BIOTECHNOLOGY & BIOMOLECULAR SCIENCES

BABS3021/MICR3621

MICROBIAL GENETICS

COURSE MANUAL

TERM 3, 2020

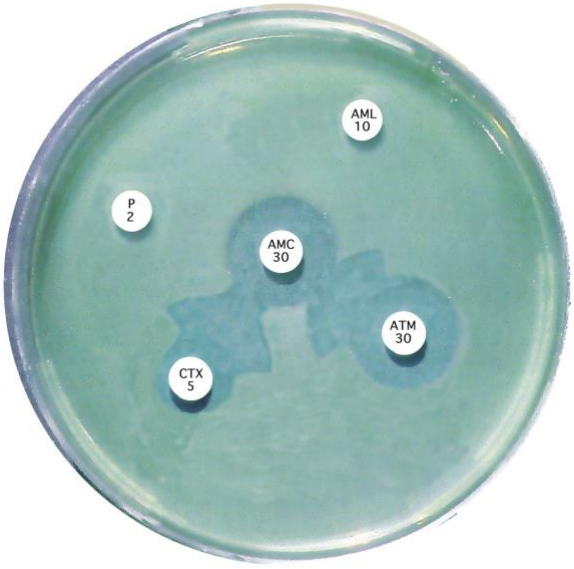

Image: John Wilson

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General Course Information

Introduction and welcome

Microbial Genetics is a course worth 6 units of credit consisting of lectures, tutorials, and practical investigations. All components of the course will be delivered online in T3 2020. Pre-requisites are 12 UoC from MICR2011 or BIOS2021/BABS2204 or BIOC2621/BABS2264 or BIOC2201. The course aims to present students with the background to microbial genetics and technologies currently used to address microbial genetics. The course is designed to provide opportunities for students to gain knowledge and insight into the scientific developments of today's front-line research. The following pages contain a summary of the course structure and learning outcomes. A detailed description of the practical investigations, associated tutorials and assessment tasks for the course can be found in a separate document and on Moodle.

The course embraces a number of topics in microbial genetics, many of which are new whereas others extend from 2nd level microbiology, genetics and molecular biology courses. It is intended for students interested in microbiology, molecular biology and genetics. The course covers fundamentally important and well-established concepts in microbial genetics, while emphasising the latest discoveries that have emerged from contemporary research efforts in the field (presented by senior researchers in the School). A strong component of the course is discussion of findings based on the use of 'omics'. Topics may include genetics of bacteriophages & viruses, bacteria, archaea and yeast, mutation and evolution, mechanisms of gene transfer, gene regulation and adaptive responses, and genomics and functional genomics of individual microorganisms and whole microbial communities.

The practical component includes discussions and activities related to wet-lab microbial genetics experiments (investigations) that complement lecture material. The practicals and tutorials emphasise interaction between demonstrators and students in tutorials each week, including engagement through a rich variety of concept tutorials. The *Investigations* cover diverse topics including experiments and outcomes involving bacteria or archaea involving transposon mutagenesis, gene library construction, gene complementation using recombinant plasmids, gene expression and regulation studies, UV mutagenesis and DNA repair, restriction/modification systems, transformation of haloarchaea and a variety of gene exchange techniques. The socioeconomic impact of microbial genetics is also discussed.

Course staff

Below are contact details for staff involved in the course. However, the best way to contact instructors is to use Microsoft Teams to send a direct message or a message in a discussion forum.

Lecturers	**Phone**	**Email**
Mark Tanaka (MT) (Course Coordinator)	9385 2038	m.tanaka@unsw.edu.au
Rick Cavicchioli (RC)	9385 3516	r.cavicchioli@unsw.edu.au
Megan Lenardon (ML)	9385 1780	m.lenardon@unsw.edu.au
Jai Tree (JT)	9385 9142	j.tree@unsw.edu.au
Belinda Ferrari (BF)	9385 2032	b.ferrari@unsw.edu.au
Brendan Burns (BB)	9385 3659	brendan.burns@unsw.edu.au
Matt Baker (MB)	9385 1255	matthew.baker@unsw.edu.au
Suhelen Egan (SE)	9385 8569	s.egan@unsw.edu.au
Torsten Thomas (TT)	9385 3467	t.thomas@unsw.edu.au

Lab and tutorial staff	**Phone**	**Email**
Jason Sercombe (Practical coordinator)		jason.sercome@unsw.edu.au
Jeff Welch		j.welch@unsw.edu.au
Elessa Marendy	9385 2093	e.marendy@unsw.edu.au
Gee Chong Lin		g.ling@unsw.edu.au
Tim Nguyen		thinh.nguyen@unsw.edu.au

For administrative matters contact the following staff members.

Administrative staff	**Phone**	**Email**
Julna Zhao (BABS student advisor)	9385 8047	BABStudent@unsw.edu.au
Anne Galea (BABS Director of Teaching)		BABSteaching@unsw.edu.au
Gavin Edwards (Associate Dean, Education)	9385 4652	g.edwards@unsw.edu.au

Course learning outcomes

Course Learning Outcome (CLO)	Related Tasks & Assessment
1. Explain complexity of microbial genetics based on acquired knowledge of the facts, concepts, principles and procedures presented during the course.	Practical/tutorials and lectures; practical and lecture-based assessments.
2. Integrate knowledge from different sources, e.g. investigations, lectures, assignments, other units such as microbiology, biotechnology and biochemistry.	Practical/tutorials and lectures; practical and lecture-based assessments.
3. Identify and use the information retrieval systems in the library and on the web effectively and efficiently as a supplement to lectures, tutorials and practical classes.	Practical/tutorials and lectures; practical and lecture-based assessments.
4. An understanding of experiments, employing a personally responsible, scientifically honest and systematic approach. This includes competently organising laboratory data, making accurate and complete observations and records, developing an appreciation of the use of laboratory equipment and the performance of techniques with safety and reliability.	Practical/tutorials; indirectly through practical-based assessments.
5. Develop the ability to interpret data, analyse results and discuss these with respect to the aims of the experiment. This involves understanding both the principles and methodology of the experiments.	Practical/tutorials; indirectly through practical-based assessments.
6. Write a report based upon the results of experimentation performed in the laboratory, using a style that mimics the drafting of a published paper. This involves using an appropriate structure and inclusion of content suitable for each section of the report (Aim, Introduction, Methods, Results, Discussion, References).	Practical Report on Investigation
7. Demonstrate an ability to think critically. This involves critiquing experimental design and possibly augmenting experiments in practical classes, and evaluating scientific findings and expressed opinions.	Practical class tutorials; lectures; directly assessed in presentations; indirectly assessed in practical report on investigations and lecture-based exams.
8. Gain Science student graduate attributes: Research, inquiry and analytical thinking abilities; Capability and motivation for intellectual development; Ethical, social and professional understanding; Communication; Teamwork, collaborative and management skills; Information literacy.	Through achievement of CLO 1-7.

Online resources

Microsoft Teams: communication will occur primarily through Teams. The live tutorials/pracs and Q&A sessions will be conducted through video calls in Teams. Online discussions will take place in Teams. General information about the course will also be provided in Teams.

Moodle: Information about the course will also be posted on Moodle, which will also be used for the practical quiz, the exams, and for the submission of reports.

For information on how to use these resources see https://teaching.unsw.edu.au/moodle-login and https://student.unsw.edu.au/teams-students .

We may occasionally use other electronic resources in this course.

Textbooks

Useful textbooks are:

Molecular Genetics of Bacteria, 2013, 4th Ed, L. Snyder, J. E. Peters, T. M. Henkin, W. Champness Wiley ISBN: 9781555816278).

Note that there is no single textbook which covers all material in this course. The following texts may be additional useful references. Copies of these should be available in the Biomed library. Individual published papers will also be provided by some lecturers as relevant source material.

Microbial Genetics**,** 1994, 2nd Ed, by S.R. Maloy, J.E. Cronan & D. Freifelder; Jones and Bartlett Pub.

An Introduction to Genetic Analysis, (all editions) by A.J.F. Griffiths, J.H. Miller, D.T. Suzuki, R.C. Lewontin & W.M. Gelbart; W.H. Freeman & Co. Pub.

The **UNSW Library** (https://www.library.unsw.edu.au/) is also a useful resource for finding and accessing relevant texts.

Course Schedule and Assessments

Overview of activities

All **lectures** will be delivered online. They are *asynchronous* in that recordings will be provided for you to view (in weeks 1-5 and 7-10). In addition, online *synchronous* (live) review sessions will be held each week at 10am on Thursdays. These will be question-and-answer (*Q&A*) sessions in which you will have the opportunity to ask lecturers questions to clarify lecture material. Please watch lectures before the corresponding review session. Note: a review session *will* be held in week 6 (Flexibility Week).

The **practicals and tutorials, which together are referred to as *Investigations*,** will have asynchronous and synchronous components. A synchronous (live) tutorial will be held each week on Wednesday from 10am to 12pm except for week 6. **You are expected to attend all of these sessions**. The tutorial will cover the *Investigations*; these times will also be used to discuss the practical material, some of which you will work through in your own time (asynchronously). In weeks 9 and 10 you will present the results of your investigation into *Microbial Genetics and Society*.

Assessment will consist of four components: (1) a practical quiz, (2) practical work including a report and a presentation (3), a midterm exam, and (4) a final exam in the exam period. More details are given in the Assessments section below. Key dates for the activities and assessments are as follows.

Key dates

Week	Prac/Tute Topic	Wed 10am-12pm	Q&A (Lectures)	Thu 10-11am	Assessment	Weight
1			MT	17 Sep		
2	Inv 1	23 Sep	MT	*24 Sep		
3	Inv 2	30 Sep	RC	1 Oct		
4	Inv 3	7 Oct	MT	*8 Oct	Prac quiz (7 Oct)	10
5	Inv 4	14 Oct	MT	*15 Oct		
6		-	ML	22 Oct		
7		28 Oct	MB	29 Oct	Midterm (28 Oct)	25
8	Inv 5	4 Nov	RC, BF	5 Nov		
9		11 Nov	TT, SE	12 Nov	Presentation (11 Nov)	10
10		18 Nov	JT, BB	19 Nov	Presentation (18 Nov)	(10)
10					Prac report+log due: 5pm 18 Nov	30
Exam					Final exam (Exam period)	25

Inv = Investigation
Presentations will take place over two weeks (9 and 10)
**Q&A optional in weeks 2,4,5 ("office hour" for MT to answer general questions)*
MT will host all Q&A sessions

- Investigation 1: Transfer of genes by F-prime
- Investigation 2: (a) DNA repair mechanisms in bacteria
  (b) Restriction and modification of DNA
- Investigation 3: Genetic transfer of antibiotic resistance
- Investigation 4: Transposon mutagenesis
- Investigation 5: Genetics of haloarchaea
- Presentations: Microbial genetics and society

Lecture topics

The lecture topics are listed in the following table.

Lecture topics

Week	Lecturer	Topic of recording	Q&A session
1	MT	1. Introduction to Microbial Genetics	
1	RC	2. Bacterial conjugation	
1	RC	3. Bacterial conjugation	MT: welcome to the course
2	RC	4. Lambda phage	
2	RC	5. Lambda phage	
2	RC	6. Lambda phage	MT: optional discussion
3	RC	7. Lambda phage	
3	RC	8. Archaeal genetics	
3	ML	9. Eukaryotic microbes: yeast molecular genetics	RC review (Lec 2-8)
4	ML	10. Eukaryotic microbes: yeast molecular genetics	
4	ML	11. Eukaryotic microbes: yeast molecular genetics	
4	ML	12. Eukaryotic microbes: yeast molecular genetics	MT: optional discussion
5	ML	13. Eukaryotic microbes – fungal pathogen genetics	
5	ML	14. Eukaryotic microbes – fungal pathogen genetics	
5	MB	15. Ancestral reconstruction and phylogenetics	MT: optional discussion
6	-	[Flexibility week]	ML review (Lec 9-14)
7	RC	16. Antarctic environmental omics	
7	RC	17. Antarctic environmental omics	
7	RC	18. Antarctic environmental omics	MB, MT review (Lec 1, 15)
8	RC	19. Antarctic environmental omics	
8	RC	20. Antarctic environmental omics	
8	BF	21. Terrestrial environmental omics	RC, BF review (Lec 16-21)
9	MT	22. Microbial mutation and evolution	
9	TT	23. Lateral gene transfer and evolution	
9	SE	24. Microbial signalling and interactions	MT, TT, SE review (Lec 22-24)
10	JT	25. Bacterial epigenetics	
10	JT	26. Post-transcriptional regulation in bacteria	
10	BB	27. Cyanobacterial genetics	JT, BB review (Lec 25-27)

- The lectures will be asynchronous: watch the lectures when it suits you but do so by the Thursday of the week indicated so that you are informed and ready for the Q&A sessions.

Assessments

The assessment components are as follows.

1. **Practical quiz**

This will be a multiple-choice quiz that you will take online *during the tutorial in week 4*. This is worth 10% of the course. You will have 30 minutes to complete it and the start time will be announced at the scheduled tutorial.

2. **Practical work**
   a) **Practical report**
      - All students will be required to submit one practical report worth 25% of the final grade, and complete a lab-log worth 5% of the final grade.
        - *BABS3021 Prac Report* (for BABS3021 students only) will be based on *Investigation 3* (*Genetic transfer of antibiotic resistance*). This is worth 25%. Details of the format required for the report are provided in the next section.
        - *MICR3621 Prac Report* (for MICR3621 students only). For this assignment, you will design your own scientific investigation. This is worth 25%. Details of the format required for this report will be provided in Moodle.
        - *Lab-log* (for both BABS3021 and MICR3621): The second component of the Practical Report will be a log of your activities and reflections on all of the Investigations. This is worth 5%. **Make sure you take notes at or after each prac/tutorial session so that you can complete this component**.
      - **Deadline**: The practical report is due for submission via Turnitin in Moodle by 5pm on the due date. A penalty of 20% of the total value of the assignment per day will be applied to late assignments. **It is strongly recommended that you start working on the practical report early in the term**.

   b) **Presentation**

   During the tutorial sessions in weeks 9 and 10 you will have the opportunity to present (online via Microsoft Teams) your views on a current issue involving microbial genetics. See the notes for *Microbial Genetics and Society* for details. This presentation will be assessed and is worth 10%.

3. **Midterm exam**

   The midterm exam will be held in week 7 during the scheduled practical. It will cover material delivered by Rick Cavicchioli and Megan Lenardon in weeks 1-5 (excluding Lecture 1 and Matt Baker's lecture on “Ancestral reconstruction and phylogenetics”). This is worth 25%.

4. **Final exam**

   The final exam will be held in the exam period. This is worth 25%. It will cover material in weeks 6-10 and include Matt Baker's lecture on “Ancestral reconstruction and phylogenetics”. This exam also covers material delivered in the practicals and tutorials.

Exam format:

- Both exams will consist mainly of multiple-choice questions, but there may also be short-answer or essay questions.

- The exams will be "open book". You may use your lecture notes, practical reports, textbook, or the internet. But you ***must not*** communicate with anyone else during the exam. You ***must not*** copy any text (even if you then edit the copied text); write your own answers ***in your own words***. The exams and prac reports will be scrutinised using Turnitin.

- Click here to see a check list for preparing to sit an online exam.

Structure and format of practical report

The BABS3021 practical report should be written in the format of a research article in a scientific journal such as the *ISME Journal, Environmental Microbiology, Journal of Bacteriology, Applied and Environmental Microbiology, Molecular Microbiology, Infection and Immunity.* Note that the styles of articles written in journals such as *Science* and *Nature* are **not** appropriate for your reports.

Heading: Investigation number and title; date; name of student.

Abstract: A brief, single paragraph description which identifies the aims and outcomes of the work.

Introduction: This section should contain a statement of the aims and objectives of the particular investigation and give a brief general idea of how these aims were accomplished. Generally, the Introduction should be about ½ a typed page, should commence with the introductory material and conclude with the main aims. The Introduction should be written describing known facts and concepts and should therefore be written in the present tense. The description of the aims should be written in the past tense as they should describe what you did, not what you will do.

Materials and Methods: This section should be brief and may consist of merely a reference to the relevant prac. notes.

Results: The results should present all data relating to the investigation. It should include tables or figures (if appropriate). Tables and figures should not be redundant, *i.e.* do not include a table if the data is already presented in a figure. Note however that all data should be recorded.

Each table or figure must have a heading and legend which contains sufficient details to enable the reader to understand them. Do not use "keys" embedded within figures. Describe all symbols, etc in the figure legend. The results presented may be the original copy of the observations made but more often will be derived from the originals. There should also be a clear indication given where somebody else's results are involved, e.g. class results.

It is important to be aware that presenting just tables and/or figures is not sufficient. The Results section must include text that describes the data. A good way to approach this is to construct the Results section by writing text, and when appropriate, refer to the figures and tables. Ensure that the text "leads" the use of the figures and tables, and not the converse. An example of how to structure the results is:

"In order to determine the most efficient method for gene transfer, four procedures were examined. The most efficient method appeared to be the chemical transformation procedure

using rubidium chloride where levels as high as 8 x 10^8 transformants ug^{-1} were obtained (Table 1). In comparison, the calcium chloride procedure produced the least number of transformants (3 x 10^5 transformants ug^{-1})."

Ensure that the results describe precisely what was observed. This may not necessarily be what you expected to observe.

The length of the Results section will vary depending on the quantity of data that needs to be described.

Discussion: Do not combine the Results and Discussion section. In the Discussion section of your report, inferences and conclusions based on the results obtained, should be presented. While the Results section provided all the data from your experiments, the Discussion should highlight the important findings and package the information in a way that allows the reader to think about the data in a meaningful way. A good approach is to describe key results by referring to specific data (not simply saying "the results showed"), provide an interpretation of the results (even if the results are not what was expected), and then refer to what may have been expected and what has been described in the literature. It may also be appropriate to suggest ways of improving the experimental design, or suggesting additional experiments. After dealing with one set of important data, move on to another set of data. After covering all the relevant information, it is useful to include a brief (single paragraph) summary that overviews the main findings and "reminds" the reader of the key issues. This also helps to illustrate to the reader (your demonstrator) that you understand the main points.

The length of the Discussion should be about 1 ½ typed pages (standard A4 page, 2-3 cm margins, single spacing, 12 point Times New Roman font). Clearly the length will depend on the amount of data that needs to be discussed. Aim to have "sufficient" discussion, *i.e.* not too brief that too much is assumed, and not too long that the main points get lost.

References: Do not use footnotes. Record all literature cited in a complete, accurate and consistent manner. Examine a research paper (*e.g. J. Bacteriol.*) and adopt this style. Citations within the text should also follow a "journal" style. The easiest is to refer to references in the text as (March et al, 2002) and then record the references numerically and in alphabetical order in the reference section. Note that if the reference is "March, P. 2002. The life and times……", the citation is (March, 2002). If the reference is "March, P. and Takayama, K. 2002. My life as ……", the citation is (March and Takayama, 2002). If the reference includes more than two authors, the citation is (March et al, 2002).

General approach: Each report that is written, for undergraduate classes right through to Nobel prize winning reports, will require individual assessment of how to describe the data, and how to "tell the story". With experience your ability to write scientific stories will improve. Learn from previous reports and apply this knowledge to your next report. The word-processor facilitates story writing immensely, *i.e.* cutting and pasting to find the right overall structure. As a general guide I find that a report flows most easily if it is written in the following order: Heading, Results, Materials and Methods, Discussion, Introduction, References. The rationale for this is that the Results form the basis of the report and must be considered before the Discussion can be derived. Once this is complete it becomes clear what needs to be "introduced" in the Introduction so that the reader will have the right background to understand the Results and the Discussion.

Marks: A general guide to the awarding of marks is:

Heading	½
Abstract	½
Introduction	2
Materials and Methods	½
Results	3
Discussion	3
References	½

Reports that are submitted past the due date will be penalized **20% per day** unless valid special consideration is provided (see special consideration in ‘Administrative Matters’).

Administrative Information

Special consideration and further assessment

Students who believe that their performance, either during the session or in the end of session exams, may have been affected by illness or other circumstances may apply for special consideration. Applications can be made for compulsory class absences such as (laboratories and tutorials), in-session assessments tasks, and final examinations.

You must submit the application prior to the start of the relevant exam, or before a piece of assessment is due, except where illness or misadventure prevent you from doing so. If you become unwell on the day of the exam or fall sick during an exam, you must provide evidence dated within 24 hours of the exam, with your application.

UNSW has a fit to sit/submit rule which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so.

You must obtain and attach Third Party documentation before submitting the application. Failure to do so may result in the application being rejected.

Further information on special consideration can also be found at https://student.unsw.edu.au/specialconsideration.

If you experience a technical issue before or during an exam

- Take screenshots of as many of the following as possible:
    - error messages
    - screen not loading
    - timestamped speed tests
    - power outage maps
    - messages or information from your internet provider regarding the issues experienced

All screenshots must include the date and time the issue occurred.

- If the Course Coordinator or Tutor is present online during the assessment in chat, make contact immediately and advise them of the issue.
- Submit a Special Consideration application immediately at the conclusion of your assessment and upload your screenshots.

The fit to sit policy still applies to online examinations and if a student sits an exam they are declaring themselves well enough to do so. We understand that at times a student may become sick during an exam, if during an online exam a student feels unwell to the point that they cannot continue with the exam, they should take the following steps:

- Stop working on the exam and take note of the time
- If the Course Coordinator or Tutor is present online during the assessment in chat, make contact immediately and advise them that you are unwell
- Immediately submit a Special Consideration application saying that you felt ill during the exam and were unable to continue

- If you were able to advise your Course Coordinator or Tutor of your illness during the assessment, attach screenshots of this conversation to your Special Consideration application.

HOW TO APPLY FOR SPECIAL CONSIDERATION

The application must be made through Online Services in myUNSW (My Student Profile tab > My Student Services > Online Services > Special Consideration).

Students will be contacted via *their official university email* as to the outcome of their application.

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 and received Special Consideration approval. Mid-term supplementary exams will be held during the term as determined by the course convenor. Final supplementary exam will be run by The Exam Office during the supplementary exam period.

For Term 3 2020, Supplementary Exams will be scheduled between Monday 11 January – Friday 15 January, 2021.

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. Failure to sit for the appropriate exam may result in an overall failure for the course. Further assessment will NOT be offered on any alternative dates.

Academic integrity, referencing and plagiarism

There is no prescribed referencing style for this course; thus, students can choose a style they desire from an accepted journal in the field. However, the chosen style needs to be used consistently throughout an assignment.

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits**:** honesty, trust, fairness, respect, responsibility and courage.[1] At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

Further information about academic integrity and **plagiarism** can be located at:

- The *Current Students* site https://student.unsw.edu.au/plagiarism**,** and
- The *ELISE* training site https://subjectguides.library.unsw.edu.au/elise.

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

Continual course improvement

Periodically student evaluative feedback on the course is gathered, using among other means, UNSW's myExperience course survey. Student feedback is taken seriously, and continual improvements are made to the course based in part on such feedback. Significant changes to the course will be communicated to subsequent cohorts of students taking the course. Changes to the course for T3 2020 will be outlined in the "My Feedback Matters" section on moodle.

Equitable Learning Services

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to register with Equitable Learning Services (https://student.unsw.edu.au/els) and discuss their study needs with the course coordinator prior to, or at the commencement of, their course. 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.

Links to further resources at UNSW

Contact and administration

- The Current Students Gateway: https://student.unsw.edu.au/
- Biosciences Student Office*:* https://www.babs.unsw.edu.au/contact/biosciences-student-office
- School of Biotechnology and Biomolecular Sciences website for current students*:* https://www.babs.unsw.edu.au/current-students/undergraduate-programs
- MyUNSW: https://my.unsw.edu.au/
- UNSW Academic Calendar Key Dates: https://student.unsw.edu.au/dates
- UNSW IT Service Centre: https://www.myit.unsw.edu.au/services/students

Academic support

- Academic Skills Support: https://student.unsw.edu.au/skills
- Conduct and Integrity Unit: https://student.unsw.edu.au/conduct.
- Plagiarism: https://student.unsw.edu.au/plagiarism
- UNSW Learning Centre: http://www.lc.unsw.edu.au/
- Equitable Learning Services (ELS): https://student.unsw.edu.au/els

Student Life, Health and Wellbeing

- The Hub: https://student.unsw.edu.au/hub
- Student Wellbeing & Health: https://student.unsw.edu.au/wellbeing

- University Health Service: http://www.healthservices.unsw.edu.au/
- Student Counselling & Psychological Services (CAPS): https://student.unsw.edu.au/counselling
- UNSW Careers and Employment Service: http://www.careers.unsw.edu.au/
- ARC- Student Life: https://www.arc.unsw.edu.au/
- UNSW Student Life*:* https://www.unsw.edu.au/life