PROGRAMME SPECIFICATION (Taught Postgraduate)	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	MRes
4	**Programme Title**	Biotechnology and Biodesign
5	**Programme Code**	4868F
6	**Programme Accreditation**	Not applicable
7	**QAA Subject Benchmark(s)**	Not available
8	**FHEQ Level**	Level 7
9	**Last updated**	September 2021

10 Programme Aims

1. The primary purpose of this programme is to provide Biology and related science graduates with the advanced conceptual understanding, detailed factual knowledge, training in design thinking and project design, and specialised technical skills for them to follow successful careers in the biotechnology industry. The training forms an excellent foundation for 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 principles of design thinking and project design
    c. the scientific concepts of the role of recombinant DNA technology in both fundamental research and applied technology.
    d. the fundamental role played by microorganisms in the search and discovery of commercially significant natural products.
    e. the role of biotechnology in agriculture.
    f. biotechnology in commercial enterprise.
    g. understanding of fundamental control and modelling concepts and their application in bioprocessing systems.
    h. statistical concepts and theory and their application in process engineering;
    i. advanced practical skills in molecular biological techniques, handling microorganisms and data analysis.

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 design-thinking based approaches to solve problems.

2. The qualities and attributes of graduates will be such that they are able to:
    a. 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.
    b. Demonstrate self-direction and originality in tackling and solving problems, and act independently in planning and implementing tasks at a professional level.
    c. Continue to advance their knowledge and understanding, and to develop new skills to a high level; and will have.

d. Display 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 global and local 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:
    a. Understanding key concepts and technical procedures that underpin biotechnology.
    b. Understanding key concepts and technical procedures that underpin recombinant DNA technology.
    c. The use of appropriate information technology.
    d. The presentation and communication of results of a research enquiry in both spoken and written form.
    e. The ability to critically review and assess scientific research reports and papers relevant to their area of expertise.
    f.

The programme will also enable students to meet the Masters level (M, level 4) 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 (subject) (X).

Knowledge and Understanding

Strategies to achieve learning outcomes are presented below as descriptive statements of the methods employed. 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, applied bioinformatics, and the computational analysis of biological systems.

A7. An understanding of the principles of design thinking and project design.

Teaching and Learning Methods

Teaching Strategy
Specialist knowledge and understanding are primarily imparted through lectures (A1-A6), practical classes (A2, A3, A4), seminars (A1-A7), computer workshops (A2, A3) and site visits (A3).

Learning Strategy
The understanding of lecture material is encouraged through independent reading (A1-A7) 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- A7), computer workshops (A2, A3) and a major research project leading to the MRes 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 the Semester 1 and 2 examination periods. 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 Phase 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 MRes project and thesis allow cognitive skills B1-B6 to be applied to a specific research problem developed with guidance from the **project** module team.

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 MRes research project is also important and is particularly useful for further developing 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 MRes thesis.

Practical Skills

On completing the programme students should be able to:

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 and process control.

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

C6. Deploy design-thinking approaches to solve problems in biotechnology.

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-C6) is provided on an individual basis during the dissertation project in which the student works within a university research team.

Learning Strategy
Independent reading of recommended references is important in understanding how knowledge is applied and techniques used (C1-C6). 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 phase 1 modules and later in specialised modules, and finally through participation in data interpretation (C5-C6). Learning is reinforced and further developed as students apply their skills in data collection, analysis, interpretation and presentation in their MRes project and thesis.

Assessment Strategy

Formal examinations (C1-C4, C6) 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-C6). Some of the skills are further practiced and assessed by means of the MRes thesis (C6).

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 starts in mid-September. The MRes comprises 60 credits of taught modules and a research project (120 credits). The programme is divided into phase 1 (September – January), phase 2 (January – April) and phase 3 (May – August). The start of MRes phases 1 and 2 broadly correspond to the start of undergraduate semesters 1 and 2. Res phase 2 ends in April and the MRes research phase 3 starts at the beginning of the Easter term in May, extending to the end of August.
Two compulsory modules are taken during phase 1. One compulsory module s taken in phase 2.
In phase 1, students undertake the workshop component of the research project where they develop skills in design thinking and work on their project idea and proposal. The main laboratory work takes place in phase 2 and 3 with the final submission of a MRes thesis in the style of a research article suitable for publication in a leading journal in the field in which the project is developed.
The MRes project allows students to apply the subject specific skills and understanding (A1-A6), the practical skills (C1-C7), 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, full time modular Masters degree programme. It conforms to the modular structure of other Masters programmes taught in the School of Natural and Environmental Sciences and is delivered through inter-school collaboration with other Schools, including Schoo of Computing and the School of Architecture, Landscape and Planning. It consists of two strands: a *taught component*, which runs from late September until the end of March, and a *project*, for which a dissertation 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 170 credits and a further 10 credits are for the optional specialist modules appropriate to the focus of the degree. The optional module is 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 laboratory based. 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 strongly encouraged to publish the results of their dissertations.

Programme regulations (link to on-line version)

Regulations 21-22 4868F

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 and improving the quality and standards of teaching and 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.