25 School of Biosciences

BI827		Advanced Drug Design				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	30 (15)	100% Coursework	

Contact Hours

The module comprises of a number of practical workshops and seminars to introduce the key concepts and practical techniques for each of the disciplines covered in the drug design module. The workshops will be aligned with a two week practical to design, express, purify, characterise a target protein in a suitable format for biophysical screening and characterisation in a drug screening process. The workshops and seminars will be complemented by a series of lectures to introduce the fundamental knowledge that underpins the techniques covered. There will be a number of guest lectures from industrialists skilled in the areas and with a broad knowledge of the multidisciplinary nature of drug design. Additionally there are planned visits to an industrial site. Students will also be expected to present a review of a relevant recent paper at a Journal club and write a short review of their findings. Additionally there will be a theoretical group task to design discover a novel approach and design a discovery program to a disease.

Seminars and workshops (including preparation time) (40 h)
Laboratory practical and write up (40 h)
Lectures (including guest lectures) (40 h)
Industrial Site visits (15 h)
Journal Club (preparation and write up) (15 h)
Self Study (150 h)

Learning Outcomes

The intended subject specific learning outcomes and, as appropriate, their relationship to programme learning outcomes:
a. Knowledge and understanding of drug discovery and design including the techniques used in identifying and elaborating new molecular entities for therapeutic intervention.
b. Practical experience of discovery programme design and a selection of approaches utilised
c. Experimental design and analysis

The intended generic learning outcomes:
a. Communication; the ability to organise information clearly and present both orally and in a written format for a variety of audiences including both academic and industrial scientists.
b. Analytical Skills – processing, interpretation and critical analysis of information from literature and databases and experimental data sources. An ability to choose appropriate data and experimental design to test and validate hypotheses.
c. Self-motivation and independence. Time and Workload management to meet targets (including experimental) and deadlines.
d. Information technology. Understanding and utilisation of technology to search, retrieve and process data and scientific information.

Method of Assessment

In-class test (one problem and one essay) (40 %)
Practical and write up (40%)
Journal Club presentation and write up (20%)

Preliminary Reading

The reading list will focus mainly on the latest scientific literature including primary research articles. This will be used to exemplify taught course components through case study based approaches. Students will be provided with the majority of this reading material although in some cases retrieving additional material from journals will form the basis assignments. Key Journals for the course will be Journal of Medicinal Chemistry and Bioinorganic Medicinal Chemistry Letters, together with Nature Drug Discovery and Drug Discovery Today for review articles. Many standard biochemistry and Chemistry textbooks available within the library will also cover many elements of the course material.

Pre-requisites

Synopsis *

The module will consider the key aspects of drug design providing an overview of the drug discovery process and more in depth analysis and experience of early stage drug discovery focusing on therapeutic target identification and analysis, with consideration of mode of intervention. The course will cover the development screening approaches with an emphasis on small molecule hit identification and validation with practical experience of the approaches used in lead optimisation. It will also provide an insight into molecular pharmacology, safety and concepts of formulation considerations. The module will be delivered through seminars, workshops by specialists in the techniques utilised by the pharmaceutical and biotech industry, including external specialists. It will include case studies and a practical involving screening design and in-silico follow up of hit matter.

BI830		Science at Work				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn	M	30 (15)	100% Coursework	Lloyd Prof D

Contact Hours

Kent-based and external speakers will give seminars followed by discussion/group work using material provided in advance (3 hours per week). The total number of study hours expected of students will be 300, with 36 hours contact time, and the remainder self-study time during and outside of the academic term.

Learning Outcomes

The intended subject specific learning outcomes:
a. An understanding and critical appreciation of the principles of public engagement
b. Knowledge of current theoretical perspectives on how to communicate science to the public
c. An understanding of the impact of science upon a range of professional disciplines
d. An insight into how different professions deal with complex scientific information and disseminate this information to their clients and audiences
e. Recognition of career opportunities within science communication
f. A knowledge and understanding of the social, political and economic impact of science

The intended generic learning outcomes:
g. Through the use of primary texts as well as secondary sources, students will be able to marshal information effectively
h. Through seminar discussion and lectures they will be encouraged to develop a critical, analytic perspective on such information
i. Through encountering new critical perspectives on science, students will develop independence of thought
j. Seminar work, including presentations, will improve students' grasp of communication and working with others
k. To be able to evaluate critically and communicate effectively in a number of the following formats
l. Students will enhance their proficiency with regard to improving their own learning and performance

Method of Assessment

The module will be 100% coursework assessed.
Marks for this module will comprise written assessments stimulated by seminar discussions and associated work. This will be in the form of essays (2 x 2,000 words, 25% each).
50% of the mark will comprise a blog (approximately 4,000 words) relating to the on the impact of science on a specific scientific or professional discipline.

Preliminary Reading

J. Gregory, S. Miller, Science in Public: Communication, Culture and Credibility, (Perseus, US,2000)
S. Allan, Media, Risk and Science (OUP,2002)
Engaging Science: Thoughts, deeds, analysis and action (Wellcome, 2006)

Pre-requisites

While taking this module you must take HI866 - Science and Medicine in Context

Synopsis *

Science has a profound influence on professional practice in the private and public sector. This module considers the ways in which different professions interact with science and scientists, and how this influences the work they do. Their interaction with the public will also be discussed. A series of speakers with diverse professional backgrounds (education, industry, government, policy making, the law, the media) will describe their work, the role of science in the profession, and the way in which science influences their actions and interactions with the public and other professions. This will relate to scientific content in a range of scientific contexts, including cancer, reproductive medicine, biotechnology and healthcare. This will be illustrated by case studies presenting challenges and dilemmas concerning the communication of science in the context of different professions and their target audiences.

BI835		Science Communication and Society Project				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	60 (30)	100% Project	

Contact Hours

Students will meet with their supervisors to discuss their work in progress.

They can expect a total of up to 4 hours' one-to-one contact with their supervisor in the course of preparing their work during the summer term. Meetings with a supervisor are guaranteed within term-time; over the summer vacation meetings are at the supervisor's discretion. By this time students are expected to have prepared themselves adequately to complete their dissertation without further assistance.

Students are expected to put in a total of 600 hours' work in the preparation of their project.
The dissertation should be 12,000 words long.

Learning Outcomes

The intended subject specific learning outcomes:
a. They will have improved their appreciation of the social and cultural mechanisms that shape the production of scientific knowledge
b. They will understand the role of communicational media in propagating and shaping scientific knowledge
c. An appreciation of how research leads to knowledge
d. Students will gain in-depth knowledge of a chosen episode in the history of science from the scientific revolution to the present
e. They will understand key methods in the history of science
f. Students will have an in-depth understanding of an advanced research topic
g. Develop ability to simplify complex scientific information for a non-scientific audience

The intended generic learning outcomes:
h. Through the use of primary texts as well as secondary sources, students will be able to marshal information effectively
i. They will develop a critical, analytic perspective on such information
j. Through encountering new critical perspectives on science, students will develop independence of thought
k. The dissertation will improve students' communication
l. Students will enhance their proficiency with regard to improving their own learning and performance

Method of Assessment

For dissertation projects:
The module will be 100% assessed on the basis of the written dissertation. Students are expected to include research on both primary and secondary sources. They are expected to engage with scholarship and critical debates connected with their chosen field of study.

For practical projects:
20% of the mark will be awarded for a research dissertation on the topic, to be agreed after discussion with the student and academic supervisor (10,000 words).
10% of the mark will be for a written document outlining the aims of the project, needs of the audience, and how these needs will be matched by the proposed activities (5,000 words).
50% of the mark will be for the science communication package developed. The mark will include the research undertaken on the audience, appropriateness of the material for the audience, depth of science and presentation.
20% of the mark will be awarded for evaluation strategy and the interpretation of evaluation data (5,000 words plus appendices).

Preliminary Reading

Each student's reading list will be unique, based upon their chosen area of research. They will discuss possible readings with their chosen supervisor. The supervisor will make some suggestions but it is part of the research brief that students should generate their own bibliographies.

Pre-requisites

Whilst taking this module you must take HI866 - Science and Medicine in Context, and BI830 Science@work

Synopsis *

For dissertation projects:
Following discussion with their supervisors, students will generate their own title for a dissertation. Preparation of the dissertation is described below.

For practical projects:
This extended project will be particularly suited to students who have entered the programme with a first degree in the sciences. The project will involve the development of an extensive "package", using appropriate media to communicate scientific principles, which can subsequently be used by appropriate non-specialist audiences. As part of the project, students must research their chosen audience to ascertain their needs in terms of communicating science. The project must be informed by a period of in-depth research on the scientific topic and preparation of a dissertation. Having developed a suitable package of activities, students will then develop evaluation methods to monitor their project work, and apply these methods to evaluate effectiveness. Interpretation of evaluation data will be undertaken during the final stages of the project.

BI836		Practical and Applied Research Skills for Advanced Biologists				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn	M	30 (15)	100% Coursework	Moore Dr S
2	Canterbury	Autumn	M	30 (15)	100% Coursework with Pass/Fail Elements	Moore Dr S

Contact Hours

Seminars, including preparation time (50 h)
Laboratory workshops (30 h)
Online Workshops (20 h)
Preparation of lab report (30 h)

Peer Review Assignment (20 h)
Self study (150 h)

Learning Outcomes

The intended subject specific learning outcomes:
a. Knowledge and understanding of key principles in molecular biology
b. Practical experience of modern molecular biology and its application to solve research problems
c. Experimental design within a biological research context
d. Interpretation of biological data
e. Organisation and presentation of experimental data

The intended generic learning outcomes:
a. Communication: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences
b. Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others
c. Team work: the ability to work both independently and as part of a research group using peer support, diplomacy and collective responsibility
d. Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines
e. Information technology: use of appropriate technology to retrieve, analyse and present scientific information

Method of Assessment

A. Assessments associated with online workshops (Pass/Fail at 70% pass mark; multiple attempts permitted until pass mark is achieved)
B. Peer Review Assignment (40% of module mark)
C. Lab report (4,000 words) (60% of module mark)

Preliminary Reading

The reading list will be research articles, which will be used to drive a case-study based approach to learning. Students will be provided with their own copies of this reading material, but in some cases they will be set tasks for receiving appropriate journal articles to which we already have access.

Synopsis *

The module aims to develop understanding and practical skills in molecular biology, based around interactive workshops, practical sessions and group work . The module will involve practical sessions covering key practical and transferable skills in molecular biology and biotechnology. These will be accompanied by interactive workshops and classes that review the theory of these techniques, and will use case studies to illustrate their impact and importance in both academic and industrial settings. Students will learn skills in experimental design using appropriate case studies that will embed them within the relevant research literature. They will also gain experience of analysis and statistical interpretation of complex experimental data.

BI837		The Molecular and Cellular Basis of Cancer				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	15 (7.5)	50% Coursework, 50% Exam	Garrett Prof M

Contact Hours

Lectures and seminars (27 h)
Seminar preparation (54 h)
Self study (69 h)

Learning Outcomes

The intended subject specific learning outcomes:
Knowledge and understanding of:
a. The molecular changes that lead to the development of specific cancers
b. The changes in cellular and tissue pathology in specific cancers
c. The global incidence of different type of cancer, their clinical manifestations and the risk factors in their development and treatment
d. Practical methods for distinguishing malignant and healthy tissue

The intended generic learning outcomes:
a. Communication: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences
b. Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others
c. Reflection: make use of constructive informal feedback from staff and peers and assess own progress to enhance performance and personal skills
d. Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines
e. Information technology: use of appropriate technology to retrieve, analyse and present scientific information

Method of Assessment

Examination (50%)
Written essay-style assessment on the molecular and cellular biology of cancer (50%)

Preliminary Reading

"The Biology of Cancer", Robert A. Weinberg, Garland Press (2006), will be the key text for this course; it will also be a primer for other Spring term modules. The book will be supplemented with reviews and original articles which will be provided for students or for which we have journal access thought the Templeman Library.

Synopsis *

This module will introduce the key mechanisms, processes and factors that underpin cancer development, including oncogenes, tumour suppressor genes, growth factor signalling and angiogenesis. It will review the different types of cancer and their global incidence, comparing this with environmental and cultural risk factors. Inherited predisposition will be covered within the context of specific cancers, and the clinical and pathological manifestation of specific tumours will be explored in lectures and in the practical class associated with the module.

BI838		Genomic Stability and Cancer				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	15 (7.5)	50% Coursework, 50% Exam	Lloyd Prof D

Contact Hours

Lecture and seminars (27h)
Seminar preparation (48 h)
Self study (75 h)

Learning Outcomes

The intended subject specific learning outcomes:
Knowledge and understanding of:
a. Endogenous and exogenous sources of DNA damage and their relationship with cancer incidence
b. Key mechanisms involved in maintaining genomic integrity
c. The relevance of the biological response to DNA damage to disease incidence and therapy
d. Biological investigation of DNA damage and its repair

The intended generic learning outcomes:
a. Communication: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences
b. Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others
c. Reflection: make use of constructive informal feedback from staff and peers and assess own progress to enhance performance and personal skills
d. Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines
e. Information technology: use of appropriate technology to retrieve, analyse and present scientific information

Method of Assessment

Examination (50%)
Critical analysis of research literature (50%)

Preliminary Reading

Significant coverage of DNA damage and response mechanisms are covered in standard cell biology textbooks that are already housed in the Templeman library. These will provide a useful initial primer to the module, but more depth will be developed by consideration of specific journal articles and reviews. These will be available by our existing subscription to cancer-specific research journals, e.g. Cancer Research, Oncogene, etc. Students will be provided with their own copies of this reading material, but in some cases they will be set tasks for receiving appropriate journal articles to which we already have access.

Synopsis *

This module introduces and develops knowledge in the key area of genome maintenance. Students will learn how loss of genomic integrity leads to enhanced cancer incidence, and how biological processes and the environment contribute to genetic instability. The cellular mechanisms that lead to cancer incidence, together with those that protect cells from the onset of carcinogenic processes will be reviewed. This module will also examine the use of DNA damaging agents in cancer therapies, and incorporate practical experience of investigating the cellular responses to DNA damage.

BI840		Cancer Therapeutics: From the Laboratory to the Clinic				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
3	Canterbury	Spring	M	15 (7.5)	100% Coursework	Garrett Prof M

Contact Hours

Lectures and seminars (27 h)
Seminar preparation (57 h)
Self study (66 h)

Learning Outcomes

The intended subject specific learning outcomes. On successfully completing the module students will be able to:
1. Understand and critically evaluate current clinical management of cancer
2. Demonstrate a critical appreciation of stages of pharmaceutical development in harnessing laboratory-based research through pre-clinical and in vivo evaluation and clinical trials
3. Understand the industrial and regulatory processes that lead to the licensing of therapeutic drugs
4. Demonstrate knowledge and understanding of the development of specific therapeutic agents and the complex processes that determine progression from the bench to the clinic, for instance small chemical entities and antibody conjugates
5. Demonstrate cutting edge understanding and knowledge ofthe complexity of personalisation of medicine in the "omics" era.

The intended generic learning outcomes. On successfully completing the module students will be able to:
1. Communication: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences
2. Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others
3. Reflection: make use of constructive informal feedback from staff and peers and assess own progress to enhance performance and personal skills
4. Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines
5. Information technology: use of appropriate technology to retrieve, analyse and present scientific information

Method of Assessment

Written essay critically evaluating translational research data and clinical management pathways (1,000 words) (50%)
Mock report for the Medical Health Research Agency or National Institute for Clinical Excellence (2,000 words) (50%)

Preliminary Reading

Standard Pharmacology texts, (e.g. Rang, Dale and Ritter, Pharmacology, 6th Edition) are already stocked in the Templeman Library, and these will provide a sufficient primer for this module. Further reading material will be provided by specific journal articles which will be used to propose a case study-driven approach and will take into account published data from laboratory-based and clinical studies. The Templeman Library already have access to the key journals that will allow this study approach.

Synopsis *

This module provides students with critical perspectives upon current and emerging cancer therapies, how they are developed, and how they are applied in the clinical setting. The harnessing of scientific knowledge in the treatment of disease requires a complex series of highly regulated studies that must be performed under highly-regulated legal and ethical frameworks. This module reviews the transition from promising cancer therapy to fully realised therapeutic agent, using specific therapies as examples. It will also discuss the emerging potential for personalised medicine based on patient-specific molecular biomarkers.

BI841		The Science of Reproductive Medicine				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	30 (15)	100% Coursework	Griffin Prof D

Contact Hours

Each week there will be three contact hours contact time, consisting of lectures, seminars and discussion group work. The total number of study hours for this module will be 300, with the remaining time reserved for self study to include reading, critical analysis of relevant material, preparations for seminar and group work and assessment.

Learning Outcomes

The intended subject specific learning outcomes. At the end of the module, students should be able to display:
a. A broad knowledge and understanding of the scientific basis of reproductive medicine as outlined in the course content
b. The ability to synthesise and present their knowledge and understanding as a reasoned, coherent piece of work
c. The ability to search, synthesise and evaluate the scientific literature pertaining to reproductive medicine
d. The ability to analyse and apply unfamiliar data sets and apply the knowledge gained in unfamiliar situations

The intended generic learning outcomes. At the end of the module, students should be able to display:
a. An ability to search primary texts as well as secondary sources and marshal information effectively
b. A critical, analytical perspective on the scientific literature
c. Some independence of thought and originality in the presentation of a scientific document
d. The ability to reference the scientific literature properly and present a bibliography in a means consistent with a scientific document
e. The ability to present a range of scientific media (graphs, tables, figures, video, large datasets etc.) in an appropriate fashion
f. The ability to give a competent scientific presentation

Method of Assessment

The module will be 100% coursework assessed.
30% of this mark will come from an extended essay. Students will be required to write a short dissertation on a subject agreed by themselves and the course team of up to 5,000 words.
20% of the mark will be assessment of a 15 minute scientific PowerPoint presentation presented in the style of a conference talk on the area on which the essay was based.
50% of the mark will come from ongoing assessment set by individual lecturers at the end of their teaching period.

Preliminary Reading

Speroff L, Glass RH, Kase NG. Clinical Gynecologic Endocrinology and Infertility. Williams and Wilkins, Baltimore MD,

Shah K, Sivapalan G, Gibbons N, Tempest H, Griffin DK (2003) The genetic basis of infertility. Reproduction 126: 13-25.

Semen analysis: a new manual and its application to the understanding of semen and its pathology. Asian Journal of Andrology 12, 11-13 (January 2010)

Existing Templeman Library research journal provision will be used for this module, with occasional Document Delivery service.

Synopsis *

The practice of reproductive medicine is underpinned by a scientific basis stretching back hundreds of years. New discoveries are being put into medical practice on a regular basis and reproductive medicine research is well known for its translational element. This module will explore the fundamentals of reproductive medicine, Obstetrics, Gynaecology, Urology, Andrology, Managing abnormal pregnancies and pre-term birth, Infectious diseases affecting reproduction, Sex determination, reproductive endocrinology, cancer and fertility, causes of infertility and Genetics. This module will be science-based, informed and led by the scientific and medical literature and modern discoveries. Specifically:

• What is reproductive medicine? (Darren Griffin)
• Obstetrics, Gynaecology and Urology (Michael Summers)
• The science of Andrology (Sheryl Homa)
• Managing abnormal pregnancy and premature birth (Vimal Vasu)
• Infectious disease and reproductive medicine (Gary Robinson)
• Sex determination (Peter Goodfellow)
• Endocrinology and Reproduction (Michael Sumners)
• Cancer and Reproduction (Bill Gullick/ Dan Lloyd)
• The causes of infertility (Darren Griffin)
• Infertility and Genetics (Darren Griffin)
• Genetics and Pregnancy (Darren Griffin)

BI842		The IVF World				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	15 (7.5)	100% Coursework	Griffin Prof D
2	Canterbury	Spring	M	15 (7.5)	100% Coursework	Griffin Prof D

Contact Hours

In the first instance there will be three contact hours per week, consisting of lectures, seminars and discussion group work (total 12 hours over 4 weeks). The remainder of the course will then be a week long practical "taster of IVF hands-on course" (40 hours) held in the bioscience teaching labs. The total number of study hours for this module will be 150, with the remaining time reserved for self study to include reading, critical analysis of relevant material, preparations for seminar and group work and assessment.

Learning Outcomes

At the end of the module, students should be able to display:
a. A broad knowledge and understanding of clinical and scientific aspects of IVF treatment as outlined in the course content
b. The ability to search, synthesise and evaluate the scientific and medical literature pertaining to IVF
c. The ability to analyse and evaluate unfamiliar scenarios and apply the knowledge gained in unfamiliar situations
d. Competent practical skills similar to those practised by a clinical embryologist, (albeit using model organisms)
e. The ability present their skills as a well-presented laboratory notebook

The intended generic learning outcomes. At the end of the module, students should be able to display:
a. An ability to search primary texts as well as secondary sources and marshal information effectively
b. A critical, analytical perspective of the medical literature
c. Some independence of thought and originality in the presentation of a scientific document
d. The ability to reference the scientific and medical literature properly and present a bibliography in a means consistent with a scientific document
e. The ability to present a range of media (graphs, tables, figures, video, large datasets etc.) in an appropriate fashion
f. The ability to give a competent scientific presentation

Method of Assessment

The module will be 100% coursework assessed.
30% of this mark will come from in course assessment of the students' practical competences
70% of the mark will be assessment the quality of the laboratory report book and reflective log including attention to detail of the "patient" material.

Preliminary Reading

A Textbook of In Vitro Fertilization and Assisted Reproduction: The Bourn Hall Guide to Clinical and Laboratory Practice: Includes Bourn Hall Protocols on CD-ROM, Third Edition. Peter R. Brinsden Informa Healthcare; 3 edition (August 12, 2005)

Synopsis *

Around 1-2% of all babies in the UK are born by IVF, with varying figures in many other countries. Internationally, reproductive medicine generally, and IVF in particular, is an area in which the UK is world-leading. This module will explore the many aspects of practical IVF (including ICSI, and PGD) and the factors that affect it. A feature of the module will be the presentation of similar issues from different perspectives e.g. that of the clinician, the counsellor and the laboratory manager.

A career as a scientist in reproductive medicine (e.g. clinical embryologist) is a popular path. Although the proposed module does not aim to address the specific goal of training prospective clinical embryologists in how to perform their operational tasks (such training is provided in-house in a highly regulated clinical environment and leads to a vocational qualification), this module will give students a realistic expectation of the likelihood of them excelling in, and enjoying this popular career path. This module will thus explore the basics of lab technique and good practice, pipette making, egg collection and in-vitro maturation, sperm assessment, insemination, ICSI, embryo grading, assisted hatching, spreading and preimplantation diagnosis. For obvious reasons embryos from non-human model species (e.g. mouse, bovine, pig) will be used. Specifically:

• Referral categories for IVF (Laurence Shaw)
• The IVF laboratory (Alan Thornhill)
• IVF and ICSI (Alan Thornhill)
• Preimplantation Diagnosis and Screening
• Careers in reproductive medicine (Darren Griffin, Alan Thornhill)
• Practical course (Darren Griffin, Alan Thornhill)

BI845		MSc Project				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
3	Canterbury	Whole Year	M	60 (30)	100% Project	Ellis Dr P

Contact Hours

The students will be supervised by a member of academic staff who, in liaison with other group members, will offer day-to-day supervision, advice on project progression and technical guidance. Students will be working full time in the laboratory for approximately 14 weeks; this time will involve a combination of laboratory work, reading and preparing the scientific report, and poster.

Learning Outcomes

a. How to design a project based around specific research questions and hypotheses
b. How appropriate technologies may be applied/adapted to address specific research questions and hypotheses
c. How to design and execute experiments to address specific research questions and hypotheses
d. How to record experimental procedures and data appropriately using good laboratory practice
e. How to write research articles in an appropriate, concise, informative and lucid style in keeping with high impact factor scientific journals

Method of Assessment

Poster for research symposium (takes place mid-August, 20%)
6,000-word Project report (submitted early September, 80 %)
NB. A pass mark in the report is also a requirement for the successful completion of this module.

Preliminary Reading

Existing Templeman Library research journal provision will be sufficient for this module, with occasional Document Delivery service.

Synopsis *

Students will undertake an independent research project that will be designed by the student, in consultation with an academic supervisor, to address specific research questions. Students will be trained in key techniques relating to the project, and will work independently under the supervisor's guidance to design and execute experiments that will address the questions formulated earlier. The students will spend approximately 14 weeks in the laboratory and with then write up their findings in the style of a scientific report for publication in a high impact factor scientific journal. They will present a poster and an oral presentation in research symposia arranged by the School.

BI851	Advanced Molecular Processing for Biotechnologists and Bioengineers					
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	30 (15)	100% Coursework	Smales Prof M

Contact Hours

The module will comprise a number of practical workshops and seminars to introduce key concepts and practical techniques in each of the disciplines to be covered (drug discovery and design, systems biology and synthetic biology, gene expression and the engineering of cells to modulate cellular processes, the mechanics of cells from an engineering perspective, industrial biotechnology (specifically biofuels and small molecule systems biology), protein and vaccine based drugs, regenerative medicine and bionanomaterials). These workshops will be aligned with two laboratory practicals, including one engineering mammalian cells and a synthetic biology approach in bacteria to generate microcompartments. These will be complemented by a series of 2 h classroom-based discussions/workshops/lectures that will address in further each of the areas mentioned above. Students will also be expected to present in Journal club style a recent (last 12 months) review paper on the area of their choosing. Following this they will be required to write a minireview of the area in the style of Nature Biotechnology itself taking a particular angle or position on the field. The students will also be set a group work task whereby they will be required to use their knowledge and expertise obtained during the module to design a theoretical novel approach/system that addresses an area of research in industrial biotechnology and present this in a poster and seminar format.

Seminars, and workshops including preparation time (40 h)
Laboratory practicals and write up (40 h)
Preparation of minireview (30 h)
Preparation for journal club (15 h)
Preparation and delivery of group work (25 h)
Self study (150 h)

Learning Outcomes

The intended subject specific learning outcomes:
a. An overview of knowledge and understanding of key drivers and principles in drug design, systems biology, synthetic biology, bioenergy, cell engineering, bionanomaterials and protein/vaccine based drugs and their application to industrial biotechnology and bioengineering
b. Practical experience of modern cell engineering and synthetic biology approaches
c. Experimental design within a biotechnological and bioengineering research context

The intended generic learning outcomes:
a. Communication: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences including academic and industrial
b. Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others
c. Team work: the ability to work both independently and as part of a research group using peer support, diplomacy and collective responsibility
d. Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines
e. Information technology: use of appropriate technology to retrieve, analyse and present scientific information
f. Scientific writing: ability to interpret and critique the findings of others and collectively develop an opinion in an area, communicating this via the presentation of theories and ideas in a review format

Method of Assessment

Practicals and writeup (10% each = total 20%)
Presentation for journal club (20%)
Minireview (7,500 words) (40%)
Group work (20%)

Preliminary Reading

The reading list will largely be the latest review and primary research articles in this area, which will be used to drive a case-study based approach to learning. Students will be provided with their own copies of this reading material, but in some cases they will be set tasks for receiving appropriate journal articles to which we already have access. Two key Journals will be Nature Biotechnology and Biotechnology and Bioengineering. Many basic biochemistry text books within the Library also cover much of the material which will be delivered.

Synopsis *

This module will consider key areas of biotechnology and bioengineering including an introduction to drug discovery and design, systems biology and synthetic biology, gene expression and the engineering of cells to modulate cellular processes, the mechanics of cells from an engineering perspective, industrial biotechnology (specifically biofuels and small molecule systems biology), protein and vaccine based drugs, regenerative medicine and bionanomaterials. This will be delivered through workshops and seminars by specialists within the CMP and involve a number of course work assignments that will consider the most current research and thinking in these areas. This will be complemented by two three day practical's, one on mammalian cell engineering and the other on synthetic biology.

BI852 Advanced Analytical and Emerging Technologies for Biotechnology and Bio

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	30 (15)	100% Coursework	Masterton Dr R

Contact Hours

The module will comprise a number of practical workshops and seminars to introduce the key concepts and practical techniques in each of the disciplines to be covered. These workshops will be aligned with a one week laboratory practical, whereby the students are required to design their own analytical process and procedure to purify and characterise a protein from a mammalian cell culture and then use the subsequent material to setup a crystallisation trial. The workshops and seminars will be complemented by a series of lectures that will introduce the key fundamental knowledge that underpins the different analytical techniques. We will also have several guest lectures from industrialists working in analytics to show how the various technologies are integrated into the commercial environment. The learning will be reinforced by visits to the industrial sites to see the technologies in action.

Seminars, and workshops including preparation time (40 h)
Lectures (15 h)
Laboratory practical and write up (50 h)
Industrial site visits and preparation (20 h)
Industrial guest lectures, discussions and preparation (25 h)
Self study (150 h)

Learning Outcomes

The intended subject specific learning outcomes:
a. Knowledge and understanding of key analytical technologies used in the analysis of cell based expression systems in the biotechnology and bioengineering field
b. Practical experience of modern analytical technologies utilised in academia and industry in the field
c. A fundamental understanding of the principles underlying spectroscopic, chromatographic, sequencing, microscopy and physical methods of analysis
d. Basic skills in the interpretation of data from analytical analysis of products and samples
e. Ability to design appropriate analytical experiments to answer questions to be addressed
f. An appreciation of the importance of analysis for quality assurance, process monitoring and fundamental understanding of biological systems

The intended generic learning outcomes:
a. Communication: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences including academic and industrial
b. Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others. An appreciation of how to utilise multiple data sets together to characterise a system or molecule.
c. Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines
e. Information technology: use of appropriate technology to retrieve, analyse and present scientific information

Method of Assessment

Practicals 60%
In class tests 40%

In detail:
Practical 1 on mass spectrometry, CD and fluorescence and write up (20%)
Practical 2 on protein recovery, purification and purification and write up (20%)
Design an analytical approach to purification and characterisation of a monoclonal antibody presentation (20%)
In class test (one problem question, 20%)
In class test (one essay, 20%)

Preliminary Reading

The reading list will largely be the latest review and primary research articles in this area, which will be used to drive a case-study based approach to learning. Students will be provided with their own copies of this reading material, but in some cases they will be set tasks for receiving appropriate journal articles to which we already have access. Key Journals will be Nature Biotechnology, Analytical Chemistry, Analytical Biochemistry, Biotechnology and Bioengineering, and Genetic Engineering News to which the students can subscribe free of charge. Many basic biochemistry and chemistry text books within the Library also cover much of the material which will be delivered.

Synopsis *

This module will consider key areas of analytical technologies used for the analysis of proteins, small molecules and cells. This will include mass spectrometry techniques (GC-MS, ESI-MS, MALDI-ToF MS), crystallography and NMR, spectroscopy (UV-vis, IR, Raman, fluorescence, ESR), chromatography, DNA and RNA sequencing, bioinformatics, microscopy (AFM, EM), electrophoresis, (qRT)-PCR, 'omics' approachs, glycosylation profiling, cell based assays, simple fermentation control and measurements. Industrial case studies will be covered to demonstrate how different techniques and approaches are integrated in a commercial environment. Students will also be expected to design and implement a protocol aim at recovering and characterising a protein molecule from mammalian cell culture within set constraints and parameters. There will also be a visit to an industrial analytical laboratory to demonstrate such technologies in the work place. This will be delivered through workshops and seminars by specialists within the CMP and involve a number of course work assignments that will consider the most current research and thinking in these areas. This will be complemented by a one week practical where the students are asked to design a process to purify and characterise a molecule and then use this to setup a crystallisation screen.

BI853		Bacterial Pathogens				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
3	Canterbury	Spring	M	15 (7.5)	60% Coursework, 40% Exam	Shepherd Dr M

Contact Hours

Total contact hours: 28
Private study hours: 122
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes.
On successfully completing the module students will have:
• A systematic understanding of and a critical awareness of current problems and/or new insights related to bacterial pathogens.
(Programme outcomes A1, A2, A3)
• A comprehensive understanding of techniques applicable to bacterial pathogen research.
(B1, B2, C1)
• An understanding how our current knowledge impacts upon future research to combat the spread of bacterial infections. (Programme outcomes A4, A5)
• An ability to critically evaluate current research in the field of bacterial pathogens and to evaluate methodologies/research findings and develop critiques of them.
(Programme outcomes B2, C5)

The intended generic learning outcomes.
On successfully completing the module students will have:
• Communication skills: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences.
(Programme outcome D1)
• Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others.
(Programme outcome B2)
• Team work skills: the ability to work both independently and as part of a research group using peer support, diplomacy and collective responsibility.
(Programme outcome D4)
• Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines.
(Programme outcome D3)
• Information technology skills: use of appropriate technology to retrieve, analyse and present scientific information. (Programme outcome B3)

Method of Assessment

Main assessment methods
Assignment – computer workshop (30%)
Assignment - presentation (30%)
Exam - 2h (40%)

Reassessment methods
Reassessment Instrument: 100% coursework.

Preliminary Reading

The reading list will be research articles, which will be used to drive a case-study based approach to learning. Students will be provided with their own copies of this reading material, but in some cases they will be set tasks for receiving appropriate journal articles to which we already have access.

Synopsis *

The module aims to develop an in depth understanding of bacterial pathogens, based around lectures and interactive workshops. Key topics include Gram-negative pathogens (e.g. E. coli, Pseudomonas), Gram-positive pathogens (e.g. Staphylococcus aureus, Bacillus anthracis, Mycobacterium tuberculosis), current and emerging virulence traits (e.g. adhesion, invasiveness, enhanced spread, toxin production, antimicrobial drug resistance). The module will involve a rotation of seminars covering key theoretical concepts, mechanistic insights into host:pathogen interactions, and discussion of practical approaches to combat the spread of bacterial infections. These will be accompanied by interactive workshops wherein students will analyse, present and discuss the relevant research literature. In addition, a computer workshop will provide bioinformatics training for the analysis of genomic traits pertaining to bacterial virulence. The students will gain experience in scientific design, literature analysis, scientific communication and the analysis and interpretation of complex experimental data.

BI854 Fungi as Human Pathogens

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	15 (7.5)	60% Coursework, 40% Exam	Hall Dr B

Contact Hours

Contact hours 28:
Seminars/discussion sessions (8x3h).
Journal club presentations (1 h).
Laboratory workshop: (3h).

Self-study (122):
Preparation for seminars/workshops (50 hours),
Laboratory workshop (12 hours)
Presentation (15 hours)
Revision and exam preparation (45 hours)

Learning Outcomes

The intended subject specific learning outcomes:
1. a systematic understanding of and a critical awareness of current problems and/or new insights related to fungal pathogens
2. a comprehensive understanding of techniques applicable to fungal pathogen research
3. understanding how our current knowledge impacts upon future research to combat the spread of fungal infections
4. an ability to critically evaluate current research in the field of fungal pathogens and to evaluate methodologies/research findings and develop critiques of them

The intended generic learning outcomes:
1. Communication: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences
2. Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others
3. Team work: the ability to work both independently and as part of a research group using peer support, diplomacy and collective responsibility
4. Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines
5. Information technology: use of appropriate technology to retrieve, analyse and present scientific information

Method of Assessment

Article evaluation worksheets (short worksheets to be used for preparation of weekly in-class discussions) 10%.
Oral presentation (journal club-style presentation) 25%.
Examination (2 x 1h essays): 40%.
Laboratory workshop. Group and individual work to investigate the modes of anti-fungal drug action: 25%.

Preliminary Reading

The reading list will be research articles, which will be used to drive a case-study based approach to learning. Students will be provided with their own copies of this reading material, but in some cases they will be set tasks for receiving appropriate journal articles to which we already have access.

Synopsis *

The module aims to develop an in depth understanding of fungal pathogens, based around lectures and interactive workshops. Key topics include severe, recurrent and chronic fungal diseases (such as cryptococcal meningitis, candidiasis and chronic pulmonary aspergillosis).and molecular mechanisms underlying resistance to anti-fungal drugs. The module will involve a rotation of seminars covering key theoretical concepts, mechanistic insights into host:pathogen interactions, and discussion of practical approaches to combat the spread of fungal infections. These will be accompanied by interactive workshops wherein students will analyse, present and discuss the relevant research literature. The students will gain experience in scientific design, literature analysis, scientific communication and the analysis and interpretation of complex experimental data.

BI855		Advances in Parasitology				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	15 (7.5)	60% Coursework, 40% Exam	Tsaousis Dr A

Contact Hours

Contact hours: 28 hours
Seminars/discussion sessions: 8 x 3 hours
Journal club presentations: 1 hours
Laboratory training session: 3 hours

Self-study: 122 hours
Preparation for seminars/workshops: 50 hours
Laboratory workshop: 12 hours
Presentation: 15 hours
Revision and exam preparation: 45 hours

Learning Outcomes

The intended subject specific learning outcomes:
1. A systematic understanding of and a critical awareness of current problems and/or new insights related to eukaryotic pathogens
2. A comprehensive understanding of techniques applicable to research involving parasites
3. An understanding how our current knowledge impacts upon future research to combat the spread of parasitic infections
4. An ability to critically evaluate current research in the field of parasitology and to evaluate methodologies/research findings and develop critiques of them

The intended generic learning outcomes
1. Communication: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences
2. Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others
3. Teamwork: the ability to work both independently and as part of a research group using peer support, diplomacy and collective responsibility
4. Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines
5. Information technology: use of appropriate technology to retrieve, analyse and present scientific information
6. Practical skills: use of appropriate tools and laboratory techniques to retrieve scientific information

Method of Assessment

Article evaluation worksheets (short worksheets to be used for preparation of weekly in-class discussions) 10%.
Oral presentation (journal club-style presentation) 25%.
Laboratory workshop. Group and individual work to investigate potential parasitic infections using microscopy and molecular biology techniques: 25%.
Examination (2 x 1h essays): 40%.

Preliminary Reading

The reading list will be research articles, which will be used to drive a case-study based approach to learning. Students will be provided with their own copies of this reading material, but in some cases they will be set tasks for receiving appropriate journal articles to which we already have access.

Synopsis *

The module aims to develop an in depth understanding of eukaryotic pathogens, based around lectures and interactive workshops. Key topics include: Introduction to parasitology (parasitism as a strategy), Evolution and taxonomy of parasitic protozoa, Cell structures and functions, Molecular biology of parasitic protozoa, The unique biochemistry of parasitic protozoa, Apicomplexa (Plasmodium, Toxoplasma, Babesia, Cryptosporidium), Parasitic Excavates (Trypanosoma, Leishmania, Naegleria, Trichomonas), Overview of medically important helminths, Host-parasite-vector immune interactions. The module will involve a rotation of seminars covering key theoretical concepts, mechanistic insights into host: pathogen interactions, and discussion of practical approaches to combat the spread of parasitic infections. These will be accompanied by interactive workshops wherein students will analyse, present and discuss the relevant research literature. In addition, a laboratory workshop will provide training for the identification of medically important parasites using microscopy and molecular biology techniques. The students will gain experience in scientific design, literature analysis, scientific communication and the analysis and interpretation of complex experimental data.

BI856 Viral Pathogens

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	15 (7.5)	100% Coursework	Moores Dr AA

Contact Hours

Total contact hours: 28
Private study hours: 122
Total study hours: 150

Learning Outcomes

The intended subject specific learning outcomes:
1. Knowledge and understanding of key principles in virology
2. Understanding of modern virology and its application to solve research problems
3. Experimental design within a biological research context
4. Interpretation of biological data
5. Organisation and presentation of experimental data

The intended generic learning outcomes
1. Communication: ability to organise information clearly, present information in oral and written form, adapt presentation for different audiences
2. Analytical skills: interpretation of data, marshalling of information from published sources, critical evaluation of own research and that of others
3. Team work: the ability to work both independently and as part of a research group using peer support, diplomacy and collective responsibility
4. Self-motivation and independence: time and workload management in order to meet personal targets and imposed deadlines
5. Information technology: use of appropriate technology to retrieve, analyse and present scientific information

Method of Assessment

Assessment method:
Written assessment (News & Views Article) (60%)
Presentation (40%)

Reassessment method:
100% coursework

Preliminary Reading

The reading list will be research articles, which will be used to drive a case-study based approach to learning. Students will be provided with their own copies of this reading material, but in some cases they will be set tasks for receiving appropriate journal articles to which we already have access.

Synopsis *

The module aims to develop understanding and analytical skills in virology, based around seminars and interactive workshops. The initial stages of the module will involve an intensive rotation of seminars covering key practical and transferable skills in virology and molecular biology. These will be accompanied by interactive workshops wherein students will analyse, present and discuss the relevant research literature. The students will gain experience in scientific design, literature analysis, scientific communication and the analysis and statistical interpretation of complex experimental data.