PROGRAMME SPECIFICATION	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	M.Sc.
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**	May 2011

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 some emphasis on 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; and
(c) bioinformatics for interpretation of 'platform-based' technologies.
(d) the fundamental role played by microorganisms in the turnover of pollutants and in the search and discovery of commercially significant natural products;
(e) the role of biotechnology in agriculture
(f) biotechnology and commercial enterprise.
(g) generic 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 initiative and to solve problems.

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

(h) 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. Provision will address the needs of employers in 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 industrial 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 (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.

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 C6 and D1 to D6. Methods are chosen because they are appropriate for the delivery of an outcome. Modules which teach and/or assess a particular outcome are shown below each statement, compulsory modules are shown in bold text, optional modules in normal text.

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 and microbial technology.

BIO8017, *BIO8009, BIO8010*, *CME8020*, *BIO8030, BIO8031,* **BIO8041, BIO8096, MMB8001**

A2. An understanding of the role of microbial diversity in the search and discovery of

bioactive compounds.
BIO8041

A3. An understanding of fermentation, process control and industrial scale processes.

CME8020, **BIO8017**, *BIO8031*

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

BIO8017, *BIO8030, BIO8031,* **BIO8050, BIO8096**

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

BIO8030, BIO8031, **BIO8050, BIO8041, BIO8096**

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.

BIO8096, MMB8001

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 M.Sc. 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 January during MSc Phase 1. 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.

BIO8052, **BIO8017,** *CME8020,* **BIO8096**

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

CME8020, **BIO8017, BIO8096**

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

BIO8017, *BIO8009, BIO8010***,** *CME8020, BIO8030, BIO8031,* **BIO8050, BIO8041, BIO8096, MMB8001**

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.

BIO8017, *BIO8009, CME8020, BIO8030, BIO8031,* **BIO8050, BIO8041, BIO8096**

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.

BIO8017, *BIO8009, BIO8010, CME8020, BIO8030, BIO8031,* **BIO8050, BIO8041, BIO8096**

B6. Solve problems.

BIO8052, **BIO8096, BIO8010**

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 M.Sc 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 M.Sc. 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 M.Sc. thesis and (at the discretion of the External Examiner) by *viva voce* examination.

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)

BIO8017, BIO8050, BIO8041, BIO8096

C2. Practical experience in the selective isolation and characterisation of industrially significant micro-organisms isolated from soil/marine environment.

C3. An understanding of the principles, applications and limitations of molecular biological techniques.

BIO8017, *BIO8009,* **BIO8050, BIO8041**

C4. An understanding of the principles and practices of recombinant DNA technology in agricultural sustainability.

BIO8050

C5. An understanding of the principles and practices of fermentation and process control processes.

CME8020, **BIO8017, BIO8096**

C6. An understanding of the principles and practices of bioremediation techniques and technology.

BIO8010

C7. An understanding of the principles and practices of intellectual property management and technology transfer.

MMB8001

C8. The ability to critically assess the quality of the experimental data generated by these techniques.

BIO8052, **BIO8017, BIO8050, BIO8041, BIO8096**

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 a five month 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-C5). 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 (C6). Learning is reinforced and further developed as students apply their skills in data collection, analysis, interpretation and presentation in their M.Sc. project and thesis.

Assessment Strategy

Formal examinations (C1, C2, C3, C5) 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 M.Sc. thesis and by the *viva voce* examination.

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.

BIO8017, *BIO8009, BIO8010, CME8020, BIO8030, BIO8031,* **BIO8050, BIO8041, BIO8096, MMB8001**

D2. Make use of library and other information sources.

*BIO8052, BIO8009, BIO8010***, BIO8017,***BIO8030, BIO8031,* **BIO8050, BIO8040, BIO8096,** *CME8020,* **MMB8001**

D3. Use IT resources skilfully and appropriately.

BIO8052, **BIO8096**

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

*BIO8052, BIO8009, BIO8010***, BIO8017,***BIO8030, BIO8031,* **BIO8050, BIO8041, BIO8096,** *CME8020,* **MMB8001**

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

*BIO8052, BIO8009, BIO8010***, BIO8017,***BIO8030, BIO8031,* **BIO8050, BIO8041, BIO8096,** *CME8020,* **MMB8001**

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

BIO8052, CME8020, **BIO8096**

Teaching and Learning Methods

Teaching Strategy

The teaching of transferable skills is an integral part of the whole M.Sc. 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 M.Sc. 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 and possibly (at the discretion of the External Examiner) by *viva voce* examination.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

The 12-month course starts in mid-September. The M.Sc. comprises 100 credits of taught modules and a research project (80 credits). The programme is divided into phase 1 (September – January), phase 2 (January – April) and phase 3 (May – August). The start of M.Sc. phases 1 and 2 broadly correspond to the start of undergraduate semesters 1 and 2. M.Sc. phase 2 ends in April and the M.Sc. research phase 3 starts at the beginning of the Easter term in May, extending to the end of August.

Three compulsory modules (BIO8017, CSC8313 and MMB8001) are taken during phase 1. Two compulsory modules (BIO8050 and BIO8041) are taken over a shorter period in phase 2. Optional modules can be taken in either phase 1 or phase 2 but normally a maximum of one will be allowed to be taken during phase 1.

In phase 3, students undertake an independent project (80 credits) leading to a report that has to be submitted by the end of August. An initial project proposal is developed towards the end of phase 1 (mid-January). Although not finalised or committed, students are encouraged to develop their proposal plans during phases 1 and 2 in view of the need to make the most of opportunities presented by independent work. However, 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-C6), the cognitive skills (B1-B6) and the key skills (D1-D6) gained during the taught components.

Vivas with the external examiner will be held in May when the Joint Board of Examiners considers the examination and course work results for the taught component of the degree. The external examiner will discuss project proposals with all or a selection of the students at that time and will moderate all final project reports in September for the October Board of Examiners.

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 M.Sc. programmes taught in the School of Biology, and the School of Agriculture, Food and Rural Development and is delivered through inter-school collaboration with other Schools, including Civil Engineering and Geosciences. It consists of two parts: 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.

All of the taught modules are of 10 credits. The compulsory modules account for 70 credits and a further 30 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 Ph.D. 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 M.Sc. students have been successful in this respect.

Programme regulations (link to on-line version)

Go to http://www.ncl.ac.uk/regulations/docs/ and follow links for 2009/10 Degree Programme Regulations, SAGE Faculty, School of Biology, MSc

13 Criteria for admission

Entry qualifications
Minimum of a lower second class BSc Honours degree. Normally the first degree subject should be related to the MSc subject.

Admissions policy/selection tools
Applicants who meet the criteria for admission are automatically sent an offer by the University. Applicants with qualifications and experience outside the normal criteria are referred to the Postgraduate Admissions team within the School of Biology for a decision.

Non-standard Entry Requirements
None

Additional Requirements
None

Level of English Language capability
IELTS 6.5 except countries exempted by University policy.

14 Support for Student Learning

Induction
During the first week of the first semester students attend an induction programme. New students will be given a general introduction to University life and the University's principle support services and general information about the School and their programme, as described in the Degree Programme Handbook. New and continuing students will be given detailed programme information and the timetable of lectures/practicals/labs/ tutorials/etc. The International Office offers an additional induction programme for overseas students.

Study skills support
Students will learn a range of Personal Transferable Skills, including Study Skills, as outlined

in the Programme Specification. Some of this material, e.g. time management is covered in the appropriate Induction Programme. Students are explicitly tutored on their approach to both group and individual projects.

Numeracy support is available through Maths Aid.

Help with academic writing is available from the Writing Centre.

Academic support
The initial point of contact for a student is with a lecturer or module leader, or their tutor (see below) for more generic issues. Thereafter the Degree Programme Director or Head of School may be consulted. Issues relating to the programme may be raised at the Staff-Student Committee, and/or at the Board of Studies.

Pastoral support
All students are assigned a personal tutor whose responsibility is to monitor the academic performance and overall well-being of their tutees. In addition the University offers a range of support services, including one-to-one counselling and guidance or group sessions/workshops on a range of topics, such as emotional issues eg. Stress and anxiety, student finance and budgeting, disability matters etc. There is specialist support available for students with dyslexia and mental health issues. Furthermore, the Union Society operates a Student Advice Centre, which can provide advocacy and support to students on a range of topics including housing, debt, legal issues etc.

Support for students with disabilities
The University's Disability Support Service provides help and advice for disabled students at the University - and those thinking of coming to Newcastle. It provides individuals with: advice about the University's facilities, services and the accessibility of campus; details about the technical support available; guidance in study skills and advice on financial support arrangements; a resources room with equipment and software to assist students in their studies.

Learning resources
The University's main learning resources are provided by the Robinson and Walton Libraries (for books, journals, online resources), and Information Systems and Services, which supports campus-wide computing facilities.

All new students whose first language is not English are required to take an English Language Proficiency Test. This is administered by INTO Newcastle University Centre on behalf of Newcastle University. Where appropriate, in-sessional language training can be provided. The INTO Newcastle University Centre houses a range of resources which may be particularly appropriate for those interested in an Erasmus exchange.

15 Methods for evaluating and improving the quality and standards of teaching and learning

Module reviews
All modules are subject to review by questionnaires which are considered by the Board of Studies. Changes to, or the introduction of new, modules are considered at the School Teaching and Learning Committee and at the Board of Studies. Student opinion is sought at the Staff-Student Committee and/or the Board of Studies. New modules and major changes to existing modules are subject to approval by the Faculty Teaching and Learning Committee.

Programme reviews
The Board of Studies conducts an Annual Monitoring and Review of the degree programme and reports to Faculty Teaching and Learning Committee.

External Examiner reports
External Examiner reports are considered by the Board of Studies. The Board responds to these reports through Faculty Teaching and Learning Committee. External Examiner reports are shared with institutional student representatives, through the Staff-Student Committee.

Student evaluations
All modules, and the degree programme, are subject to review by student questionnaires. Informal student evaluation is also obtained at the Staff-Student Committee, and the Board of Studies. The National Student Survey is sent out every year to final-year undergraduate students, and consists of a set of questions seeking the students' views on the quality of the learning and teaching in their HEIs. With reference to the outcomes of the NSS and institutional student satisfaction surveys actions are taken at all appropriate levels by the institution.

Mechanisms for gaining student feedback
Feedback is channelled via the Staff-Student Committee and the Board of Studies.

Faculty and University Review Mechanisms
The programme is subject to the University's Internal Subject Review process. Every five years degree programmes in each subject area are subject to periodic review. This involves both the detailed consideration of a range of documentation, and a two-day review visit by a review team which includes an external subject specialist in addition to University and Faculty representatives. Following the review a report is produced, which forms the basis for a decision by University Teaching and Learning Committee on whether the programmes reviewed should be re-approved for a further five year period.

16 Regulation of assessment

Pass mark
The pass mark is 50 (Postgraduate programmes)

Course requirements
Progression is subject to the University's Masters Degree Progress Regulations, Taught and Research and Examination Conventions for Taught Masters Degrees. Limited compensation up to 40 credits of the taught element and down to a mark of 40 is possible and there are reassessment opportunities, with certain restrictions.

Common Marking Scheme

The University employs a common marking scheme, which is specified in the Taught Postgraduate Examination Conventions, namely:

Summary description applicable to postgraduate Masters programmes		**Summary description applicable to postgraduate Certificate and Diploma programmes**	
<50	Fail	<50	Fail
50-59	Pass	50 or above	Pass
60-69	Pass with Merit		
70 or above	Pass with Distinction		

Role of the External Examiner
An External Examiner, a distinguished member of the subject community, is appointed by Faculty Teaching and Learning Committee, after recommendation from the Board of Studies. The External Examiner is expected to:

- See and approve examination papers
- Moderate examination and coursework marking
- Attend the Board of Examiners
- Report to the University on the standards of the programme

In addition, information relating to the programme is provided in:

The University Prospectus (see http://www.ncl.ac.uk/postgraduate/)

The School Brochure (contact enquiries@ncl.ac.uk)

The University Regulations (see http://www.ncl.ac.uk/calendar/university.regs/)

The Degree Programme Handbook

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. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

Annex

Mapping of Intended Learning Outcomes onto Curriculum/Modules

		Intended Learning Outcomes			
Module	**Type**	**A**	**B**	**C**	**D**
BIO8017	**Compulsory**	**1,3,4**	**1,2,3,4,5**	**2,3,4,7**	**1,2,4,5**
BIO8041	**Compulsory**	**1,4,5,**	**3,4,5**	**1,3,8**	**1,2,4,5**
BIO8050	**Compulsory**	**4,5**	**3,4,5**	**2,3,7**	**1,2,4,5**
BIO8096	**Compulsory**	**1,4,5**	**1,2,3,4,5,6**	**2,4,7**	**1,2,3,4,5,6**
CSC8313	**Compulsory**	**1,4**	**1,2**	**1,3**	
MMB8001	**Compulsory**	**1**	**3**	**7**	**1,2,4,5**
BIO8009	*Optional*	*1*	*3,4,5*	*3*	*1,2,4*
BIO8010	*Compulsory*	*1*	*3,5*	*5*	*1,2,4,5*
BIO8030	*Optional*	*1,4,5*	*3,4,5,*		*1,2,4,*
BIO8031	*Optional*	*1,3,4,5*	*3,4,5,*		*1,2,4,*
BIO8052	*Optional*		*1*	*7*	*3,6*
CME8020	*Optional*	*1,3*	*1,2,3,4,5*	*4*	*1,2,4,6*