2019-2020 Graduate Calendar

The information published in this Graduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2019-2020 academic year, including the Summer Semester 2019, Fall Semester 2019 and the Winter Semester 2020.

For your convenience the Graduate Calendar is available in PDF format.

If you wish to link to the Graduate Calendar please refer to the Linking Guidelines.

The University is a full member of:

• Universities of Canada

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June 28, 2019	Revision 1
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Disclaimer

The Office of Graduate and Postdoctoral Studies has attempted to ensure the accuracy of this on-line Graduate Calendar. However, the publication of information in this document does not bind the university to the provision of courses, programs, schedules of studies, fees, or facilities as listed herein.

Limitations

The University of Guelph reserves the right to change without notice any information contained in this calendar, including any rule or regulation pertaining to the standards for admission to, the requirements for the continuation of study in, and the requirements for the granting of degrees or diplomas in any or all of its programs.

The university will not be liable for any interruption in, or cancellation of, any academic activities as set forth in this calendar and related information where such interruption is caused by fire, strike, lock-out, inability to procure materials or trades, restrictive laws or governmental regulations, actions taken by the faculty, staff or students of the university or by others, civil unrest or disobedience, Public Health Emergencies, or any other cause of any kind beyond the reasonable control of the university.

The University of Guelph reaffirms section 1 of the Ontario Human Rights Code, 1981, which prohibits discrimination on the grounds of race, ancestry, place of origin, colour, ethnic origin, citizenship, creed, sex, sexual orientation, handicap, age, marital status or family status.

The university encourages applications from women, aboriginal peoples, visible minorities, persons with disabilities, and members of other under-represented groups.

Introduction

Collection, Use and Disclosure of Personal Information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90f31_e.htm. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes. Certain personal information is disclosed to external agencies, including the Ontario Universities Application Centre, the Ministry of Advanced Education and Skills Development, and Statistics Canada, for statistical and planning purposes, and is disclosed to other individuals or organizations in accordance with the Office of Registrarial Services Departmental Policy on the Release of Student Information. For details on the use and disclosure of this information call the Office of Registrarial Services at the University at (519) 824-4120 or see https://www.uoguelph.ca/registrar/

Statistics Canada - Notification of Disclosure

For further information, please see Statistics Canada's web site at http://www.statcan.gc.ca and Section XIV Statistics Canada.

Address for University Communication

Depending on the nature and timing of the communication, the University may use one of these addresses to communicate with students. Students are, therefore, responsible for checking all of the following on a regular basis:

Email Address

The University issued email address is considered an official means of communication with the student and will be used for correspondence from the University. Students are responsible for monitoring their University-issued email account regularly.

Home Address

Students are responsible for maintaining a current mailing address with the University. Address changes can be made, in writing, through Registrarial Services.

Name Changes

The University of Guelph is committed to the integrity of its student records, therefore, each student is required to provide either on application for admission or on personal data forms required for registration, their complete, legal name. Any requests to change a name, by means of alteration, deletion, substitution or addition, must be accompanied by appropriate supporting documentation.

Student Confidentiality and Release of Student Information Policy Excerpt

The University undertakes to protect the privacy of each student and the confidentiality of their record. To this end the University shall refuse to disclose personal information to any person other than the individual to whom the information relates where disclosure would constitute an unjustified invasion of the personal privacy of that person or of any other individual. All members of the University community must respect the confidential nature of the student information which they acquire in the course of their work.

Complete policy at https://www.uoguelph.ca/secretariat/office-services/university-secretariat/university-policies .

Learning Outcomes

Graduate Degree Learning Outcomes

On May 27, 2013, the University of Guelph Senate approved the following five University-wide Learning Outcomes as the basis from which to guide the development of graduate degree programs, specializations and courses:

1. Critical and Creative Thinking
2. Literacy
3. Global Understanding
4. Communication
5. Professional and Ethical Behaviour

These learning outcomes are also intended to serve as a framework through which our educational expectations are clear to students and the broader public; and to inform the process of outcomes assessment through the quality assurance process (regular reviews) of programs and departments.

An on-line guide to the learning outcomes, links to the associated skills, and detailed rubrics designed to support the development and assessment of additional program and discipline-specific outcomes, are available for reference on the Learning Outcomes website

Critical and Creative Thinking

Critical and creative thinking is a concept in which one applies logical principles, after much inquiry and analysis, to solve problems with a high degree of innovation, divergent thinking and risk taking. Those mastering this outcome show evidence of integrating knowledge and applying this knowledge across disciplinary boundaries. Depth and breadth of understanding of disciplines is essential to this outcome. At the graduate level, originality in the application of knowledge (master's) and undertaking of research (doctoral) is expected.

In addition, Critical and Creative Thinking includes, but is not limited to, the following outcomes: Independent Inquiry and Analysis; Problem Solving; Creativity; and Depth and Breadth of Understanding.

Literacy

Literacy is the ability to extract information from a variety of resources, assess the quality and validity of the material, and use it to discover new knowledge. The comfort in using quantitative literacy also exists in this definition, as does using technology effectively and developing visual literacy.

In addition, Literacy includes, but is not limited to, the following outcomes: Information Literacy, Quantitative Literacy, Technological Literacy, and Visual Literacy.

Global Understanding

Global understanding encompasses the knowledge of cultural similarities and differences, the context (historical, geographical, political and environmental) from which these arise, and how they are manifest in modern society. Global understanding is exercised as civic engagement, intercultural competence and the ability to understand an academic discipline outside of the domestic context.

In addition, Global Understanding includes, but is not limited to, the following outcomes: Global Understanding, Sense of Historical Development, Civic Knowledge and Engagement, and Intercultural Competence.

Communication

Communication is the ability to interact effectively with a variety of individuals and groups, and convey information successfully in a variety of formats including oral and written communication. Communication also comprises attentiveness and listening, as well as reading comprehension. It includes the ability to communicate and synthesize information, arguments, and analyses accurately and reliably.

In addition, Communication includes, but is not limited to, the following outcomes: Oral Communication, Written Communication, Reading Comprehension, and Integrative Communication.

Professional and Ethical Behaviour

Professional and ethical behaviour requires the ability to accomplish the tasks at hand with proficient skills in teamwork and leadership, while remembering ethical reasoning behind all decisions. The ability for organizational and time management skills is essential in bringing together all aspects of managing self and others. Academic integrity is central to mastery in this outcome. At the graduate level, intellectual independence is needed for professional and academic development and engagement.

In addition, Professional and Ethical Behaviour includes, but is not limited to, the following outcomes: Teamwork, Ethical Reasoning, Leadership, Personal Organization and Time Management, and Intellectual Independence.

Table of Contents

Bioinformatics

Bioinformatics is the development and application of computational and statistical techniques for solving problems involving complex biological data. This emerging discipline is growing rapidly alongside technological developments for large-scale data generation in the life sciences, such as in genomics, proteomics, functional pathway analysis, health sciences, and biodiversity. Demand is accelerating for new approaches for data storage, retrieval, analysis, and applications. A new generation of professionals is required to meet this demand, having bioinformatics skills and the capacity to create new approaches.

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MBINF Program

Admission Requirements

Students will be admitted to the Master of Bioinformatics program from a range of undergraduate programs in the life sciences. Students from undergraduate programs in the physical or computational sciences will be considered for admission if they are considered to have sufficient biological background. Students must begin the Master of Bioinformatics program in a fall semester. To be considered for admission, applicants should meet the minimum requirements of a four-year degree from a recognized post-secondary institution with a minimum 75% average over the last two years of full-time equivalent study.

Space in the program is limited and prospective students are encouraged to apply as early as possible. Application details are posted on the program website.

Program Requirements

A total of 4.0 credits are required, which must include:

BINF*6110	[0.50]	Genomic Methods for Bioinformatics
BINF*6210	[0.50]	Software Tools for Biological Data Analysis and Organization
BINF*6890	[0.50]	Topics in Bioinformatics
BINF*6970	[0.50]	Statistical Bioinformatics
BINF*6999	[1.00]	Bioinformatics Master's Project

The advisory committee and/or the Graduate Program Committee may require additional courses.

Advisory Committee

Students taking the Master of Bioinformatics will have an advisor and a co-advisor. Both the advisor and the co-advisor must be members of the Bioinformatics Graduate Faculty such that one has expertise in the life sciences and the other has expertise in statistics or computing.

Duration of the Program

Students normally take 3 courses per semester for two semesters (3.0 credits) and complete the Bioinformatics Master's Project (1.0 credit) in a third semester. Therefore, the program typically takes 12 months of full-time study. There is, however, the option to continue the Bioinformatics Master's Project into a second fall semester, in which case the program will take 16 months of full-time study.

MSc Program

Admission Requirements

Students may be admitted to the MSc in Bioinformatics program from a range of undergraduate programs in the life, physical, statistical, mathematical, and computational sciences. To be considered for admission, applicants should meet the minimum requirements of a four-year degree from a recognized post-secondary institution with a minimum 75% average over the last two years of full-time equivalent study.

Applicants should indicate their research interests and their preferred advisors. Prospective students are encouraged to speak with potential advisors before applying to the MSc program. Offers of admission will only be issued in cases where a member of Bioinformatics Graduate Faculty has agreed to be the advisor.

Program Requirements

A total of 2.0 credits are required, which must include:

BINF*6110	[0.50]	Genomic Methods for Bioinformatics
BINF*6210	[0.50]	Software Tools for Biological Data Analysis and Organization

The advisory committee and/or the Graduate Program Committee may require additional courses. When the course work is satisfactorily completed, the submission and successful defence of an appropriate thesis on an approved topic completes the requirements for the MSc in Bioinformatics.

Advisory Committee

Students taking the MSc in Bioinformatics will have an advisory committee comprising at least two members of the Bioinformatics Graduate Faculty. The advisor must be a member of the Bioinformatics Graduate Faculty.

Duration of the Program

The program typically takes 16-24 months of full-time study.

PhD Program

Admission Requirements

1. Applicants with a master's degree

Applicants holding either a Master of Bioinformatics, an MSc in Bioinformatics, or a masters in a related discipline with a GPA above 80 over the last two years equivalent of full time study will be considered for admission.

2. Applicants without a master's degree (i.e., direct entry)

Strong applicants (GPA>80) may be admitted without holding a master's degree provided that their undergraduate major is appropriate. In these cases, the program committee will assign necessary courses to ensure sufficient preparedness for research.

3. General Requirements

Before a recommendation of admission can be issued, applicants are encouraged to speak with potential advisors before applying to the PhD in Bioinformatics program.

Program Requirements

A minimum of 1.0 credit is required, which must include:

BINF*6500   [1.00]   PhD Research Writing in Bioinformatics

The program committee and the advisory committee may, and usually will, require additional courses. After the prescribed course work is satisfactorily completed, a qualifying examination is taken. Finally, the submission and successful defence of an appropriate thesis on an approved topic completes the requirements for the PhD in Bioinformatics.

Advisory Committee

Students taking the PhD in Bioinformatics will have an advisory committee comprising at least three members of the Graduate Faculty, two of whom should be Bioinformatics Graduate Faculty. The advisor must be a member of the Bioinformatics Graduate Faculty. Usually, if there is a co-advisor, (s)he will also be a member of the Bioinformatics Graduate Faculty; under special circumstances, the Director, after consultation with the Bioinformatics Program Committee, may approve a co-advisor who is not a member of the Bioinformatics Graduate Faculty.

Duration of the Program

The completion period of the program is 12 semesters of full-time study.

Collaborative Specializations

Artificial Intelligence

The MSc in Bioinformatics program participates in the collaborative specialization in Artificial Intelligence. MSc students wishing to undertake thesis research with an emphasis on artificial intelligence are eligible to apply to register concurrently in Bioinformatics and the collaborative specialization. Students should consult the Artificial Intelligence listing for more information.

Courses

Bioinformatics Core Courses

BINF*6110 Genomic Methods for Bioinformatics W [0.50]

This course provides an introduction to current and emerging methods used to generate genomic data analyzed in bioinformatics. This may include techniques for DNA sequencing as well as transcriptome, proteome and metabolome analysis. The objective is to develop an appreciation for the challenges of producing data.

Restriction(s):   Restricted to students in Bioinformatics programs. Students in other programs may consult with course instructor.
Department(s):   Dean's Office, College of Biological Science

BINF*6210 Software Tools for Biological Data Analysis and Organization F [0.50]

This course will familiarize students with tools for the computational acquisition and analysis of molecular biological data. Key software for gene expression analyses, biological sequence analysis, and data acquisition and management will be presented. Laboratory exercises will guide students through application of relevant tools.

Restriction(s):   Restricted to students in Bioinformatics programs. Students in other programs may consult with course instructor.
Department(s):   Dean's Office, College of Biological Science

BINF*6410 Bioinformatics Programming F [0.50]

This course will introduce bioinformatics students to programming languages. Languages such as C and Perl will be introduced with a focus on bioinformatics applications. The topics covered will serve to aid students when existing software does not satisfy their needs.

Restriction(s):   Restricted to students in Bioinformatics programs. Students in other programs may consult with course instructor.
Department(s):   Dean's Office, College of Biological Science

BINF*6420 Biosequence Pattern Analysis W [0.50]

This course is an overview course on different approaches to analyze biological sequences. Basic concepts are introduced, as well as related algorithms.

Restriction(s): Restricted to students in Bioinformatics programs. Students in other programs may consult with course instructor.
Department(s): Dean's Office, College of Biological Science

BINF*6500 PhD Research Writing in Bioinformatics F,W,S [1.00]

Background literature pertinent to the student's initial research direction will be studied. Starting with a reading list provided by the advisor and the instructor, the student will build on this list and construct a major literature review over two semesters. As the student begins to generate initial ideas for their own research direction, their ideas are written and explained. The emphasis will be on a sub-field or sub-fields of bioinformatics and the depth of study will be appropriate to the doctoral level.

Restriction(s): PhD students in Bioinformatics program
Department(s): Dean's Office, College of Biological Science

BINF*6890 Topics in Bioinformatics F [0.50]

Selected topics in bioinformatics will be covered. The course might focus on biological or informatics topics, or upon a mixture of both.

Restriction(s): Restricted to students in Bioinformatics programs. Students in other programs may consult with course instructor.
Department(s): Dean's Office, College of Biological Science

BINF*6970 Statistical Bioinformatics W [0.50]

This course presents a selection of advanced approaches for the statistical analysis of data that arise in bioinformatics, especially genomic data. A central theme to this course is the modelling of complex, often high-dimensional, data structures.

Prerequisite(s): Introductory courses in statistics, mathematics and programming
Restriction(s): Restricted to students in Bioinformatics programs. Students in other programs may consult with course instructor.
Department(s): Dean's Office, College of Biological Science

BINF*6999 Bioinformatics Master's Project F,W,S [1.00]

A major research paper is completed and presented by students in the Master of Bioinformatics program.

Prerequisite(s): BINF*6110, BINF*6210
Restriction(s): Restricted to MBNF students only
Department(s): Dean's Office, College of Biological Science

Note

Some courses may not be offered every year. Students planning to take a course from the above list should consult with the Graduate Program Assistant for availability and scheduling.

Electives

Biological Sciences

ANSC*6370	[0.50]	Quantitative Genetics and Animal Models
HHNS*6440	[0.50]	Nutrition, Gene Expression and Cell Signalling
MCB*6370	[0.50]	Protein Structural Biology and Bioinformatics
PLNT*6160	[0.50]	Advanced Plant Breeding II
PLNT*6500	[0.50]	Applied Bioinformatics

Computer Science

CIS*6080	[0.50]	Genetic Algorithms
CIS*6120	[0.50]	Uncertainty Reasoning in Knowledge Representation

Mathematics and Statistics

STAT*4340	[0.50]	Statistical Inference
STAT*6801	[0.50]	Statistical Learning
STAT*6802	[0.50]	Generalized Linear Models and Extensions
STAT*6950	[0.50]	Statistical Methods for the Life Sciences

Note

Some courses may not be offered in every semester. Students planning to take a course from the above list should consult with the department offering the course to check for availability and scheduling.