BIOC3111
Molecular Biology of Proteins
Session 1, 2018
Course Outline
COURSE DESCRIPTION

BIOC3111 is all about proteins. It builds on the concepts of protein structure and function introduced in the two pre-requisite courses, BIOC2101 and BIOC2201. It is a course that most students really enjoy and which students rate very highly in UNSW surveys (MyExperience).

BIOC3111 serves as an introduction to modern protein science. The lecture series covers fundamental aspects of protein structure and function, with an emphasis on the tools and processes. It has a further emphasis on proteomics, which is the large-scale study of proteins inside the cell. The course is a core third year component in biochemistry majors and an elective in other related discipline areas such as biotechnology, bioinformatics and molecular biology.

The teaching in Molecular Biology of Proteins gives valuable experience in the enquiry process underlying scientific research and discovery. In particular, the practical course is an extended project that encourages student involvement in experimental design and gives extensive hands-on experience. The course also gives useful training in scientific writing and very detailed feedback on lab reports.

COURSE STAFF

Co-ordinator
Prof. Marc Wilkins Biotechnology & Biomolecular Sciences
Room 2112 Biological Sciences South (E26)
m.wilkins@unsw.edu.au

Lecturers
Dr. Till Boecking (School of Medicine, UNSW)
Prof. Paul Curmi (Physics, UNSW)
Dr. Bruno Gaeta (Computer Science & Engineering, UNSW)
Dr. Gene Hart-Smith (Biotechnology and Biomolecular Sciences)
Dr. Fatemeh Vafaee (Biotechnology and Biomolecular Sciences)
Prof. Marc Wilkins (Biotechnology and Biomolecular Sciences)

Technical Officers
Dr. Owen Sprod

Demonstrators
Dr. Owen Sprod
Ms. Daniela-Lee Smith
Mr. Ryan Separovich
### PRACTICALS
Mondays 2 to 6 pm (E26 Teaching Lab 11)

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Activity</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26th Feb.</td>
<td>(no prac)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1st March</td>
<td>Course introduction and OHS</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>2nd March</td>
<td>Sequences and protein evolution – I</td>
<td>MW</td>
</tr>
<tr>
<td>2</td>
<td>5th March</td>
<td>Prac: Introduction and protein assays</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>8th March</td>
<td>Sequences and protein evolution – II</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>9th March</td>
<td>Post translational modifications – I</td>
<td>MW</td>
</tr>
<tr>
<td>3</td>
<td>12th March</td>
<td>Prac: Purification of rGCBK</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>15th March</td>
<td>Post translational modifications – II</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>16th March</td>
<td>Bioinformatics – I</td>
<td>BG</td>
</tr>
<tr>
<td>4</td>
<td>19th March</td>
<td>Prac: Affinity chromatography</td>
<td>BG</td>
</tr>
<tr>
<td></td>
<td>22nd March</td>
<td>Bioinformatics – II</td>
<td>TB</td>
</tr>
<tr>
<td></td>
<td>23rd March</td>
<td>Protein engineering – I</td>
<td>TB</td>
</tr>
<tr>
<td>5</td>
<td>26th March</td>
<td>Prac: Affinity chromatography, EARLY BIRD QUIZ</td>
<td>TB</td>
</tr>
<tr>
<td></td>
<td>29th March</td>
<td>Protein engineering – II</td>
<td>TB</td>
</tr>
<tr>
<td></td>
<td>30th March</td>
<td>(no lecture – Good Friday)</td>
<td>TB</td>
</tr>
<tr>
<td></td>
<td>30th March</td>
<td>Mid-session break</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>9th April</td>
<td>Prac: Enzyme assays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12th April</td>
<td>Mass spectrometry – I</td>
<td>GHS</td>
</tr>
<tr>
<td></td>
<td>13th April</td>
<td>Mass spectrometry – II</td>
<td>GHS</td>
</tr>
<tr>
<td>7</td>
<td>16th April</td>
<td>Workshop on Report Writing,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to Mass Spectrometry Facility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19th April</td>
<td>Proteomics – I</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>20th April</td>
<td>Proteomics – II</td>
<td>MW</td>
</tr>
<tr>
<td>8</td>
<td>23rd April</td>
<td>Prac: Proteolytic digestion. REPORT 1 DUE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>26th April</td>
<td>Protein-protein interactions – I</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>27th April</td>
<td>Protein-protein interactions - II</td>
<td>MW</td>
</tr>
<tr>
<td>9</td>
<td>30th April</td>
<td>Prac: Proteolytic digestion and mass spectrometry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3rd May</td>
<td>Protein-protein interactions and crosslinking – III</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>4th May</td>
<td>Systems biology of networks</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>7th May</td>
<td>Prac: Protein crosslinking analysis</td>
<td>FV</td>
</tr>
<tr>
<td></td>
<td>10th May</td>
<td>The human proteome project</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>11th May</td>
<td>Clinical proteomics</td>
<td>MW</td>
</tr>
<tr>
<td>11</td>
<td>14th May</td>
<td>Prac: Proteomic data analysis (Computer Lab)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17th May</td>
<td>Biophysical analysis – I</td>
<td>PC</td>
</tr>
<tr>
<td></td>
<td>18th May</td>
<td>Biophysical analysis – II</td>
<td>PC</td>
</tr>
<tr>
<td>12</td>
<td>21st May</td>
<td>Workshop on Report Writing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24th May</td>
<td>Protein folding and binding – I</td>
<td>PC</td>
</tr>
<tr>
<td></td>
<td>25th May</td>
<td>Protein folding and binding – II</td>
<td>PC</td>
</tr>
<tr>
<td>13</td>
<td>28th May</td>
<td>What’s in the exam? REPORT 2 DUE, LAB BOOK DUE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31st May</td>
<td>Revision on Structural Biology (no lecture)</td>
<td>MW</td>
</tr>
<tr>
<td></td>
<td>1st June</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### LECTURES
Thurs. 10 to 11 am (AGSM Pioneer G27-G04)
Fridays 2 to 3 pm (CLB 5 - E19-G06)

MW: Prof Marc Wilkins  
BG: Dr Bruno Gaeta  
TB: Dr Till Boecking  
GHS: Dr Gene Hart-Smith  
FV: Fatemeh Vafaee  
PC: Prof Paul Curmi
COURSE AIMS

The course aims to provide a solid foundation from which students can pursue future protein work in industry or academia (including Honours or PhD projects that involve characterising proteins). Weekly practical sessions provide exposure to procedures used in the purification and analysis of proteins, with particular attention to the planning and execution of experimental protocols.

Aims

- Provide a solid foundation for further work on proteins
- Create an environment for student engagement and motivation
- Application of theory to experimental research

Student learning outcomes

Some of the skills the course will aid in developing include:

- technical skills from extensive lab work
- skills in experimental design
- the ability to analyse data, and interpret this through the scientific literature
- problem solving and innovative and original thinking
- writing skills
- self-learning techniques, including independent and reflective learning
- working within a small group to build skills in scientific collaboration.

Science graduate attributes developed in the course

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Level of focus</th>
<th>Activities / Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research, inquiry and analytical thinking</td>
<td>3</td>
<td>Lectures. Continuous laboratory experiment. Short and long answer exam tasks. Data analysis and laboratory report.</td>
</tr>
<tr>
<td>Capability and motivation for intellectual development</td>
<td>3</td>
<td>Troubleshooting during laboratory work. Working with complex data. Synthesis of results from multiple pracs.</td>
</tr>
<tr>
<td>Ethical, social and professional understanding</td>
<td>1</td>
<td>Healthy and safety in laboratory experiments, Genetically modified organisms in laboratory work. Health and safety online quiz.</td>
</tr>
<tr>
<td>Communication</td>
<td>2</td>
<td>Oral communication during laboratory experiments. Written laboratory reports. Short and long answer questions in exams.</td>
</tr>
<tr>
<td>Teamwork, collaboration, management</td>
<td>2</td>
<td>Group lab work and planning of continuous prac. Online discussions.</td>
</tr>
<tr>
<td>Information literacy</td>
<td>3</td>
<td>Data analysis in laboratory work. Mining of scientific literature for laboratory reports.</td>
</tr>
</tbody>
</table>
CONTINUAL COURSE IMPROVEMENT

Student evaluative feedback from UNSW's Course and Teaching Evaluation and Improvement (CATEI / MyExperience) process is gathered each year. This feedback is incredibly useful and is reviewed at the end of the session.

As a result of course feedback in 2014, the assessment weighting was modified to give more marks to individual reports, over the group report. Only one report is now a group report.

As a result of feedback from 2014, 2015 and 2016, the proportion of the course assessment from exams was decreased. From 2014 to 2017, it has been decreased from 55% to 40%.

It was commented in 2014 that students might enjoy more lectures from the course co-ordinator. This occurred in 2015 and will continue for 2016 and 2017. IN 2018, a further 2 new lectures will be from the course co-ordinator.

In 2015 it was commented that we would benefit from more spectrophotometers for the kinetics aspects of the prac. In 2016 and 2017, we have two new spectrophotometers and will also borrow instruments from other labs to make this part of the lab run more efficiently.

In 2015 and 2016 students comments that some revision material, and sample questions, might be useful for their study of protein structure. In 2017, this is now part of a new revision lecture for this part of the course.

In 2018, the enzyme activity aspects of the prac have been moved earlier in the prac. This will allow a more comprehensive first report to be written. The advanced enzyme kinetics have been removed from the prac. Report writing workshops will be held to provide tips on writing and the opportunity for feedback on reports before they are due.
ASSESSMENT – SUMMARY AND DUE DATES

<table>
<thead>
<tr>
<th>% Final mark</th>
<th>What</th>
<th>Date</th>
<th>Time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5%</td>
<td>Early Bird Quiz</td>
<td>26th March</td>
<td>60 mins</td>
<td>Held at start of prac</td>
</tr>
<tr>
<td>37.5%</td>
<td>Final Examination</td>
<td>TBA</td>
<td>120 mins</td>
<td>Date / time set by Central</td>
</tr>
</tbody>
</table>

Laboratory reports (50%)

| 5%         | Laboratory Notebook          | Weekly     | Stamped each week, assessed 28th May |
| 20%        | Individual Short Report 1    | 23rd April | 2.00 pm    | Hand in at prac                           |
| 25%        | Individual Short Report 2    | 28th May   | 2.00 pm    | Hand in at prac                           |

DETAILS OF COURSE ASSESSMENT

Examinations (total 50%)

An Early Bird Exam (12.5%) consisting of long answer questions from the lecture content until that date will be assessed. The Final Examination (37.5%) will have a mix of short and long answer questions and will examine the remaining lecture material for the course. No material is examined twice. The date for the final exam is set according to Central Timetabling.

Supplementary Examinations will be held for students submitting special consideration, (see these Course Notes, below, for further information concerning Special Consideration and Further Assessment). Supplementary Examinations may be held in an oral format at the discretion of the examiner.

Laboratory notebook (5%)

Students are required to maintain records of their laboratory work and results in a bound notebook. This should be a working document where you keep all your records and notes. There should be no requirement to add to the record of the work during a laboratory session after leaving the laboratory, apart from the computer processing of data.

At the end of each laboratory session, or the start of the next week, students must get the lab notebook stamped and signed off by a demonstrator.

Individual reports (two reports, 20% then 25%)

Each student will prepare two small reports, of up to 4 pages in length. Report 1 will present and discuss results from purification and activity assays of carbamate kinase. Report 2 will present and discuss the results of mass spectrometry of carbamate kinase.

Extensive guidelines will be given for the individual written assignments, during the pracs, and workshops held on report writing.
PRACTICALS

The practical component of the course uses the purification and characterization of the cloned protozoan enzyme carbamate kinase from *Giardia intestinalis* as a vehicle to introduce the rationales and techniques used in protein purification, handling and analysis.

The range of approaches that we hope to cover during the practical work includes:

- Cell lysis and clarification
- IMAC purification
- Protein quantitation: Bradford, Lowry and spectrophotometric methods
- SDS-PAGE analysis
- Microtitre plate-based activity assays
- Limiting proteolysis for domain structure and protease sensitivity
- Peptide mapping by mass spectrometry
- Crosslinking mass spectrometry
- Mass spectrometry data analysis
- Homology searches and molecular modelling

**Health and Safety**

There is a compulsory BABS Health and Safety Quiz that must be done by every student before they can undertake laboratory work. This is accessible in Moodle under the **Practicals** tab for the course. Further details on this will be given in Lecture 1 for the course.

As from 2018, it will also be compulsory for students (and staff) to wear safety glasses during all wet-lab pracs.

**Your Lab Book**

Your laboratory notebook is the primary repository of your experimental data. Details of the work performed in each practical session should be entered in as clear and concise a fashion as possible. Each new practical session should begin on a new page with the date and a brief explanatory title.

Examples of information that properly belongs in your notebook:

- Risk assessments for each new activity
- Raw experimental results - tabulate data when possible. Paste in spectrophotometer traces etc.
- Calculations
- Memos - “Remember to pH it next time” or similar
- Brief conclusions that help to direct later report writing and further experiments

Remember that you are expected to keep your Laboratory Notebook up-to-date during the practical classes. Many entries can be made **before** a practical class, in preparation for the laboratory work, and **during** the practical class in the form of recording results, observations and calculations. Your lab book is a working document and will probably be a bit messy. But that’s OK! At the end of each practical class, or the start of a prac, demonstrators will stamp your laboratory notebook. The Laboratory Notebook will be submitted for final signoff in the last week.
RESOURCES FOR STUDENTS – LECTURES AND PRACS

Course Moodle site

As far as possible, all course notes and information will be provided via the Course Moodle site. This will include the various sections of this “Course Outline”, lecture handouts and/or copies of PowerPoint presentations, links to Lecture recordings, additional information about assessment tasks and course administration as it becomes available, and announcements. Students should consult the Moodle site on at least a weekly basis.

Results generated in pracs will be uploaded onto Moodle, for analysis in the prac or for use in the written reports.

References and reading

There is no set text for this course. Individual lecturers may however refer you to various textbooks.

Your lecturers will refer largely to reviews and research papers. You will be able to find most of these on-line, however those that are hard to find will be put on the course web site.
OTHER ADMINISTRATIVE MATTERS

Many administrative matters are covered in other sections of the Course Outline and Practical Notes, and further matters are covered in information distributed via the course Blackboard site.

Expectations of Students

Students are expected to attend all practical classes. Attendance records will be kept in practical classes, attendance at less than 80% of classes may result in the grade of UF. You must let the course co-ordinator know if you are going to miss a prac.

Submission of Assignments

The written assignments will be collected at the start of the prac class, on the day it is due. Extensions, for late submission of an assignment without penalty will only be granted by the course co-ordinator before the submission deadline, not after. Late submission of assignments may attract a penalty, of up to 10% of the awarded mark per day.

Laboratory Note Books will be signed off by the tutor or demonstrator each week and at the end of the course.

STUDENTS WITH DISABILITIES

Any students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course coordinator (details at the front of this manual). This should be done prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or http://www.studentequity.unsw.edu.au/). Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.
SPECIAL CONSIDERATION AND FURTHER ASSESSMENT

Students who believe that their performance, either during the session or in the end of session exams, may have been affected by illness or other circumstances may apply for special consideration. Applications can be made for compulsory class absences such as (laboratories and tutorials), in-session assessments tasks, and final examinations. Students must make a formal application for Special Consideration for the course/s affected as soon as practicable after the problem occurs and within three working days of the assessment to which it refers.

Students should consult the "Special Consideration" section of Moodle for any specific instructions related to each BABS course. Further general information on special consideration can also be found at https://student.unsw.edu.au/special-consideration.

HOW TO APPLY FOR SPECIAL CONSIDERATION

Applications must be made via Online Services in myUNSW. You must obtain and attach Third Party documentation before submitting the application. Failure to do so will result in the application being rejected. Log into myUNSW and go to My Student Profile tab > My Student Services channel > Online Services > Special Consideration. After applying online, students must also verify supporting their documentation by submitting to UNSW Student Central:

- Originals or certified copies of your supporting documentation (Student Central can certify your original documents), and
- A completed Professional Authority form (pdf - download here).

The supporting documentation must be submitted to Student Central for verification within three working days of the assessment or the period covered by the supporting documentation. Applications which are not verified will be rejected.

Students will be contacted via the online special consideration system as to the outcome of their application. Students will be notified via their official university email once an outcome has been recorded.

SUPPLEMENTARY EXAMINATIONS

The University does not give deferred examinations. However, further assessment exams may be given to those students who were absent from the final exams through illness or misadventure. Special Consideration applications for final examinations and in-session tests will only be considered after the final examination period when lists of students sitting supplementary exams/tests for each course are determined at School Assessment Review Group Meetings. Students will be notified via the online special consideration system as to the outcome of their application. It is the responsibility of all students to regularly consult their official student email accounts and myUNSW in order to ascertain whether or not they have been granted further assessment.

For Semester 1 2018, BABS Supplementary Exams will be scheduled:

► Between 14th to 21st July 2018

Further assessment exams will be offered on this day ONLY and failure to sit for the appropriate exam may result in an overall failure for the course. Further assessment will NOT be offered on any alternative dates.
ACADEMIC HONESTY AND PLAGIARISM

Plagiarism is the presentation of the thoughts or work of another as one's own.* Examples include:

- direct duplication of the thoughts or work of another, including by copying work, or knowingly permitting it to be copied. This includes copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person’s assignment without appropriate acknowledgement;
- paraphrasing another person’s work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and,
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

Students are reminded of their Rights and Responsibilities in respect of plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks, and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms.

The Learning Centre website is the central University online resource for staff and student information on plagiarism and academic honesty. It can be located at:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.
† Adapted with kind permission from the University of Melbourne.
The Golden Rule of Avoiding Plagiarism: Make sure your assignments are referenced correctly

Most academic work draws on the words, information and ideas of other writers. Referencing is a system that allows you to acknowledge the contribution of other writers in your work. Whenever you use words, ideas or information from other sources in your assignments, you must cite and reference those sources.

Referencing

There are several referencing methods. Short referencing guides for commonly used styles are available from The Learning Centre. Commonwealth Style Guides for other referencing systems are available at many libraries and bookshops.

Follow the referencing style recommended by your faculty. Many faculties or schools within the University offer guides indicating how referencing should be done. Check with your lecturer or tutor about their preferred method.

Why Reference?

Inaccurate references or—worse still—no references at all can be regarded as plagiarism. All University assignments must contain references; an unreferenced essay implies every word, idea and fact is your own work, so beware!

References must always be accurate; your tutor/lecturer should be able to trace your sources. The best way to make sure you reference accurately is to keep a record of all the sources you used when reading and researching for an assignment. Write down the bibliographical information and the library call number (in case you need to find a book again).

Common Forms of Plagiarism

From Obvious to More Subtle*

Copying an essay from another student and submitting it as your own work

Copying a journal article or a section of a book and submitting it as your own work

Copying sentences or paragraphs from someone else (essay, article, book, lectures, etc.)

Quoting from a source ‘word for word’, without using quotation marks or proper acknowledgment is plagiarism.

Using significant ideas from another author without acknowledgement

Putting someone else’s ideas into your own words and not acknowledging the source of the ideas is plagiarism.

Heavy reliance on the written expressions of someone else without proper acknowledgment

Lifting sentences or paragraphs from someone else, without using quotation marks, but with proper acknowledgment. Here the impression is that the idea or information comes from the source cited, but that the phrasing, the choice of words to express it, is your own contribution.

Excessive reliance on other people’s material

Avoid repeated use of long quotations. Too many direct quotations (even with quotation marks and with proper acknowledgment) result in your sources speaking for you, meaning your own contribution is minimal. Use your own words more and rely less on quotations.

(* We are indebted to the UNSW School of Political Science for this discussion of plagiarism)

(Illustration source: Burdess, N., The Handbook of Student Skills, 1991, Prentice Hall, Australia)