

Programmatic Review of the Faculty of Engineering and Science 2017

Phase 2: Programme Review

PROGRAMME PANEL REPORT

SCHOOL: School of Science
DEPARTMENT: Department of Biological Sciences
DATE: March 28th – 29th 2017

PROGRAMMES SUBMITTED FOR REVIEW

Major Awards

Higher Certificate in Applied Biosciences (Embedded Award)
Bachelor of Science in Applied Biosciences and Biotechnology
Bachelor of Science (Honours) in Pharmaceutical Biotechnology

Non-Major Awards

None

PROGRAMME REVIEW PANEL MEMBERSHIP

Dr. John MacSharry, Deputy Director of Graduate Entry Medicine, UCC
Dr. Brendan O Connor, Senior Lecturer in Biochemistry, DCU
Dr. Barbara Burgoyne, PDMS LM-API Manager/Senior Scientist, Janssen
Dr. Liz Creedon, Consultant Scientist, Eli Lilly
Caroline O'Reilly, Head of Department of Management & Enterprise, CIT.

PROGRAMME REPRESENTATION

Programme Staff

Research

Prof. Hugh McGlynn, Head of School of Science & Informatics, Dr. Brendan O Connell, Dr. Helen O'Shea, Prof. Aidan Coffey, Dr. Maire Begley, Dr. Brigid Lucey, Prof. Roy Sleator, Prof. Jim O'Mahony, Dr. Fiona O'Halloran, Dr. Helena Stack, Dr. Michael Callanan, Dr. Karen Finn, Dr. Craig Murphy, Dr. Rosemary Rea.

Academic

Dr. Rosemary Rea, Anne Ward, Prof. Jim O'Mahony, Dr. Karen Finn, Margaret Lane, Prof. Roy Sleator, Dr. Craig Murphy, Maretta Brennan, Dr. Noreen Quinn, Eleanor Baldwin.

Learner Representatives

BSc (Hons) Pharmaceutical Biotechnology

Year 1: Ross Connolly, Kailey Noonan, Sean Collins

Year 2: Amy O'Conner, Adam O'Leary, Jess Cronin, Georgina Kingston

Year 3: Keith McCormick, Hayley Whitby

Year 4: Eimear Stapleton, Gillian Crowley, Patrick O'Sullivan, John Coakley

BSc Applied Bioscience & Biotechnology

Year 1: Gavin Murray, Alison Bermingham, Leanne Crowley

Year 2: Monica Murphy, Evelyn Shortall, Sinead Pearce

Graduates

Fiona Hennessy (2015) – Industry based PhD - MSD

Shauna Wallace (2015) – Phd UCC in Neurosciences

Kate Crowley (2016) – Pharma Biotechnology Graduate Programme, MSD Brinny

Aisling O'Neill (2014) Quality Control Analysts, Eli Lilly

Jamie Ring (2014) Technical Operations Support, Eli Lilly

Robert Andrew, Lancaster Labs, Janssen

External Stakeholders

John McCaughley, Janssen Pharmaceuticals

Mark Phelan, Abbvie

Ciara McHale, Eli Lilly

Michael Kelleher, MSD Brinny

Collette Kirby, MSD Brinny

Orla Dalton, ENVA

PROGRAMME SUMMARY AND MAJOR CHANGES PROPOSED

1. BACHELOR OF SCIENCE IN APPLIED SCIENCES AND BIOTECHNOLOGY

1.1. Programme Summary

The Bachelor of Science in Applied Biosciences and Biotechnology is a three year (6 semesters) full-time NFQ Level 7 degree programme. Students who successfully complete year 2 of this programme and do not wish to progress to year 3 will receive the Higher Certificate in Applied Biosciences. This Level 6 award is embedded within the Level 7 programme.

The Bachelor of Science in Applied Biosciences and Biotechnology and the Bachelor of Science in Food and Health Science share a common year one and two. Students are required at the start of third year to choose their preferred qualification option of Bachelor of Science in Applied Biosciences and Biotechnology or Bachelor of Science in Food and Health Science.

The Bachelor of Science in Applied Biosciences and Biotechnology was developed to meet the growing demand for technicians and analysts in the biotechnology and pharmaceutical industries and beyond, producing graduates with the requisite skills and knowledge in bioanalytics, biochemistry, bioassay, microbiology and DNA-based methods. In addition, the requirements of the services and research laboratories for staff trained in advanced biologically based analytical techniques are met by graduates of the course. This course provides students with a broad scientific education. Knowledge of environmental science, analytical techniques, quality management and bioprocessing are seen as key requirements and these disciplines are studied in detail. Laboratory work forms a substantial part of the course, allowing students to develop and refine essential practical skills. The development of high-level laboratory skills and the ability to use them in the service of biological science are key aims of this course.

Graduates from this course are qualified to work in a number of areas within industry such as quality, biochemistry, microbiology, bioassay, upstream and downstream processing, environmental testing of water. Suitably qualified graduates of the BSc in Applied Biosciences and Biotechnology may also apply for entry to Year 4 of the BSc (Honours) in Pharmaceutical Biotechnology (Level 8).

1.2. Major Changes Now Proposed

The key changes proposed can be summarised as follows:

Six new modules (detailed below) have been proposed for the Applied Biosciences and Biotechnology programme.

After completion of stage 2 students can select to progress to the BSc Applied Biosciences and Biotechnology or BSc Food and Health Science. The flow of modules in stage 2 has been changed (as detailed below) to ensure that students have exposure to modules for both Biosciences and Biotechnology and Food and Health Science disciplines enabling them to make an informed decision for progression to stage 3.

Stage 1 Key Changes

- Maths for Biological Sciences, Mandatory (Stage 1, Semester 1) and Biostatistics and Probability, Mandatory (Stage 1, Semester 2)

Both math modules in stage 1 will be tailored for Biological Science students. Maths for Biological Sciences replaces Essential Mathematical Skills (MATH6000) and will cover basic arithmetic and algebra, indices and logs, functions and graphs, some introductory differentiation. Biostatistics and Probability replaces MATH6002 Calculus and Statistics (MATH6002) and will introduce students to descriptive and summary statistics, probability, regression and correlation.

Stage 2 Key Changes

- Introduction to Pharmacology, Mandatory (Stage 2, Semester 1)

This module is a new introduction to the programme and is designed to be a mandatory semester 1 module in stage 2. Space on the programme for this module will be generated by moving Introductory Cell Biology (BIOL6023) from semester 1 to semester 2 of stage 2. This will be the mandatory Bioscience and Biotechnology module while Human Nutrition (BIOL6025) will be the mandatory Food and Health Science module. Animal and Crop Science (AGRI6020) has changed from mandatory to elective to enable Human Nutrition (BIOL6025) to become a mandatory module.

- Computational Biology, Elective (Stage 2, Semester 1)

This module is proposed to replace BioComputing (BIOT6010) and will run in semester 1 of stage 2. Computational Biology will retain some of the basic IT literacy training of its predecessor, and deliver this content to an advanced level with a focus on biological sciences. In addition, modern IT skills used in the biological sciences, such as biostatistics and bioinformatics, will be addressed, in line with feedback from industry employers on graduate skill needs.

- BIOL7018 Nutritional Analysis, Elective (Stage 2, Semester 2)

The status of this module has changed from mandatory to elective. Introduction to Cell Biology (BIOL6023) has been moved from semester 1 to semester 2 of stage 2 and will be the mandatory module in place of Nutritional Analysis (BIOL7018). Upstream Bioprocessing (BIOT6007) remains as an elective in semester 2, stage 2. Therefore students intending to pursue the BSc in Applied Biosciences and Biotechnology would be encouraged to choose Upstream Bioprocessing (BIOT6007) as their elective. Students intending to pursue BSc in Food and Health Science will be encouraged to choose Nutritional Analysis (BIOL7018) as their elective. Environmental studies (ENVI6001) has been removed as an elective as there is a stage 3 mandatory Environmental Science and Industrial Hygiene module.

Stage 3 Key Changes

- Pharma Analytics, Mandatory (Stage 3, Semester 1)

This module is proposed to replace Chromatographic Techniques (BIOT8003) and is tailored to familiarise students with the analytical testing requirements in the pharma / biopharma industry. This module will retain some elements of BIOT8003 with incorporation of key concepts for the pharma / biopharma industry such as Process Analytical Technology, role of chromatography in purification and in-process and release testing and analytical testing requirements of raw materials, drug substance and drug product.

- MANU7007 Validation Science, Mandatory (Stage 3, Semester 1)

Validation Science has been identified by students and industry as a critical module for all biosciences students and particularly those focused on the biotechnology industry. The Validation Science module has now been included as an elective module in stage 3 of the programme.

- ENVI7001 Environmental Science and Industrial Hygiene (Stage 3, Semester 2)

This module has been moved from semester 1 to semester 2 of stage 3 to make way for Validation Science (MANU7007). In semester 2, this module will be mandatory and replaces Medical Laboratory Practice (BIOL7027). Environmental Science and Industrial Hygiene is considered more relevant than Medical Laboratory Practice to the programme outcomes for Applied Biosciences and Biotechnology.

A summary of all changes and rationale for same for all stages of the programme are presented hereunder.

Summary of changes and rationale for Stage 1 Semester 1

Module	Status	Changes and Rationale
CMOD6001 Creativity, Innovation and Teamwork	Mandatory	No Change
CHEM6011 Biological Chemistry 1	Mandatory	No Change
BIOL6003 Laboratory Operations	Mandatory	Title changed to better reflect the module content. Learning outcomes and indicative content reviewed but only minor changes in content. The coursework has been changed to 30% MCQ and 50% SAQ and a lab every second week to reduce the amount of report writing for the student.
BIOL6007 Biomolecules and Cells	Mandatory	Weighting of assessments: there are 4 components, 2 theory and 2 lab based. Equal weighting (30%) now given to the two theory assessments. Lab components unchanged.
MATH6999 Maths for Biological Sciences New module	Mandatory	This module replaces Essential Mathematical Skills (MATH6000) and is tailored for Biological Science students. It will cover basic arithmetic and algebra, indices and logs, functions and graphs, some introductory differentiation.
PHOL6006 Human Anatomy and Physiology	Mandatory	Learning outcomes and indicative content updated: to better reflect module content and include other systems, such as the Immune System, to provide a foundation for other modules including Nutrition and Health and Biochemical Pharmacology. The total lab component has been reduced from 50% to 35% to better reflect the level of lab work and report writing in the module, put more weight on the theory of this module. The

		MCQ theory assessment increase from 25 to 30% and the SAQ theory assessment increased from 25 to 35%. Book resources updated.
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Summary of changes and rationale for Stage 1 Semester 2

Module	Status	Changes and Rationale
CHEM6009 Biological Chemistry 2	Mandatory	No change
Draft Biostatistics and Probability New module	Mandatory	Both math modules in stage 1 will be tailored for Biological Science students. Maths for Biological Sciences replaces This module replaces Calculus and Statistics (MATH6002) and is tailored to Biological Science students. It will introduce students to descriptive and summary statistics, probability, regression and correlation.
BIOM6001 Microbes, Enzymes and Energy	Mandatory	An additional learning outcome was added reflect an important aspect to be delivered in the module. Allocation of marks for assessments changed. Two based on labs worth 20% each. This remains the same. The two theory assessments were 20% for MCQ in week 7 and 40% for a short answer exam at semester end worth 40%. Both theory assessments remain and will have equal weighting of 30% each. The allocation of marks proposed is to ensure a fairer distribution of marks relative to work required for each assessment.
BIOT6001 Introduction to Biotechnology	Mandatory	Learning outcomes reworded slightly. Allocation of marks for assessments changed. All 4 assessments were allocated 25% of marks. Proposed that two theory assessments allocated 30% each and lab reports and lab exam allocated 20% each. Adjustment to marks allocation because weighting for lab component was considered too high relative to the effort required and the proposed allocation of marks, 30% for each short answer questions is a fairer distribution of marks.
PHYS6044 Heat and Light	Mandatory	No change
FOOD6001 Science of Food and Health	Elective	Coursework changed – now includes a project element to engage students and move from traditional assessment modes, while spreading workload over the full semester.
FREE6001	Elective	-----

Summary of changes and rationale for Stage 2 Semester 1

Module	Status	Changes and Rationale
BIOL6024 Structural Biochemistry	Mandatory	Number of learning outcomes reduced and changes to indicative content to better reflect module content. Practical reports increased from 10 to 20% to encourage more effort with data analysis and scientific writing and reflect the time and effort required for laboratory reports. Practical examination reduced from 30 to 20% to allow for greater emphasis on laboratory reports. Module resources updated.
BIOT6002 Immunoanalysis	Mandatory	Learning outcomes & indicative content reviewed & updated with only minor change in order & content. Minor change to description for CA. Book resources updated. Improvement to module content & layout to better suit module requirements.
BIOM6006 Microbial Diversity	Mandatory	Eliminated of one continuous assessment exam to reduce the number of assessments from four to three (including lab assessment). Reduced frequency for lab reports from "weekly reports" to "themed reports every second week".
Draft Introduction to Pharmacology New module	Mandatory	New module for this programme. In this programme there are biotech and nutrition focused mandatory modules in the first semester of stage 1. This is the biotech module.
BIOL6025 Human Nutrition	Mandatory	Status changed from elective to mandatory. Learning outcome & indicative content changed to minimise overlap with FOOD6001 and make module more focused. Removed sports nutrition and included an introduction to metabolic pathways for generating energy from macronutrients. Updated book resources.
Draft Computational Biology New module	Elective	Replaces module BioComputing (BIOT6010). Computational Biology will retain some of the basic IT literacy training of its predecessor, and deliver this content to an advanced level with a focus on biological sciences. In addition, modern IT skills used in the biological sciences, such as biostatistics and bioinformatics, will be addressed, in line with feedback from industry employers on graduate skill needs.
AGRI6020	Elective	Change from mandatory to elective to enable Human Nutrition (BIOL6025) become a mandatory module.

Animal and Crop Science		
BIOT6004 Forensic Science CHEM6010 Biological Chemistry 3	Electives	BIOT6004 - removed from the programme based on student feedback. CHEM6010 – removed as this module has not been delivered on the programme in the last five years.
FREE6001	Elective	-----

Summary of changes and rationale for Stage 2 Semester 2

Module	Status	Changes and Rationale
BIOM6007 Bacteriology	Mandatory	Eliminated of one continuous assessment exam to reduce the number of assessments from four to three (including lab assessment). Reduced frequency for lab reports from "weekly reports" to "themed reports every second week".
BIOL6017 Metabolic Biochemistry	Mandatory	Learning outcomes and indicative content updated to better reflect the module content and expand scope. Practical reports increased from 10 to 20% to encourage more effort with data analysis and scientific writing and reflect the time and effort required for laboratory reports. Introduced themed laboratory reports in an attempt to reduce weekly workload on the student. Practical examination reduced from 30 to 20% to allow for greater emphasis on laboratory reports. Marks for MCQ1 theory assessment reduced from 30 to 25%. Format of second theory assessment changed from MCQ to SAQ format and marks assigned increased from 30 to 35%. This change was made to place greater emphasis on writing skills. Book resources updated.
BIOL6023 Introductory Cell Biology	Mandatory	Minor changes to learning outcomes. Module resources updated.
BIOT7002 Bioanalytical Techniques	Mandatory	Learning outcome & indicative content: reviewed, updated content to reflect & focus requirements of module & improve module material. Coursework: change to MCQ for continuous assessment 1. Resources updated.
BIOT6005 Intro to Quality Systems	Mandatory	Learning outcome updated. Indicative content: minor changes to expand & improve module material. Coursework: change to MCQ for CA1. Resources updated.

BIOL7018 Nutritional Analysis	Elective	Food and Nutrition focused elective for semester 2. Learning outcome & indicative content changed to minimise overlap with CHEM7003 and BIOL6025. Included nutritional assessment in indicative content. Updated book resources. Changed assessment to labs 25% (from 30%) as only 4 labs and no lab exam. Presentation component changed to 25% (from 20%).
BIOT6007 Upstream Bioprocessing	Elective	Biotech focused elective for semester 2. Title change: to link with the follow on module Downstream Bioprocessing. NFQ level: changed from fundamental to intermediate. Intro to Biotech BIOT6001: precursor to this module LO1: clarify to better reflect content. Assessment breakdown: Course work 40% (down from 50%), End of module formal examination 60% (Up from 50%): changed to reflect that this is a module with a terminal exam and reduce student workload. Module resources: updated.
ENVI7001 Environmental Studies	Elective	Removed from the programme. Sufficient coverage of topic with Environmental Science and Industrial Hygiene (ENVI7001) in stage 3.
FREE6001	Elective	No change

Summary of changes and rationale for Stage 3 Semester 1

Module	Status	Changes and Rationale
Draft Pharma Analytics New module	Mandatory	New module (replacing chromatographic techniques) tailored to familiarise students with the analytical testing requirements in the pharm / biopharma industry.
GENE7002 Molecular Biology	Mandatory	Indicative content: more economically defined than previously to allow more flexibility in delivery, in what is a broad subject; also a more streamlined follow-on from second year biochemistry, where previously there appeared to be a small amount of overlap. Assessment breakdown: remove the previous revision exercise, which was worth 10%, and to change the mid-semester MCQ weighting to 30%, from the previous value of 20%. The mid-semester and week 13 MCQs now have equal value, which is much more appropriate to the amount of examination material assessed at either time. Module resources: updated.
BIOL70001	Mandatory	Learning outcomes and indicative content have been updated to better reflect the module content. Indicative content has been expanded to include disease-specific therapies to link

Applied Enzymology		the module with fourth year Biochemical Pharmacology (BIOL8009). Marks assigned to practical reports increased from 10 to 20% to give greater weight to lab reports and better reflect the time and effort required to prepare these detailed reports. Themed lab reports will reduce weekly workload on students. Marks assigned to practical examination reduced from 30 to 20% to allow for more weighting on lab reports. Book resources updated.
BIOM7001 Analytical Microbiology	Mandatory	Indicative content: more economically defined to allow greater flexibility in delivery, considering the broad scope of analytical microbiology, including in the pharmaceutical industry. Assessment breakdown: removal of laboratory exam (15%) and increase weighting of lab reports from 15% to 30% to reflect effort and time required for these reports. The laboratory practical skills will be tested in the laboratory practical's themselves.
BIOT7003 Industrial Biotechnology	Mandatory	The learning outcomes were changed to reflect the inclusion of microbial production of commercially important products as an important area that wasn't mentioned in the previous descriptor. The content of the module is otherwise unchanged.
MANU7007 Validation Science New addition of an existing module	Elective	New module for this programme. Valuable module ahead of students going into work placement.
FREE6001	Elective	-----

Summary of changes and rationale for Stage 3 Semester 2

Module	Status	Changes and Rationale
PLAC7001 Biosciences Placement	Mandatory	Changes to the wording of learning outcomes to better reflect the components being assessed. Changes to assessments: removal of CV and mini report. The module can be assessed adequately using the two remaining components.
ENVI7001 Environmental Science and Industrial Hygiene	Mandatory	Move to second semester to enable students the option of Validation Science in the first semester. Additional content; genetic modification applications in environmental biotechnology. Assessment breakdown: lab mark changed from 40% for reports to 20% reports and 20% presentation on group findings during module case study. Presentation

		component included to assess variety of learning skills and incorporate teamwork and collaboration into module
BIOT7004 Pharma Quality Management	Mandatory	Title change: now include the word Pharma to distinguish it from the similar module delivered in the NHS programme. Learning outcomes and indicative content updated to remove Statistical Process Control and Lean manufacturing to address overlap with the 4th year Quality module. The recommended resources have been updated. Assessment breakdown: One assessment at the end of the semester to reduce student workload. Introduction of a written report on quality-related data/case studies covered in class each week. The latter will allow more in class interaction with students and will provide them with more hands-on experience in dealing with “real-life” quality.
BIOT7001 Applied Biotechnology	Mandatory	Learning outcomes and indicative content updated to better reflect module content. Book resources updated.

2. BACHELOR OF SCIENCE (HONOURS) IN PHARMACEUTICAL BIOTECHNOLOGY

2.1. Programme Summary

The Bachelor of Science (Honours) in Pharmaceutical Biotechnology is a four year (8 semesters) full-time NFQ Level 8 Honours degree programme. Many of the world’s top Biotechnology companies have a strong presence in Ireland. In general, the industry is moving towards a more ‘bio-based’ approach to pharmaceutical manufacture. Consequently, there is a greater need to produce highly trained graduates who possess Pharmaceutical Biotechnology related skills. The course is specifically designed to train students in all aspects of modern biotechnology. Graduates from this course are qualified to work in a number of areas within the biotechnology industry, including roles such as Quality Control analysts, Microbiologists, Biopharmaceutical Process Scientists, Bioassay Technical Specialists and Research Assistants. This course is also an excellent platform for further studies, both in terms of short add-on courses, and more structured postgraduate degrees such as Master of Science and PhD programmes.

The programme is offered as a level 8 abinitio award via the CAO under CR325. The programme operates on the basis of common first and second year shared with the BSc in Applied Sciences and Biotechnology. Students who successfully complete the BSc in Applied Sciences and Biotechnology and attain the CIT entry criteria for level 7 to level 8 progression can join year four the Bachelor of Science (Honours) in Pharmaceutical Biotechnology award.

Major Changes Now Proposed

The key changes proposed can be summarised as follows:

Ten new modules have been proposed for the Pharmaceutical Biotechnology programme.

In the case of seven of these modules (detailed below) the focus of the original module remains i.e. replacing like with like, however modules have been updated to more accurately reflect module content and tailor to pharmaceutical biotechnology students. The proposed revisions were considered sufficient to warrant a new module descriptor. Three modules (Introduction to Pharmacology, Bioreactor Operations and Protein Informatics) are entirely new additions.

Stage 1 Key Changes

- Maths for Biological Sciences, Mandatory (Stage 1, Semester 1) and Biostatistics and Probability, Mandatory (Stage 1, Semester 2)

Both math modules in stage 1 will be tailored for Biological Science students. Maths for Biological Sciences replaces Essential Mathematical Skills (MATH6000) and will cover basic arithmetic and algebra, indices and logs, functions and graphs, some introductory differentiation. Biostatistics and Probability replaces MATH6002 Calculus and Statistics (MATH6002) and will introduce students to descriptive and summary statistics, probability, regression and correlation.

Stage 2 Key Changes

- Introduction to Pharmacology, Mandatory (Stage 2, Semester 1)

This module is proposed to replace Introductory Forensic Science (BIOT6004) which is no longer considered relevant for the programme. It will lay the foundations for the fourth year Biochemical Pharmacology (BIOL8009) module by introducing the concept of drug targets, dose-response relationships, and how the human body absorbs, distributes and eliminates drugs and therefore is an important introductory module for pharmacological principles.

- Mammalian Biotechnology, Mandatory (Stage 2, Semester 1)

This module is proposed to replace Cellular Biotechnology (BIOT6006) and is tailored to familiarise students with growing and maintaining mammalian cells *in vitro*. BIOT6006 was deemed too general with some overlap with existing micro based modules. This new module focuses specifically on mammalian cells and is pertinent considering the key role of these cells in biologics-based manufacturing.

- Computational Biology, Elective (Stage 2, Semester 2)

This module is proposed to replace BioComputing (BIOT6010). Computational Biology will retain some of the basic IT literacy training of its predecessor, and deliver this content to an advanced level with a focus on biological sciences. In addition, modern IT skills used in the biological sciences, such as biostatistics and bioinformatics, will be addressed, in line with feedback from industry employers on graduate skill needs.

Stage 3 Key Changes

- Pharma Analytics, Mandatory (Stage 3, Semester 1)

This module is proposed to replace Chromatographic Techniques (BIOT8003) and is tailored to familiarise students with the analytical testing requirements in the pharma / biopharma industry. This module will retain some elements of BIOT8003 with incorporation of key concepts for the pharma / biopharma industry such as Process Analytical Technology, role of chromatography in purification and in-process and release testing and analytical testing requirements of raw materials, drug substance and drug product.

Stage 4 Key Changes

- Biosciences Literature Review, Mandatory (Stage 4, Semester 1)

This module is proposed to replace Project Research Phase (INTR8016). This new module is required to introduce a 1 hour instructional lecture to complement the marking scheme for the literature review. It was not possible to update the existing descriptor as it is a college-wide module.

- Biotechnology Management, Elective (Stage 4, Semester 1)

This module is designed to replace Research Management (BIOT8009) and will provide students with a basic knowledge and understanding of planning, project management and experimental design and interpretation.

- Bioreactor Operations, Elective (Stage 4, Semester 1)

This laboratory based module is designed to let students gain additional practical experience with preparation and operation of lab scale bioreactors. Eli Lilly has kindly donated valuable bioreactors which will help in the introduction of this module.

- Protein Informatics, Mandatory (Stage 4, Semester 2)

This module is designed to replace Bioinformatics (BIOT8006) and focuses specifically on therapeutic proteins; their structure, function, evolution and engineering for improved therapeutic potential. Replacing Bioinformatics, which was DNA centric, this new module better aligns with the existing protein focused modules in the programme.

A summary of all changes and rationale for same for all stages of the programme are presented hereunder.

Summary of Changes and Rationale for Stage 1 Semester 1

Module	Status	Changes and Rationale
CMOD6001 Creativity, Innovation and Teamwork	Mandatory	No Change
CHEM6011 Biological Chemistry 1	Mandatory	No Change
BIOL6003 Laboratory Operations	Mandatory	Title changed to better reflect the module content. Learning outcomes and indicative content reviewed but only minor changes in content. The coursework has been changed to 30% MCQ and 50% Short answer questions and a lab practical every second week to reduce the amount of report writing for the student.
BIOL6007	Mandatory	Weighting of assessments: there are 4 components, 2 theory and 2 lab based. Equal weighting (30%) now

Biomolecules and Cells		given to the two theory assessments. Lab components unchanged.
MATH6999 Maths for Biological Sciences New module	Mandatory	This module replaces Essential Mathematical Skills (MATH6000) and is tailored for Biological Science students. It will cover basic arithmetic and algebra, indices and logs, functions and graphs, some introductory differentiation.
PHOL6006 Human Anatomy and Physiology	Mandatory	Learning outcomes and indicative content updated: to better reflect module content and include other systems, such as the Immune System, to provide a foundation for other modules including Nutrition and Health and Biochemical Pharmacology. The total lab component has been reduced from 50% to 35% to better reflect the level of lab work and report writing in the module, put more weight on the theory of this module. The MCQ theory assessment increase from 25 to 30% and the short answer questions theory assessment increased from 25 to 35%. Book resources updated.

Summary of Changes and Rationale for Stage 1 Semester 2

Module	Status	Changes and Rationale
CHEM6009 Biological Chemistry	Mandatory	No change
Draft Biostatistics and Probability New module	Mandatory	Both math modules in stage 1 will be tailored for Biological Science students. Maths for Biological Sciences replaces This module replaces Calculus and Statistics (MATH6002) and is tailored to Biological Science students. It will introduce students to descriptive and summary statistics, probability, regression and correlation.
BIOM6001 Microbes, Enzymes and Energy	Mandatory	An additional learning outcome was added to reflect an important aspect to be delivered in the module. Allocation of marks for assessments changed. Two based on labs worth 20% each. This remains the same. The two theory assessments were 20% for MCQ in week 7 and 40% for a short answer exam at semester end worth 40%. Both theory assessments remain and will have equal weighting of 30% each. The allocation of marks

		proposed is to ensure a fairer distribution of marks relative to work required for each assessment.
BIOT6001 Introduction to Biotechnology	Mandatory	Learning outcomes reworded. Allocation of marks for assessments changed. All 4 assessments were allocated 25% of marks. Proposed that two theory assessments allocated 30% each and lab reports and lab exam allocated 20% each. Adjustment to marks allocation because weighting for lab component was considered too high relative to the effort required and the proposed allocation of marks, 30% for each short answer questions is a fairer distribution of marks.
PHYS6044 Heat and Light	Mandatory	No change
FOOD6001 Science of Food and Health	Elective	Coursework changed – now includes a project element to engage students and move from traditional assessment modes, while spreading workload over the full semester.
FREE6001	Elective	-----

Summary of Changes and Rationale for Stage 2 Semester 1

Module	Status	Changes and Rationale
BIOL6024 Structural Biochemistry	Mandatory	Number of learning outcomes reduced and changes to indicative content to better reflect module content. Practical reports increased from 10 to 20% to encourage more effort with data analysis and scientific writing and reflect the time and effort required for laboratory reports. Practical examination reduced from 30 to 20% to allow for greater emphasis on laboratory reports. Module resources updated.
BIOT6002 Immunoanalysis	Mandatory	Learning outcomes & indicative content reviewed & updated with only minor changes in order & content. Minor change to description for continuous assessment. Book resources updated. Improvement to module content & layout to better suit module requirements.
BIOM6006 Microbial Diversity	Mandatory	Elimination of one continuous assessment to reduce the number of assessments from four to three (including lab assessment). Reduced frequency for lab reports from "weekly reports" to "themed reports every second week".

Draft Mammalian Biotechnology New module	Mandatory	New module (replacing BIOT6006 Cellular Biotechnology) tailored to familiarise students with growing and maintaining mammalian cells <i>in vitro</i> . BIOT6006 was too general with some overlap with existing micro based modules.
Draft Introduction to Pharmacology New module	Mandatory	New module to replace Introductory Forensic Science (BIOT6004). Module will initially link with the first year Human Anatomy and Physiology (PHOL6006) module and lay the foundations for the fourth year Biochemical Pharmacology (BIOL8009) module. This module will introduce the concept of drug targets, dose-response relationships, and how the human body absorbs, distributes and eliminates drugs and therefore an important introductory module for pharmacological principles.
BIOT6008 Environmental Biotechnology	Elective	Update module description, learning outcomes and indicative content to better reflect module content. Assessment breakdown: Increase weighting of two short answer assessment from 30 to 35%. Decrease weighting of lab reports from 40 to 30%. This is a fairer distribution of marks relative to the work involved for each component. Status changed to elective as more appropriate to have Introduction to Pharmacology as mandatory. Module resources updated.
BIOT6004 Forensic Science CHEM6010 Biological Chemistry 3	Electives	BIOT6004 - removed from the programme based on student feedback. CHEM6010 – removed as this module has not been delivered on the programme in the last five years.
FREE6001	Elective	-----

Summary of Changes and Rationale for Stage 2 Semester 2

Module	Status	Changes and Rationale
BIOM6007 Bacteriology	Mandatory	Elimination of one continuous assessment to reduce the number of assessments from four to three (including lab assessment). Reduced frequency for lab reports from "weekly reports" to "themed reports every second week".
BIOL6017	Mandatory	Learning outcomes and indicative content have been updated to better reflect the module content and

Metabolic Biochemistry		expand scope. Practical reports increased from 10 to 20% to encourage more effort with data analysis and scientific writing and reflect the time and effort required for laboratory reports. Introduced themed laboratory reports in an attempt to reduce weekly workload on the student, promote higher quality reports with reduced quantity. Practical examination reduced from 30 to 20% to allow for greater emphasis on laboratory reports. Marks for MCQ1 theory assessment reduced from 30 to 25%. Format of second theory assessment changed from MCQ to SAQ format and marks assigned increased from 30 to 35%. This change was made to place greater emphasis on writing skills. Book resources updated.
BIOT6007 Upstream Bioprocessing	Mandatory	Title change: to make the link clearer with the follow on module Downstream Bioprocessing NFQ level: changed from fundamental to intermediate. Intro to Biotech BIOT6001 would be considered the precursor to this module LO1: clarify to better reflect content Assessment breakdown: Course work 40% (down from 50%), End of module formal examination 60% (Up from 50%): changed to reflect that this is a module with a terminal exam and reduce student workload. Module resources: updated
BIOT7002 Bioanalytical Techniques	Mandatory	Learning outcome & indicative content: reviewed and updated content to reflect & focus requirements of module & improve module material. Coursework: change to MCQ for continuous assessment 1. Resources updated.
BIOT6005 Intro to Quality Systems	Mandatory	Learning outcome updated. Indicative content: minor changes to expand & improve module material. Coursework: change to MCQ for continuous assessment 1. Resources updated.
Draft Computational Biology New module	Elective	Replaces module BioComputing (BIOT6010). Computational Biology will retain some of the basic IT literacy training of its predecessor, and deliver this content to an advanced level with a focus on biological sciences. In addition, modern IT skills used in the biological sciences, such as biostatistics and bioinformatics, will be addressed, in line with feedback from industry employers on graduate skill needs.
FREE6001	Elective	-----

Summary of Changes and Rationale for Stage 3 Semester 1

Module	Status	Changes and Rationale
Draft Pharma Analytics New module	Mandatory	New module (replacing BIOT8003 Chromatographic Techniques) tailored to familiarise students with the analytical testing requirements in the pharm / biopharma industry.
GENE7002 Molecular Biology	Mandatory	Indicative content: more economically defined than previously to allow more flexibility in delivery, in what is a broad subject; also a more streamlined follow-on from second year biochemistry, where previously there appeared to be a small amount of overlap. Assessment breakdown: remove the previous revision exercise, which was worth 10%, and to change the mid-semester MCQ weighting to 30%, from the previous value of 20%. The mid-semester and week 13 MCQs now have equal value, which is much more appropriate to the amount of examination material assessed at either time. Module resources: updated.
BIOL70001 Applied Enzymology	Mandatory	Learning outcomes and indicative content have been updated to better reflect the module content. Indicative content has been expanded to include disease-specific therapies to link the module with fourth year Biochemical Pharmacology (BIOL8009). Marks assigned to practical reports increased from 10 to 20% to give greater weight to lab reports and better reflect the time and effort required to prepare these detailed reports. Themed lab reports will reduce weekly workload on students. Marks assigned to practical examination reduced from 30 to 20% to allow for more weighting on lab reports. Book resources updated.
BIOM7001 Analytical Microbiology	Mandatory	Indicative content: more economically defined to allow greater flexibility in delivery, considering the broad scope of analytical microbiology, including in the pharmaceutical industry. Assessment breakdown: removal of laboratory exam (15%) and increase weighting of lab reports from 15% to 30% to reflect effort and time required for these reports. The laboratory practical skills will be tested in the laboratory practical's themselves.
BIOT6009 Downstream Bioprocessing	Mandatory	Addition of a new learning outcome and removal of LO4 to better reflect module content. Indicative content: updated to better reflect content. Removal of regulatory requirement as will now be covered in the module Pharma Analytics. Assessment breakdown: both theory assessments

		increased to 35% and labs reduced to 30%. Site visit reports no longer required. Module resources: updated
MANU7007 Validation Science	Elective	No change
FREE6001	Elective	-----

Summary of Changes and Rationale for Stage 3 Semester 2

Module	Status	Changes and Rationale
PLAC7001 Biosciences Placement	Mandatory	Changes to the wording of learning outcomes to better reflect the components being assessed. Changes to assessments: removal of CV and mini report. The module can be assessed adequately using the two remaining components.
BIOT7007 Molecular Diagnostics	Mandatory	Update indicative content to better reflect module content. Assessment breakdown: reduce the number of assessments from 3 to 2 to reduce student workload. Increase weighting of two remaining assessments to 50% each.
BIOT7004 Pharma Quality Management	Mandatory	Title change: now include the word Pharma to distinguish it from the similar module delivered in the Nutrition and Health Science programme. Learning outcomes and indicative content updated to remove Statistical Process Control and Lean manufacturing to address overlap with the stage 4 module Pharma Regulation and Compliance. The recommended resources have been updated. Assessment breakdown: One assessment at the end of the semester to reduce student workload. Introduction of a written report on quality-related data/case studies covered in class each week. The latter will allow more in class interaction with students and will provide them with more hands-on experience in dealing with “real-life” quality.
BIOT7001 Applied Biotechnology	Mandatory	Learning outcomes and indicative content updated to better reflect module content. Book resources updated.

Summary of Changes and Rationale for Stage 4 Semester 1

Module	Status	Changes and Rationale
Draft Biosciences Literature Review New module	Mandatory	New module needed to introduce a 1 hour instructional lecture to complement the marking scheme for the literature review.
BIOT8001 Molecular Biotechnology	Mandatory	Update indicative content to better reflect module content. Assessment breakdown: reduce the number of assessments from 3 to 2 to reduce student workload. Change from formal exam to continuous assessment.
BIOT8004 Advanced Bioanalytical Techniques	Mandatory	Learning Outcomes: revised & expanded to reflect new areas of application of bioanalytical techniques. Indicative content: Updated & modified to reflect learning outcomes. Biostats removed to minimise overlap with other modules. Continuous assessment changed from short answer questions to MCQ. All resources updated. Move from semester 2 to semester 1.
BIOM8002 Antimicrobial Strategies	Mandatory	Title change: to better reflect its' content. Indicative content has been altered mainly to remove some items as all topics listed in the old descriptor could not be covered in sufficient detail in the timeframe of the module. The revised content is now a better reflection of topics relevant to Pharma Biotech students. Assessments – the presentations have been removed to reduce student workload so larger weighting is now given to the MCQ. Students obtain enough experience at presenting in other modules. Topics covered in these presentations will still be covered in the revised module. The resource list of books and papers has been updated.
BIOL8023 Cell Systems Biology	Mandatory	Learning outcomes - updated and expanded to better reflect content. Indicative content – updated and expanded to better reflect content. Assessment breakdown – edited to increase weighting of the presentations. Coursework - edited to reduce assessment fatigue. Workload – edited to bring it line with other 4th year modules 2+1.
Draft	Elective	Replaces Research Management (BIOT8009). Designed to create a module that provides students with a basic knowledge and understanding of

Biotechnology Management New module		planning, project management and experimental design and interpretation.
Draft Bioreactor Operations New module	Elective	New laboratory based module designed to let students gain additional practical experience with Bioreactor vessels.
PHOL8002 Pathophysiology	Elective	Removed as no longer delivered on the programme.
FREE6001	Elective	-----

Summary of Changes and Rationale for Stage 4 Semester 2

Module	Status	Changes and Rationale
INTR8015 Project – Implementation Phase	Mandatory	No Change
BIOL8009 Biochemical Pharmacology	Mandatory	Learning outcome and indicative content have been updated to better reflect the module content. Course work will now include two assessments worth 20% instead of one assessment worth 40% at end of semester. This will reduce the workload for students at the end of the semester. This assessment mode better suits the module content and learning outcomes of this module. Book resources updated.
Draft Protein Informatics New module	Mandatory	New module. The new module focuses specifically on therapeutic proteins; their structure, function, evolution and engineering for improved therapeutic potential. Replacing Bioinformatics, which was DNA centric, this new module better aligns with the existing protein focused modules in the programme.
BIOT8002 Pharma Regulation and Compliance	Mandatory	Title change: Previously Regulatory Affairs and Compliance. Learning outcome and indicative content: updated & revised to expand and improve module. Book & Web Resources updated. Move from semester 1 to semester 2.

BIOT8005 Biopharmaceutical Science	Mandatory	Learning outcomes - updated and expanded to better reflect content. Indicative content – updated and expanded to better reflect content. Assessment breakdown – edited to increase weighting of the presentations. Coursework - edited to remove site visits, which are no longer viable. Workload – edited to bring it line with other 4th year modules 2+1.
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A. PANEL FINDINGS AND RECOMMENDATIONS

1. OVERALL RECOMMENDATION TO ACADEMIC COUNCIL ON REVALIDATION

Contingent upon confirmation of the successful completion of the internal programme and module moderation process, the Panel **recommends to Academic Council that the programmes listed above be revalidated** for a further five years or until the next Programmatic Review, whichever is sooner, with effect from 1 September 2017.

Other than Registrar's Office approval of the programme and module specifications on conclusion of internal moderation, no conditions are attached to this recommendation.

2. GENERAL

2.1. **Commendation:** The Panel **commends** the commitment of the academic staff to the Programmatic Review process evidenced by the detailed analysis and reflection underpinning the self-review of their programmes, the quality of documentation submitted and the professional and enthusiastic manner in which they engaged with the review panel throughout the visit.

2.2. **Commendation:** The panel **commends** the programme teams on producing a top quality graduate which reflects real world industry needs.

3. ENTRANT AND GRADUATE PROFILE, AWARD AND PROFESSIONAL ENVIRONMENT

3.1 The panel notes that the Department of Biological Sciences is working to delivery top quality programmes with equipment which is not best matched to current industry needs. The panel notes that currently the programme is facing increases in student numbers which is challenging the provision of appropriate resources and notes that currently laboratory resources are operating to capacity levels.

Recommendation: The panel **recommends** that CIT prioritise the provision of funding to support the on-going maintenance, updating of laboratory equipment and provision of appropriate space to ensure graduates are work ready for the Pharmaceutical sector. The housing and validation of an existing Bioreactor facility similar to that used in industry should be prioritised. CIT should prioritise same in any future capital funding calls via the Higher Education Authority.

3.2 The panel notes that the programme offers some very distinctive features which to date have contributed positively to the pharmaceutical sector in the provision of highly skilled graduates. In light of an increasing number of course options for students in the area of Pharmaceutical Biotechnology, course marketing requires careful consideration

Recommendation: The panel **recommends** that the programme marketing be revisited to ensure that the programme remains to the forefront in the minds of potential students when considering a career in Pharmaceutical Biotechnology.

4. PROGRAMME OPERATION AND PERFORMANCE

4.1 **Commendation:** The panel **commends** the work of the School, Department and programme teams in the support they provide to their students. Clear evidence was presented to the panel of the work being done in the area of student success. This work included Institute and School initiatives such as Good Start, Just Ask, PALS, Academic Success Coaching, Early Intervention and SPARQS etc.

4.2 **Commendation:** The panel **commends** the Department on the operation of their programmes in terms of student recruitment, retention and graduation rates.

4.3 **Recommendation:** The panel **recommends** that the Department would further increase the delivery of its curricula to incorporate learning in the form of a Certificate or Special Purpose Award which will assist PhD graduates transition from academia to industry.

4.4. Students expressed a desire for increased opportunities for levels of interaction particularly in relation to work placement with peers. The students noted that currently 1st year students have an opportunity to meet with 4th year students. Students also expressed a wish to provide feedback mid-semester as opposed to at the end of a semester.

Recommendation: The panel **recommends** that the Department establish opportunities for peer to peer informal gatherings which would allow the current link between 1st and 4th year students to be extended to allow all programme years to interact with the subsequent year e.g. 2nd years talking to 1st years, 3rd years talking to 2nd years etc. More formal student feedback should also be sought mid-semester to assist the Department respond to student issues.

4.5 The programme team expressed concern at the significant increase in number of students requiring Final year Projects and the resourcing of same. Options such as the Stratification of Final year Projects into wet and dry labs and the completion of projects in teams was discussed. The panel also noted that phase one of the project i.e. the literature survey (a full 5 credit module) in semester one did not require a second reader.

Recommendation: The panel **recommends** that the Department continue to explore options which will support the best outcome in terms of student learning and that the college would afford the appropriate available supports to allow for the implementation of same. Current best practice would suggest that the appointment of a second reader is appropriate for all stages of a Final Year Project and careful consideration should be given to implementation of same. In order to maintain transparency and fairness in marking across a large number of project supervisors the programme team should consider making project submissions in stage one available for viewing by all supervisors.

5. PROPOSED PROGRAMME SPECIFICATION (INCL. DELIVERY AND ASSESSMENT)

5.1 **Commendation:** The panel **commends** the panel for their continuation of work placement and the successful implementation of final year projects. The panel also noted that industry and graduate stakeholders requested programme updates which are reflected in the planned programme changes. The programme team are to be commended for putting forward a programme which is aligned and reflects elements of future proofing, to support industry needs.

- 5.2 **Recommendation:** The inclusion of the work placement has been and will continue to be a key component of the programme success. The panel **recommends** that work placement team consider how best to deliver the work placement module as student numbers increase. Consideration should be given to how best to prepare the learner, secure additional work placement opportunities and resource the associated increase in administrative workload.
- 5.3 **Recommendation:** The panel **recommends** that that each programme team articulate a Teaching, Learning and Assessment strategy particular to their programme. For some programmes, this might address issues such as large class teaching; valid, reliable and authentic assessment strategies for large class groups; the appropriate use of technology etc.
- 5.4 **Recommendation:** The panel **recommends** that the development of student soft skills be reviewed to take a holistic programme review from first to final year of the development of students soft skills. The delivery of group based projects, presentation skills and problem based learning are all key industry requirement. They should be incorporated and built upon from year one and the programme team should consider how these can be phased in each year by reviewing the programme assessment strategies.
- 5.5 **Recommendation:** The panel **recommends** that particular attention be paid to the completion of lab reports by students with a view to achieving consistency of practice in terms of student submission requirements across programme years and service delivery modules. The programme team should consider reducing the number of lab reports and focus on increasing the quality of production and ensure same is linked to current Standard Operating Procedures in industry. This would also facilitate more time for student assessment using other instruments which would contribute to overall skill development including soft skills.
- 5.6 **Recommendation:** The panel **recommends** that module delivery should ensure that lab and lecturer content are aligned where possible to afford the student the best possible learning experience. Where additional learning supports such as tutorials are provided they should be timetabled to be accessible and the use of lunch breaks where they are a student's only break should be avoided if possible.

MODULES

This section presents the findings and recommendations from an indicative review of modules carried out by the members of the Peer Review Panel. The Panel notes that a comprehensive survey of module specifications could not be carried out in the context of this review.

Therefore, a recommendation of the Panel to revalidate the programme(s) under review is contingent on the successful completion of the subsequent internal programme and module moderation process carried out by, or on behalf of, the CIT Registrar's Office.

- 6.1 **Recommendation:** The panel **recommends** that the modules descriptors be updated to incorporate a part time delivery workload.
- 6.2 **Recommendation:** The panel **recommends** that module resources include web based resources in addition to textbooks and articles. This will ensure modules have access to the most up to date learning material for the student.

6. OTHER FINDINGS AND RECOMMENDATIONS

- 7.1 **Recommendation:** The panel support the strategic aim of the School to enhance its technical resources in terms of Laboratory space, equipment and ongoing maintenance. The panel strongly recommends that the School actively pursues calls for capital funding proposals when released by the Higher Education Authority.

7. DEROGATIONS SOUGHT

- 7.1. The Panel confirms that all large modules included in the programmes align with CIT policy on large credit modules.

B. PROGRAMME FINALISATION

[This section will be completed by the CIT Registrar's Office.

It records the implementation of any panel requirements and the completion of the internal module moderation process. Confirmation of completion by the CIT Registrar's Office is required for both before the programmes can be submitted to the CIT Academic Council for revalidation.]

1. IMPLEMENTATION OF PANEL REQUIREMENTS/RECOMMENDATIONS

DEPARTMENT TO FILL IN TABLE HERE ALONG THE LINES OF

3.2 Recommendation The Department is currently updating all marketing material

2. MODULE AND PROGRAMME MODERATION

C. APPENDIX – TIMETABLE OF PHASE 2 MEETINGS