachelor's degree in Exercise Science, Kinesiology or another closely related area is pretty much considered the entry-level requirement to be an EP. That being said, more and more healthcare facilities are requiring their EPs to hold a master's degree. Colleges and universities typically offer one or a combination of the following 4 study tracks to their Exercise Science/Exercise Physiology students: clinical (applied), clinical (research), human performance and pre-health professional.

TOXICOLOGY

AT A GLANCE

This branch is a scientific discipline, overlapping with biology, chemistry, pharmacology and medicine that involves the study of the adverse effects of chemical substances on living organisms and the practice of diagnosing and treating exposures to toxins and toxicants. It is also the study of the adverse effects of chemicals including drugs on living systems and the means to prevent such affects.

SKILLS REQUIRED

- Isolate, identify and measure toxic substances or radiation and any harmful effect they have on humans, animals, plants or ecosystems
- Plan and carry out a range of experiments in the field or laboratories, looking at the biological systems in plants and animals
- Analyze and evaluate statistical data and research scientific literature
- Write reports and scientific papers, present findings and in case of forensic work, give evidence in court
- Liaise with regulatory authorities to make sure you're complying with local, national and international regulations

LABOR MARKET

An entry-level Toxicologist with less than 1 year experience can expect to earn an average total compensation (includes tips, bonus, and overtime pay) of \$62,828 based on 28 salaries. An early career Toxicologist with 1-4 years of experience earns an average total compensation of \$71,910 based on 150 salaries. A mid-career Toxicologist with 5-9 years of experience earns an average total compensation of \$90,425 based on 58 salaries. An experienced Toxicologist with 10-19 years of experience earns an average total compensation of \$106,597 based on 65 salaries. In their late career (20 years and higher), employees earn an average total compensation of \$108,090.

COMMON OCCUPATION

TOXICOLOGIST

Job Description

Toxicologists study toxic agents and their effect on living organisms. Toxic agents can include chemicals and radiation used to kill weeds. In small enough amounts, chemicals can be harmless. It is the job of a toxicologist to make sure substances remain harmless. Their goal is to protect the health and safety of all living things. Toxicologists do experiments to find out how toxic a substance is. They collect water and soil samples to test in their labs. They might observe plants and animals in the field. They analyze their findings to decide what type of risk they are dealing with. They record these findings and write reports. They tend to specialize in one area. Some do research on new products before they are sold in stores. They might do tests to make sure these products are safe. Many of these experts work in the pharmaceutical industry. They test new drugs before they are released to the public. Others work in the food industry and test new food products.

Attributes and abilities

- Conduct lab tests to identify and analyze toxic substances
- Evaluate the risks of exposure to toxins
- May help develop laws controlling the use of chemicals in everyday items
- Some treat patients or animals that have been exposed to harmful chemicals
- Professors teach students at universities
- Requires an interest in the health and wellbeing of others
- Be able to work independently and as a part of a team

Earnings

Most toxicologists work full time and earn an annual salary. They can earn from \$30,000 to over \$100,000 a year. Income largely depends on their level of education, experience, and employer. Those who are new to the field and have a bachelor's degree can make from \$30,000 to \$40,000 a year. People who have a master's degree or PhD can earn more. These graduates start out earning between \$40,000 and \$60,000 a year. Senior toxicologists with graduate degrees can earn from \$80,000 to more than \$100,000 a year. However, there are few jobs at the supervisory level.

Education and Training

You can start preparing to be a toxicologist in high school. Make sure to take lots of science and math courses. You need at least a bachelor's degree to work in this field. You can study toxicology or a related subject like chemistry or biochemistry. This degree might be enough to get an entry-level job, such as a lab technician. A bachelor's degree takes 4 years to complete.

Most toxicologists have at least a master's degree. It is required if you want to advance to senior positions. Graduate programs focus on a specific area of the field. For example, you might study environmental toxicology. It is important to decide what specialty interests you before applying. A master's degree takes 1 to 3 years to earn. You can then choose to earn a PhD. Many toxicology students take this route. You need a PhD if you want to teach at a university or move into a supervisory role. A PhD takes at least 4 years to complete.

Interview with Professional

- 1. Tell me about your job. Is what you do different in any way from what others in your occupation do?**

I've been working as a medical toxicologist for 5 years. Unlike general toxicologists, medical toxicologists go through medical school.

I deal with people who are poisoned, whether it's because of an accident or a self-inflicted overdose. At

the same time, I practise general adult medicine in a hospital, and conduct research in toxicology and drug safety. As well, I have some administrative responsibilities and do a lot of teaching of medical students and even other doctors.

2. Can you tell me about your background and how you got into this field?

I was originally taking pharmacy at university and received degrees in pharmacy and medicine. I was attracted to the field of toxicology because I found it to be intellectually stimulating. My interest in toxicology developed over time from an evolving medical interest.

3. What personal characteristics are required for someone to be successful in your job?

To excel in this field, one must be reasonably bright with a fair bit of knowledge. You have to be a good communicator due to a lot of interaction with doctors, nurses, and patients. You also need to be able to keep up to date with developments in the field of toxicology.

4. How much job security is there for people in your field?

If you're doing a good job as a toxicologist, then you should be able to stay in the field for as long as you like or until you retire. However, there are only 500 to 600 people in the world who do this job.

5. What other jobs could you do with the skills you have gained in this field?

A toxicologist could work as a general internist, looking after patients in a clinic or hospital setting. He or she could also potentially work in government or pharmaceutical research.

6. What do you think the future holds for people in your occupation?

Other than any new developments in treatments, the field should stay stable in the future.

7. What are the biggest challenges in your job?

My biggest challenge is practicing in the absence of good science. This means that I may not always know what to do for a patient because there's no previous path to help me. I have to use my intuition to guide me.

8. Are there many opportunities in your field? What should people do to get started?

It's a demanding field but one that also has a lot of opportunity. If you want to be a medical toxicologist, you must start by going to medical school. For general toxicology you must complete a master's degree or a PhD in the field.

PHARMACOLOGY

AT A GLANCE

This major involves examining the interactions of chemical substances with living systems with a view to understanding the properties of drugs and their actions, including the interactions between drug molecules and drug receptors and how these interactions elicit an effect. Mostly the courses examine the different classes of drugs, how they are used therapeutically, their mechanisms of action, how they are handled by the human body, and their role in the society.

SKILLS REQUIRED

Pharmacologists aim to understand how medicines and other drugs work so they can be used effectively and safely. They also conduct research to aid drug discovery and development.

- Design, plan and conduct controlled experiments and clinical trials to improve understanding of a drug's activity
- Use computers, high technology measuring systems and other sophisticated equipment to collect, analyze and interpret complex data
- Apply and develop the results of research to work through a variety of applications, such as new products, processes and techniques
- Organize and oversee tests of new drugs and medicines and to ensure quality control and secure approval for their use

LABOR MARKET

An entry-level Pharmacologist with less than 1 year experience can expect to earn an average total compensation (includes tips, bonus, and overtime pay) of \$77,935 based on 8 salaries. An early career Pharmacologist with 1-4 years of experience earns an average total compensation of \$81,522 based on 39 salaries. A mid-career Pharmacologist with 5-9 years of experience earns an average total compensation of \$102,724 based on 8 salaries. An experienced Pharmacologist with 10-19 years of experience earns an average total compensation of \$119,249 based on 12 salaries. In their late career (20 years and higher), employees earn an average total compensation of \$122,316.

COMMON OCCUPATION

PHARAMCOLOGIST

Job Description

These scientists do in-depth research on how drugs interact with the human body. They may study specific drugs, such as painkillers or antibiotics. Or, they can help come up with new treatments for health

problems. Discoveries in this field make a big impact on the world. For example, vaccines have nearly eliminated diseases like polio. Other drugs help people with all sorts of conditions. Whether you have thinning hair or hyperactivity, there is now treatment available. But progress also brings challenges. Each new discovery raises more questions about the human body. That sparks more research.

Pharmacology involves many different sciences. As a result, there are many areas of focus. People in this field can specialize in branches of chemistry or biology. They can also focus on the immune system. Some scientists study the effects of drugs on the body. Others explore how our bodies absorb drugs. Still others study poisons and diseases. Some pharmacologists do all their research in labs. Others, especially those who work for drug companies, have other duties as well. This can include doing tests on human volunteers. Then, they may do a trial release of the drug. Finally, some scientists work with marketers to promote new drugs. They follow the whole process of taking a medication from the lab to the store shelf.

Attributes and Abilities

- Conduct research in labs
- Test new drugs on humans volunteers and oversee trial releases
- Help market new drugs
- Some are also doctors, and others tech at universities
- Usually specialize in a particular area of research
- Required to be patient and curious about the new medications

Earnings

In general, pharmacologists can earn anywhere from \$40,000 to \$120,000 a year.

Earnings depend on many factors. Experience, employer, and education all play a role. Those with advanced degrees tend to earn the highest salaries. For example, a new researcher with a master's degree might make \$40,000 to \$60,000 a year. An experienced researcher with a PhD can earn more than \$120,000 a year. Some pharmacologists teach at universities on a full-time basis. They often start at about \$50,000 to \$70,000 a year as assistant professors. By mid-career, they may make between \$65,000 and \$100,000 a year. Those with many years of experience can earn more than \$120,000 a year.

Education and training

To work as a pharmacologist, you need at least a bachelor's degree. However, getting more education will help you qualify for more advanced jobs.

You can start to prepare for this career in high school. Take as many math and science courses as you can. Next, you need a Bachelor of Science (BSc) degree in pharmacology or a related field. Getting a master's degree or PhD, however, opens up more options. With a master's degree, you can work as a technologist in a lab. This job is a little more technical than an assistant role. You can also work as a research associate. A master's degree takes about 2 years to finish.

If you want to do independent research or teach at a university, you will need a PhD. It takes at least another 4 years to get a PhD.

Interview with Professional

1. Tell me about your job. Is what you do different in any way from what others in your occupation do?

Rather than dispense drugs like a pharmacist, I conduct studies on drugs before they reach the market. Before a pharmaceutical product is released to the general public, it has to go through many stages of tests. In my work as a clinical scientist for a large pharmaceutical company, I coordinate trials II through IV. I work on testing vaccines for infectious diseases such as those that are sexually transmitted.

Each phase gets a bit larger in scale. Phase II uses human volunteers to do further tests. If the results continue to exhibit themselves in humans, we move to the third stage. Phase III involves clinical trials with larger groups of patients in selected areas.

Once we have shown that the drug works and there are no serious side effects, I'll even work with the marketing team to decide how to get the word out concerning our new product. Stage IV involves a follow-up to see how the drug is working and selling once it's on the market.

2. Can you tell me about your background and how you got into this field?

I spent a lot of time in school to get this job. In fact, I have a PhD in pharmacology. When I finally graduated, I needed a change from the lab. I wanted to experience the business side of things in a drug company, to see drugs being developed for patients.

I made a lot of contacts while pursuing my degree, particularly when attending scientific conferences. So, I immediately started calling them. I spoke to several people in the industry about different types of positions available. I also had great references from professors. All those things helped me get a job.

3. What personal characteristics are required for someone to be successful in your job?

Because this job involves so many different tasks, it also incorporates many different skills and traits.

You're responsible for almost every aspect of a product's development.

The key is to remain analytical and precise. Everything has to be organized. You have to watch out for all details. Every protocol has to be followed because patients' lives are at risk.

It takes a tough person to do this job. The pressure can be extreme.

4. How much job security is there for people in your field?

If you have a full-time, permanent position, there is job security in this business. However, your career with a company may be made tenuous by company mergers.

5. What other jobs could you do with the skills you have gained in this field?

Depending on your level of education, you might become a university professor. But because there are so many aspects to this job, you'll have a foot in the door of several occupations.

For example, since a large part of your job is bringing pharmaceutical products to the general public, you could edit a bio-medical journal for the public. You could also join the government's department of regulatory affairs. They set down the rules all pharmaceutical companies must follow, so you'll know a lot about what they do from working the other side.

Or you could take your marketing experience to a career in sales or marketing. You'll have a great understanding of the way pharmaceuticals are targeted in industry and released to the public.

6. What do you think the future holds for people in your occupation?

There are a lot of exciting new discoveries to keep up with. There always seem to be new medical problems identified, so more pharmacologists are needed to help develop solutions.

New developments in computer technology will also continue to make things happen faster. The ability to collect and organize data using advanced software saves scientists a lot of time, and helps get the study results sooner.

7. What are the biggest challenges in your job?

There are two things that, in general, separate the great pharmacologists from the rest. The first is prioritizing. Because there are so many things for you to do, it's sometimes difficult to decide which tasks are more urgent. For example, writing a newsletter can wait because a drug shipment needs to get to a clinic urgently.

The other challenge is finding ways to make procedures more efficient. You design all the forms and questionnaires, so it's important to make them easier for people so that you can get your results sooner.

8. Are there many opportunities in your field? What should people do to get started?

There are a number of opportunities in pharmacology. A master's degree or PhD will help dramatically when searching for jobs, but you can enter the industry with a bachelor's degree and gain experience with time.

Take advantage of any opportunities that present themselves. Enter the business at a different level—for example, as a salesperson—and move up. Talk to everyone you can in the industry. Find out what different areas of pharmacology are out there.

Openings do come up sporadically. Just keep trying, sending out resumes, making contacts, and following up.

MARINE BIOLOGY

AT A GLANCE

This area of study focuses on the study of ocean-dwelling plants and animals as well as the general functioning of the ocean's ecosystem. It may be a stand-alone major or an option for a specific track in a general biology major. This major can be a good choice if you want to work in an aquarium or become a marine researcher, but you may need to seek a graduate degree or higher in order to find jobs.

SKILLS REQUIRED

- An affinity with the marine environment and an interest in aquatic life
- Excellent numerical and statistical skills
- Practical fieldworks skills
- Patience and good observational skills
- Excellent teamwork and personal communication abilities
- Good written and oral communication skills
- To be prepared to work outdoors in an weathers – perhaps at sea

LABOUR MARKET

An entry-level Marine Biologist with less than 1 year experience can expect to earn an average total compensation (includes tips, bonus, and overtime pay) of \$50,367 based on 53 salaries. An early career Marine Biologist with 1-4 years of experience earns an average total compensation of \$50,449 based on 203 salaries. A mid-career Marine Biologist with 5-9 years of experience earns an average total compensation of \$52,167 based on 105 salaries. An experienced Marine Biologist with 10-19 years of experience earns an average total compensation of \$60,100 based on 86 salaries. In their late career (20 years and higher), employees earn an average total compensation of \$73,809.

COMMON OCCUPATION

MARINE BIOLOGIST

Job description

Marine biology is perfect for budding underwater explorers. It's just the job for those who are fascinated by sharks, fish, coral, and other sea creatures. Marine biologists are scientists who study saltwater life and its environment. There are many areas that marine biologists can focus on. Some do research on certain animals, like seals or sharks. For example, they might study the migration of some animals. Or, they may study the changes in population in various kinds of fish. Some people research marine toxins. These toxins can be natural, like in poisonous sea life, or manmade.

Some biologists study how these types of creatures interact with each other. For instance, they might observe how sea anemones and coral interact in their habitats. Others study the effects of weather and environmental changes on the oceans. Many of these biologists look at climate change and its effect on the ocean. Marine biologists collect and analyze samples. They conduct tests and experiments in their field of study. They gather the data, and then write reports and research papers. Their work can be used for many purposes. Some scientists try to solve problems like water pollution. They may also help to draw up policies that will preserve marine life. Some biologists work with others to develop new underwater technology. Those who work as professors teach marine biology to students. They conduct classes and mark tests and papers. People who work for a fishery might study diseases that affect stock. Some biologists work for zoos and aquariums. They teach the public about sea life and help take care of the animals.

Attributes and abilities

- Study population levels, migration patterns and other characteristics of marine life
- Collect samples and analyze the chemical makeup of marine plants and animals
- Provide advice on conservation, environmental policy, and fisheries management
- Some care for animals in aquariums or zoos
- Professors teach students
- Scuba diving training and experience is helpful

Earnings

Earnings for marine biologists can range from about \$25,000 to over \$100,000 year. Their actual income depends on a number of factors.

A biologist's level of experience and position can affect earnings. Graduate students in marine biology earn as little as \$15,000 to \$25,000 a year. They work as research or teaching assistants. Once they start

doing their own research, they can earn between \$40,000 and \$85,000 a year. Many marine biologists work as biology professors at universities. Experienced professors can earn between \$60,000 and \$140,000 a year. Their income depends in part on how many articles or books they publish. People with more seniority tend to earn the most. Marine biologists at aquariums or in administrative jobs earn \$25,000 to \$35,000 a year. Their salaries depend on their level of education and the size of the facility.

Education and training

Marine biology is a large field. The education you need depends on the type of position you want to get.

Jobs that don't involve research may only require a bachelor's degree in marine biology. However, not all universities offer programs in marine biology. You may also be able to enter the field with a degree in biology or zoology. It takes 4 years to earn a bachelor's degree.

A graduate degree opens up many more opportunities. With a master's degree, you can work as a lab tech or research assistant. You may also be able to get a technical position at an aquarium. A master's degree takes another 2 years to earn.

For independent research and administrative jobs, you need a PhD. You also need a PhD to work in a large number of environmental protection agencies. Most academic and research positions ask for research experience as well as a PhD. It takes another 4 or 5 years to earn this degree.

Interview with Professional

- 1. Tell me about your job. Is what you do different in any way from what others in your occupation do?**

I am an academic marine biologist. As a university professor, my time is divided between teaching and research. During the school term, I can be found in the lab or classroom, while in the summer, I'm out doing fieldwork at research stations all over the world. As part of my research, I've worked with fish, crabs, clams, mussels, and many other underwater animals.

I specialize in marine bio-molecular ecology. This means that I study marine ecology using new techniques in molecular biology. One example of these new techniques is using DNA information to track the migration of animals, rather than physically "tagging" them.

- 2. Can you tell me about your background and how you got into this field?**

I grew up on the west coast and my high school had a marine biology course that included lots of field trips to the ocean. This early experience, combined with the help of a few really good science teachers,

made me want to study marine biology at university. I studied at several universities and eventually earned my PhD.

After finishing the PhD, I was fortunate enough to receive a national award for research. This award did a great deal to further my research, since it allowed me to cut down on my teaching load for several years. Most PhDs and junior professors are so busy teaching that they have little time for research.

3. What personal characteristics are required for someone to be successful in your job?

To be an academic marine biologist, you must be good at school. You have to do a lot of required coursework. You should also be hard-working; new professors typically work 60 hours per week.

Organization and the ability to multitask are important as well. As a professor, you are responsible for doing research, teaching, marking papers, and meeting with colleagues and students—often all in the same day. Marine biologists at universities should also be good administrators, as they are usually called upon to manage graduate students, post-doctoral fellows, and secretaries.

Finally, you have to be aggressive. Although most professors are great, some can be very competitive.

4. How much job security is there for people in your field?

Once you get tenure as a university professor, the job is for life. However, it can be very difficult to get there. First, you have to work for 4 to 7 years as an assistant or associate professor and prove yourself by publishing many papers.

5. What other jobs could you do with the skills you have gained in this field?

The biological and ecological knowledge you gain as a marine biologist could be used in many ways. You could work as a high school biology teacher, or at a public aquarium. You could also become a journalist and write about scientific news and issues.

Marine biologists have also been known to work as environmental consultants, or to become assessment biologists for government departments that manage fish stocks.

6. What do you think the future holds for people in your occupation?

If global warming becomes severe, more marine biologists will be needed to study, and hopefully mitigate, the resulting ecological changes. Rising water temperatures will force some fish stocks to move or even lead to their extinction.

7. What are the biggest challenges in your job?

The toughest part of working as a marine biologist at a university is the hours. It can be very difficult to balance my teaching and research activities without working more than 60 hours a week. If you work more than 60 hours a week, it can take a serious toll on your family life.

8. Are there many opportunities in your field? What should people do to get started?

There are lots of opportunities to do graduate or post-graduate work. Before you start, however, get some scientific experience in a lab or in the field. Grad students who have done hands-on research, even if it isn't in the area of marine biology, are always better prepared than those who haven't done so.

WHO EMPLOYS BIOLOGY GRADUATES

Wondering where to Jump Start your career? Below is a list of employers who typically hire Biology Graduates.

- Manufacturing and processing companies
- Government agencies
- Engineering firms
- Industrial inspection firms
- Scientific research and development companies
- Non-profit agencies
- Conservation authorities
- Law firms
- Zoos, aquariums, national/provincial parks
- Hospitals and medical centres
- Environment and pollution control
- Self-employed/freelance
- Pharmaceutical companies
- Academic medical centres/laboratories

- Consumes health libraries
- Consulting firms
- Universities and colleges
- Magazines and newspapers
- Publishing companies
- Boards of education

POSSIBLE CAREER PATHS

Below is a sample of many types of occupations and jobs pursued by graduates of this program.

Note: This is not an exhaustive list. Detailed career profiles are available in the Career Centre. Some occupations require further education and experience.

Biological Technician*	Biochemist*
Health Records Professional*	Radiation Therapist*
Technical Sales Representative*	Technical Writer*
Environmental Educator	Doctor*
Toxicologist*	Quality Controller*
Hydrometric Technologist	Food Science Technologist / Food Scientist*
Regulatory / Government Affairs Specialist	Research Technician
Veterinary Technician*	Health Policy Analyst
Teacher/Professor*	Medical Illustrator*
Compliance Promotion Specialist	Aquaculture Technician
Paramedic*	Occupational Therapist*
Ophthalmic Medical Technologist	Public Relations Specialist*
Entomologist	Patient Services Coordinator
Chiropractor*	Botanist*
Optometrist*	Biostatistician
Pharmacologist*	Speech-language pathologist*
Massage Therapist*	Genetic Counsellor*
Science Magazine Editor/ Writer	Intellectual Property Lawyer
Entrepreneur*	Environmental Lawyer
Research Associate	Medical Librarian
Clinical Research Coordinator Assistant	Herbarium Technician
Curator*	Dietician*
Wildlife Biologist	Biotechnologist*
Zoologist*	Ecologist*

Informationist	Facilities Manager/Supervisor
Community Health Worker	Validation Specialist
Medical Transcriptionist*	Epidemiologist*
Biomedical Engineer*	Geneticist*
Marine Biologist*	Biologist*
Comparative Physiology	Biotechnology
Physiotherapist*	Quality Assurance Auditor
Ornithologist	Pharmaceutical Financial Analyst
Exercise Physiologist	Product Marketing Manager
Diagnostic Medical Sonographer*	Health Care Administrator*
Recreation Director*	Business Development Research Analyst
Audiologist*	
Molecular Biology	Bioinformatics
Cytotechnologist*	Operations Research Analyst*
Bacteriologist	Bioinformatics Programmer
Forensic Laboratory Analyst	Bioinformatics Specialist*
Microbiologist*	Logistics Specialist*
Medical Geneticist	Computer Scientist*
	Web Developer*
	Business Systems Analyst*
Ecology & Evolution	
Environmental Health Officer*	
Conservation Biologist	
Restoration Biologist	
Conservation Officer*	
Agronomist*	

* View these titles at Career Cruising, available on [CLN](#) under the *Resources* tab.

HOW TO GAIN EXPERIENCE

Internal Research Opportunities

While there are countless numbers of research opportunities within the University of Toronto, all research opportunities and positions are very competitive on all three campuses, Scarborough, St. George, and Mississauga. In general, undergraduate students within the University of Toronto can apply to any research opportunities on any of the three campuses. However, this depends on the requirements of the

positions. For that reason, it is highly encourage (if not mandatory) to read the position requirements prior to applying for a position. Research opportunities and research related information within the University of Toronto can be found in multiple places and locations. Some of the places where research positions and information can be found in the following places:

- University of Toronto Mississauga Research - <https://www.utm.utoronto.ca/biology/research>
- University of Toronto Career Learning Network (CLN) - <https://clnx.utoronto.ca/>
- University of Toronto Faculty of Medicine - <https://medicine.utoronto.ca/research>
- University of Toronto Research and Innovation - <https://research.utoronto.ca/>
- Undergraduate Research Opportunities at the St. George Campus - <http://glse.utoronto.ca/undergraduate-research-opportunities>
- University of Toronto Faculty of Medicine – Banting & Best Diabetes Centre <https://bbdc.org/>

External Research Opportunities

There are many places outside of the University of Toronto that have opportunities for undergraduate students as well. Many hospitals, healthcare centres, clinics and other medical and healthcare institutions are constantly seeking proactive undergraduate students to work in their labs and offices. To find some of the many opportunities out there, check the following websites:

- List of Research Opportunities (Internal and External) - <http://www.glse.utoronto.ca/research-opportunities>
- Research Trainee at St. Michael's Hospital - <http://stmichaelshospitalresearch.ca/future-students-trainees/>
- Sunnybrook Health Sciences Centre – Undergraduate Students <https://sunnybrook.ca/research/content/?page=sri-ed-undergrad>
- Office of Research Trainees and University Health Network (UHN) – Prospective Trainees <https://uhntrainees.ca/prospective-trainees/>
- Centre for Addiction and Mental Health (CAMH) – Students and Fellows <https://www.camh.ca/en/Science-and-Research/research-students-and-fellows>
- Baycrest Health Sciences – Research <https://www.rotman-baycrest.on.ca/index.php?section=668>

- The Hospital for Sick Kids – Student and Fellow Resources
<http://www.sickkids.ca/Research/StudentandFellowResources/RTC/Training-Programs/Summer-Research-Program/summer-program-positions/index.html>
- Mount Sinai Hospital – Careers and Volunteers http://www.mountsinai.on.ca/about_us/careers
- Women’s College Hospital – Trainees <https://www.womensresearch.ca/trainees/undergraduate-summer-program/>

Additional Student Related Organizations

Join a student club or an academic society at UTM to meet like-minded people, explore your interests, and make valuable connections. To view a list of current clubs and societies, visit the Centre for Student Engagement’s website. Some organizations you may consider are:

- Erindale Biology Society
- Biotech Investment Club
- Pre- Medical Club
- Health Out Loud at UTM
- Global Brigades
- World Wildlife Foundation at UTM

Create a LinkedIn Profile

Create a LinkedIn profile to connect with professionals in various fields, explore the career paths of UTM alumni, research employers, apply for specific positions, and more. Need help? Come to the Career Centre to book a LinkedIn profile critique.

Join a Professional Associations

There are many benefits of becoming a member of associations, such as developing a network of contacts, learning about industry trends, accessing industry-related job postings, and adding your affiliation on your resume. Some associations related to this major are:

- Canadian Society for Molecular Biosciences (CMB) <https://csmb-scbm.ca/>
- Canadian Society for Medical Laboratory Science (CSMLS) <https://csmls.org/>
- BIOTECanada <http://www.biotech.ca/>

Sample Job Postings for Graduating students/recent graduates

Below is a sample of delisted positions that have been posted on UofT's Career Learning Network (CLN). To access current listings, login to CLN and click on *Jobs*

- Medical Editor, Kendle INC Research
- Pharmaceutical Sales Representative, Impres Pharma Inc.
- Animal Care Clinics Volunteer, St. Clair Veterinary Facilities
- Ambulatory Care Clinics Volunteer, St. Joseph's Health Centre Toronto
- Public Relations Manager, The Healing Cycle Foundation
- Bioinformatics/Genome Research, Department of Biology, UTM
- Health Records Technician, Toronto Central Community Care Access Centre
- Aquaculture Research Technician, Aquabiotech
- Coordinator, Planning Ecology, Toronto and Region Conservation Authority
- Research Technologist, SickKids
- Lab Technician in Neurobiology, Toronto General Hospital
- Invasive Species community Outreach Liaison, Central Lake Ontario Conservation Authority
- Sleep Technician Trainee, Sleep Disorders Clinic Centre for Sleep and Chronobiology
- Clinical Assistant, Unionville Family Wellness Centre
- Data Analyst, Acumed Medical Ltd.

How Can the Career Centre Help

Library Resources

The Career Resources Library contains information about a wide range of occupations in all industries, resume and cover letter resources, effective work search methods, graduate/ professional school preparation guides and more. Below listed are some sample of Career Centre Library Resources:

- Resource Guide to Careers in Toxicology
- Clinical Contacts Canada: Your Guide to Drug Development
- Pharmacy School Admission Requirements
- Career Opportunities in Health Care
- Great Jobs for Biology Majors
- BIOTECH CAREER GUIDE

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- Scientific Types and Others with Inquiring Minds
- Put your science to work: The Take Charge Career Guide for scientists

You can also visit our online library collection by going to the Career Centre website:

<https://www.utm.utoronto.ca/careers/> and click on the Career Planning icon and then scroll down to Library Resources. Once you register, you can download a book for up to 14 days.

Appointments

- Attend a one-on-one appointment with a [career counsellor or an employment strategist](#) to discuss what career options might work for you and determine a job search plan.
- Meet with an [academic or departmental advisor](#), who can guide you in achieving academic success. Contact the Office of Registrar or your department for more information

Career Planning by Year

Visit our Career Planning by Year page for ideas of important career related activities for each year. You can visit us in the Career Centre to find out more about careers that interest you. The UTM program plans are also a good resource to learn more about how you can use your degree and to find out how to map out your academic career path for each year while at UTM: www.utoronto.ca/program-plans.

The Natural Occupational Binder

The National Occupational Code Binders in the Career Resources Library provide very detailed, specific and extensive information relating to hundreds of careers. From general overviews of the job, to working conditions, to sample job postings related to the field and related articles, the binders are sure to provide you with in-depth answers to many of your job-specific questions.

Tip sheets

Do you like information in an easy-to-read, easy-to-digest, take home format? Take a look at our tip sheets on subjects like Effective Interviewing, Networking and Preparing for Graduate School.

Events

Would you like a chance to interact with prospective employers and expand your networking circle? The Career Centre offers a number of events that help you brush shoulders with professional and experts from all fields. Attend the Get Experience Fair, Get Hired Fair, Professional School Fair and Summer Job Fair. Practice putting those networking skills to use and land yourself a job! Check out the events and workshops section of the Career Learning Network to find out what is happening on Campus.

Extern Job Shadowing Program

Are you still curious about what career path is best for you? Would you like a chance to experience working in an industry to find out if it's really the path for you? The Extern Job Shadowing Program can help. This job-shadowing programs grants you a one-to-five day placement in a career of your choice. Go

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to the Career Learning Network to register for the workshops that will help you to prepare for your placement. To register go to: www.clnx.utoronto.ca and then go to [workshops and events to see when the next workshop is happening.](#)

Talk to Professors

Connecting with our professors can be a great way to explore the different paths a major can lead you to, as well as learn about possible opportunities for research, volunteer, or becoming a TA. Drop by during their office hours or request an appointment.

Career Counselling

Are you feeling lost, unsure and overwhelmed with finding out what career path you would like to choose? Or you've decided on a career or the type of job you want, but what are the next steps? Our career counsellors are here to help. Book an appointment with one of our professionals who can help you determine what paths you can take after graduation or how your area of study can relate to a career post-grad.

Job postings

Are you graduating soon or a recent graduate? Sign up for the Graduating Students Employment Service (GES) or the Recent Graduate Employment Service (RGES). These services allow you to gain access to full-time job postings while your final year of study or access full-time job postings for up to two years after you graduate. To learn more, check out our Career Centre website.

Please feel free to come and visit us in Room 3094, South Building. You can also reach us by phone, 905-828-5451 or email at careers@utm.utoronto.ca.

ALUMNI PROFILE

Name: Misu Paul

Grad Year: 2008

Degree: BSc

Program: Biology, Biotechnology and Chemistry

Title: Asst. Program Officer

Industry: Natural & Applied Sciences

Organization: Canadian Food Inspection Agency

Q: Briefly describe your current position and responsibilities, including challenges/rewards. How did you go about your job search upon graduating -- what strategies were most successful and why do you think you were hired?

In my work I deal with consumer protection issues as they relate to food. I applied to jobs that had a direct or indirect connection to the sector I was interested in (regulatory), combined with my field of technical expertise (biology and biotechnology).

Q: List the key positions you have held since graduation, and any post-graduate degrees/diplomas you earned after graduation. If applicable, list any other ways you are involved in your profession or in your community (member of a professional association, involved as a leadership volunteer, etc).

I completed an internship with a health products company in my senior year and briefly worked in clinical research after graduation. I have continued to pursue career relevant professional training which is a perk in the public service. I am also a member of the Community of Federal Regulators on GCPedia.

Q: What personal characteristics/skills are most important for success in your job/field?

My job requires initiative, judgement and flexibility. You also need fantastic research, writing and people skills.

Q: During your university career did any key experiences assist you in making your career choices? If yes, how so? (Internships? Extern Program? Volunteering? Student clubs? Summer job? Mentorship?)

I did a summer research opportunity project in first year, an internship and an independent research project in my final year. I gained much more career direction from these courses than in-class courses.

Q: What have been the keys to your success? What advice would you give to students who wish to pursue a similar career path? If you had the chance to plan your studies and your career path again, what would you do differently (if anything)?

The keys to my success were networking and a creative, analytical approach to problem solving. I would advise students who want to do writing/research based work in the field of biology, to put in effort in understanding research methodologies and writing techniques, as well as concepts of biology. For students interested in public service, apply for the student internships and placements in the federal, provincial and municipal governments. Although I came into the job from the private sector, most of their recruitment really goes back to students.

ADDITIONAL WEB RESOURCES

- BioTalent Canada – Career Tools: <https://www.biotalent.ca/en/careerplanning>
- TalentEgg – Health Care Career Guide: <https://talentegg.ca/career-guides/healthcare>
- Jobpostings.ca – Career guides in Health Care, pharmacy and biotech:
<https://www.jobpostings.ca/career-guides>
- American Institute of biological sciences – About Careers in Biology:
<https://www.aibs.org/careers/>
- The Scientist magazine for life science professionals: <https://www.the-scientist.com/>
- Canada’s Top 100 Employers for Young Workers:
https://www.canadastop100.com/young_people/

References

- Overview: <https://www.thebalancecareers.com/top-jobs-for-biology-majors-2059884>
- Information about Job description, attributes and abilities, earnings, education and training , interview with professionals: <https://public-careercruising-com.myaccess.library.utoronto.ca/en/>
- Information about labour market: <https://www.payscale.com/>