Module Guide

Module handbook, schedule and coursework - select 'print book' to save as PDF!

Site: Moodle@Brookes
Course: U14587: Advances in Biotechnology (SEP-2017 to DEC-2017)
Moodle Book: Module Guide
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1. U14587 Biotechnology

Biotechnology encompasses the use of living organisms, cells or biological processes to produce commercial products such as drugs, enzymes or antibodies. What does it take to turn a basic biological process into a commercially viable product? We will study the different ‘building blocks’ of biotechnology, which include molecular and cell biology, genome editing, microbiology, plant science, recombinant protein production and vaccines. You will address a real-world challenge using principles of synthetic biology and drawing upon primary, current literature. Throughout the course, we will discuss commercial and business aspects of biotechnology, as well as ethical issues and public perception of emerging technologies. You will also gain experience in science communication by giving a short ‘TED-Style’ talk, and curating a professional biotechnology Twitter group account.

2. Changes to module handbook in response to module review

2017:

The module name and description changed in order to make it more clear to students what 'biotechnology' was about. Assignment briefs changed slightly, and the lab practicals were replaced with bioinformatics practicals, to support progression from Year 2 to Year 3.

2016:

The module was reviewed after its first run in the academic year 2015/16. In response to student feedback, the following changes were made to the module guide:

1) The module description in Chapter 1 was expanded to emphasise the focus on learning how to think and communicate innovatively, and the opportunities offered within the syllabus to practice these skills.

2) To engage students with the assessment criteria for the presentation assignment, and to encourage them to produce a draft at an early stage in the semester, a session focusing on formative peer assessment of presentation outlines in Week 5 was introduced.

3) Section 7.2 was modified to include the specific assessment criterium: 'Your talk should be aimed at a broader audience with understanding of biology, but no specialist knowledge in your topic area'.

3. Contact information and schedule

Module leader

Dr Anne Osterrieder

Email: a.osterrieder@brookes.ac.uk

Tel: x3700

Room: GIP - Sinclair Annex SNAG.01

Office hours:

Tuesdays 10-12 pm

Wednesdays 1-2 pm.

You can also chat with me on Google Hangout during these times, or email me to arrange a different appointment.

Module tutors and teaching assistants

Name	Role	Contact details (@brookes.ac.uk)	Office hours
Dr Anne Osterrieder	Module leader /Lecturer	a.osterrieder	Mon 4-5 Thur 12-1 SNAG.01
Prof Chris Hawes	Co-teacher	chawes	
Dr Verena Kriechbaumer	Co-teacher	p0075096	
Dr Tudor Georgescu	Co-teacher	tgeorgescu	
Dr Dave Gervais	Guest lecturer	dave.gervais@portonbiopharma.com	

Lecture and practical schedule

Lectures provide the minimum, essential information that you will need to understand the basic concepts and ideas underlying the subjects studied within this module. The lectures will provide a platform from which you can progress, working independently, to advance your knowledge and understanding of key research topics. The module has several key sections: Microbial biotechnology, plant biotechnology, recombinant proteins and protein expression systems, medical biotechnology, synthetic biology

and genome editing, and biotechnology business, careers and entrepreneurship.

Within each you will explore specific topics with directed reading so that you gain in-depth knowledge. As an honours level module, there is a difference in the structure and emphasis of teaching methods compared to the basic and advanced modules you have studied previously. Students are expected to do a larger proportion of the learning process independently, and tutors are here to support, advise, facilitate and direct your learning. Through directed, essentially independent learning, you will have the opportunity to practice honours level skills that are in fact akin to professional skills, and will be in demand during your future career. These include:

- Information retrieval using databases of scientific research literature, online journals and libraries.
- The development of faculties of critical evaluation, logical thinking and synthesis of scientific data and ideas.
- Executing complex experimental procedures then analysing, interpreting and presenting results and the available scientific literature.
- Curate a professional, public social media account.

You will be asked to complete a module evaluation toward to the end of the semester and will be told when and how to complete this. This is a key component of the module and helps us to improve the module in the future. We also welcome specific feedback after each teaching session.

Week (date)	Day / time	Room	Title	Staff
1 (25 Sept)	Mon / 13:00	CLC2.07	Introduction to module and coursework; introduction to Biotechnology; formation of Twitter groups.	AO
2 (2 Oct)	Mon / 13.00	CLC2.07	Protein production and therapeutic proteins. Synthetic biology.	AO
3 (9 Oct)	Mon / 13.00	CLCG.10	Synthetic biology - Practical 1	AO
4 (16 Oct)	Mon / 13:00	CLC2.07	Microbial biotechnology. Genome editing.	AO,
5 (23 Oct)	Mon / 13:00	CLCG.10	Synthetic biology - Practical 2	AO
6 (30 Oct)	Mon / 13:00	CLC2.07	Medical biotechnology and gene therapy. Guest lecture (Tudor Georgescu): Bioethics and eugenics	AO TG
7 (6 Nov)	Mon / 13:00	CLC1.05	Mini Symposium: Emerging topics in biotechnology (assessed)	AO
8 (13 Nov)	Mon / 13:00	CLC2.07	Guest lectures TBC (Alex Batchelor, Orbit)	AO,
9 (20 Nov)	Mon / 13:00	CLC2.07	Biotechnology business, careers and entrepreneurship	AO, VK
10 (27 Nov)	Mon / 13:00	CLC2.07	Guest lecture (Chris Hawes): Plant biotechnology. Guest lecture (Dave Gervais).	CH, DG
11 (4 Dec)	Mon / 13:00	CLC2.07	Exam revision lecture and Biotech Bakeoff/Cheese-eating.	AO

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4. Study time expectations and assessment weightings

Study times are given as a guideline - you will need to devote more private study time to those areas that you find most challenging. The aim of this table is to illustrate that for a single module you are expected to study for a total ~150 hours, and that your reading and revision should be in every week of the module not limited to the run to the exam period.

Module component	Contact time (hrs)	Expected private study time (hrs)	Total study time (hrs)	Weighting (%)
Scientific report	6 (two practicals)	24 (research, planning, figure and table preparation, writing)	30	20
Oral presentation	3 (mini symposium)	20 (research and reading, preparation and practice of a 5-minute talk)	23	15
Twitter account	2 (discussion in lectures)	20 (online Twitter tutorials; researching and curating resources related to course content; online group work incl. social media strategy development and evaluation; equivalent to an average of 2 hours per week over 9 weeks)	22	15
Exam	30 (lectures incl. revision, field trip)	45 (research and reading to support lecture preparation and revision; equivalent to an average of 4 hours per week over 11 weeks).	75	50
		Total	150	

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5. Coursework learning outcomes

On successful completion of this module, students will be able to:	Brookes Attribute developed	Other GAs developed
1. Understand and explain key advanced concepts concepts of biotechnology and its various applications. applications.	Academic literacy	Research literacy
2. Discuss the use of genetic tools to modify living organisms and cellular processes for biotechnological applications.	Academic literacy	Research literacy
3. Appreciate some of the ethical concerns and public perception of biotechnology,	Personal critical self awareness	Academic literacy Active citizenship
4. Apply scientific knowledge and innovative thinking to address a real-world challenge.	Research literacy	Academic literacy
5. Produce a scientific report, outlining experimental design, applications, challenges and business aspects of a novel product.	Academic literacy	Research literacy
6. Present key points of complex biotechnology concepts to non-experts.	Academic literacy	Active citizenship
7. Create and curate a professional scientific online presence.	Digital and IT literacy	Personal critical self awareness Academic literacy, Research literacy Active citizenship

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6. Coursework schedule and deadlines

Coursework schedule

This module follows the principles of the University's Assessment Compact, developed in conjunction with the Student Union, to ensure good practice and transparency in assessment and feedback processes, see: http://www.brookes.ac.uk/aske/BrookesACompact/.

Coursework	Learning outcomes assessed	Deadlines and marking
Scientific report	• *Apply scientific knowledge and innovative thinking to address a real-world challenge.* • *Produce a scientific report, outlining experimental design, applications, challenges and business aspects of a novel product.*	This assignment is split into two parts. Part 1(10%): To be submitted electronically via Turnitin by Week 3, Tuesday 23.55 pm. Feedback and mark returned electronically by module leader within two weeks. Part 2 (10%): To be submitted electronically via Turnitin by Week 6, Tuesday 23.55 pm. Feedback and mark returned electronically by module leader within two weeks.
Oral presentation	• *Understand and explain key concepts of biotechnology and its various applications.* • *Appreciate some of the ethical concerns and public perception of biotechnology.* • *Present key points of complex biotechnology concepts to non-experts.*	To be presented in mini symposium in Week 7. Peer feedback and peer marking; final mark awarded by module leader.
Twitter group work	• *Appreciate some of the ethical concerns and public perception of biotechnology.* • *Present key points of complex biotechnology concepts to non-experts.* • *Create and curate a professional scientific online presence.*	Formative feedback given by module leader by email in Week 4. Submission of individual Twitter portfolio by email/Google Drive to module leader by Week 9, Tuesday 23.55 pm. Peer marking and feedback of group Twitter accounts; final mark awarded by module leader.

7. Coursework assessment criteria

In this section you will find the specific assessment criteria for each piece of coursework.

To see the University's general assessment criteria, please follow this link: https://moodle.brookes.ac.uk/mod/equella/view.php?id=284266.

7.1. CW1: Twitter biotechnology feed

Assignment Title

Twitter biotechnology feed

Assignment Aim

To curate a professional Twitter feed highlighting current and emerging topics in biotechnology.

Learning Outcomes Assessed

- *Understand and explain key advanced concepts of biotechnology and its various applications.*
- *Discuss the use of genetic tools to develop transgenic plants and animals for research and biotechnological applications.*
- *Appreciate some of the ethical concerns and public perception of genetic technologies and applications, and engage in discussion about these issues.*
- *Create and curate a professional Twitter account and critically evaluate its impact on themselves and their audiences.*
- *Learn independently or as part of a group, work collaboratively offline and online, and share ideas and resources.*

Assignment Task/Brief and Assessment Criteria

In a small group, you will create and curate a professional biotechnology-themed 'Twitter' account. This will give you experience in communicating science, and will create a group-sourced repository of resources covering current biotechnology topics, helping you with your reading. Most of this activity will take place online, with feedback emailed to each group in Week 4. There will be a briefing session in Week 1, and peer assessment and marking will take place in Week 9.

You will:

- Collaboratively develop a sustainable social media posting strategy and schedule. You will be able to do this during the lecture slot on Mondays, to make it easier for groups to meet.
- Identify, explain and critically evaluate high-quality resources such as science news articles, primary or review science papers, explanatory websites, engaging videos, or other media. Your content should draw upon the topics discussed in the lectures, and increasingly connect topics and themes from different weeks.
- Run a creative campaign for Biology Week (7-15 October 2017) to engage non-experts with biotechnology.
- Your tweets should have a short explanation or commentary - do not just copy and paste a URL and its title. You can use Twitter's 'thread' function to expand the character limit (you can thread your tweets by replying to your own tweets).
- Engage with the other module Twitter accounts and other Twitter users through re-tweets and replies.
- Evaluate your account's impact and reach using Twitter's analysis function and specialist websites.

Your final mark will consist of two components:

1) An electronic portfolio of all of your individual tweets in a Word document, submitted electronically for anonymous marking via TurnitIn by Tuesday Week 9, 23.55 pm. This will be graded by the module leader and have a weight of 50% for your final coursework mark.

2) Anonymous peer assessment of your group Twitter account (deadline for feedback emailed to module leader is Tuesday Week 9, 23.55 pm). Each group will assess the other groups using a marking pro forma. The module leader will calculate the average peer mark, which has a weight of 50% for your final coursework mark.

Specific assessment criteria and grade bands can be found here:

2017 U14587 General peer assessment criteria_microblogging.docx

Peer marking pro forma (for group account):

https://moodle.brookes.ac.uk/pluginfile.php/1339802/mod_resource/content/1/2017%20U14587%20Twitter%20peer%20assessment%20pro%20forma.docx

Individual portfolio marking pro forma:

https://moodle.brookes.ac.uk/pluginfile.php/1339800/mod_resource/content/1/2017%20U14587%20Twitter%20individual%20marking%20pro%20forma.docx

Submission Weighting : 15%.

Submission Method: Electronic submission of individual tweets for anonymous marking via email to module leader, by Tuesday Week 10 23.55 pm. Peer assessment of groups, pro formas emailed to module leader by Tuesday Week 10, 23.55 pm.

Return Method: Marks and collected feedback will be distributed electronically by the module leader.

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7.2. CW2 and CW3: Scientific report

Assignment Title

Scientific report (Practical 1 and 2)

Assignment Aim

To prepare a scientific report on the design and in silico assembly of a synthetic biosensor plasmid.

Learning Outcomes Assessed

- Apply scientific knowledge and innovative thinking to address a real-world challenge.
- Produce a scientific report, outlining experimental design, applications, challenges and business aspects of a novel product.

Assignment Task/Brief and Assessment Criteria

You will address a real-world challenge using principles of synthetic biology and drawing upon primary, current literature. For this, you will design a synthetic plasmid *in silico* using bioinformatics and the standard 'BioBricks' components (available at http://iGEM.org), and outline possible applications and challenges of your plasmid in a wider context.

The course includes two practicals. In the first practical, you will learn how to navigate the iGEM Standard Biological Parts repository through a number of exercises. In the second practical, you will assemble your own synthetic plasmid and produce a plasmid map. n.

The scientific report (2500 words) will be split into two assignments: The first assignment (< 1000 words), carrying 10%, will be a short literature review of existing iGEM projects and their underlying scientific concepts, at the end of which you will outline your idea for your own synthetic plasmid. Only the literature review part will be marked, and formative feedback will be given on the introduction, as well as on your idea and design process. In the second part of the assignment, worth 10%, you will describe your final plasmid including the scientific rationale and design process, and will provide a general discussion.

Scientific report - CW2 and CW3

This assignment consists of two parts, CW2 and CW3. CW2 will form the introduction for your final report (CW3, 2500 words in total). Therefore, the maximum word count for the first part of the scientific report is 1000 words (CW2). This will leave you 1500 words to describe the implementation, methods, results and discussion of your idea in Practical 2 (CW3). Your submissions will be marked in Turnitin, and you will receive your feedback and your two grades electronically. Each grade counts as 10% of your final module mark, giving the whole scientific report a weighting of 20%.

CW2 assignment details and weightings

- Maximum word count for this assignment 1: 1000 words (10% leeway).
- Presentation (10%): Headings and subheadings, figures and diagrams, grammar/spelling/punctuation.
- Writing style (20%): Logical structure, easy to follow, clear and concise, scientific.

- Content (60%): Synthesis of sources. Overview over synthetic biology and examples of biosensors (from the iGEM website or from scientific journal articles). Examples are explained clearly and correctly. Explanation of the relevant iGEM case studies.
- References (10%): Sources are appropriate, reliable and of high quality. Formatting of in-text citations and reference list in Brookes Harvard style.
- Aims and objectives (not marked, 250-300 words): Proposal for your own biosensor, outlining the literature that informed your design, and your rationale for this particular design.

CW3 assignment details and weightings

- Maximum word count for this assignment 1: 1500 words not including introduction, 2500 words in total (10% leeway).
- Introduction - re-use, but will not be marked again.
- Presentation (10%): Headings and subheadings, figures and diagrams, grammar/spelling/punctuation.
- Aims and objectives, rationale - (10%): Aims of the practical, objectives, rationale of the biosensor identified, including concise explanation of the science.
- Content (60%):
  - Aims and objectives: Proposal for your own biosensor, outlining the literature that informed your design, and your rationale for this particular design.
  - Methods: Description and referencing of all software used. Table with all components, accession numbers.
  - Results: Diagram explaining the structure of the plasmid. Plasmid map created in Benchling.
  - Discussion: Discuss advantages and disadvantages, benefits and challenges of your biosensor, e.g. virtual versus real-life functionality, cost and business implications, biosafety, ethics, etc.
- References (10%): Sources are appropriate, reliable and of high quality. Formatting of in-text citations and reference list in Brookes Harvard style.

Submission Weighting : 20% (2x 10%)

Submission Method: Electronically via Turnitin.

Return Method: Marks and feedback will be distributed electronically by the module leader via Turnitin.

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7.3. CW4: Oral presentation

Assignment Title

Oral presentation

Assignment Aim

To contribute to a mini symposium through holding a short oral presentation on an emerging topic in biotechnology.

Learning Outcomes Assessed

- *Understand and explain key advanced concepts of biotechnology and its various applications.*
- *Discuss the use of genetic tools to develop transgenic plants and animals for research and biotechnological applications.*
- *Appreciate some of the ethical concerns and public perception of genetic technologies and applications, and engage in discussion about these issues.*
- *Research, review and synthesise the specialist literature for presentation.*

Assignment Task/Brief and Assessment Criteria

You will produce a short talk on a current topic in biotechnology, selected from the list of presentation topics available on Moodle.

- Your talk should be aimed at a broader audience with understanding of biology, but no specialist knowledge in your topic area
- Your talk should not be longer than five minutes.
- You should use Google Slides/Keynote/Power Point to prepare your slides - but avoid cramming your slides with text and bullet points.
- Your talk needs to show a clear structure, providing an introduction or context, a middle part, and a critical evaluation and conclusion.
- Your argumentation should be evidence-based and make use of a range of different sources, which should be referenced on the bottom of each slide where they occur.
- Your grammar, spelling and slide layout should be without errors and clearly legible.
- Your presentation style should be professional and engaging.

Your presentation will be marked by academic staff and your peers, and your final grade will be a combination of both, with a weighting of 80% academic staff/20% average peer mark.

Specific assessment criteria for grade bands can be found here:
Oral presentation - assessment criteriaFile

Peer marking pro-forma:
https://moodle.brookes.ac.uk/mod/resource/view.php?id=837173

Academic staff marking pro forma:
https://moodle.brookes.ac.uk/mod/resource/view.php?id=837174

Presentation topics

1. **Biotechnology and sustainability**
2. **Biotechnology applications in space travel.**
3. **New model organisms in biotechnology**
4. **Synthetic cell biology**
5. **Future directions for genome editing**
6. **Current biotechnology advances in the food industry**
7. **Biotechnology vs ageing.**

Submission Weighting : 15%.

Submission Method: Talk will be delivered in the mini symposium in Week 7 and assessed by peers and academic staff.

Return Method: Marks and feedback will be distributed electronically by the module leader.

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8. Exam

You should base your learning for the exam on the core text book 'Introduction to Biotechnology' by Thieman and Palladino, as this forms the framework for the lectures.

All of the lectures and practicals have been designed to provide additional information to the book content, as they contain current examples, applications and issues, and also cross-link topics with each other. Any other reading that you do on your own beyond these core materials will help to broaden your horizon, expand your thinking, and help you to demonstrate that you have engaged with the course.

Detailed information about slides are available either in the relevant chapter of the core text book, or on the websites linked to at the bottom of each slide. Putting together your own annotations is a very useful exercise in practising to explain concepts in written form.

Exam format:

The exam will have two sections.

You will need to answer **all** short questions from Section A (requiring a short paragraph), worth 30 marks.

You will need to pick **only one** question from Section B. Answer the question in essay format, worth 50 marks.

The exam will be two hours long, and you will not require a calculator.

The exam is worth 50% of your total mark.

8.1. Old exam questions

Examination Questions 2016

Section A

A1. Why is it important to add trypsin to a fibroblast cell culture before it is passaged (subcultured)? What happens if cells are incubated in trypsin too long? **6 marks**

A2. What is chymosin, where was it originally produced, how is it produced now, and what is it used for? **6 marks**

A3. Name three advantages and three disadvantages of continuous culture fermentation, compared to batch culture fermentation. **6 marks**

A4. Describe how the influenza vaccine has been produced traditionally, and outline two alternative methods. Include the name of the processes and which products are harvested for downstream vaccine production. **6 marks**

A5. Explain the main principle of *ex situ* soil clean-up, and give two examples. **6 marks**

Section B

B1. You are asked to peer review a research proposal. The authors are planning to produce a therapeutic human antibody in tobacco plants as a pilot study, with the long-term aim to carry out clinical trials. Outline the key points that the authors need to address to complete their project successfully.

B2. Provide a critical overview of the past, present and future of gene therapy, taking into account clinical examples, and critically evaluate challenges associated with the different approaches.

B3. Explain the molecular mechanisms of CRISPR/Cas9-mediated genome editing, and its advantages over other genome editing techniques. Illustrate its potential impact using two examples of recent applications, and discuss the ethical and societal implications of this new technology.

B4. Explain the biological causes of cystic fibrosis. Describe which treatments are available to patients now, and discuss which technologies might be available for treatment in the future, taking into account commercial and ethical considerations.

Examination Questions 2015

Section A

Answer **all** questions (30 marks). The answers require a short paragraph.

A1. Why is it important to add trypsin to a fibroblast cell culture before it is passaged (subcultured)? What happens if cells are incubated in trypsin too long? **5 marks**

A2. Name three advantages and three disadvantages of continuous culture fermentation, compared to batch culture fermentation. **6 marks**

A3. Describe how the influenza vaccine has been produced traditionally, and outline two alternative methods. Include the name of the processes and which products are harvested for downstream vaccine production. **6 marks**

A4. What is the difference between first-generation and second-generation biofuels, and why would second-generation biofuels be preferable? **6 marks**

A5. Explain what SNPs are, and how they can be used to diagnose human genetic disease conditions. Name one example for a genetic disease that can be identified through SNP analysis. **7 marks**

Section B

Answer **one** question (70 marks).

B1. In your undergraduate project, you cloned a mutated version of chymosin. Your preliminary data indicate that your version might be more efficient than the current commercially available protein. You would like to apply for funding for a two-year study, to optimise the protein production process in the first year and carry out enzyme tests in the second year. What do you need to know about the protein properties of chymosin before writing your proposal? Based on this information, make a recommendation about the best protein expression system to use for chymosin expression.

B2. Provide a critical overview of the past, present and future of butanol production, taking into account examples of traditional and modern production methods, as well as environmental and societal issues.

B3. Describe in clear and concise terms how CRISPR/Cas9-mediated genome editing works. Illustrate its potential impact using examples of applications, and discuss the ethical and societal implications of this new technology.

B4. You are asked to peer review a research proposal. The authors are planning to produce a therapeutic human antibody in tobacco plants as a pilot study, with the long-term aim to carry out clinical trials. Outline the key points that the authors need to address to complete their project successfully.

8.2. Revision questions

This page lists some examples for possible exam questions, some of which have been asked in previous years, others which have been taken from the accompanying biotechnology course text books.

Examples of relevant text book questions

1. Explain how prokaryotic cell structure differs from eukaryotic cell structure by describing at least three structural differences. Provide specific examples of how prokaryotic cells have served important roles in biotechnology.
2. Describe how yeasts differ from bacteria and describe the role(s) of yeast in at least two important biotechnology applications.
3. If organisms produce proteins on their own, why should companies be allowed to patent proteins?
4. Discuss the four major ways in which vaccines can be made to fight a virus or bacterium, and describe how each vaccine works.
5. How can information gained form studying microbial genomes be used in microbial biotechnology? Provide three examples.
6. Name three therapeutic recombinant proteins produced in bacteria and explain what they are used for.
7. Describe three specific examples of a bioremediation application. Include in your description the organisms likely to be involved in the process, and discuss potential advantages and disadvantages of each application.
8. What is regenerative medicine? Describe potential ways in which tissue engineering may be used to treat disease.

Examples of previous exam questions

1. Outline a strategy taken to use genetic manipulation for crop improvement. Illustrate your answer with specific examples.
2. How can we utilise plants for the production of high value non-food products?
3. Critically evaluate the potential for genetic technologies to cure human diseases. In your answer you should discuss different methods for correcting genetic conditions and compare their advantages, limitations and safety issues.
4. Discuss the development and application of Bt insecticides highlighting the relative merits of topical versus genetically modified plants delivery.
5. Discuss the current approaches used for biofuel generation and, giving reasons, which area would you recommend developing for the long term energy strategy of the UK.
6. How would you transform a plant to produce a commercially viable protein-based pharmaceutical such as a vaccine or antibody? Discuss the potential for such drugs for the treatment of common infectious diseases.
7. Using specific examples discuss whether you agree with this statement. "Biotechnology will provide a cure for most genetic disorders diseases within the next two decades".

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9. Study skills and resources

Specific reading for each topic area can be found in the Aspire reading list (left column). You will be expected to read these sources and make use of the material in your exam answers.

Study skill resources

http://www.brookes.ac.uk/services/upgrade/study-skills/time-management.html

http://www.brookes.ac.uk/services/upgrade/study-skills/research-finding.html

http://www.brookes.ac.uk/services/upgrade/study-skills/report-writing.html

http://www.brookes.ac.uk/services/upgrade/study-skills/referencing.html

http://www.brookes.ac.uk/services/upgrade/study-skills/revision.html

http://www.brookes.ac.uk/services/upgrade/study-skills/exams.html

Tutorials can be booked with the Upgrade service using the following email upgrade@brookes.ac.uk

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10. Practicals

Synthetic biology practicals will run in Week 3 and Week 5, in the main module slot on Monday afternoon from 1-4 pm, in a pooled computer room. These will only involve computer work.

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