PROGRAMME SPECIFICATION	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	MSc
4	**Programme Title**	Industrial and Commercial Biotechnology
5	**UCAS/Programme Code**	5017F
6	**Programme Accreditation**	Not applicable
7	**QAA Subject Benchmark(s)**	Not Available
8	**FHEQ Level**	Level 7
9	**Date written/revised**	September 2021

10 Programme Aims

1. The primary purpose of this programme is to provide Biology (microbiological, biochemical, molecular, environmental) science graduates with the advanced conceptual understanding, detailed factual knowledge, and specialised technical skills for them to follow successful careers as scientists in the biotechnology industry. The training given also forms an excellent introduction to microbiology, molecular biology and bioinformatics for the students opting to follow a research orientated career path.

   Specifically, the course aims to provide an advanced understanding of:

(a) the scientific concepts and practices that underpin industrial biotechnology with insights into developing the interface between the biological sciences and biotechnological processes;
(b) the scientific concepts of the role of recombinant DNA technology in both fundamental research and applied technology;
(c) the fundamental role played by microorganisms in the search and discovery of commercially significant natural products;
(d) the role of biotechnology in agriculture;
(e) biotechnology in commercial enterprise;
(f) understanding of fundamental control and modelling concepts and their application in bioprocessing systems;
(g) statistical concepts and theory and their application in process engineering; and
(h) generic practical skills in molecular biological techniques, handling microorganisms and data analysis;
(i) knowledge of the sources of biomass and the range of technologies available for conversion into energy.

   In addition to these academic and technical objectives, the course aims to equip its graduates with a suite of key skills, including the ability to communicate effectively, to employ IT and library resources appropriately, the capacity to prioritise work and to meet deadlines, the ability to work independently and in collaboration with others, and the capacity to use initiative and to solve problems.

2. The qualities and attributes of graduates will be such that they are able to:

(i) deal with complex biotechnological issues both systematically and creatively, making sound judgements in the absence of complete data, and to communicate their conclusions clearly to specialists and non-specialists alike;

(ii) demonstrate self-direction and originality in tackling and solving problems, and act independently in planning and implementing tasks at a professional level;

(iii) continue to advance their knowledge and understanding, and to develop new skills to a high level; and will have

(iv) the qualities and transferable skills necessary for employment requiring: the exercise of initiative and personal responsibility; decision making in the complex and unpredictable situations; and the independent learning ability required for continuing professional development.

3. Skills gained will address both small and large biotechnological concerns, in higher education, and in governmental and non-governmental research institutes. These organisations need suitably trained staff with a specialised interdisciplinary background to implement their research and development programmes. Graduates will be suitable employees because they will have acquired skills and demonstrated proficiency in:

(i) understanding key concepts and technical procedures that underpin biotechnology;

(ii) understanding key concepts and technical procedures that underpin recombinant DNA technology;

(iii) the use of appropriate information technology;

(iv) the presentation and communication of results of a research enquiry in both spoken and written form;

(v) the ability to critically review and assess scientific research reports and papers relevant to their area of expertise.

The programme will also enable students to meet the Masters level (level 7) of the QAA framework for higher education qualifications for England, Wales and Northern Ireland.

11 Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas. The programme outcomes have references to the benchmark statements for Biosciences.

Knowledge and Understanding

On completing the programme students should:

Strategies to achieve learning outcomes are presented below as descriptive statements of the methods employed. The learning outcomes are coded A1 to A6, B1 to B6, C1 to C5 and D1 to D6. Methods are chosen because they are appropriate for the delivery of an outcome.

A Knowledge and understanding

A successful student will have gained and be able to demonstrate:

A1. An advanced knowledge and understanding of the concepts and practices that underpin biotechnology including molecular biology, bioinformatics and microbial technology.

A2. An understanding of the role of microbial diversity in the discovery of bioactive compounds for the biotechnology industry.

A3. An understanding of fermentation, process control and industrial scale processes, including the role of statistical concepts and theory in their implementation.

A4. An understanding of the role and impact of gene technology in biotechnology.

A5. An awareness of the social and ethical implications of developments in biotechnology.

A6. An advanced knowledge and understanding of a range of appropriate optional subjects to suite personal interests and career positioning including: commercial applications of biotechnology, social impact of applied science, microbial transformations of organic pollutants and principles of plant disease management.

Teaching and Learning Methods

Teaching Strategy

Specialist knowledge and understanding are primarily imparted through lectures (A1-A6), practical classes (A2, A3, A4), seminars (A1-A6), computer workshops (A2, A3) and site visits (A3).

Learning Strategy

The understanding of lecture material is encouraged through independent reading (A1-A6) assisted by the provisions of extensive, albeit prioritised reference lists. Such learning is reinforced by formative feedback provided by practical exercises (A2, A3, A4), seminars (A1-A6), computer workshops (A2, A3) and a major research project leading to the MSc. thesis (A1-A6), and independent problem solving exercises (A3).

Assessment Strategy

Progress in the taught parts of the course is assessed by continuous assessment and/or by written examinations held in examination period at the end of each semester. Some taught modules are 100% continuously assessed.

Intellectual Skills

On completing the programme students should be able to:

B1. Critically assess the quality of data generated by the application of molecular biological and microbiological techniques used in industrial biotechnology.

B2. Present and summarise such data, and to critically appraise its significance, using statistical techniques where appropriate.

B3. Critically assess the value and limitations of existing information on a given subject.

B4. Formulate or recognise key hypotheses, to test hypotheses using rational and consistent quantitative or qualitative arguments, and to identify key data which allow such tests to be made.

B5. Critically assess the value and limitations of new data in relation to existing information on a given subject, to draw logical conclusions, and to identify appropriate avenues for further study.

B6. Solve problems.

Teaching and Learning Methods

Teaching Strategy

The cognitive skills (B1-B6) are developed initially in the Semester 1 modules through a combination of lectures, practical classes, computer-based and problem solving exercises. They are progressed in the specialised compulsory modules and in optional specialised modules, there they are applied to specific research issues. The MSc project and thesis allow cognitive skills B1-B6 to be applied to a specific research problem or issue guided by individual supervision either in an industrial or university research setting.

Learning Strategy

Students are encouraged to acquire cognitive skills in a variety of ways including the development of a project proposal and through coursework and discussion following seminars (B1-B3). The design and practice of the MSc research project is also important and is particularly useful for further developing most, if not all, of the cognitive skills (B1-B6).

Assessment Strategy

Cognitive skills (B1-B6) are assessed by means of coursework (scientific reports, essays and calculations), and unseen written examinations. Some, or all, of B1-B6 (depending on topic) are also examined by means of the MSc thesis.

Practical Skills

On completing the programme students should be have acquired:

C1. Practical experience in a range of molecular techniques (including DNA isolation/purification, PCR, sequence analysis/bioinformatics and selective isolation of industrially significant micro-organisms.)

C2. An understanding of the principles, applications and limitations of molecular biological techniques.

C3. An understanding of the principles and practices of recombinant DNA technology in agricultural sustainability including intellectual property management.

C4. An understanding of the principles and practices of fermentation, process control, renewable energy and the control of pollutants.

C5. The ability to critically assess the quality of the experimental data generated by these techniques.

Teaching and Learning Methods

Teaching Strategy

Understanding and experience of molecular biological and microbiological techniques used in industrial biotechnology, notably microbial technology, are provided by individual and group based practical classes supplemented by lectures and seminars. More advanced training in some skills (C1-C5) is provided on an individual basis during the 12-week dissertation project in which the student works within a university research team or within an industrial work setting.

Learning Strategy

Independent reading of recommended references is important in understanding how knowledge is applied and techniques used (C1-C4). However, students are encouraged to acquire skills through active participation in project planning, experimental design and data interpretation as part of the coursework covered initially in the semester 1 modules and later in specialised modules, and finally through participation in data interpretation (C5). Learning is reinforced and further developed as students apply their skills in data collection, analysis, interpretation and presentation in their MSc project and thesis.

Assessment Strategy

Formal examinations (C1, C2 and C4) are used to assess some subject specific/practical skills, especially when additional reading reinforces learning. However, most of these skills are assessed by coursework reports and presentations (C1-C4). Some of the skills are further practiced and assessed by means of the MSc thesis (C5).

Transferable/Key Skills

On completing the programme students should be able to:

D1. Communicate by means of well prepared, clear presentations, and concise and grammatically correct written documents.

D2. Make use of library and other information sources.

D3. Use IT resources skilfully and appropriately.

D4. Plan, organise and prioritise work activities in order to meet deadlines.

D5. Work independently, with initiative, and also in teams.

D6. Show originality and initiative in tackling and solving problems.

Teaching and Learning Methods

Teaching Strategy

The teaching of transferable skills is an integral part of the whole MSc programme. Verbal presentational skills are encouraged and developed particularly in seminars. All skills (D1-D6) are important in planning, carrying out, presenting and being examined in the research project and MSc thesis. Development of project proposals (D1, D2, D4, D5) and independent problem solving (D6) teach students about the importance of communication skills, information sources and originality and independence in the implementation of their knowledge.

Learning Strategy

A wide range of methods is used to reinforce the teaching of key skills and aid understanding. There is some recommended reading, but most of the key skills are developed through practical classes (D1-D6), seminars (D1), problem solving exercises (D3, D6), the research project (D1-D5) and by communicating information in short oral presentations (D1, D3).

Assessment Strategy

Key skills are not independently assessed. However, communication (D1), library (D2), and IT skills (D3), and the ability to meet deadlines (D4) are indirectly assessed by coursework (scientific/technical reports, posters and essays). All key skills (D1-D6) are examined by means of a dissertation and presentation.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

The 12-month course starting at the beginning of October. The MSc comprises 120 credits of taught modules and a research project (60 credits). During semesters 1 and 2 students undertake 50-credits of compulsory teaching and select 10-credits from a list of available options. Students will also prepare a project inception report in semester 2, in preparation for their research dissertation projects in semester 3.

In semester 3, students undertake an independent project (leading to a report, in the format of a research article that has to be submitted during August. Students will also present their results in a 10-minute oral presentation. Students wishing to do projects in industrial settings may have to make their choices earlier given the competition for industrial placements. The MSc project allows students to apply the subject specific skills and understanding (A1-A6), the practical skills (C1-C5), the cognitive skills (B1-B6) and the key skills (D1-D6) gained during the taught components.

Key features of the programme (including what makes the programme distinctive)

This is a one year, fulltime modular Masters degree programme. It conforms to the modular structure of other MSc programmes taught in the School of Natural and Environmental Sciences and is delivered through inter-school collaboration with School of Engineering and SAGE Faculty Office. It consists of two parts: a *taught component*, which runs from October until the end of March, and a *project*, for which a journal-style report is submitted by the end of August. Successful completion of the taught component is required in order for a student to progress to the dissertation project.

The compulsory modules account for 160-credits and a further 20-credits are for the optional specialist modules appropriate to the focus of the degree. The optional modules are chosen from a range of options that enables students to add relevant specialist topics according to their preferences and their prior knowledge.

Dissertation projects are usually laboratory based, but may also involve desk or literature studies. During the dissertation project, students may be based in the university, working alongside PhD students and postdoctoral research associates in established research groups, or alternatively the dissertation may entail working elsewhere, in collaboration with an industrial or academic partner. Students are encouraged to publish the results of their dissertations, and several past MSc students have been successful in this respect.

Programme regulations (link to on-line version)
Regulations 2021-22 5017F
13 Support for Student Learning
Generic information regarding University provision is available at the following link: https://www.ncl.ac.uk/ltds/assets/documents/qsh_progspec_generic_info.pdf
14 Methods for evaluating & improving the quality & standards of teaching & learning
Generic information regarding University provision is available at the following link: https://www.ncl.ac.uk/ltds/assets/documents/qsh_progspec_generic_info.pdf *Accreditation reports* *Additional mechanisms*
15 Regulation of assessment
Generic information regarding University provision is available at the following link: https://www.ncl.ac.uk/ltds/assets/documents/qsh_progspec_generic_info.pdf
In addition, information relating to the programme is provided in:
The University Prospectus: http://www.ncl.ac.uk/undergraduate/degrees/#subject Degree Programme and University Regulations: http://www.ncl.ac.uk/regulations/docs/

Please note. This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided.