BIOC2201 Principles of Molecular Biology - Course Outline

1. Information about the Course

<table>
<thead>
<tr>
<th>Course Code</th>
<th>BIOC2201</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Name</td>
<td>Principles of Molecular Biology</td>
</tr>
<tr>
<td>Academic Unit</td>
<td>School of Biotechnology and Biomolecular Sciences</td>
</tr>
<tr>
<td>Level of Course</td>
<td>Level 2</td>
</tr>
<tr>
<td>Units of Credit</td>
<td>6UOC</td>
</tr>
<tr>
<td>Session(s) Offered</td>
<td>Session 2</td>
</tr>
<tr>
<td>Assumed Knowledge, Prerequisites or Co-requisites</td>
<td>BABS1201 and CHEM1011 or CHEM1031 or CHEM1051 and CHEM1021 or CHEM1041 or CHEM1061</td>
</tr>
<tr>
<td>Hours per Week</td>
<td>6 HPW</td>
</tr>
<tr>
<td>Number of Weeks</td>
<td>12 weeks</td>
</tr>
</tbody>
</table>

Course Assessment

<table>
<thead>
<tr>
<th>Task</th>
<th>% of total mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Theory Examination</td>
<td>40%</td>
</tr>
<tr>
<td>Final Written Practical Examination</td>
<td>25%</td>
</tr>
<tr>
<td>Mid-Session Test</td>
<td>15%</td>
</tr>
<tr>
<td>Tutorial Tests</td>
<td>12%</td>
</tr>
<tr>
<td>Practical Report</td>
<td>8%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
</tr>
</tbody>
</table>
## Course Structure

### Summary of Course Structure (for details see 'Course Schedule')

<table>
<thead>
<tr>
<th>Component</th>
<th>HPW</th>
<th>Time</th>
<th>Day</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LECTURES</strong></td>
<td>2-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture 1</td>
<td>1</td>
<td>1 - 2 pm</td>
<td>Monday</td>
<td>Ainsworth G03 (K-J17-G03)</td>
</tr>
<tr>
<td>Lecture 2</td>
<td>1</td>
<td>1 - 2 pm</td>
<td>Thursday</td>
<td>Ainsworth G03 (K-J17-G03)</td>
</tr>
<tr>
<td>Lecture 3</td>
<td>1</td>
<td>11am - 12noon</td>
<td>Friday</td>
<td>Ainsworth G03 (K-J17-G03)</td>
</tr>
<tr>
<td><strong>LABORATORIES</strong></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab – Option 1</td>
<td>3</td>
<td>2 pm - 5 pm</td>
<td>Tuesday</td>
<td>Lab 122/123</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wallace Wurth</td>
</tr>
<tr>
<td>Lab – Option 2</td>
<td>3</td>
<td>10 am - 1 pm</td>
<td>Wednesday</td>
<td>Lab 122/123</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wallace Wurth</td>
</tr>
<tr>
<td>Lab – Option 3</td>
<td>3</td>
<td>2 pm - 5 pm</td>
<td>Wednesday</td>
<td>Lab 122/123</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wallace Wurth</td>
</tr>
<tr>
<td><strong>TUTORIALS</strong></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Group Tutorials*</td>
<td>1</td>
<td>5 pm - 6 pm*</td>
<td>Friday, Weeks 3, 5, 7, 9 and 12*</td>
<td>Tutorial room locations to be announced</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Special Details

* Small Group Tutorials are held during Weeks 3, 5, 9 and 12 of session. In Week 7, a mid-session test will be held during the tutorial time in your allocated tutorial class venue. Tutorial venues will be announced in Week 1.
## 2. Course Schedule

<table>
<thead>
<tr>
<th>Week Commencing</th>
<th>Monday 1 - 2 pm</th>
<th>Tuesday 11 - 12 pm</th>
<th>Wednesday 1 - 2 pm</th>
<th>Thursday 1 - 2 pm</th>
<th>Friday 5 – 6 pm</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Jul</td>
<td>Introductory Lecture - VM</td>
<td>Nucleic Acids I - VM</td>
<td>DNA Replication I - VM</td>
<td>Nucleic Acids I - VM</td>
<td>No Tutorial</td>
</tr>
<tr>
<td>31 Jul</td>
<td>Nucleic Acids II - VM</td>
<td>Translation I - LLM</td>
<td>Optional Review Q&amp;A - VM</td>
<td>PCR - VM</td>
<td>No Tutorial</td>
</tr>
<tr>
<td>7 Aug</td>
<td>DNA Replication II - LLM</td>
<td>Translation I - LLM</td>
<td>Gene Expression I - VM</td>
<td>Transcription - LLM</td>
<td>Mid-Session Break</td>
</tr>
<tr>
<td>14 Aug</td>
<td>Protein Structure - RLB</td>
<td>Gene Expression II - VM</td>
<td>Gene Expression III - VM</td>
<td>Protein Structure - RLB</td>
<td>No Tutorial</td>
</tr>
<tr>
<td>21 Aug</td>
<td>Practical Revision I - VM</td>
<td>Recombinant DNA Techniques I - VM</td>
<td>Recombinant DNA Techniques II - VM</td>
<td>Practical Revision II - VM</td>
<td>No Tutorial</td>
</tr>
<tr>
<td>28 Aug</td>
<td>Gene Expression IV - VM</td>
<td>Recombinant DNA Techniques III - VM</td>
<td>Recombinant DNA Techniques IV - VM</td>
<td>Recombinant DNA Techniques V - VM</td>
<td>No Tutorial</td>
</tr>
<tr>
<td>4 Sep</td>
<td>Recombinant DNA Techniques I - VM</td>
<td>Bioninformatics - MW</td>
<td>Public Holiday</td>
<td>No Lecture</td>
<td></td>
</tr>
<tr>
<td>11 Sep</td>
<td>Recombinant DNA Techniques II - VM</td>
<td>3rd year courses in BABS</td>
<td>2 Oct</td>
<td>No Lecture</td>
<td></td>
</tr>
<tr>
<td>18 Sep</td>
<td>Recombinant DNA Techniques III - VM</td>
<td>Recombinant DNA Techniques IV - VM</td>
<td>9 Oct</td>
<td>No Lecture</td>
<td></td>
</tr>
<tr>
<td>25 Sep</td>
<td>Recombinant DNA Techniques V - VM</td>
<td>Recombinant DNA Techniques VI - VM</td>
<td>16 Oct</td>
<td>No Lecture</td>
<td></td>
</tr>
</tbody>
</table>

VM – A/Prof Vincent Murray; LLM – A/Prof Louise Lutze-Mann; RLB - Dr. Rebecca LeBard; MW – Prof Marc Wilkins
3. Staff Involved in the Course

<table>
<thead>
<tr>
<th>Staff</th>
<th>Role</th>
<th>Name</th>
<th>Contact Details</th>
<th>Consultation Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Convenors</td>
<td></td>
<td>A/Prof Vincent Murray</td>
<td><a href="mailto:v.murray@unsw.edu.au">v.murray@unsw.edu.au</a></td>
<td>By appointment*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr Rebecca LeBard</td>
<td><a href="mailto:r.lebard@unsw.edu.au">r.lebard@unsw.edu.au</a></td>
<td>By appointment</td>
</tr>
<tr>
<td>Additional Teaching Staff</td>
<td>Lecturers</td>
<td>A/Prof Louise Lutze-Mann</td>
<td><a href="mailto:l.lutze-mann@unsw.edu.au">l.lutze-mann@unsw.edu.au</a></td>
<td>By appointment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prof Marc Wilkins</td>
<td><a href="mailto:m.wilkins@unsw.edu.au">m.wilkins@unsw.edu.au</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demonstrators &amp; Tutors</td>
<td>See Moodle for demonstrator</td>
<td>Moodle Discussion Boards</td>
<td>Scheduled laboratory and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lists</td>
<td></td>
<td>tutorial times</td>
</tr>
<tr>
<td></td>
<td>Technical &amp; Laboratory</td>
<td>Angela Guider</td>
<td><a href="mailto:a.guider@unsw.edu.au">a.guider@unsw.edu.au</a></td>
<td>Scheduled laboratory times</td>
</tr>
<tr>
<td></td>
<td>Staff</td>
<td>Li Zhang</td>
<td><a href="mailto:lily.zhang@unsw.edu.au">lily.zhang@unsw.edu.au</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elessa Marendy</td>
<td><a href="mailto:e.marendy@unsw.edu.au">e.marendy@unsw.edu.au</a></td>
<td></td>
</tr>
</tbody>
</table>

* The best time to consult the Course Convenor, Vincent Murray, is during the laboratory times when no appointment is required.
4. Course Details

Course Description  
BIOC2201 provides an introduction to modern molecular biology and covers the molecular mechanisms of gene expression and fundamental aspects of recombinant DNA technology. The major topics covered include: the structure, function and properties of DNA and RNA; the replication and transcription of DNA; protein synthesis (translation); regulation of gene expression; molecular biological techniques (DNA cloning, hybridisation analysis, DNA sequencing, the polymerase chain reaction (PCR), and microarrays); bioinformatics; applications of molecular biology; biotechnology; and recent advances in molecular biology. The practical component of this course has been designed to complement lecture material and introduce students to current experimental techniques in molecular biology.

Course Aims  
- This course aims to introduce students to core concepts in modern molecular biology, focusing on the detailed mechanisms underlying the process of gene expression and current recombinant DNA techniques and their applications.
- This course also aims to introduce students to current laboratory techniques in molecular biology via experiments designed to reinforce and consolidate the concepts presented in lectures.

Student Learning Outcomes  
By the end of this course, you will be able to:
- Describe the structure, function and properties of nucleic acids (DNA and RNA).
- Explain the processes of DNA replication, transcription and translation, including the principle steps and enzymes involved.
- Describe and compare the mechanisms for regulating gene expression in bacteria and eukaryotes.
- Describe and list applications of molecular biological techniques, including DNA cloning, DNA sequencing, site-directed mutagenesis, the polymerase chain reaction (PCR) and microarrays.
- List and describe applications of molecular biological techniques in biotechnology.
- Provide a broad definition of bioinformatics and its applications.
- Follow the correct procedures for working safely and effectively in a modern molecular biology laboratory.
- Demonstrate a range of practical techniques in molecular biology that are commonly employed in the isolation, purification, manipulation and analysis of nucleic acids.

Graduate Attributes Developed in this Course  

<table>
<thead>
<tr>
<th>Science Graduate Attributes</th>
<th>Select the level of FOCUS</th>
<th>Activities / Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research, inquiry and analytical thinking abilities</td>
<td>3</td>
<td>Guided laboratory practicals; independent and collaborative experimental work; analysis of experimental results; inquiry into molecular biological concepts and theories; experimental report writing with peer review; bioinformatics lecture to introduce students to modern techniques in handling large biological data sets.</td>
</tr>
<tr>
<td>Capability and motivation for intellectual development</td>
<td>3</td>
<td>Small group tutorials aimed at establishing the fundamental language and themes in molecular biology and developing effective scientific communication skills; conceptual tests and an exam question writing challenge designed to evaluate and hone applied thinking; scientific report writing with peer review to develop self-critical awareness and reflective skills.</td>
</tr>
<tr>
<td>Ethical, social and professional understanding</td>
<td>2</td>
<td>Lecture component addresses ethical and social issues relevant to the field of molecular biology; lectures and tutorials feature current research strategies and findings in molecular biology and related clinical and/or medical fields.</td>
</tr>
<tr>
<td>Communication</td>
<td>3</td>
<td>Revision lectures aimed at developing effective scientific writing and communication skills through the analysis of model exam answers; small group tutorials that provide personalised feedback on scientific communication proficiencies in exam responses.</td>
</tr>
<tr>
<td>Teamwork, collaborative and management skills</td>
<td>3</td>
<td>Scientific report writing with peer review component to help students reflect on the strengths and weaknesses of their work as well as that of their peers; group discussions facilitated via Moodle; collaborative laboratory experiments and integration of data/results; exam question writing challenge to facilitate collaborative study strategies for mid-term exams.</td>
</tr>
<tr>
<td>Information literacy</td>
<td>3</td>
<td>Opportunities for self-directed learning embedded into lecture material promote development of information literacy skills; scientific report writing with associated literature review.</td>
</tr>
</tbody>
</table>

### Course Topics and Additional Class Information

#### Main Lecture Topics
- The structure and properties of nucleic acids (Lecturer: A/Prof Vincent Murray)
- DNA replication (Lecturer: A/Prof Louise Lutze-Mann)
- DNA transcription and translation (Lecturer: A/Prof Louise Lutze-Mann)
- Protein structure (Lecturer: Dr. Rebecca LeBard)
- Control of gene expression (Lecturer: A/Prof Vincent Murray)
- Recombinant DNA techniques (Lecturer: A/Prof Vincent Murray)
- Biotechnology (Lecturer: A/Prof Vincent Murray)
- Stem cells (Lecturer: A/Prof Vincent Murray)
- Bioinformatics (Lecturer: Prof Marc Wilkins)

#### Small Group Tutorials
Small group tutorials are run in Weeks 3, 5, 9 and 12 of session. The tutorial program is designed to help each student achieve a better understanding of the lecture topics presented. The scheduled tutorial topics are as follows:

- **Week 3**: The structure and function of nucleic acids
- **Week 5**: DNA replication, transcription and translation
- **Week 9**: Protein structure and gene expression
- **Week 12**: Recombinant DNA techniques and stem cells

A 15 minute tutorial test will be conducted at the beginning of each tutorial to encourage students to study the lecture topics. The test is then followed by a group discussion of the lecture topics covered in the test and/or revision activities designed to reinforce key concepts and theories. Each test is worth 3% of the overall assessment marks in BIOC2201, with the total of four tutorial tests contributing 12% to the final assessment in the course. In past years, it has been noted that there is a very strong correlation between tutorial test marks and final examination performance. NB: Tutorial groups will be confirmed and announced via Moodle by the end of Week 1.

#### Review Lectures
Practical ‘Review Lectures’ are scheduled for designated BIOC2201 lecture slots throughout the session. During these classes, previous practical laboratory material will be revised. This will provide students with the opportunity to revise practical laboratory material and reflect upon their own level of comprehension of the material presented in the practical classes.
### Optional Q&A Session Lectures

‘Optional Review Question and Answer Sessions’ will be conducted during various lecture time-slots throughout the session. These sessions provide students with an opportunity to ask lecturers questions pertaining to the current lecture series and will assist with preparations for mid-semester tests and final exams. Attendance at these sessions is non-compulsory.

### Mid-Session Test

A Mid-Session Tests will be held during the tutorial time slot in Week 7 of session. This test is worth 15% of the overall assessment in BIOC2201 and will be held under strict examination conditions in your designated tutorial room. The test will cover lecture material from Weeks 1-6 of session. More test details will be released prior to Week 7.

### Practical Program

Students will be enrolled in one of the following laboratory times:

- Tuesday 2pm – 5pm
- Wednesday 10am – 1pm
- Wednesday 2pm – 5pm

Final laboratory demonstrator groups will be announced at the beginning of Week 2. A list will be displayed on the BIOC2201 Moodle site.

There will be **NO** laboratory classes held in Week 1 of session. Laboratory classes will begin in Week 2 of session. BIOC2201 laboratory classes will be scheduled as outlined below.

**BIOC2201 Laboratory Class Schedule:**

- **Week 1** – No laboratory classes
- **Week 2** – Nucleic Acid Analysis I: Human DNA extraction and Sexing PCR set-up
- **Week 3** – Nucleic Acid Analysis II: PCR analysis and restriction enzyme digests
- **Week 4** – Nucleic Acid Analysis III: RNA processing and agarose gel electrophoresis
- **Week 5** – Computer Exercise I (Computer Lab 142, Biological Sciences Building)
- **Week 6** – Induction of β-galactosidase in *E. coli*, Part 1*
- **Week 7** – Induction of β-galactosidase in *E. coli*, Part 2*
- **Week 8** – Mitochondrial PCR I and DNA Cloning I: Ligation of vector and insert
- **Week 9** – Mitochondrial PCR II and DNA Cloning II: Transformation
- **MID-SESSION BREAK – no classes**
- **Week 10** – DNA Cloning III: Blue/white selection, plasmid isolation and R.E. digest.  
  Virtual Lab – Next-gen sequencing of Melanoma
- **Week 11** – Mitochondrial PCR III and DNA Cloning IV: R.E. digest analysis
- **Week 12** – Computer Exercise II (Computer Lab 142, Biological Sciences Building)
- **Week 13** – Optional Practical Revision Activities

* **NOTE:** The 2-week “Induction of β-galactosidase in *E. coli*” practical will require a full written report to be prepared by each student. This report is worth 8% of your final assessment mark in BIOC2201. The electronic copy should be named “StudentNumberBIOC2201” e.g. z1234567BIOC2201.doc. A paper copy must also be submitted to the BSB Student Office, Room G27, Biological Sciences Building.

Further instructions and guidelines for the report and peer assessment components are provided in this manual. Additional details will be given during lectures and through announcements in Moodle.

[**PLEASE NOTE:** There will be **NO EXEMPTIONS** from practicals for repeat students. Experience has shown that repeat students who do not attend practical sessions perform little better than at their first attempt although, theoretically, they should have much more time for study!! Those who maintain closer contact with the School by completing the practical program perform much better, in many cases achieving a higher graded pass in the subject.]
## 5. Assessment Tasks and Feedback

<table>
<thead>
<tr>
<th>Task</th>
<th>Knowledge &amp; abilities assessed</th>
<th>Assessment Criteria</th>
<th>% of total mark</th>
<th>Date of Assessment Task</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutorial Test 1*</td>
<td>Lecture material: The structure and properties of nucleic acids</td>
<td>Accuracy, depth and clarity of scientific expression</td>
<td>3 %</td>
<td>Friday, Week 3, 5-6 pm, Tutorial Room</td>
<td>Tutor Week 4 Test returned with written feedback</td>
</tr>
<tr>
<td>Tutorial Test 2*</td>
<td>Lecture material: DNA replication, transcription and translation</td>
<td>Accuracy, depth and clarity of scientific expression</td>
<td>3 %</td>
<td>Friday, Week 5, 5-6 pm, Tutorial Room</td>
<td>Tutor Week 6 Test returned with written feedback</td>
</tr>
<tr>
<td>Tutorial Test 3*</td>
<td>Lecture material: Protein structure and gene expression</td>
<td>Accuracy, depth and clarity of scientific expression</td>
<td>3 %</td>
<td>Friday, Week 9, 5-6 pm, Tutorial Room</td>
<td>Tutor Week 10 Test returned with written feedback</td>
</tr>
<tr>
<td>Tutorial Test 4*</td>
<td>Lecture material: Recombinant DNA techniques &amp; stem cells</td>
<td>Accuracy, depth and clarity of scientific expression</td>
<td>3 %</td>
<td>Friday, Week 12, 5-6 pm, Tutorial Room</td>
<td>Tutor Week 13 Test returned with written feedback</td>
</tr>
<tr>
<td>Mid-Session Test*</td>
<td>Lecture material: All lecture topics covered in Weeks 1-6</td>
<td>Accuracy, depth and clarity of expression</td>
<td>15 %</td>
<td>Friday, Week 7, 5-6 pm, Tutorial Room</td>
<td>Tutor Week 9 Tutor feedback</td>
</tr>
<tr>
<td>Scientific Report on β-galactosidase Practical</td>
<td>Scientific communication skills, information literacy skills, data manipulation &amp; presentation</td>
<td>Accurate and appropriate presentation, description, manipulation &amp; discussion of data</td>
<td>8 %</td>
<td>Final Written Report is due Week 9</td>
<td>Demonstrator Week 11 Returned with written feedback</td>
</tr>
<tr>
<td>Final Theory Examination* (Paper 1, 2 hours)</td>
<td>Theory presented in Week 1 - 12 lectures</td>
<td>Accuracy, depth and clarity of scientific expression</td>
<td>40 %</td>
<td>November examination period (date to be announced)</td>
<td>Course Coordinator After Final Exam Period myUNSW</td>
</tr>
<tr>
<td>Final Written Practical Examination* (Paper 2, 2 hours)</td>
<td>Practical work conducted throughout Weeks 2 – 12 (also reviewed in lectures)</td>
<td>Precise and thorough processing of data; accuracy, depth and clarity of scientific expression</td>
<td>25 %</td>
<td>November examination period (date to be announced)</td>
<td>Course Coordinator After Final Exam Period myUNSW</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>-</td>
<td>-</td>
<td>100 %</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* Please note that all four tutorial tests, the mid-session test and the final theory and practical examinations will consist of a combination of questions with different formats. These may include multiple choice, fill-in-the-blanks, true or false, short answer and extended (short essay) answer questions. Further details of each assessment task will be released via Moodle announcements and during lectures prior to each test.
6. Additional Resources and Support

<table>
<thead>
<tr>
<th>Text Books</th>
<th>Recommended Texts:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
</tr>
</tbody>
</table>

**Additional Molecular Biology Reference Text:**


<table>
<thead>
<tr>
<th>Course Manual</th>
<th>The BIOC2201 Course Manual is available for purchase through the UNSW Bookshop and can be downloaded via the BIOC2201 Moodle site.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required and Additional Readings</td>
<td>Details of recommended readings and reference materials will be provided by individual lecturers during lectures and online via Moodle.</td>
</tr>
<tr>
<td>Recommended Internet Sites</td>
<td>Details of recommended internet sites will be provided by individual lecturers during lectures and online via Moodle.</td>
</tr>
<tr>
<td>Societies</td>
<td>ASBMB – Australian Society for Biochemistry and Molecular Biology <a href="http://www.asbmb.org.au">www.asbmb.org.au</a></td>
</tr>
<tr>
<td>Computer Laboratories</td>
<td>Computer laboratory 142, located on the ground floor of the Biological Sciences Building, is a student laboratory used for course classes and independent research/studies (when not booked for classes).</td>
</tr>
</tbody>
</table>

7. Required Equipment, Training and Enabling Skills

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>Practical Requirements: Laboratory coat and closed shoes (no thongs, sandals, or open-toed shoes). NB: safety glasses will be provided in class where necessary.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabling Skills Training Required to Complete this Course</td>
<td>ELISE</td>
</tr>
</tbody>
</table>

8. Course Evaluation and Development

Student feedback is gathered periodically by various means. Such feedback is considered carefully with a view to acting on it constructively wherever possible.
## 9. Administration Matters

<table>
<thead>
<tr>
<th>Topic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRACTICALS AND TUTORIALS:</strong></td>
<td></td>
</tr>
<tr>
<td>1. <strong>A pass in BIOC2201 is conditional upon a satisfactory performance in the practical program.</strong> A satisfactory performance means that:</td>
<td></td>
</tr>
<tr>
<td>(i) you have attended <strong>ALL</strong> of the practical classes,</td>
<td></td>
</tr>
<tr>
<td>(ii) you have achieved an overall pass mark in the practical examination, and</td>
<td></td>
</tr>
<tr>
<td>(iii) you have kept an accurate and up-to-date laboratory manual, including the recording of all data and calculations required on the &quot;Results&quot; or &quot;Questions&quot; sheets at the end of each practical. Because you will need your practical folder to study for the practical examination which is to be held in the examination period, we will not be collecting folders at the end of the session. It will be your responsibility to make certain you have entered the <strong>correct information</strong> for each of the practical experiments (that is, that all of the &quot;Results&quot; and &quot;Questions&quot; sheets are completed correctly).</td>
<td></td>
</tr>
<tr>
<td>2. <strong>The Tutorials and Computer Exercises</strong> are very important elements of the curriculum. <strong>ALL</strong> tutorials and computer exercises are <strong>COMPULSORY</strong> components of the course-work for BIOC2201, and time has been set aside in your class schedule to ensure that you are able to attend them. The content of these exercises is examinable, either through the practical examination, theory examinations, or both.</td>
<td></td>
</tr>
<tr>
<td>3. <strong>Practical examination:</strong> This examination will be carried out by the UNSW Examinations Branch and will be scheduled by them in the Session 2 November examination period. <strong>See the UNSW examination timetable for the date and location.</strong> The exam will be entirely written, <strong>2 hours in duration,</strong> and will involve some calculations based on typical experimental data and a series of questions to test your understanding of the experimental concepts and techniques covered in the practical component of the course.</td>
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<td><strong>NOTE:</strong> Those students who do not achieve a pass in the practical examination will be required to supply their practical manual for checking (including the Written Practical Report). If this cannot be achieved before the final assessment review meetings then final marks will be <strong>WITHELD (WD)</strong> until the completed practical manual is presented.</td>
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<td><strong>LECTURES:</strong></td>
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<td>Attend <strong>ALL</strong> lectures and try to take comprehensive lecture notes. <strong>DO NOT</strong> rely solely on Echo360, lecture hand-outs, lecture notes from other students and text-books. The lecturer who presents the lectures will set the examination questions and will also be responsible for marking the relevant examinations/tests. Each lecturer will take you through the intricacies of the various topics in molecular biology in a way that you may find difficult to reproduce by simply reading through the syllabus, lecture hand-outs and the prescribed texts. The most efficient way of ensuring that you have covered all aspects of the syllabus is by attending <strong>ALL</strong> the lectures and participating in <strong>ALL</strong> tutorials and lab classes.</td>
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<td><strong>General Enquiries</strong></td>
<td>All general administrative enquiries can be directed to the <strong>BSB Student Office</strong>, G27, Ground Floor, Biological Sciences Building, opening hours: Mon-Fri 9am-12:30pm and 1:30pm-4:30pm.</td>
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<td><strong>Occupational Health and Safety</strong></td>
<td>Covered shoes and lab coats must be worn whenever you are working in the laboratory. Eating, drinking, smoking and running are not permitted in the lab. Anyone who violates these regulations will not be allowed to proceed with the practical class.</td>
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<td>UNSW WHS policies and procedures (2011) stipulate that everyone attending a</td>
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UNSW workplace must ensure their actions do not adversely affect the health and safety of others. This outcome is achieved through a chain of responsibility and accountability for all persons in the workplace.

As part of this the School has undertaken detailed risk assessments of all course activities and identified all associated potential hazards. These hazards have been minimised and appropriate steps taken to ensure your health and safety. For each activity, clear written instructions are given and appropriate hazard warnings or risk minimisation procedures included for your protection. Please refer to the Risk Assessment sections at the beginning of each practical outline in this manual for specific risks and hazards associated with the laboratory component of this course.

It is your responsibility to prepare for all practical work. You should be familiar with the procedures scheduled for the practical class and identify all personal protection requirements needed to complete the exercise in a safe manner. Material Safety Data Sheets (MSDS) are available from your demonstrator for any hazardous chemicals. At the commencement of each new practical your demonstrator will review any risks with you. It is essential that you are present at the beginning of each class to ensure that you understand any risks and can review the safety procedures. If you are not present you may be excluded from the class.

You must comply with all safety instructions and observe all safety notices. Failure to comply with safety instructions may be considered a form of academic misconduct and may be investigated by WorkCover as a breach of the NSW WH&S Act (2011).

Following are some simple rules which will ensure good laboratory practice and minimise the consequences of risks:-

- Wear adequate protective clothing including, a lab coat, covered shoes and, when appropriate, gloves and safety glasses (provided where necessary).
- Acquaint yourself with the safety equipment in the lab.
- Do not eat, drink, smoke, or apply make-up in the lab. Do not bring food, drink etc. into the lab. Do not sit on laboratory benches.
- Do not invite anyone into the lab.
- In the event of an accident with a microbial culture, or hazardous chemical, ask a fellow student to call someone in authority immediately. Do not move and risk the spread of contamination. If there is a fire or you are at risk from a chemical spill, remove yourself from immediate danger and call someone in authority immediately.
- Dispose of all waste correctly.
- Label all materials correctly and place in the relevant containers provided.
- Operate all equipment carefully and correctly. If in doubt regarding the correct method of operation consult a demonstrator before proceeding.
- Keep your bench tidy during experimental work and clean up and disinfect your bench before leaving the laboratory. Ensure that you wash your hands before leaving.
- If you feel physical discomfort from your work or have an allergic reaction, consult your demonstrator or another person in authority.
- If you get any biological or chemical substance your eye, immediately go to a tap and wash your eye. While washing your eye, alert someone to your situation so that they can assist you and gain the attention of someone in authority. Continue to wash your eye until someone in authority indicates for you to do otherwise. Note that you should always wear safety glasses when handling hazardous substances.
- Information on relevant WH&S policies and expectations at UNSW: [http://safety.unsw.edu.au/](http://safety.unsw.edu.au/)
**Missed Practical Classes:**
If you miss a practical class due to illness or some other unavoidable circumstance that can be verified via professional documentation, you must inform your demonstrator and provide them with a copy of your professional documentation (e.g. medical certificate) so that they can make a note of your legitimate absence in their roll book. Do not apply online; do not email the course coordinator to say that you are ill; do not send a copy of your professional documentation to the course coordinator.

Separate “Catch-Up” labs are not conducted but it may be possible to attend an alternative lab during the week of your absence; however, you MUST contact the course coordinator to ask for permission to attend an alternative lab. If you cannot attend an alternative lab, then you will need to catch up on missed work by speaking to your demonstrator or class colleagues.

**Missed Tutorial Tests and/or the Mid-Session Test:**
If you miss a Tutorial Test or the Mid-Session Test (in Week 7) due to illness or some other unavoidable circumstance that can be verified via professional documentation, you MUST apply for Special Consideration according to the UNSW Special Consideration and Further Assessment Policy outlined on the following page. You should also inform your tutor about your application so that they can note it in their roll book. Separate “Catch-Up” tutorials are not conducted and there are NO alternative times provided to sit the Tutorial Tests or the Mid-Session Test. You will need to catch up on missed tutorial work by speaking to your tutor or class colleagues. Depending on their overall performance at the end of the course, students with compliant applications for Special Consideration will either receive an average mark for their missed test or will be invited to sit further assessment on the supplementary exam date (see below). However, such outcomes will NOT be determined until the end of the final examination period, so please DO NOT ask your course coordinators about this matter prior to this time.

**Missed Final Exams:**
If you miss a final exam due to illness or some other unavoidable circumstance that can be verified via professional documentation, you must apply for Special Consideration according to the UNSW Special Consideration and Further Assessment Policy outlined on the following page. The same advice applies to students who sit the final exams but believe that their performance was negatively affected by illness or some other circumstance(s) that can be documented by professional means. All applications for Special Consideration for the final exams will be reviewed after the final examination period. Students with compliant applications will be sent an offer to sit one or more supplementary exams via their UNSW student e-mail account after the final examination period.
SPECIAL CONSIDERATION AND FURTHER ASSESSMENT SEMESTER 2 2017

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 the UNSW current students’ website for further information [https://student.unsw.edu.au/special-consideration](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

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 2 2017, BABS Supplementary Exams will be scheduled between 4th - 8th of December 2017

For BIOC2201: Wednesday 6th of December

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.
Those 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 Convenor 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.

<table>
<thead>
<tr>
<th>Student Complaint Procedure¹</th>
<th>School Contact</th>
<th>Faculty Contact</th>
<th>University Contact</th>
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<td></td>
<td><strong>Prof Marc Wilkins</strong>&lt;br&gt;Grievance Officer&lt;br&gt;University of Sydney (Biotechnology and Biomolecular Sciences)&lt;br&gt;<a href="mailto:m.wilkins@unsw.edu.au">m.wilkins@unsw.edu.au</a>&lt;br&gt;Tel: 9385 3633</td>
<td><strong>A/Prof Chris Tisdell</strong>&lt;br&gt;Associate Dean (Education)&lt;br&gt;<a href="mailto:cct@unsw.edu.au">cct@unsw.edu.au</a>&lt;br&gt;Tel: 9385 7111</td>
<td><strong>Student Conduct and Appeals Officer (SCAO)</strong>&lt;br&gt;within the Office of the Pro-Vice-Chancellor (Students) and Registrar.&lt;br&gt;Tel: 02 9385 8515, email: <a href="mailto:studentcomplaints@unsw.edu.au">studentcomplaints@unsw.edu.au</a>&lt;br&gt;University Counselling and Psychological Services&lt;br&gt;Tel: 9385 5418</td>
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What is 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 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, website, 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.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

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

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

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
LECTURE SUMMARIES

NUCLEOTIDES, NUCLEIC ACIDS & THE PROPERTIES OF DNA AND RNA
(A.Prof. V. Murray - 4 lectures)

1. Structure of purine and pyrimidine nucleotides and their phosphorylated derivatives; polymeric nucleotides: DNA, the repository of genetic information and RNA, the mediator of its expression.
2. The three major classes of cellular RNA - messenger RNA, ribosomal RNA and transfer RNA; hybridization of DNA and RNA; RNA secondary structure; outline of the role of RNA in protein synthesis.
3. Polynucleotides - nature and properties of the phosphodiester linkage; single and double stranded structures; forces which stabilize the double-stranded DNA structure; nucleases: enzymes which degrade polynucleotides.
4. Properties of DNA - size range of naturally occurring DNA molecules; effect of temperature, DNA Hybridisation, shear forces, acid, alkali; the condensation of long DNA molecules in vivo (via formation of nucleosomes, 30nm fibres, solenoids etc) into chromatin structure.
5. Properties and uses of restriction enzymes.
6. The basic principles of molecular cloning.

DNA REPLICATION, TRANSCRIPTION AND TRANSLATION
(A/Prof Louise Lutze-Mann - 6 lectures)

1. Replication of DNA - events at the replicating fork; enzymes involved in the synthesis of DNA; the fidelity of DNA replication: the proof-reading mechanism; DNA repair - an introduction.
2. Transcription; DNA-dependent RNA polymerase - mechanism of RNA synthesis; comparison with DNA synthesis; primary transcription products and post-transcriptional modifications.
3. Messenger RNA; template characteristics; comparison of prokaryotic and eukaryotic mRNAs; post-transcriptional modification, "capping"; poly-A tail; splicing.
4. Ribosomes; localisation and isolation; differences between prokaryotic and eukaryotic ribosomes; composition; subunit functions; polysomes.
5. Genetic Code; features - universality; reading; degeneracy.
6. Transfer RNA; general structure; structure-function; aminoacylation; isoaccepting tRNAs.
7. Initiation, elongation and termination of polypeptides; "factors"; role of GTP.
8. Antibiotics as translational inhibitors: streptomycin, tetracycline, chloramphenicol, erythromycin.
PROTEIN STRUCTURE
(Dr Rebecca LeBard - 1 lecture)

1. Revision of general protein structure - amino acid structure; side-chain properties of the 20 amino acids; peptide bond structure and formation; the 4 levels of protein structure hierarchy (primary, secondary, tertiary and quaternary) and the bonds/forces involved at each level.
2. DNA-binding motifs in proteins - zinc fingers; leucine zippers; helix-turn-helix.
3. DNA-protein and protein-protein interactions - in transcription, translation and control of gene expression; molecular models.

GENE EXPRESSION - Control of Protein Synthesis
(A.Prof. V. Murray - 4 lectures)

1. Introduction, terminology, induction (derepression), repression, constitutive proteins and enzymes, co-ordinate control, regulatory genes, structural genes, operon, promoter site, operator site etc.
2. Operator models of transcriptional control mechanisms. Discussion of the basis of control of gene expression is by the specific interactions between proteins and regions of the DNA and that these interactions can be controlled by small molecules.
3. Lactose (lac) operon - general features. Evidence - genetic and biochemical Catabolite repression - role of cAMP
4. Tryptophan Operon - co-repressor requirement
5. Eukaryotic gene expression - comparison with prokaryotes Transcription factors, upstream regulatory sequences (URS), Enhancers, silencers etc.
6. Characteristic protein domains involved in protein-nucleic acid interactions; Zinc finger, helix-turn-helix, leucine zipper, etc.
7. Translational control
8. Microarrays
9. RNAi and its applications
INTRODUCTION TO RECOMBINANT DNA TECHNIQUES
(A.Prof. V. Murray - 6 lectures)

Recombinant DNA techniques enable the identification and isolation of genes and the determination of their detailed structure. In eukaryotes, one gene may constitute only one millionth of the total genome and molecular cloning techniques are used to amplify a segment of a genome containing the gene of interest.

In this series of lectures, the basic principles involved in recombinant DNA technology will be outlined together with applications of the study of gene structure and function in humans.

1. Review of the properties and uses of restriction enzymes.
2. Review of the basic principles of molecular cloning.
3. Cloning vectors, with the emphasis on those with \textit{E. coli} as the host.
4. Brief overview of other vector/host systems.
5. Hybridisation procedures: Southern and Northern blotting.
6. Construction of genomic libraries and the methods for their screening.
7. The conversion of mRNA into cDNA and the uses of cDNA libraries. Advantages and disadvantages as compared to genomic libraries.
8. The polymerase chain reaction (PCR) and its applications.
9. DNA sequencing.

BIOTECHNOLOGY AND STEM CELLS
(A.Prof. V. Murray - 1 lecture)

Genetically modified organisms, biotechnology, stem cells, induced pluripotent stem cells - "re-programming" of adult somatic cell to pluripotent stem cells by transcription factors.

BIOINFORMATICS
(Prof. M. Wilkins - 1 lecture)

Cellular systems are incredibly complex. They carry genetic information in their genome sequences, and use this to build every nuance of living organisms. To help us understand this complexity, the field of bioinformatics has emerged. This assists us with the storage, analysis and interpretation of biological data - particularly that in the fields of biochemistry and molecular biology, genomics and proteomics. This lecture will provide a brief introduction to bioinformatics, and will illustrate the connection between DNA sequence, gene and protein expression, protein structures and function. It will give some insights into how this is helping us model and thus understand complete cellular systems.
NUCLEOTIDES, NUCLEIC ACIDS AND GENE STRUCTURE

1. What is the repeating unit of DNA?

2. Which are the purine bases? Which are the pyrimidine bases?

3. Which bases are different between DNA and RNA?

4. What is the point of attachment of a purine with a sugar in a nucleotide?

5. What is the point of attachment of a pyrimidine with a sugar in a nucleotide?

6. What is a phosphodiester bond? What is the acid that reacts to form a phosphodiester bond?

7. What is meant by 'polarity'?

8. What is meant by the term 'antiparallel'?

9. What are the forces which stabilize the DNA double helix?

10. DNA and RNA are both highly negatively charged. Which groups carry this charge?

11. Write out shorthand representations for: a deoxynucleoside, a 5'-nucleotide, a 5'-nucleoside triphosphate, a 5'-deoxynucleoside triphosphate, a dinucleotide with a 5'-hydroxyl and a 3'-phosphate.

12. Compare the effect of alkali on DNA and RNA and why is it different?

13. Define the terms endonuclease and exonuclease.

14. Which chemical groups are responsible for the strong absorption of UV light by nucleic acids?

15. What do the terms 'GC content' and 'T_m' mean as applied to DNA?

16. How does T_m vary with GC content?

17. What are the main components of chromatin?

18. What is the nucleosome?
19. "It has not escaped our attention that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material" - Watson & Crick (1953) Nature 171, 737-738. What was the pairing and how does it suggest a replication mechanism?

20. What are the two major steps in gene expression?

21. What are the three main classes of RNA?

22. What type of enzyme are restriction enzymes?

23. Write down some possible DNA sequences that may be recognised by a restriction enzyme.

24. Products of restriction enzyme digestion of DNA can have cohesive or blunt ends. What does this mean?

25. Assuming a random arrangement of bases in DNA, what are the average lengths of fragments products by restriction enzymes with (a) a 4 base recognition sequence and (b) a 6 base recognition sequence?

26. Describe the process of cloning a DNA fragment.

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**REPLICATION, TRANSCRIPTION AND TRANSLATION**

1. What are the requirements of DNA polymerase for activity?

2. Why is DNA replication said to be semi-conservative?

3. Explain what is meant by saying that DNA replication is discontinuous.

4. Which strand is the leading strand and which is the lagging strand when DNA replicates?

5. What enzyme activities are possessed by DNA polymerase I?

6. What is the role of primase in DNA replication?

7. What are the requirements of RNA polymerase for activity?

8. Is the mRNA copied from the coding or non-coding strand of DNA?
9. Given that eukaryotic DNA polymerases replicate DNA more slowly than their prokaryotic counterparts and that eukaryotic cells typically contain 1000 times as much DNA as a bacterial cell, how do eukaryotic cells manage to replicate their DNA in a reasonable time?

10. Compare the mechanisms of action of DNA and RNA polymerases.

11. Why is tRNA called an adaptor molecule?

12. Where in a tRNA molecule does the amino acid attach to form aminoacyl-tRNA?

13. Where in a tRNA molecule is the anticodon and what is its function?

14. How are the amino acids activated for protein synthesis?

15. Are there differences in initiation of protein synthesis between prokaryotes and eukaryotes?

16. What are the different types of protein "factors" required for protein synthesis?

17. What steps in protein synthesis require the input of energy?

18. There are three "steps" in elongation of a growing peptide chain (per one amino acid addition). What are they?

19. What are the characteristic differences between prokaryotic and eukaryotic messenger RNAs?

20. Do these differences reveal anything of the possible control mechanisms for protein synthesis?

21. What are the post-transcriptional modifications to eukaryotic messenger RNA?

22. What is the process of "splicing" of eukaryotic pre-messenger RNA?

23. What is the code contained within the messenger RNA?

24. Is this code universal? That is, is it the same for lower to higher organisms?
PROTEIN STRUCTURE

1. Can you recognise the hydrophilic and non-polar amino acids and their R-group types?

2. Can you recognise the basic and acidic amino acids amongst the 20 amino acids?

3. What is the relationship between amino acid sequence and protein tertiary structure?

4. Describe the major factors that stabilise an alpha helix.

5. Describe the major factors that stabilise a beta-sheet.

6. What covalent bonds are involved in the maintenance of tertiary structure?

7. What type of amino acids contribute to hydrophobic interactions in a protein molecule and where are they found in a protein molecule?

8. What type of amino acids contribute to hydrogen bonding interactions in a protein molecule and where are they found in a protein molecule?

9. What type of amino acids contribute to ionic bond interactions in a protein molecule and where are they found in a protein molecule?

10. What type of amino acids contribute to disulphide bonds in a protein molecule and where are they found in a protein molecule?

11. Describe the major energetic contributions to protein stability.

12. Describe the different types of interactions that can occur between proteins and DNA.

13. Name three common motifs that occur in eukaryotic DNA-binding proteins and describe their basic structures.

14. What are the characteristics of zinc finger domains?

15. One type of protein-protein interaction occurs via a leucine 'zipper', describe the features of such an interaction.
GENE EXPRESSION

1. What does transcriptional control of protein synthesis involve?

2. What is an operon?

3. What is the proposed mechanism of control of protein synthesis for genes in an operon?

4. Describe the features of the Lac operon

5. What is meant by positive and negative control in relation to transcriptional control?

6. What is catabolite repression?

7. Why is the lac repressor a negative effector whereas the cAMP activator protein is a positive effector?

8. What is the proposed mechanism for catabolite repression?

9. What is inducer exclusion?

10. How does glucose inhibit the production of cAMP?

11. What are the essential features of the tryptophan operon?

12. Using the trp operon as an example, what is attenuation of transcription?

13. How does the proposed mechanism of attenuation involve levels of aminoacyl transfer RNA?

14. What are the general features of a eukaryotic promoter?

15. What is a TATA box?

16. How is it thought that the binding of RNA polymerase II is controlled?

17. What is an enhancer?

18. What are microarrays and what information can be obtained from a microarray?

19. What is RNAi and how can it be used?

20. What is microRNA?
INTRODUCTION TO RECOMBINANT DNA TECHNIQUES

1. What is meant by the term ‘genome’?

2. What are the approximate sizes of the E. coli and human genomes?

3. What is a vector?

4. What is an insert?

5. What are the desirable properties of a cloning vector?

6. Describe some of the features of the pUC vectors.

7. What is meant by the term "insertional inactivation"? How is this used to select clones versus re-ligated vector?

8. Describe the process of cloning a DNA fragment.

9. What is the role of DNA ligase? What are the requirements in regard to the ends of the DNA being ligated?

10. How can purified DNA molecules (e.g. plasmids) be introduced into bacterial cells?

11. Describe the situations where lambda phage constructs are used as vectors.

12. Describe the process of hybridisation using a radioactively labelled DNA fragment as the probe.

13. What is a genomic library and what is the most important property of such a library?

14. How can hybridisation be used to select a clone containing a gene of interest?

15. What is cDNA and how is it prepared?

16. Why is a cDNA library less complex than a genomic library? How is such a library prepared?

17. What is the difference between a cDNA library and a genomic library?

18. How can cDNA clones be used?

19. Some cDNA clones can be used to express the encoded protein products; what characteristics are required to allow this to occur?
20. What is the principle of Sanger's manual method of DNA sequencing?

21. What is automated DNA sequencing?

22. Describe the process of Illumina short read DNA sequencing.

23. What is RNA-seq?

24. What is exome-seq?

25. Describe the process of DNA amplification using the polymerase chain reaction.

26. How do you calculate the size of a PCR product?

**BIOINFORMATICS**

1. What is bioinformatics?

2. What is bioinformatics useful for? Provide general and specific examples.

**STEM CELLS**

1. What is the definition of a “stem” cell?

2. What are embryonic stem cells?

3. What are somatic (also called adult) stem cells?

4. What are the therapeutic uses of stem cells?

5. What are Induced pluripotent stem cells?

6. How are transcription factors used in the generation of Induced pluripotent stem cells?

7. Name the transcription factors used in the generation of Induced pluripotent stem cells.
PRACTICALS

GENERAL INFORMATION

(A) TIME
There will be 3 hours of practical work per week:
The practical work is an integral and compulsory part of the Molecular Biology course. The practicals are designed to introduce you to basic techniques, to teach you experimental method and several practical classes will reinforce and extend certain aspects of the lecture material. Therefore, you will find that if you make a serious attempt to understand the practicals, your understanding of the course as a whole will be improved considerably.

(B) GENERAL INFORMATION

(i) Students should at all times wear a laboratory coat and have adequate foot protection. Students without footwear or wearing thongs will not be permitted in the laboratory.

(ii) A medical certificate is required from students who are absent from the practical class due to illness. Medical certificates are to be submitted to your BIOC2201 demonstrator.

(iii) Each student is responsible for the safe handling and correct storage of all equipment, and glassware used during the practical classes. ALL glassware used during a practical class MUST be thoroughly cleaned with soap and water (or as directed by laboratory staff).

(iv) At the beginning of each practical class there will be a short talk on the day's experiment. If you miss this talk, you will not be permitted to participate in the class because it contains important safety information.

(v) Most of the experiments are performed in pairs and sometimes in bench or demonstrator groups. Get to know your demonstrator and the students on your particular bench.
(C) PREPARATION

To derive the full benefit from the practical work, it is necessary to study the notes and relevant material BEFORE the class and not just blindly follow a "recipe". A "recipe approach" is easy to detect and your demonstrator will discuss the matter with you if they suspect that you are not preparing for your lab classes in advance. Students who adopt a "recipe approach" generally fail to understand the practical and obtain inferior results. Therefore, they also penalise themselves when they subsequently attempt to answer practical questions or write their practical report.

We have found that a good way to prepare for the next laboratory exercise is to make a short summary of the actual techniques and manipulations that you will be using in the laboratory. This summary can take the form of some brief, written comments, or it can take the form of a flow diagram that maps out the steps that you will have to take in order to complete the experiment. This summary or flow diagram should be written out on the blank sheet that is provided for this purpose at the beginning of each practical activity in this manual. Your Demonstrator will check to see this flow diagram has been completed BEFORE you start the experiment each week as a sign that you have come into the laboratory prepared to do the work.

If you have difficulty with the preparation, you are encouraged to consult your course convenor BEFORE the practical. You will never be penalised for seeking information or explanation.

(D) ASSESSMENT

PLEASE NOTE: A PASS IN BIOC2201 IS CONDITIONAL UPON A SATISFACTORY PERFORMANCE IN THE PRACTICAL PROGRAM.

(E) PRACTICAL WORK

The observations from your laboratory work must be recorded neatly at the time the observations are made. For most experiments, there is ample space provided for this recording of data in the practical notes themselves. These recorded data therefore form the bulk of the information you will need to answer the questions that accompany each practical.

After completing each practical task, you are required to answer a series of questions relating to that task. These activities are clearly marked on pages located at the end of the procedural notes for each practical task in this manual. The exercises may require you to include one or two pages of recorded data, such as graphs and/or calculations, and they may also ask you to provide answers to questions that refer to various procedural or theoretical aspects of the corresponding practical. All answers to these question sheets should be written in pen (not pencil), and any graphs should be drawn properly on graph paper, titled and labelled correctly on both axes (with appropriate units). The blank space provided after each question on the question sheets usually indicates the length of the answer required. If the question requires detailed calculations, include the steps in your calculations and provide at least one detailed
sample calculation so that your demonstrator can follow your working. If the data are provided and your calculations are clearly set out and legible, your demonstrator will trace any mistakes you might make. Your demonstrator will be checking to see that you keep all of your laboratory work up to date, including your practical results and answers to the question sheets. It is in your own best interest that all practical work is completed and checked, as the final written practical examination is directly based on all aspects of these tasks.

(F) FEEDBACK ON SUBMITTED WRITTEN MATERIAL

For Tutorial Tests (3% each) and the written Scientific Report (8%), your tutor/demonstrator will comment on the following (where appropriate):

1. Scientific content (your mark will be based on this)
2. Clarity of expression
3. Logical progression of ideas
4. Grammatical expression and spelling
5. Legibility (very important for effective communication)

Your tutor will grade points 2 -5 as very poor, poor, acceptable, good, very good, excellent; with comments where appropriate.

In this course, we mark exam papers based on scientific content. However, your future employer will appreciate clear and concise writing as a very effective communication skill. We will provide you with feedback on this particular graduate attribute at various stages throughout the course.
ACADEMIC MISCONDUCT

Information concerning the University Regulations concerning Academic Misconduct can be found on the UNSW website: https://my.unsw.edu.au/student/academiclife/assessment/AcademicMisconduct.html.

It is essential that all students read this information.

Academic Misconduct may apply to any work or document related to assessment that is submitted to the School; this includes the laboratory work you document/discuss within this manual, the three mid-session Tests and the final examinations in June.

All work submitted for assessment must represent a student's own individual efforts. Copying or paraphrasing another person's work and using another student's experimental results are all examples of academic misconduct (see Academic Honesty and Plagiarism).

ATTENDANCE AT CLASSES

Students are expected to be regular and punctual in attendance at all classes (lectures, practicals, review lectures/tutorials and mid-session tests). Although attendance at lectures is not considered compulsory, students are reminded that the lectures are guaranteed to cover the examinable theoretical material and attendance is the most efficient way to receive the details of the syllabus. Please note that student attendance at lectures may be randomly recorded for the purpose of correlating class attendance with assessment outcomes in BIOC2201.

Professional documentation (e.g. medical certificates) explaining absences from formal assessments and laboratory classes should be included with an online application for Special Consideration according to the guidelines (and online via Moodle). All such documentation should be submitted within three days of the absence in question. This procedure will ensure that you are not penalised for absences for which there were appropriate medical or compassionate reasons.

IMPORTANT NOTE: IF STUDENTS ATTEND LESS THAN EIGHTY PERCENT OF THEIR POSSIBLE CLASSES, THEY MAY BE REFUSED FINAL ASSESSMENT AND/OR A PASS GRADE IN THE COURSE.
LABORATORY SAFETY

Biochemical and molecular biology laboratories contain chemicals and equipment that are potentially dangerous when misused or handled carelessly. Consequently, safe experimental procedures and responsible conduct in the laboratory are essential at all times. The regulations governing conduct in the laboratory have been set down by the NSW Workplace Health & Safety Regulations 2011, NSW WHS Regulations 2011, NSW Work-cover Publications, Work-safe National Codes of Practice and Guidance Notes and Australian Standards AS:2243 series Safety in Laboratories. These policies and standards apply to all university staff and students.

Students are responsible for:

- Complying with the requirements of this policy, legislation and Australian Standards
- Following directions given to them by the person supervising their work
- Co-operating in the performance of risk assessments
- Participating in induction and training programs
- Reading MSDS’s for substances to be handled prior to doing experiments

Failure to comply will result in expulsion from the laboratory class.

PPE\(^1\) REQUIREMENTS IN THE LABORATORY

- **Students must purchase a laboratory coat and wear it when in the laboratory.** It should be removed when leaving the lab e.g. on visits to the computer lab or toilets. Lab coats should not be left on benches or stools but hung on the coat hooks that are provided at the back of the laboratory.

- **Safety glasses** will be provided in the laboratory and MUST be worn when required, especially when handling of corrosive and toxic compounds.

- **Disposable plastic gloves will be provided for certain manipulations. These should be discarded after use or if torn.** All gloves should be removed from your hands by first holding the gloves at the wrist and pulling to turn them inside out before they are discarded into one of the ‘solids waste’ containers on top of bench.

- **Never** throw gloves or any other laboratory material into the ‘Paper Only’ or ‘Domestic/Household Waste’ bins.

- **Never** use gloved hands to open doors etc. Either ask someone to open the door for you or remove one glove temporarily. **Always** remove gloves before leaving the lab.

- **Suitable foot protection must be worn.** Students with bare feet, thongs, exposed shoes or strappy sandals will not be allowed into the working area.

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1 PPE – Personal Protection Equipment
SAFETY RULES IN THE LABORATORY

- Eating, drinking and smoking are forbidden in the laboratory.

- Students with long hair must tie it back.

- Laboratory coats and appropriate footwear (NO thongs or open-toed shoes) must be worn at ALL times.

- All work with toxic, corrosive or flammable (etc.) chemicals must be conducted in a fume cupboard where possible.

ALL INJURIES OR ACCIDENTS WITH CHEMICALS MUST BE REPORTED IMMEDIATELY - either to your demonstrator or to a member of the technical staff.

RISK ASSESSMENTS

For your own protection and that of those with whom you will be working, before each week's experiment is started, you should read the notes and instructions provided on the Risk Assessment for each experiment and take note of any hazards in the procedures to be used for that laboratory session.

Risk Assessments have been carried out on all practicals to highlight the potential for possible risks to the users. These cover chemical, biological and physical hazards. This is to ensure that the proper precautions are taken during all laboratory procedures.

The chemical risks have been assessed using MSDSs (Material Data Safety Sheets) and are available on request. A copy of the Hazardous Substances Policy is on file in the Prep Room.

As strong acids, alkalis and other toxic substances have to be used in some procedures, the relevant safety instructions will be included at the appropriate places in the manual. Such dangerous materials must never be pipetted by mouth, they should be manipulated with great care and, if any come into contact with skin or clothing, wash the affected areas with water immediately, seek assistance and any antidote that may be applied.

Poisonous solutions will be provided in automatic dispensers; these should be operated gently and carefully because careless use can cause breakage or a spray of the reagent. Automatic pipettors will be provided where possible.
EMERGENCY PROCEDURES

• In the event of a fire or other serious emergency, the building may be evacuated. When the alarm has been activated, a “get ready to evacuate” siren will sound. You should immediately cease work and secure your workplace (e.g. cap solutions, turn off Bunsen burners). The second stage is the “evacuate the building” call. You should immediately make your way to the nearest exit unless another exit is designated by staff. Follow directions from the staff and evacuation wardens and gather at the Michael Birt Gardens in front of the Chancellery Building (near Gate 9 on High Street). You should wait there until you have been checked off by your demonstrator.

• Emergency eye wash stations and safety showers are installed at the back of the lab. Seek staff help immediately if these are required.

• For procedures to clean up large or hazardous spills, seek staff help immediately.

• If you are in doubt about any safety matter, please consult a member of staff.
SAFETY IN HANDLING LABORATORY CHEMICALS

PIPETTING

Essentially all hazardous solutions (acids, alkalis, toxic solutions etc.) that are needed in the practical class will be provided in dispensers which will be set to deliver the correct volume. See Appendix for proper handling.

For all other pipetting, pipetting aids such as Gilson Pipetmans or Eppendorf pipettes will be provided for use during classes. See Appendix for proper handling instructions.

BROKEN GLASSWARE AND OTHER SHARP OBJECTS

Should any breakage of glassware occur, the fragments must be swept up immediately and placed in the special bins provided for glass. These bins are located at the front of each laboratory and are clearly marked "BROKEN GLASS ONLY". Other sharp objects e.g. needles or razor blades should be placed in the yellow "Sharps" Bins located on each bench-top. Broken glass or other sharp objects MUST NOT be placed in the waste paper bins or in any other bins, UNDER ANY CIRCUMSTANCES.

DISPOSAL OF “CLINICAL” WASTE

Special labelled enamel or plastic containers are available on each laboratory bench for the disposal of gloves, gels, tips, microcentrifuge tubes, and any other used disposable plastic ware or Glad-wrap. Never, ever put this material in the normal waste paper bins.

DISPOSAL OF CHEMICAL (LIQUID) WASTE

According to the Environmental Policy of the University no chemical waste may be disposed of down the laboratory sinks.

All chemical residues must be placed in the appropriate waste containers which will be provided in the laboratory. Solvent, aqueous, biological wastes and some chemicals may have separate waste containers which are usually located in the fume cupboards. For disposal details, always check your practical manual, the instructions written on the waste disposal containers in the lab, or ask your demonstrator.