Graduate Certificate in Bioinformatics

Program description:

This Graduate Certificate in Bioinformatics provides a solid foundation in the theories, methods, and applications of bioinformatics. Students will learn to use a variety of methods and computational tools to process, analyze, interpret, and communicate complex biological data, which are applicable to a variety of scientific fields, including human genetics and precision medicine, livestock and plant genomics, and microbiology. Through this professional graduate certificate, students can enhance their career in biomedical research, drug development and smart agriculture.

Why a graduate certificate?

In a fast-growing knowledge economy, a graduate certificate provides the flexibility and opportunity for accelerated access to the job market in hot fields that are currently under great need for highly qualified and skilled personnel. It also provides a golden opportunity to professionals for specialization or re-training to a new field.

While being a full-time graduate course program, core classes of this certificate take place in the evening, enabling both students and professionals to attend in parallel with their other activities.

Why Bioinformatics?

Genetic information of all organisms (humans, animals, plants, microorganisms) is encoded mainly in the biochemical sequence of the four DNA bases (A, T, C, G) and forms their genome, which in case of humans is 3-billion-DNA-base-long. To store the extraordinary amount of genomic information in non-digital media we would need more than 1200 hefty telephone books (1000 pages each); until recently more than a day would have been needed to “read” just a single page of these books with devices called sequencers, which were the size of a large refrigerator. However, today, a new generation of sequencers (often of the size of a cell phone) can read all

these pages in a matter of hours, enabling us for the first time to resolve fundamental questions about life and use this information for applications in almost all areas of modern life and economy. The incredible amount of data produced through these new disruptive technologies is handled by bioinformaticians, that in recent years are in high demand but great shortage.

Bioinformatics applications now form the basis of most genetic testing applications and include but are not limited to:

Health Care
Personalized Genomics, Precision Medicine, Molecular Diagnostics, Genetic Testing and Screening, Genomic Epidemiology, Antimicrobial Resistance Surveyance and Monitoring

Wellness
Population Genetics, Ancestry Services, Wellness Genomics, Nutrigenomics

Agriculture
Smart Agriculture, Antibiotic Resistance and One Health, Crop Health and Sustainability, Livestock Sustainability, Enhancement and Health

Biotech Research and Development
Novel Drug Development, Testing and Diagnostic Monitoring Services

Environment and Sustainability
Wastewater and Water System Monitoring, Toxicology, Impact and Sustainability Tracking and Tracing

Experience and comfort in Bioinformatic analysis is an asset and valuable skillset in all biological sciences and a distinguishing factor by many employers when seeking new hires in these fields.

Who are the people taking this program?

You are:

- A graduate with a Bachelor in Life Sciences, Natural Sciences, Computer sciences, Engineering or related fields that wants to get highly specialized skills in bioinformatics applications that will provide them with accelerated access to highly skilled well-paid jobs in bioinformatics, without the need to get through a full 2-4 year graduate program.

- A graduate with a Bachelor in Natural Sciences, Computer Sciences, Engineering or related fields that wants to follow later a career in Life Sciences through an MSc but lack the basic background for such a transition.

- A graduate with a Bachelor in Life Sciences, Natural Sciences, Computer sciences, Engineering or related fields that wants to improve their grade standing while attending a new program.

- A graduate with a Bachelor in Life Sciences, Natural Sciences, Computer Sciences, Engineering or related fields that prefer a course based graduate program compared to a research-intensive one.

- A graduate with a Bachelor in Life Sciences, Natural Sciences, Computer Sciences, Engineering or related fields that prefer a course based graduate program as a transition stage before enrolling to an MSc or PhD program.

- MD, MSc or PhD graduates that want to specialize in the field of bioinformatics and genome sciences.

- Current MSc or PhD students that want in parallel to acquire additional skills.

- Professionals that want to enhance their skills and learn new applications in their current job or business.

- Graduates or professionals interested in re-training to a new field and career change.

- Government employees that need introduction to new technologies.

- An international graduate that wants to enter the Canadian academic system though further specialization in the field.

- Graduates of other certificate programs that may want to combine them towards a course-based master (currently under development).

Career pathways:

The application of genomics technologies, of which bioinformatics constitutes the core, helps to solve real-world problems in multiple sectors, including health services, agriculture, environment, forestry, and mining, providing new insights into management and sustainable resource strategies in these industries.

This graduate certificate program is geared towards either life scientists with no/limited computational experience or computer scientists with no biology background and no working experience on biological data, both of whom will expand upon their undergraduate degrees and acquire skills in the field bioinformatics or transition seamlessly to more advanced graduate studies in bioinformatics or a relevant industry career. This certificate program fills an unmet need for immediate bridge training after an undergraduate degree or re-training for those individuals who may wish to acquire further specialization prior to a career change, providing a

more streamlined training experience compared to traditional two- or five-year graduate degree programs.

Graduates of this certificate program will also develop general in-demand skills in research, communication, collaboration, problem solving, and data organization. Not only are applicants with skills in Bioinformatics more likely to be considered for a position that would benefit from these skills but compiled renumeration data indicates the average annual salary of a Bioinformatician is 8.6% higher for an applicant with Bioinformatics skills compared to a one with skills in general Biology (glassdoor.com, payscale.com, talent.com).

Where can I work after graduation?

- As bioinformatician/data analyst:

In an academic/research institution

In a genetic testing lab

In a microbiology lab

In a Biotech / Startup

In R&D in the industrial sector

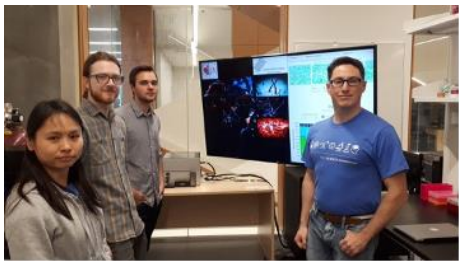
In Government of Canada and Provincial Research Centres

Why Lethbridge?

Lethbridge is a leader in the Bioinformatics field:

It is the home of the Southern Alberta Genome Sciences (SAGSC, www.sagsc.org), an institute dedicated to research and training in Genome Sciences, Bioinformatics and related applications. Participants in the program will have the opportunity to acquire work integrated learning in one of its labs and participate in the numerous extra-curricular workshops and training activities it offers. The instructors of the program include the director and the center's scientific officer, both recruited from Harvard University with additional industry experience in US genome interpretation companies.

SAGSC and the University of Lethbridge are the leading nodes of the Bioinformatics Network Alberta (BioNet Alberta), a pan-provincial network the that brings together scientists and professionals in bioinformatics from the Universities of Lethbridge, Alberta and Calgary as well as local government entities in Agriculture and Agri-Food Canada and the Canadian Food Inspection Agency. Participants in the program will have the opportunity to participate in the numerous extra-curricular training activities of the network including the BioNet annual bioinformatics conference. BioNet's program manager is located at the University of Lethbridge, facilitating these interactions.



U of L has a developed Bioinformatics Core facility, that offers fee for service bioinformatics services to academia, industry, and government, where program participants will have opportunities for work integrated learning experiences. Real-world experience in a functioning bioinformatics core facility is a significant asset and differentiator to employers considering new hires in bioinformatics fields.

Moreover, the U of L is home to the Canadian Centre for Behavioural Neuroscience (CCBN), a world-renown faculty with diverse interests in computational neuroscience and AI applications (https://www.ulethbridge.ca/artsci/neuroscience) that have led to an exponentially growing amount of data that requires computational interpretation not only for analysis but also for storage and characterization purposes, tasks ideally suited for bioinformaticians and those with experience in computational manipulation of scientific outputs. Participants in the program will have the opportunity to select a course in Computational Neuroscience and become involved with the faculty of Neuroscience to further expand knowledge into these areas of research and gain the required skills to find employment in these areas after completion.

Mode of delivery:

All core classes are delivered in a computer lab, offering direct hands-on experience with real life data and both academia and industry-oriented applications.

Classes are delivered predominantly in the late afternoon (after 5pm), once or twice per week or in intensive 2-week courses.

Participants will have the opportunity to participate in a research bases project in a lab.

The program includes multiple opportunities for working and interacting in teams and other unconventional modes of delivery that enhance the overall learning experience.

Learning Outcomes:

- Master both basic and advanced concepts of bioinformatics.
- Understand the wide range of possible bioinformatics applications in the health services sector and the agriculture industry and use bioinformatics tools in a Unix computational environment for analysis of high throughput sequencing and other omics data.
- Perform problem solving in academic and industrial environments on projects tasked with the generation and analysis of omics data.
- Organize and pursue a scientific or industrial research project in fields such as biological databases; algorithms in bioinformatics; biocomputing; basic probability and statistics in bioinformatics; genome architecture and functional genomics; and omics applications in precision health and agriculture.
- Work effectively as a member of a bioinformatics team.
- Write scientific and industrial R&D reports for bioinformatics projects to a professional standard.

Depending on prior training, students will also be able to:

- Life sciences background: Acquire skills in computer science and programming for life scientists without prior computational experience through the use of Unix systems, algorithms, data structures, string manipulation, basic concepts of software development and programming languages, such as Perl and R.
- Computer sciences/engineering background: Demonstrate knowledge in basic concepts of biological and genetic information and master further data analysis skills in a focused topic area, such as bioinformatic algorithms, genomics and medical informatics. Demonstrate competency with programming languages, such as Perl and R.

FAQ:

I am a professional and need to work during the day, can I apply for this certificate?

Yes. The three core classes are offered in the evening. In total, time commitment for the program is 3 hours twice per week for these courses during the spring term (January-April) and the first half of the summer term (May-June). For the elective course Neuroscience 5850 - Workshop in Computational Neuroscience, a two-week commitment in May is required, should the participants select this course.

If participants select the research project “Biochemistry 5990 - Independent Study”, a 10-hour commitment per week for three months is required, but professionals working during the day will be accommodated.

How can I get more information about current job opportunities in the field?

Please check the following articles and links:

Within Canada:

https://ca.indeed.com/Bioinformatics-jobs

https://www.linkedin.com/jobs/bioinformatics-jobs/

https://www.glassdoor.ca/Job/canada-bioinformatics-jobs-SRCH_IL.0,6_IN3_KO7,21.htm

https://bioinformatics.ca/job-postings/#/?&order=desc

https://www.eluta.ca/Bioinformatic-jobs

https://ca.jooble.org/jobs-bioinformatics

https://www.biotalent.ca/the-petridish/?job_search=bioinformatics&city=&cityLat=&cityLng=&bio_org_search=

https://www.jobbank.gc.ca/jobsearch/jobsearch?searchstring=bioinformatician&locationstring=&sort=M

Worldwide:

https://jobs.sciencecareers.org/jobs/bioinformatics/

https://www.indeed.com/q-Bioinformatics-jobs.html?vjk=b5e7a1b54b09da5f

https://www.bioinformatics.org/jobs/

https://www.biostars.org/t/Jobs/

I am an international student. Can I apply for this certificate?

Very likely, please check here:

https://www.ulethbridge.ca/future-student/graduate-studies/international-applicants

Can this program be combined with other programs?

We are currently developing pathways for graduates to combine this program with similar ones towards course-based Masters in the future.

Can this program be offered online?

The program is currently offered in person. However, if you are an international student interested in remote learning, please express your interest to angeliki.pantazi@uleth.ca and we may be able to accommodate you should there be sufficient demand for this.

To register for the Graduate Certificate in Bioinformatics, visit:
https://www.ulethbridge.ca/future-student/graduate-studies/bioinformatics-gc