Unit Code 307698

Biotechnology 331

Unit Coordinator: Dr Keith Gregg

School of Biomedical Sciences

UNIT OUTLINE

Study Period 1 2011
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INTRODUCTION

Welcome to Biotechnology 331.

Biotechnology can be defined as the application of biological processes for the achievement of technical goals. This can be for the benefit of society as a whole, but can also form the basis for business and commercial developments. Increasingly, the use of biotechnology plays a role in industrial, environmental, and in social, medical, and commercial applications of science. It encompasses a wide range of scientific disciplines, in processes such as the development of pharmaceuticals, medical devices and diagnostic systems for human and animal health, development of new or improved technologies for medicine, agriculture, animal and plant breeding, pest control, biosecurity, forensic investigation, and in a wide variety of processing and manufacturing industries.

It is generally acknowledged that "modern biotechnology" developed through the advent of recombinant DNA methods (genetic manipulation) in the late 1970s. However, biotechnology uses many other areas of science, including the use of living organisms to achieve specific medical, industrial, or environmental goals, the production of enzymes and monoclonal antibodies, cell nuclear transfer, stem cell growth and differentiation, genomics, and proteomics.

Biotechnology has, until recently, been dominated by activity in the USA and Europe. More recently, major programs for biotechnology elsewhere in the world have added many other countries to the list. The nature of recent developments is an important part of understanding the global significance of biotechnology.

ESSENTIAL ADMINISTRATIVE INFORMATION

<table>
<thead>
<tr>
<th>Unit Title</th>
<th>Biotechnology 331</th>
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</thead>
<tbody>
<tr>
<td>Unit Description</td>
<td>This unit has the aim of providing a broad understanding of this rapidly growing area of science, how it is used in various industries, how scientific discoveries become the basis for and providing investigative and manipulative tools in ecology, conservation, medicine, agriculture, and productive systems in businesses and industries. When combined, this provides an understanding of the capabilities and importance of biotechnology for present and future societies.</td>
</tr>
<tr>
<td>Unit Study Package Number</td>
<td>307698</td>
</tr>
<tr>
<td>Unit Coordinator</td>
<td>Dr Keith Gregg</td>
</tr>
<tr>
<td>Teaching Area</td>
<td>Biotechnology and Molecular Biology</td>
</tr>
<tr>
<td>Credit Value</td>
<td>25</td>
</tr>
<tr>
<td>Mode(s) of study</td>
<td>Internal</td>
</tr>
<tr>
<td>Co-, Pre- and Anti-requisites</td>
<td>None</td>
</tr>
<tr>
<td>Additional requirements</td>
<td>None</td>
</tr>
<tr>
<td>Core Unit status</td>
<td>If you are taking this unit as a required (core) unit in your course of study, you may be terminated from your course of study if you fail this unit twice.</td>
</tr>
<tr>
<td>Result Type</td>
<td>Grade and Mark</td>
</tr>
<tr>
<td>Ancillary Fees and Charges</td>
<td>All fee information can be obtained through the Fees Centre. Visit <a href="http://www.fees.curtin.edu.au/index.cfm">http://www.fees.curtin.edu.au/index.cfm</a> for details.</td>
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</tbody>
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Unit Website
If this unit has a website you can access the unit materials via http://oasis.curtin.edu.au

Faculty or School Website
http://www.biomed.curtin.edu.au/

Tuition Pattern
Tutorials: Monday: 12 noon – 2 p.m. (incl. week 1)
Lectures: Wednesday: 2 p.m. – 4 p.m.
Teaching material available on FLECS Blackboard following lectures.

Study Requirements
Questions relating to lectures will be handed out at the lecture and students will be expected to answer those questions in the following tutorial. Exam questions will be related, but not identical, to tutorial questions

TEACHING STAFF
Lecturer contact details are:

<table>
<thead>
<tr>
<th>Lecturer and tutor:</th>
<th>Dr Keith Gregg</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-mail:</td>
<td><a href="mailto:K.Gregg@curtin.edu.au">K.Gregg@curtin.edu.au</a></td>
</tr>
<tr>
<td>Phone:</td>
<td>9266 7671</td>
</tr>
<tr>
<td>Fax:</td>
<td></td>
</tr>
<tr>
<td>Building:</td>
<td>308</td>
</tr>
<tr>
<td>Room:</td>
<td>226</td>
</tr>
<tr>
<td>Contact Hours:</td>
<td>9 a.m. – 5 p.m. Monday – Friday by appointment</td>
</tr>
</tbody>
</table>

Dr Gregg will assist you with your learning and any problems or difficulties you may experience while undertaking this unit. He will also mark your assignments and provide feedback in relation to your progress in this unit. As Unit Coordinator, Dr Gregg will also deal with administrative aspects of the Unit.

If you wish to leave a message or question for the lecturer, the preferred method is by email, allowing for a response time of up to 2 working days. Direct contact at the office by appointment is welcomed.

UNIT COORDINATOR
In this case, the unit coordinator is also the lecturer for the unit.

UNIT SYLLABUS
Exploration of the biotechnology industry, including traditional forms and recent developments in biotechnology. Examination of how biological processes can be harnessed to perform or supplement technical processes, including their role in developing renewable and sustainable systems for agriculture and industry. Overview of the contemporary biotechnology industry and applications of biopharmaceuticals, transgenics, genomics, proteomics, and monoclonal antibody technology, DNA and protein analysis as diagnostic tools, and rational drug design. Comparisons are made of the biotechnology industry in a selection of different countries.
Principles are studied for objective assessment of positive or negative claims and arguments about biotechnology or other areas of science, approaches to decision-making, and for the development of skills for writing clear and precise scientific and other formal documents.

**LEARNING OUTCOMES**

On successful completion of this unit you will be able to:

1. Evaluate and discuss biotechnology milestones in terms of their roles in the development of modern biotechnology
2. Distill the important information from documents, into a clear and concise summary.
3. Formulate intellectually honest arguments that support or question specific views on scientific topics.
4. Analyse the major factors in evaluation of biotechnological discoveries or developments as potential products and processes across the globe.
5. Argue the international safety, social and ethical issues in the biotechnology industry and products.
6. Collect, evaluate and collate information on biotechnology products to construct clear, concise reports for a scientific audience.

**LEARNING ACTIVITIES**

Lectures will present information that forms the starting point for self-motivated information gathering.

Tutorials will cover some specific topics, such as scientific writing, valid scientific argument and debating. They will also revise lecture material and the questions that are provided to stimulate thinking and learning about the lecture topics.

Assignments are designed to provide experience in gathering, collating, and presenting information from diverse sources and analysing contradictory arguments. Evaluation of information is an important part of report writing. Style of presentation and the techniques required for clear, concise scientific communication are also covered and assessed.

**STUDENT FEEDBACK**

For Semester 1 and Semester 2 eVALUate is open for student feedback in weeks 12-17.

For other study periods see [http://evaluate.curtin.edu.au/info/dates.cfm](http://evaluate.curtin.edu.au/info/dates.cfm)

We welcome and value your feedback as one very important way to keep improving this unit. Later this semester, you will be encouraged to give unit feedback through eVALUate, Curtin’s online student feedback system (see [http://evaluate.curtin.edu.au](http://evaluate.curtin.edu.au)).

**LEARNING RESOURCES**

Material relevant to the course will be provided as hard-copy at lectures and/or tutorials and in electronic form via FLECS Blackboard. Links to specific online information sources will be provided and general internet searches are encouraged as a way of broadening the range of sources and balancing opinions.
BECAUSE OF THE RAPIDLY DEVELOPING NATURE OF BIOTECHNOLOGY, THERE IS NO SET TEXT-BOOK FOR THIS SUBJECT.

Students are expected to seek the most recent information on each topic via the internet and scholarly databases, with emphasis on demonstrably valid sources of information.

(Hint: Wikipedia can be useful as a starting point for definitions, but is not regarded as a reliable source on which to base important written information, or decisions, because of the lack of regulation in editorial alterations)

A wide variety of online text books can be accessed for free at:


For current developments in biotechnology and its basic research, the journals Nature/Biotechnology and Trends in Biotechnology are recommended.

**Recommended Resources through the www:**

A web site covering technical and ethical aspects of biotechnology and molecular biology education can be found at www.actionbioscience.org

United States Biotechnology Industry Organisation http://www.bio.org

National Centre for Biotechnology Education (UK) http://www.ncbe.reading.ac.uk/menu.html

Biotechnology Education Centre (Biotech Australia) http://www.biotechnology.gov.au


National Health Museum (USA) http://www.accessexcellence.org/


Australian Stock Exchange http://www.asx.com.au

United States Food & Drug Administration (FDA) http://www.fda.gov

Australian Therapeutic Goods Administration (TGA) http://www.tga.gov.au

**Caution!**

Google searches can be extremely helpful, but be sure to establish the nature of any website on whose information you may rely.

Not all web-sites are what they seem to be. e.g. the “Vaccination Network” is in fact an anti-vaccination network which provides misleading and in some cases blatantly false information. You are expected to be able to tell the difference between valid sites and deceptive sites, and to establish which sites provide information based on correct interpretation of reliable scientific literature.
ASSESSMENT DETAILS

Assessment Summary
The assessment for this unit consists of the following items.

<table>
<thead>
<tr>
<th>Assessment Tasks</th>
<th>marks/100</th>
<th>Due</th>
<th>Unit Learning Outcome Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article Summary</td>
<td>15</td>
<td>Monday 21 March</td>
<td>2, 6.</td>
</tr>
<tr>
<td>Can DNA from transgenic foods get into the cells of people who eat the food? Is this an important concern?</td>
<td>30</td>
<td>Thursday 21 April</td>
<td>2, 3, 4, 6.</td>
</tr>
<tr>
<td>Final Examination</td>
<td>30</td>
<td>Examination period</td>
<td>1, 2, 3, 4, 5.</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
<td></td>
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</tbody>
</table>

All components of the continuous assessment must be completed satisfactorily.

Failure to pass any single component may result in a fail for the unit.

Assignment 1 – Article Summary

Worth: 15%

Due: 11:55 p.m. Monday 21 March
An article taken from a news source, dealing with a recent biotechnological development, will be provided. Students will summarise the article to the specified number of words, or less, in a style suitable for a scientific audience. This must ensure that all significant scientific facts are included in the summary, and that the final summary is clear and concise.

Assignment 1 Marking Criteria

1. Recognition and inclusion of important detail
2. Clarity of the final summary
3. Strict adherence to the required word-limit

More information on marking criteria will be provided with assignment details.
Assignment 2 – Opinion: Can DNA from transgenic foods get into the cells of people who eat the food? Is this an important concern?

Worth: 30%

Due: 11:55 p.m. Thursday 21st April
Students will collect and collate published information that involves arguments for and against the transfer of DNA from transgenic foods that are ingested and whether this is of concern. Analysis of the information should reveal the relative supportability of opposing arguments and the conclusions reached about specific types of argument.

Assignment 2 Marking Criteria

1. Matching corresponding negative and positive claims
2. Analysis of the data supporting positive or negative claims
3. Assessment of which arguments are best supported by data
4. Final conclusions and suggestions for an appropriate biotechnology industry response

More information on marking criteria will be provided with assignment details.

Assignment 3 – Interpretation and analysis of a published article.

Worth: 25%

Test will be conducted at the tutorial on 18th May 2011
Students will read the journal article provided and then answer a series of questions based on that article and, in some cases, on information about facts or methods obtained from other articles. Students will then address those same questions under closed-book test conditions. Discussion of the questions among students is encouraged, but answers must not show collusion by students or plagiarism of work from other sources.

Assignment 3 Marking Criteria may include:

1. Understanding of the topic involved
2. Understanding of the analytical systems used and what data they provide
3. Analysis of the stated outcomes of the research. Do the data show what the authors claim?
4. Evaluation of the methods used and possible alternative approaches.
5. Clarity and conciseness of answers.

More information on marking criteria will be provided with assignment details.

Referencing Style
Students should use the Chicago referencing style when preparing assignments. More information can be found on this style from the Library web site: http://library.curtin.edu.au/referencing/index.html

Guidelines for Submission:
All assignments should be submitted electronically through FLECS Blackboard.
Assignment Marking
Marking, release of results, and feedback on written assignments will be completed within 2 weeks of the submission date if possible.

Plagiarism Monitoring
All assignments in this unit will be monitored for plagiarism. For details on what constitutes plagiarism, students should consult the university definitions and policies on: http://academicintegrity.curtin.edu.au/studentbook.html, and should consult the booklet that can be downloaded from this site.

Understanding of this concept and policies at Curtin is vital to all students, because they may differ significantly from the policies of other educational institutions.

STUDENTS’ RIGHTS AND RESPONSIBILITIES

It is the responsibility of every student to be aware of all relevant legislation, policies and procedures relating to their rights and responsibilities as a student. These include:

- the Student Charter,
- the University’s Guiding Ethical Principles,
- the University’s policy and statements on plagiarism and academic integrity,
- copyright principles and responsibilities,
- the University’s policies on appropriate use of software and computer facilities,
- students’ responsibility to check enrolment,
- deadlines, appeals, and grievance resolution,
- student feedback,
- other policies and procedures
- electronic communication with students

See www.students.curtin.edu.au/administration/responsibilities.cfm for comprehensive information on all of the above.

ADDITIONAL INFORMATION

Telephone Contacts:
If you have a query relating to administrative matters such as:-

- requests for deferment of study
- difficulties with accessing online study materials
- obtaining assessment results

You may be able to contact your Unit Coordinator or the Faculty administrator on 9266 7671 or internally extension 7671

However, communication by e-mail is preferred and generally more successful because phone calls cannot be answered during meetings or during absence from the office.
Deferrals

Supplementary examinations are awarded only at the discretion of the Board of Examiners. The aim of a supplementary examination is to allow the student to correct minor problems/deficiencies in the initial assessment and not to gain extra study time or correct major problems. The number of supplementary examinations awarded will be kept to a minimum for any one examination period and for this course of study. Note: Supplementary examinations are not automatically awarded. The Board of Examiners will carefully review individual cases. No written application for supplementary examination will be considered.

Supplementary examinations, if awarded, will be indicated on the official Curtin examination result statement posted to all students. A list confirming details will also be placed on the official School Noticeboard. It is your responsibility to check. A student who does not sit for a scheduled supplementary examination has no claim to a further examination.

UNIT STUDY CALENDAR

Semester 1, 2011

<table>
<thead>
<tr>
<th>WEEK</th>
<th>START DATE</th>
<th>MODULE:</th>
<th>ASSIGNMENT</th>
<th>DUE DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>28 Feb</td>
<td><strong>Introduction to Biotechnology</strong> The nature of biotechnology and where it began. Overview of the unit, assessment criteria and tasks.</td>
<td>1. Summary of News Article</td>
<td>21 March</td>
</tr>
<tr>
<td>2.</td>
<td>7 Mar</td>
<td><strong>The global biotechnology industry</strong> Review of the main biotechnology sectors, and companies. A summary of the global picture.</td>
<td></td>
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<tr>
<td>3.</td>
<td>14 Mar</td>
<td><strong>Scientific debate: avoiding techniques of deception.</strong> Assessment of arguments about scientific topics, including biotechnology. How do you decide what to believe or disbelieve?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>21 Mar</td>
<td><strong>Applications of genetic engineering in the modern biotechnology industry. Cell therapeutics and gene therapy</strong> Bioprocesses, cell culture and recombinant proteins as therapeutics, transgenic animals and plants. Cellular medicine, embryonic and adult stem cells, gene therapy – the correction of gene defects associated with genetic diseases</td>
<td>Assignment 1 Due 2. Does DNA from transgenic foods get into the body cells of the consumer?</td>
<td>21 April</td>
</tr>
<tr>
<td>5.</td>
<td>28 March</td>
<td><strong>Medical and Pharmaceutical Biotechnology Drug Discovery &amp; Development.</strong> Overview of the major steps to take a drug from the research laboratory through to the market place. Target validation and drug development – genomics and proteomics, rational drug design.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week</td>
<td>Date</td>
<td>Topic</td>
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</tbody>
</table>
| 6.   | 4 April | **Application of RNA interference in medical biotechnology**  
Mechanisms of RNA interference, locked nucleic acids, peptide nucleic acids. |
| 7.   | 11 April | **Agricultural Biotech, Plants and Animals**  
Agricultural applications of biotechnology; crop and animal biotechnology. Uses of transgenic animals and plants (GMOs or genetically modified organisms) in agriculture. |
| 8.   | 18 April | **Diagnostic Biotechnology**  
Technologies used - immunoassays and DNA/RNA analysis technologies. Applications and technologies for quality control, genetic screening and selection. DNA and protein chips, genetic screening for cancer and other multifactorial diseases.  
Assignment 2  
Due 21 April  
3. Analysis of a published journal article  
Test 18 May |
| 9.   | 25 April | **CLASS-FREE WEEK** |
| 10.  | 2 May | **Diagnostic Biotechnology (continued)**  
| 11.  | 9 May | **Industrial and Environmental Applications**  
Can biotechnology provide solutions to the world’s reliance on non-renewable energies? Can biotechnology lead to cleaner, greener technologies? Industrial enzymes and biocatalysts, green plastics, environmental biotechnology |
| 12.  | 16 May | **Biological Weapons, Bioterrorism, and Biosecurity**  
The threat of biological weapons and how they may be counteracted. Emerging biological threats – Bird flu, SARS, Ebola etc. Does biotechnology have solutions to such threats?  
Assignment 3  
Test at the tutorial: 18 May |
| 13.  | 23 May | **Social and Ethical Issues of Biotechnology**  
Modern biotechnology has the potential to be of great benefit to humanity. But there are also serious ethical, moral, and social issues raised by the application of biotechnology. “Playing God” Discussion of the moral, social and ethical issues created by modern biotechnology. |
| 14.  | 30 May | **Study Week** |
| 15.  | 6 June | **Examinations** |
| 16.  | 13 June | **Examinations** |