Course Outline

Contents

- Course Details
- Course Summary
- Assumed Knowledge
- Student Learning Outcomes
- Teaching Strategies
- Teaching Rationale
- Student Conduct
- Assessment
- Course Schedule
- Resources for Students
- Course Evaluation and Development

Course Details

<table>
<tr><td>Course Code</td><td>BINF3010/9010</td></tr>
<tr><td>Course Title</td><td>Applied Bioinformatics</td></tr>
<tr><td>Convenor</td><td>Bruno Gaeta (/users/z8670378)</td></tr>
<tr><td>Admin</td><td>Bruno Gaeta (/users/z8670378)</td></tr>
<tr><td>Classes</td><td>This course is worth 6 units of credit. Lectures are held online. Lectures will either be pre-recorded with a discussion session, or held live (with recording) at the following times:
<table>
<tr><td>Mon</td><td>10:00 - 12:00</td><td>online</td></tr>
<tr><td>Wed</td><td>10:00 - 12:00</td><td>online</td></tr>
</table>
Laboratories (shown in Bold on the course schedule) will be set up as self-directed exercises. The timetabled lab session on Thursdays 11am-1pm will be for consultation and discussion. Labs will open one week before the timetabled lab slot, and the lab quizzes will be due one week after the lab slot.

The midterm exam details will be advised closer to the date.

Important note: most labs will require the use of computers running a UNIX-based operating system. It is recommended that students who are not familiar with this environment attempt the optional Intro lab scheduled in week 1. This lab will include a live discussion of how to access the necessary resources remotely.

Timetable for all classes (/BINF3010/20T2/timetable)</td></tr>
<tr><td>Consultations</td><td>By appointment</td></tr>
</table>

Units of Credit	6
Course Website	https://moodle.telt.unsw.edu.au/course/view.php?id=51304 (http://cse.unsw.edu.au/~bi3010/20T2/) Note that webcms3 is used only for the course outline and is not otherwise monitored
Handbook Entry	http://www.handbook.unsw.edu.au/undergraduate/courses/current/BINF3010.html (http://www.handbook.unsw.edu.au/undergraduate/courses/current/BINF3010.html)

Course Summary

Bioinformatics (the use of computing methods for the management and analysis of molecular biology data) has become an integral component of biomolecular sciences, especially genomics and proteomics. This course focuses on the practical use of bioinformatics methods and resources for the analysis of DNA and protein sequences and structures, as well as results from microarray and proteomics, with emphasis on their evolutionary underpinnings and statistical foundations.

General course aims

- Provide an introduction to commonly used bioinformatics resources, methods and software, with an emphasis on their use, capabilities and limitations
- Provide an introduction to bioinformatics as an application area of mathematical and computational sciences

BINF3010 is a core course in the BE (Bioinformatics) program, and an elective in Science programs.

BINF9010 is a core course in the MIT (bioinformatics) program, and an elective in a number of other graduate programs including Biomedical Engineering and Biostatistics.

BINF3010/9010 does not cover bioinformatics algorithms in depth (these are covered in BINF6111 and BINF6112). The course focuses on the intelligent application of common bioinformatics methods to assist in biological discovery and is primarily targeted at students with a biology background. For students with a computing background the course provides an introduction to bioinformatics and its biological context.

Assumed Knowledge

This course is about *using* bioinformatics methods for biological research. It is *not* about developing new bioinformatics methods. As such it assumes a working knowledge of molecular biology. Biology provides the context of the content and all the examples used in its presentation, and **students with no knowledge of biology are likely to fail the course** (this is especially important for postgraduate BINF9010 students as no biology prerequisite is available for these students). In terms of computing, the course only assumes ability to use computers, although a working knowledge of the UNIX command line and of the basics of the R statistical computing environment is an advantage. Some resources will be provided for students new to UNIX and R.

Student Learning Outcomes

At the end of this course, students should be able to:

- Outline the fundamental biology concepts that provide the context for bioinformatics, including sequence, structure and function as they relate to biological information macromolecules and molecular evolution
- Use the UNIX shell to manage and analyse biological sequence and functional genomics data
- Research, identify, select and use bioinformatics tools and databases to analyse biological sequences, structures and functional genomics data

- Apply statistical thinking to the design and analysis of high-throughput molecular biology experiments, and perform a range of data processing and analysis tasks using the R environment
- Outline the strengths and limitations of the main approaches used in sequence and structural bioinformatics, functional genomics and systems biology.
- Discuss the experimental basis of protein structure determination and discuss, compare and apply a range of computational methods for analysing and predicting protein tertiary structure
- Interpret and analyze data generated by proteomics experiments using bioinformatics

This course contributes to the development of the following graduate capabilities:

The skills involved in scholarly enquiry – students need to research, compare and evaluate different bioinformatics methods as part of the practical work and final examination

An in-depth engagement with the relevant disciplinary knowledge in its interdisciplinary context – bioinformatics is presented in the context of its applications to biology, and of the computer science methods it draws on

The capacity for analytical and critical thinking and for creative problem-solving – laboratory work and assignments require students to solve a range of problems by choosing appropriate bioinformatics methods and applying them

The ability to engage in independent and reflective learning – the midsession and final examinations require students to reflect and provide a critical synthesis of the course contents

The skills required for collaborative and multidisciplinary work – the laboratory exercises are to be carried out in teams of mixed student background

The skills of effective communication – written communication is assessed principally through laboratory reports and the final examination. Effective communication between students of different backgrounds is also necessary for carrying out the laboratory assignments.

Teaching Strategies and Rationale

Bioinformatics now pervades biological research, and new methods and technologies are constantly developed. This course is aimed at teaching bioinformatics from a *user* 's perspective (as opposed to that of a *developer*), to emphasise the use of bioinformatics to assist in biological discovery. Since bioinformatics constantly evolves the goal is not to teach the use of specific tools and methods but to focus on *principles* , *limitations* and *assumptions* of common approaches to provide the means for students to research and evaluate new methods and apply them intelligently to produce meaningful results.

- In order to establish the link between the topics being covered and the current state of the art in bioinformatics research, each topic is presented by a lecturer active in research in that area or its applications
- Hands-on practical computer laboratories require the students to use a range of bioinformatics methods described in the lectures and reflect on the results they obtain
- Bioinformatics is a new discipline that changes quickly, and it is important for graduates to be able to keep in touch with the state of the art in bioinformatics methods, rather than just learn about a standard set of tools that will soon be obsolete. The course therefore emphasises fundamental principles and requires the students to demonstrate the ability to research and evaluate new methods.

Online delivery

In 2020 the course is being delivered online. This is the first time this is happening and although we are using methods that have been successful in other courses, this is new and is likely to present a challenge. The methods we are proposing (subject to change) are as follow:

- Some lecturers will present their lectures live using Microsoft Teams. There will be opportunities for questions using Chat during the lecture. Lectures will be recorded and accessible through a link on

Moodle

- Some lecturers will pre-record their lectures and make them accessible on Moodle. They will log on in Teams in the last 30 minutes of the lecture slot to answer questions.
- The labs are set up as self-directed exercises. Some exercises can be done using a standard web browser on your own computer. Others will require logging remotely onto the CSE computers to run applications there. The lecturer will be available in a Zoom session during the lab time, to answer questions. The Zoom ID will be posted on Moodle at the beginning of the lab time. Zoom is chosen as it makes it easy for students to share their screens and for the lecturer to take control of it if necessary.
- The midterm exam will be set up as a limited time-quiz in Moodle running at a set time.
- How the final exam will run is still to be determined and depends on the situation at the time.

Student Conduct

The **Student Code of Conduct** (Information (https://student.unsw.edu.au/conduct) , Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)) sets out what the University expects from students as members of the UNSW community. As well as the learning, teaching and research environment, the University aims to provide an environment that enables students to achieve their full potential and to provide an experience consistent with the University's values and guiding principles. A condition of enrolment is that students *inform themselves* of the University's rules and policies affecting them, and conduct themselves accordingly.

In particular, students have the responsibility to observe standards of equity and respect in dealing with every member of the University community. This applies to all activities on UNSW premises and all external activities related to study and research. This includes behaviour in person as well as behaviour on social media, for example Facebook groups set up for the purpose of discussing UNSW courses or course work. Behaviour that is considered in breach of the Student Code Policy as discriminatory, sexually inappropriate, bullying, harassing, invading another's privacy or causing any person to fear for their personal safety is serious misconduct and can lead to severe penalties, including suspension or exclusion from UNSW.

If you have any concerns, you may raise them with your lecturer, or approach the School Ethics Officer (mailto:ethics-officer@cse.unsw.edu.au) , Grievance Officer (mailto:grievance-officer@cse.unsw.edu.au) , or one of the student representatives.

Plagiarism is defined as (https://student.unsw.edu.au/plagiarism) using the words or ideas of others and presenting them as your own. UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several on-line sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Plagiarism and Academic Integrity (https://student.unsw.edu.au/plagiarism)
- UNSW Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism. In particular, you are also responsible that your assignment files are not accessible by anyone but you by setting the correct permissions in your CSE directory and code repository, if using. Note also that plagiarism includes paying or asking another person to do a piece of work for you and then submitting it as your own work.

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.

If you haven't done so yet, please take the time to read the full text of

- UNSW's policy regarding academic honesty and plagiarism (https://student.unsw.edu.au/plagiarism)

The pages below describe the policies and procedures in more detail:

- Student Code Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)
- Student Misconduct Procedure (https://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)
- Plagiarism Policy Statement (https://www.gs.unsw.edu.au/policy/documents/plagiarismpolicy.pdf)
- Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

You should also read the following page which describes your rights and responsibilities in the CSE context:

- Essential Advice for CSE Students (https://www.engineering.unsw.edu.au/computer-science-engineering/about-us/organisational-structure/student-services/policies/essential-advice-for-cse-students)

Assessment: BINF3010

Computer laboratory work – *30%* Computer laboratories will emphasise the use of common bioinformatics applications. Most labs will be assessed using an online moodle quiz. Laboratory quizzes will not be accepted after their set submission deadline. The labs evaluate your ability to use bioinformatics software and interpret results in the light of the theoretical background discussed in the lectures. The labs have been structured so that they can be completed on your own on your own computer as much as possible. The lab sessions are meant to be for consultation and discussion of any difficulties you have encountered doing the lab. It is recommended that you attempt to complete the lab by yourself before the corresponding lab session so you can bring your questions for the online lab session.

- **Most labs will require the use of computers running the Linux operating system. It is recommended that students with no familiarity with Linux go through the optional intro to UNIX lab. It is OK to partner with a student familiar with Linux if you can.**
- **Some labs require the use of the R statistics/scripting language. If you have not used R before, make sure to read Chapter 1 of the Manual "An Introduction to R" (including working through the introductory session given in Appendix A) that is available at http://www.r-project.org (http://www.r-project.org/)**

(http://www.r-project.org/) ***Protein modelling assignment –*** *10%* An assignment requiring you to predict the 3D structure of a protein given its sequence. Predicted structures will be compared to the “real” structure in a laboratory session. Due in week 9
Midterm examination – *20%* An examination held during the term covering the first part of the lecture and lab material.

Final examination – *40%* A 2-hour examination covering the second part of the lecture material (and some material covered in the labs) taking place in the exam period.

Assessment: BINF9010

Biology quizzes – *2%* Short quizzes to remind you of biology fundamentals relevant to the bioinformatics methods being studied. Quizzes will be administered online through the course website.

Computer laboratory work – *28%* Computer laboratories will emphasise the use of common bioinformatics applications. Most labs will be assessed using an online moodle quiz. Laboratory quizzes will not be accepted after their set submission deadline. The labs evaluate your ability to use bioinformatics software and interpret results in the light of the theoretical background discussed in the lectures. The labs have been structured so that they can be completed on your own on your own computer as much as possible. The lab sessions are meant to be for consultation and discussion of any difficulties you have encountered doing the lab. It is recommended that you attempt to complete the lab by yourself before the corresponding lab session so you can bring your questions for the online lab session.

Important notes :

- **Most labs will require the use of computers running the Linux operating system. It is recommended that students with no familiarity with Linux go through the optional intro to UNIX lab. It is OK to partner with a student familiar with Linux in the labs.**
- **Some labs require the use of the R statistics/scripting language. If you have not used R before, make sure to read Chapter 1 of the Manual "An Introduction to R" (including working through the introductory session given in Appendix A) that is available at http://www.r-project.org (http://www.r-project.org/)**

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***Midterm examination* –** *20%* An examination held during the term covering the first part of the lecture and lab material.

***Final examination* –** *40%* A 2 hour examination covering the second part of the lecture material (and some material covered in the labs) taking place in the exam period.

Course Schedule

Course lecturers:

Each section of the course is taught by a lecturer who actively works in the specific area.

- Susan Corley, School of Biotechnology and Biomolecular Sciences – s.corley@unsw.edu.au
- Paul Curmi, School of Biotechnology and Biomolecular Sciences, School of Physics – p.curmi@unsw.edu.au
- Bruno Gaeta (LiC), CSE - bgaeta@unsw.edu.au
- Peter Humburg, Stats Central - p.humburg@unsw.edu.au
- Ruiting Lan, School of Biotechnology and Biomolecular Sciences – r.lan@unsw.edu.au
- Mark Raftery, Biomolecular Research Facility UNSW – m.raftery@unsw.edu.au
- Fatemeh Vafaee, School of Biotechnology and Biomolecular Sciences - f.vafaee@unsw.edu.au
- Marc Wilkins, School of Biotechnology and Biomolecular Sciences – m.wilkins@unsw.edu.au

Week	Starting	Lec Mon 10-12	Lec 2 Wed 10-12	Lab Thu 11-1
1	Jun 1	Sequence Analysis **Gaeta**	Sequence Analysis **Gaeta**	**Intro lab** (optional) Gaeta
2	Jun 8	*Public holiday*	Sequence Analysis **Gaeta**	**Alignment and databases** Gaeta
3	Jun 15	Sequence Analysis **Gaeta**	Genome Informatics **Lan**	**MSA and phylogeny** Gaeta
4	Jun 22	RNA-Seq **Corley**	Statistics **Humburg**	**Genome Assembly** Gaeta
5	Jun 29	Statistics **Humburg**	Proteomics **Raftery**	**Midterm (TBC)**
6	Jul 6	*Flexibility week*		
7	Jul 13	Structural Bioinformatics **Curmi**	Structural Bioinformatics **Curmi**	**Visualisation and analysis using R** Gaeta
8	Jul 20	Structural Bioinformatics **Curmi**	Structural Bioinformatics **Curmi**	**RNA-Seq** Corley
9	Jul 27	Structural Bioinformatics **Curmi**	PTMs and Proteogenomics **Wilkins**	**Proteomics** Wilkins

10	Aug 3	ncRNA analysis **Vafaee**	Protein Interactions and Networks **Wilkins**	**Structure Comparison** Gaeta

Resources for Students

There is no textbook for this course. Individual lecturers will provide lists of reference books and articles.

Readings and discussion boards will be made available on the course website, which can be accessed through Moodle.

A number of bioinformatics textbooks are available through the UNSW Library for reference reading. One starting point for assistance is: info.library.unsw.edu.au/web/services/services.html (http://info.library.unsw.edu.au/web/services/services.html)

Course Evaluation and Development

Feedback on this course and on individual lecturers will be gathered through a survey at the end of session, as part of the MyExperience process. Feedback from this survey is the basis for improving the course in subsequent years. Given the course is running online this year in quite a different format, the feedback will be extremely useful in evaluating our online implementation. Feedback from last year was that there was too much content in the course. As a result some of the content was revised and pruned to keep only the most relevant aspects. Also as a result of student feedback that some students had difficulties using command line programs, some of the labs were modified to allow using web resources (when available) as an alternative to command line programs.

Special Consideration

If your work in this course is affected by unforeseen adverse circumstances, you should apply for Special Consideration through MyUNSW, including documentation on how you have been affected. If your request is reasonable and your work has clearly been impacted, then

- for an assignment, you may be granted an extension
- for the Final Exam, you may be offered a Supplementary Exam

Note the use of the word "may". None of the above is guaranteed. It depends on you making a convincing case that the circumstances have clearly impacted your ability to work.

If you are registered with Disability Services, please forward your documentation to Bruno Gaeta within the first two weeks of semester.

Other matters

Occupational Health and Safety: students are reminded of the university's OHS policies and recommendations, which are accessible at

www.riskman.unsw.edu.au/ohs/ohs.shtml (http://www.riskman.unsw.edu.au/ohs/ohs.shtml)
Information specific to OHS in the school of CSE, and especially of ergonomics issues related to use of computers can be accessed at http://www.cse.unsw.edu.au/~ohs/ (http://www.cse.unsw.edu.au/~ohs/)

Equity and diversity: note that students who have a disability that requires some adjustment in their learning and teaching environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of the course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734). Information for students with disabilities is available at:

www.equity.unsw.edu.au/disabil.html (http://www.equity.unsw.edu.au/disabil.html)

Resource created about a year ago (Tuesday 19 May 2020, 10:07:53 AM), last modified about a year ago (Thursday 21 May 2020, 08:10:06 PM).

Comments

(/BINF3010/20T2/forums/search?forum_choice=resource/46257) (/BINF3010/20T2/forums/resource/46257)

There are no comments yet.