FACULTY OF SCIENCE  
Department of Chemistry and Biomolecular Sciences  
CBMS336 MOLECULAR BIOLOGY AND GENOMICS  
First Semester 2012  
UNIT OUTLINE

Unit convenor: Prof. Ian Paulsen

Credit Points: 3 (equivalent to 9 hours/wk of contact and self study)  
Contact Hours: 6  
When Offered: D1 - Day; Offered in the first half-year  
Prerequisites: CBMS224(P)  
Offered by: Department of Chemistry and Biomolecular Sciences  
Co-taught with CBMS852

Students in this unit should read this unit outline carefully at the start of semester. It contains important information about the unit. If anything in it is unclear, please consult one of the teaching staff in the unit.

ABOUT THIS UNIT

- Molecular biology is a central science in 21st century biology and biotechnology. Understanding the fundamentals of molecular biology is essential for many other fields in the life sciences, including microbiology, cell biology, immunology and development. Molecular biology makes a significant and increasing contribution to major sectors of our society including agriculture and medicine, and is also important in environmental science and forensics. In this unit we explore topics that allow students to obtain an advanced understanding of the mechanisms of molecular biology, including those of DNA replication and recombination, prokaryotic gene expression, eukaryotic gene expression, mobile elements, the functions of the nucleus and epigenetics. We also address topics on the rapidly changing technologies in molecular biology, including those used in genome sequencing, metagenomics and microarray analysis. Practical sessions complement the lectures and provide students with hands-on experience with a range of critical laboratory skills including those required for DNA and RNA isolation, PCR and RT-PCR, cloning and bioinformatics. Students gain experience in working with both bacterial and eukaryotic systems in the laboratory classes so that their skills and experience are valuable for a variety of positions in both industry and research. The unit will include 1 weekly lecture of 2 hours and a weekly practical session of 4 hours.
There are no formal office hours for this unit. We are happy to receive students outside of the formal lecture and tutorial times but please be aware that we are not always to be found in our offices. It is generally wise to organise an appointment in advance, if possible. Email is the most expedient mode of contact.

CLASSES

- There is a 2hr weekly lecture (E6A133, 9-11am Thursday) and a weekly practical session of 4hours (E8A130, 2 – 6pm Tues or 9am-1pm Wed). The timetable for classes can be found on the University web site at: http://www.timetables.mq.edu.au/
- Attendance at practical sessions is a compulsory component of this unit.

REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

- The prescribed text for this unit is Molecular Biology Fifth edition by Robert F Weaver. Available from the Co-op bookshop.
- The following texts may also be useful and are available in the library:
  - GenesIX by Benjamin Lewin
  - The Lactose Operon by Beckwith and Zipser
  - Mobile Genetic Elements by Sherratt
  - Molecular Cloning: A Laboratory Manual by Maniatis, Fritsch and Sambrook
  - An Introduction to Genetic Engineering by Des Nicholl
- The practical manual is available online via iLearn- https://ilearn.mq.edu.au/login/MQ/
- Lecture graphics will be available online, via iLearn, prior to each lecture.

UNIT WEB PAGE

- This unit operates as an online unit via iLearn- https://ilearn.mq.edu.au/login/MQ/
ASSESSMENT

There will be four practical assignments, one based on each of the four practical experiments. For further information on the practicals and problems, see the practical notes. The assessment tasks for the unit are as follows:

- Practical work & assignments: 35%
- Problems: 5%
- Test: 10%
- Final exam: 50%

Your final grade will be based primarily on the aggregate mark, but the minimum requirement to achieve a passing grade is satisfactory performances in separately both the coursework component and the laboratory component.

LEARNING OUTCOMES

Students will be proficient in the theory and practice of a range of molecular biology experimental techniques, including PCR, restriction enzyme digestion, gel electrophoresis, cloning, site-directed mutagenesis, DNA sequencing and DNA hybridization.

Students will have a thorough understanding of essential molecular processes in the cell, especially as related to DNA and RNA. These molecular processes include transcription, translation, DNA replication, recombination, DNA repair, and transposition.

Students will have an understanding of the revolutionary impact of genomics across all biological sciences.

Students will also display evidence of good report-writing skills including appropriate scientific referencing.

TEACHING AND LEARNING STRATEGY

- The one hour face-to-face lectures will be recorded on iLectures and made available to students for review purposes. The practical course is taught in weekly 4 hour blocks. Practical experiments often involve significant waiting times, and students are encouraged to use these times to raise questions and complete assigned problem sets. All students are expected to participate in discussion during lecture timeslots. We intend to use electronic keypad data submission for some learning activities, and all students are required to participate.

RELATIONSHIP BETWEEN ASSESSMENT AND LEARNING OUTCOMES

- Practical reports are designed to enable assessment of several areas – proficiency in experimental techniques, understating of theory behind the experiments, and quality report writing with appropriate references. The problem sets and test are both designed
to allow students to assess their understanding of key areas of theoretical knowledge in molecular biology prior to the final exam. The final examination is designed to assess depth and breadth of theoretical knowledge in all aspects of molecular biology.

- Class participation and attendance are not directly assessed. However, students are expected to attend class whenever possible in order to maximise learning opportunities.

- Word length and other details of requirements for practical reports will be provided on completion of the experiments.

- Due dates for practical reports are noted above. Marked work will be returned to student as soon as practical, typically 3-4 weeks after submission.

- Practical reports are individual submissions, even if lab work is completed in small groups. Results achieved by students working together will be the same, but introductions, discussions and conclusions should all be achieved independently. Students submitting substantially similar practical reports will both be considered guilty of plagiarism and will be penalised accordingly.

- Students will, on occasion, be required to submit their work to www.turnitin.com for assessment of informational honesty, and must provide a receipt to indicate this has been done.

**TIMELY SUBMISSION**

**ALL CBMS336 assessment deadlines must be met**

- Late submissions will be penalised with 10% loss of the maximum mark for each day past the deadline.

- If there is any medical or any other reasons why you cannot submit work on time, you can apply for special consideration through the following web link: http://web.science.mq.edu.au/intranet/lt/applications/arts/special_consideration/form.php?faculty=science

**TECHNOLOGY USED AND REQUIRED**

Within this Unit, you will be introduced to Web-based search engines that are commonly used in molecular biology. Our expectation is that you will be able to readily access the internet and have a computer available to you for web browsing and preparation of your laboratory reports. *Handwritten reports will not be accepted.* Your laboratory reports will be submitted and circulated via the online Turnitin program, for which access instructions will be given at submission time.

Your practical reports will require you to carry out minor computational tasks, for which a calculator and access to basic statistical tools will be required. We place a large emphasis on correct referencing style in all your reports, and use of the program EndNote is encouraged, but not essential.
GRADUATE CAPABILITIES DEVELOPED

Graduate Capabilities: The course work and laboratory work in this unit will help you to develop the graduate capabilities that “the University’s graduates would need to develop to address the challenges, and to be effective, engaged participants in their world”. Graduate capabilities are viewed as essential for all graduates, irrespective of their course of study. Thus, in conjunction with discipline-specific skills and knowledge, they are the building blocks for developing the attributes valued in a university graduate. Some of the attributes and skills that CBMS336 can help you develop are:

- **Discipline Specific Knowledge and Skills:** The topics explored in CBMS336 are fundamental to many biological sciences. You will be applying problem-solving skills in a molecular biology context, learning a range of molecular biology experimental techniques and to apply safe laboratory practices, performing data analysis applying appropriate statistical treatment to data and using standard and specialised computer programs in the analysis of data and presentation of results.

- **Critical, Analytical and Integrative Thinking:** Within this unit you will develop and practice your ability to apply strategic problem-solving in situations where there is a clear solution and in situations demanding critical, analytical and integrative thinking. You will be solving problems by analysing the information given or discovered, looking for other sources of information to apply, looking for the scope and limitation of the context in which the problem and solution lie. In many cases you will be using standard and specialised IT technology for the discovery of information, the analysis of data and the presentation of results.

- **Problem Solving and Research Capability and being Creative and Innovative:** In both the theory and the laboratory component of this unit you will have ample opportunities to develop your problem solving skills and research capabilities. Through set assignment and prac write-up problems, and through performing the laboratory experiments, where procedures, data collection and data analysis will require you to make various decisions, you will be deeply involved in problem solving and research processes.

- **Effective Communication:** CBMS336 will help equip you with both oral and written communication skills, through your written prac reports, and through the communications you will be engaged with your lecturers, your demonstrators and your classmates.

- **Capable of Professional and Personal Judgement and Initiative:** Especially during your laboratory work, you will be expected to develop discernment and common sense in your professional and personal judgement.

- **Commitment to Continuous Learning:** We hope that you will have your enquiring minds and curiosity extended by CBMS336, and that the topics covered and skills developed will lead you to continue to pursue knowledge for its own sake. You will be have opportunities to reflect on your experiences, learn from them, and grow personally, professionally and socially.

EXAMINATION
The University Examination period in First Half Year 2012 is from 12/06/12 to 29/06/12.

- As with all subjects in the Department of Chemistry and Biomolecular Sciences, your final mark has a large component of continual assessment.
- Since your final mark is the sum of all components of this unit, you should approach this subject in a constant and diligent manner throughout the session.
- Leaving your best effort to the final examination period would be most unwise.
- Remember, marks are deducted from the continuous assessment component if you are absent without cause or if your submissions are late without cause.
- Despite the presence of a significant continuous assessment component in CBMS336, you will be required to perform satisfactorily in the final exam in order to pass the unit.

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations. [http://www.timetables.mq.edu.au/exam](http://www.timetables.mq.edu.au/exam)

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. Information about unavoidable disruption and the special consideration process is available at [http://www.reg.mq.edu.au/Forms/APSCon.pdf](http://www.reg.mq.edu.au/Forms/APSCon.pdf)

If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period. (Individual Divisions may wish to signal when the Division's Supplementaries are normally scheduled.)

You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is the final day of the official examination period.

**UNIVERSITY POLICY ON ASSESSMENT**

The University considers that assessment “of student learning performance and feedback on progress are pivotal and important processes in University learning and teaching. Assessment tasks communicate to students what must be learned and are vehicles by which the University assures itself, and society, of its graduates’ capabilities” and is based on the “premise that it is important that through assessment students are encouraged to engage in their education, rather than merely pursue grades. Student engagement is best facilitated by
learner managed learning in which students are active partners in the process through undertaking challenging responsibilities and making choices.” There are responsibilities and rights for both staff and students respect to assessment. These include, but are not limited to, the right of academic staff to require that students:

- be focused on learning rather than merely the achievement of grades;
- make the effort to be informed of the rules and requirements for progression in their degree program;
- assistance from the department, faculty and/or institution if they so require it;
- behave ethically and responsibly in their conduct of assessment tasks;
- engage in critical self evaluation in terms of their progress towards the espoused learning expectations;
- submit work on time that is their own except when shared ownership is part of the task;
- notify their lecturers as soon as possible if difficulties arise with timing, online access, availability of resources or other requirements of the task;

Students have a right to:

- be informed about all aspects of assessment policy and practices in each unit of study including criteria, standards and procedures to be met and penalties for breaches;
- consistent application of policies, procedures and penalties;
- timely return of results with feedback to enable improved performance
- information that allows them to calibrate their own performance against the expected performance standards;

The full statement on the Assessment Policy, Code of Practice and Procedure can be found at:


**ACADEMIC HONESTY**

The University declares that it is a ‘fundamental principle’ that “all staff and students act with integrity in the creation, development, application and use of ideas and information. This means that:

- all academic work claimed as original is the work of the author making the claim
- all academic collaborations are acknowledged
- academic work is not falsified in any way
- when the ideas of others are used, these ideas are acknowledged appropriately.”

You should be familiar with the University’s Policy on Academic Honesty practices and its Statement on Ethics. These can be found in the *Handbook of Undergraduate Studies* or on the web at:

- Academic Honesty Policy: www.mq.edu.au/policy/docs/academic_honesty/policy.htm

The policies and procedures explain what academic dishonesty is, how to avoid it, the procedures that will be taken in cases of suspected dishonesty, and the penalties if you are
found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

**Examples** of dishonest academic behaviours are:

**Plagiarism:** Using the work or ideas of another person and presenting this as your own without clear acknowledgement of the source of the work or ideas. This includes, but is not limited to, any of the following acts:

a) copying out part(s) of any document or audio-visual material or computer code or website content without indicating their origins

b) using or extracting another person's concepts, experimental results, or conclusions

c) summarising another person's work

d) submitting substantially the same final version of any material as another student in an assignment where there was collaborative preparatory work

e) use of others (paid or otherwise) to conceive, research or write material submitted for assessment

f) submitting the same or substantially the same piece of work for two different tasks (self-plagiarism).

**Deception:** includes, but is not limited to, false indication of group contribution, false indication of assignment submission, collusion, submission of a work previously submitted, creating a new article out of an existing article by rewriting/reusing it, using the same data to form the same arguments and conclusion, presenting collaborative work as one's own without acknowledging others' contributions, cheating in an examination or using others to write material for examination.

**Fabrication:** includes, but is not limited to, creating fictitious clinical data, citation(s), or referee reports.

**Sabotage:** includes, but is not limited to, theft of work, destruction of library materials.

Assignments are to be your own work. Using someone else’s words (either another student’s or from a book or journal article or a web site) without clear acknowledgement is plagiarism and can incur serious penalties. If it is ever necessary to use someone else’s words for a phrase or sentence, they should be placed in quotation marks and acknowledged at the end of the sentence. If you use or modify a diagram or figure from another author, that must be acknowledged underneath (e.g. Figure 3 from Brown *et al.*, 1995; figure modified from Green, 1997). Lecturers want to read your own words and ideas.

In the event that a Lecturer identifies a case of academic dishonesty, the student will be advised, either on the submitted work or by separate letter, and a record kept in the Faculty office. Students will always have the opportunity to discuss each case with their Lecturer if they indicate they wish to do so by either contacting the Lecturer or the Head of Department. Proven cases of plagiarism may result in the award of an “F” grade.

**WHAT IS REQUIRED**

**References**
Essay and practical reports need scientific references to support facts and ideas that you are referring to. These should be primarily journal articles from recent scientific literature. You should only rarely need to cite textbooks; everything in a textbook was most likely published elsewhere in the literature long before the book was published. You should not refer to websites such as Expasy or NCBI for general information; gel images in Expasy for example, have also been published elsewhere in the scientific literature. You should NEVER refer to Wikipedia or to tutorial information posted on the web at another university. The reason for these rules is that textbooks, websites and Wikipedia are not primary sources, they are compilations of previously published material. More importantly, they are not peer-reviewed (including textbooks) so the authors can say whatever they like on a topic whether it is right, or not.

Learn to use Endnote or a similar program to manage and cite your references. This will make your written work look more polished and will avoid simple mistakes which cost you marks. Endnote is available as a free download from the MQ library, along with simple online tutorials in how to use it. Format references in your work according to the guidelines of any of the following journals: Analytical Biochemistry, Journal of Biological Chemistry. The most common error students make with references is that the references in a list are inconsistent in style – they all need to be exactly the same format.

What is an essay?
An essay is a written discourse on a topic. It has a defined introduction, middle and conclusion, and contains logical arguments that follow a clear sequence. An essay does not contain dot point lists, and does not need to contain subheadings. It can contain table and figures to illustrate a point. If these are copied from a reference it needs to state that explicitly in the Figure legend or table footnote. Tables and figures should be numbered sequentially in order of their appearance in the text, and can either be inserted into the text or collated at the end. Every figure needs an explanatory legend, most tables need a footnote or two to explain the meaning of column headings. An essay has relevant references formatted as described earlier and collected at the end of the text.

What is a practical report?
A practical report has a title, aim, introduction, materials and methods, results, discussion, and references. It is divided into sections under these headings. It usually contains figures, and may contain tables as well. If these are copied from a reference it needs to state that explicitly in the Figure legend or table footnote. Tables and figures should be numbered sequentially in order of their appearance in the text, and can either be inserted into the text or collated at the end. Every figure needs an explanatory legend, most tables need a footnote or two to explain the meaning of column headings. The aim of the experiment should be clearly stated. The methods should not just be copied directly from the course manual or notes. The results should describe what you observed, irrespective of whether you think it “worked” or not. Discussion should compare your observed results with literature or other experiments in class, especially if you have positive controls to work with. A practical report has relevant references formatted as described earlier and collected at the end of the text.

HINTS ON HOW TO USE SCIENTIFIC JOURNALS

1. During CBMS336 we will use current research (as distinct from partially digested textbook examples) to illustrate principles. The most up-to-date information is published in scientific journals.
2. CBMS336 students need to read journal articles to supplement the information given in lectures and practical notes. Your own reports should be modeled on the style of scientific papers (so take careful note of their presentation). It is important that you
become efficient at using the large amount of information available. A huge number of journals and papers are available. The following paragraphs give you some guidance in doing this efficiently.

3. If everyone read scientific papers with care, effort and attention to detail, we would have to read a lot less. Develop an economical reading style and avoid too much rereading. In addition:-

4. Do not read through the paper from start to finish. A journal article is NOT a novel (though the results and ideas may be!). The various sections are there for good reasons.

5. Read and think about the Title. "Is the paper really about the subject matter I thought it was? Do I need to read it at all?"

6. **Read the Abstract** (or Summary) to confirm the suspicions formed in 2. This section should give you an idea of the main results and why they are important. Ask yourself: "Do I need to read further? Is this paper appropriate?" This is especially important if you have uncovered the reference in another paper or from Science Citation Index or Current Contents. Titles often suggest that the paper is more relevant than it really is.

7. If you continue, now **read the Results**. Examine the figures and tables. They should be self-explanatory. (This is something that you must bear in mind when you prepare your own report. Good captions and labels are vital). What do the results mean? How convincing are they? Now look at the Discussion. Do your interpretations of the data and conclusions agree with those of the author(s)?

8. How do these experiments fit in with the general research field and with current theories? In other words, why was the research conducted? This should be established in the Introduction.

9. Despite the efforts of editors and reviewers there are bad papers as well as good papers in the published literature. Some are badly presented, but contain basically good work. You have to plough through those to extract the gems of wisdom. Others look great on the surface but say nothing of importance. You should train yourself to recognize these quickly without wasting time on them. To help you here, look carefully at the following:-

   (a) What are the hypotheses (or questions) posed in the paper? (Be careful that you are not simply forming your own idea of what the paper is testing.)

   (b) What approach is used to collect the data (see Methods section).

   (c) Do the data, and the manner of collection allow a DIRECT TEST of the hypothesis? If not, what sort of experiment would?

   (d) Are there interpretations of the Results which you would make but which have been ignored by the author(s)?

10. You should try to bear these points in mind when you are reading any papers, but it will be especially important when reading the key papers for your reports, major essay and tutorial presentation. We expect that you will show evidence of having evaluated the strengths of published work.

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**LABORATORY SAFETY POLICY**

1. Laboratory coats and sensible footwear (solid closed-in shoes which provide the best protection against materials and equipment in use, no thongs nor open-toed sandals) must be worn in the lab at all times. Lab coats should be removed prior to entering common areas (eg: hallways, tea rooms).
2. Eye protection must be worn at all times in all lab areas. Safety glasses or goggles, or appropriate prescription eyewear.

2. Smoking, eating, drinking and mobile phone use are not permitted at any time in any lab.

3. You are responsible for the smooth and efficient operation of your work area. Keep your assigned work areas as tidy as possible (e.g., clean and store any used items when no longer required; return any communal reagents to their assigned place in the laboratory). Do not leave a mess for someone else (eg: co-workers or Departmental technical staff) to clean up.

4. You might be handling bio-hazardous or radioactive materials during your practicals. Mouth pipetting is NOT allowed at any time. The Chemistry and Biomolecular Sciences Department has a complete Safety Manual which you may refer to at any time prior to undertaking a hazardous task. In order to provide a safe working environment, please take this request most seriously.

5. All instructions for the handling of:
   (a) biohazardous and radioactive material;
   (b) micro-organisms;
   (c) recombinant materials; and
   (d) research equipment
must be carefully adhered to.

6. Some practical exercises may involve the examination of human fluids, human cells or human cell lines. There should be no sharing of this material or any of the instruments used to collect them.

**STUDENT SUPPORT SERVICES**

Macquarie University provides a range of Academic Student Support Services. Details of these services can accessed at [http://www.student.mq.edu.au](http://www.student.mq.edu.au).

It is absolutely essential that if you feel you are really struggling and likely to fail, you do something about it in the first six weeks of semester. Go and see student counseling or talk to one of the unit staff, and ask for help. The last day to withdraw with a W grade is May 6th. Remember, study plans, schedules and student visas can all be changed with the right paperwork, but an F on your transcript is irreversible – you are stuck with it forever.
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Submission of Assignments in 2012

1 All assignments must be submitted to the appropriate assignment box for your unit. Assignment boxes are located in the reception area of the Faculty of Science Centre (E7A 101), which is on the ground floor at the western end of building E7A. Campus maps are available at http://www.bgo.mq.edu.au/campus.htm. The Centre opens from 8.30am to 5.30pm on Monday to Friday.

2 All assignments are to be submitted by 9.00am on the date specified and must include a completed and signed coversheet stapled to the front cover. The Assignment Cover Sheet can be downloaded from the web at www.els.mq.edu.au, click on Assignment Cover Sheet.

3 There is an 'afterhours' submission box for those that wish to submit early, or have difficulty submitting their assignment for the 9:00 am deadline. This is situated in the main door to E7A on "Wally's Walk".

4 Late submission will incur a penalty of loss of 10% of the maximum marks for each day past the deadline. The faculty office staff are experienced professionals who do not ‘lose’ assignments, so don’t even bother trying that as an excuse for non-submission.

The submission date is for each practical for internal students is as follows:

- Assignment 1: Tuesday Apr 3rd (Practical 1).
- Assignment 2: Tuesday Apr 24th (Practical 2).
- Assignment 3: Tuesday May 29th (Practical 3).
- Assignment 4: Tuesday June 5th (Practical 4).

SET OF PROBLEMS

Problems 1 - 12 (page 38 of Practical Manual) should be done in time for marking and discussion during the practical session of week 12.