Faculty of Health Sciences
School of Biomedical Sciences

Bioinformatics 631
Semester One, 2012

Unit study package number: 13371
Mode of study: Internal
Tuition pattern summary: Lecture 2 X 1 hours weekly Practical 1 X 3 hours weekly
Credit value: 25
Pre-requisite units: Molecular Biology/Genetics 233, Biochemistry 233 or equivalent in previous course of study
Co-requisite units: NIL
Anti-requisite units: NIL
Additional Requirements: NIL
Result type: Grade and Mark
Approved incidental fees: All fee information can be obtained through the Fees Centre. Visit fees.curtin.edu.au for details.

Scheduled times and Venues:
Lecture: Tues 9-10am, Wed 9-10am – 404:204
Practical: Thurs 9-12 – 308:104

Unit Coordinator/Lecturer:
Name: Dr Steven Bottomley
Phone: 9266 4369
Email: S.Bottomley@curtin.edu.au
Building: Room: 308:203
Consultation times: TBA

Lecturer/Tutor:
Name: Ms Eleanor Morgan
Phone: 9266 7516 / 0408004369
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Building : Room: 308.205
Consultation times: TBA

Administrative contact:
Name: Dr Keith Gregg
Phone: 9266 7671
Email: K.Gregg@curtin.edu.au
Building : Room: 308:226

Learning Management System: Blackboard (lms.curtin.edu.au)
**Syllabus**

This unit describes the organisation and analysis of molecular biological data and explores the nexus between biology and information science. Bioinformatics is a necessary discipline to exploit the large amount of rapidly accumulating raw biological data generated by the numerous genome projects currently being undertaken. It focuses on: molecular databases and genome composition; molecular evolution and sequence alignment; phylogenetic analysis and comparative genomics. Principles are illustrated by case studies.

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**Introduction**

Welcome to Bioinformatics 631 (Introduction to Bioinformatics and Functional Genomics)

This unit will assist you in learning new skills in computational biology and will introduce new unifying concepts in molecular science.

Bioinformatics and functional genomics entails the organization and analysis of molecular biological data. It is a relatively new discipline and describes the nexus between biology and information science. Bioinformatics uses computers to collect, store, retrieve and analyse biological data. It is an enabling discipline to take advantage of the vast amount of raw biological data accumulating at an exponential rate as a consequence of the genome projects currently being undertaken around the world.

I have provided my contact details above. Feel free to contact me if you have any problems, questions or concerns as the semester progresses.

Best wishes for the coming semester,
Eleanor (Nell) Morgan
Unit Coordinator

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**Unit Learning Outcomes**

On successful completion of this unit students can:

| 1. Use primary and derived databases to collate biological sequence information relating to function | Graduate Attributes addressed: |
| 2. Generate and analyse local and global alignments of homologous nucleotide and amino acid sequences based on evolutionary concepts. | |
| 3. Construct and interpret phylogenetic trees showing evolutionary relationships between homologous sequences | |
| 4. Analyse genomic and protein sequences to predict genic structure and protein function. | |
| 5. Apply bioinformatics methods to contemporary problems in biomedical science. Report on this information in a professional manner. | |
| 6. Research a contemporary a topic in bioinformatics and present an informative tutorial/seminar to peers | |
Curtin’s Graduate Attributes

<table>
<thead>
<tr>
<th>Apply discipline knowledge</th>
<th>Thinking skills</th>
<th>Information skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication skills</td>
<td>Technology skills</td>
<td>Learning how to learn</td>
</tr>
<tr>
<td>International perspective</td>
<td>Cultural understanding</td>
<td>Professional skills</td>
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</tbody>
</table>

Find out more about Curtin’s Graduate attributes at the Office of Teaching & Learning website: otl.curtin.edu.au

Learning Activities

Students attend one 2 hour lecture and one 2-3 hour practical each teaching week. There are a total of 13 weeks in the semester, which includes a 1 week tuition free period in April.

Lectures will be presented in PowerPoint format and will be available for download online. Audio/Visual recordings (iLectures) of lectures will also be made available barring technical difficulties. Students are encouraged to ask questions during the lecture. In some weeks, student activities will be included to facilitate understanding of some concepts. The practical sessions will be held in the School computing lab (308:104). The exercises provide practical hands-on experience in the use of common Bioinformatics databases and applications. Students should keep a portfolio of practical results, which will be necessary to complete the practical tests competently. The bioinformatics project will allow students to analyse biological sequence data in a ‘pipeline’ fashion, incorporating various analysis techniques that they have learned in the practicals. In the final week, students will be asked to present a short seminar on a topic or case study in Bioinformatics.

Learning Resources

Highly Recommended Texts
Purchase of one of these texts is highly recommended.

  An excellent and mostly very readable introduction to bioinformatics and genomics. A large book with a useful web site.
  http://pevsnerlab.kennedykrieger.org/wiley/

  A concise yet comprehensive textbook written specifically for a life science audience. It covers key areas of bioinformatics and the computational methods employed in a way that is accessible to students without a sophisticated computational background.

Additional Recommended Texts
You do not have to purchase the following textbooks but you may like to refer to them.

  A gentle introduction (cook book style) to the construction of phylogenetic trees from
sequence data. Covers the use of the MEGA phylogenetics package for PC, as well as use of PhyML and Mr Bayes. Also explains the theory underlying the different phylogenetic methods. Note – this would make a useful supplementary textbook and future reference if you intend to pursue a research career in molecular genetics/evolution.

- Zvelebil, M and Baum, JO. 2008. Understanding Bioinformatics. Garland Science. Suitable for advanced undergraduates and postgraduates, "Understanding Bioinformatics" provides a definitive guide to this vibrant and evolving discipline. It is a comprehensive textbook that covers both application and theory in Bioinformatics. The book is well organized, presenting separate chapters on application (practical use of Bioinformatics tools) and theory (how the applications work). The book includes chapters on secondary and tertiary protein structure prediction that may be useful for students continuing on to Drug Discovery and Development in semester 2.

Online Resources
- Blackboard - [http://lms.curtin.edu.au](http://lms.curtin.edu.au)
- You will also be referred to a wide range of resources, including locations for software downloads and help documentation, on the World Wide Web (internet). You will also need to access a variety of internet servers in order to search databases and complete particular analyses.

Assessment Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Value (%)</th>
<th>Date due</th>
<th>Unit Learning Outcome(s) assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical/TheoryTests 1-3</td>
<td>3 X 15</td>
<td>Refer tuition schedule</td>
<td>1-5</td>
</tr>
<tr>
<td>Bioinformatics Project</td>
<td>30</td>
<td>1 June</td>
<td>1-5</td>
</tr>
<tr>
<td>Bioinformatics Presentation</td>
<td>25</td>
<td>TBA</td>
<td>6</td>
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</tbody>
</table>

Detailed information on assessment tasks

1. Students will sit three 1-hour tests covering the practical exercises undertaken. Students will be tested on their interpretation of practical analyses, as well as relevant theory covered in the lectures.
2. Students will be given a bioinformatics project in which they will consolidate their understanding and use of biological databases and analysis software. A written project report will be submitted.
3. Each student will research a topic in Bioinformatics as agreed by the Unit Coordinator. Students will present a 20-25 minute seminar to the class on their selected topic.

Fair assessment through moderation

Moderation describes a quality assurance process to ensure that assessments are appropriate to the learning outcomes, and that student work is consistently evaluated by assessors. Minimum standards for the moderation of assessment are described in the Assessment Manual, available from [policies.curtin.edu.au/policies/teachingandlearning.cfm](http://policies.curtin.edu.au/policies/teachingandlearning.cfm)
Late penalties
Students are expected to sit each practical test on the date scheduled. Students who miss a test without prior arrangement will NOT be allowed to sit the test at a later date without written certification from a medical or other professional. The penalty for late project submission is 10% per day of the total mark without prior arrangement.

Pass requirements
You must gain an average mark of at least 50% for the practical/theory tests, a mark of at least 50% for the project report and a mark of at least 50% for the presentation.

Plagiarism
Plagiarism occurs when work or property of another person is presented as one's own, without appropriate acknowledgement or referencing. Plagiarism is a serious offence. For more information refer to academicintegrity.curtin.edu.au

Additional information
Enrolment:
It is your responsibility to ensure that your enrolment is correct - you can check your enrolment through the eStudent option on OASIS, where you can also print an Enrolment Advice.

Supplementary/Deferred Exams:
Supplementary and deferred examinations granted by the School of Biomedical Sciences will be held in July, 2011, exact dates TBA. Notification to students will be made after the School of Biomedical Sciences Board of Examiners meeting via the Official Communications Channel (OCC) in OASIS. It is the student’s responsibility to check their OASIS account for official Curtin correspondence on a weekly basis. If your results show that you have been awarded a supplementary or deferred exam you should immediately check your OASIS email for details.

Student Rights and Responsibilities
It is the responsibility of every student to be aware of all relevant legislation and policies and procedures relating to his or her rights and responsibilities as a student. These include:

- the Student Charter
- the University’s Guiding Ethical Principles
- the University’s policy and statements on plagiarism and academic integrity
- copyright principles and responsibilities
- the University’s policies on appropriate use of software and computer facilities

Information on all these things is available through the University’s “Student Rights and Responsibilities” website at: students.curtin.edu.au/rights.
Recent unit changes

We welcome feedback as one way to keep improving this unit. Students are encouraged to give unit feedback through eVALUate, Curtin’s online student feedback system (see http://evaluate.curtin.edu.au/info/index.cfm). Recent changes to this unit include:

1. Modifying the assessments to use tests in lieu of written practical reports
2. Provision of iLectures on Blackboard for lectures and tutorials (2010)

http://evaluate.curtin.edu.au/info/dates.cfm
<table>
<thead>
<tr>
<th>Week</th>
<th>Begin Date</th>
<th>Lecture</th>
<th>Practical</th>
<th>Assessment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Tues 9-10 404:204</td>
<td>Thurs 9-12 308:104</td>
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</tr>
<tr>
<td>1.</td>
<td>27 Feb</td>
<td>Intro to Bioinformatics Biopolymers Databases (in lab)</td>
<td>Ex 1 DB searching</td>
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<tr>
<td>2.</td>
<td>5 March</td>
<td>Dot Plots Pairwise Seq Aln</td>
<td>Ex 2 - Pairwise Sequence Alignment</td>
<td></td>
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<tr>
<td>3.</td>
<td>12 March</td>
<td>Primer Design DB search strategies</td>
<td>Ex 3a – Primer Design Ex 3b - BLAST</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>19 March</td>
<td>Multiple Seq Aln Molecular Evolution</td>
<td>Ex 4a – MSA Ex 4b - Adv Primer Design</td>
<td>Project out</td>
</tr>
<tr>
<td>5</td>
<td>26 March</td>
<td>Phylogenetics I</td>
<td>Ex 5 Phylogenetic Analysis I</td>
<td></td>
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<tr>
<td>6</td>
<td>2 April</td>
<td>Phylogenetics II</td>
<td>Ex 6 Phylogenetic Analysis II</td>
<td>Prac Quiz 1 (1-4)</td>
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<tr>
<td>7</td>
<td>9 April</td>
<td>Tuition Free Week</td>
<td>Tuition Free Week</td>
<td></td>
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<tr>
<td>8</td>
<td>16 April</td>
<td>Molecular Evolution II</td>
<td>Ex 7 Case Studies of Mol Evol</td>
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<tr>
<td>9</td>
<td>23 April</td>
<td>Protein Function Analysis</td>
<td>Ex 8 Analysis of ESTs</td>
<td></td>
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<tr>
<td>10.</td>
<td>30 April</td>
<td>Functional Genomics I</td>
<td>Ex 9 Genome Annotation</td>
<td>Prac Quiz 2 (5-7)</td>
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<tr>
<td>11.</td>
<td>7 May</td>
<td>Functional Genomics II</td>
<td>Ex 10 High Throughput Data Analysis</td>
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<tr>
<td>12.</td>
<td>14 May</td>
<td>Proteomics</td>
<td>Project/presentation work</td>
<td></td>
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<tr>
<td>13.</td>
<td>21 May</td>
<td>L1. Gene/Protein Ontology L2. Revision</td>
<td>Prac Test / Presentations</td>
<td>Prac Quiz 3 (8-10)</td>
</tr>
<tr>
<td>14.</td>
<td>28 May</td>
<td>Study Week</td>
<td>Study Week</td>
<td>Project due 28 May</td>
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<tr>
<td>15-16.</td>
<td>4-15 June</td>
<td></td>
<td>Exam Period</td>
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