PROGRAMME SPECIFICATION	Newcastle University

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	MSc
4	**Programme Title**	Bioinformatics
5	**Programme Code**	5198F
6	**Programme Accreditation**	N/A
7	**QAA Subject Benchmark(s)**	
8	**FHEQ Level**	Level 7
9	**Last updated**	May 2023

10 Programme Aims

1. To develop the multidisciplinary skills essential to produce the trained bioinformaticians required by academia and by the pharmaceutical and biotechnology industries
2. To provide the fundamental computational knowledge required to tackle practical and theoretical problems in bioinformatics and predictive biology
3. To provide an understanding of the most commonly used and most important analytical, quantitative and experimental methods in bioinformatics
4. To develop research skills
5. To develop and improve skills in the use of literary resources and information technology
6. To develop skills in critical assessment, analysis and storage of information and/or data
7. To provide a qualification enhancing employment prospects in bioinformatics
8. To enable a choice between a computational/numerical theme or a biological theme for the more advanced studies
9. To enhance Bioinformatics research by:
   - Providing research students to undertake substantial projects in bioinformatics
   - Generating a source of qualified research students interested in pursuing PhD research in bioinformatics
10. To provide a programme which meets the FHEQ at Masters level and which takes appropriate account of the draft subject benchmark statements in Computing.

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 Computing.

Knowledge and Understanding

On completing the programme students should be able to demonstrate:

A1. An understanding of the application of computing and statistics to predictive biology.
A2. An understanding of biological data management, integration and handling.
A3. A demonstrable, broad knowledge of the computing, statistical and biological methods appropriate for dealing with bioinformatics problems.
A4. Knowledge of genomes, genome sequencing, genomic structure and comparison.
A5. An understanding of the technology for studies in modern post-genomic biology and the data that is generated by such studies.
A6. Advanced knowledge and understanding of chosen specialist areas in bioinformatics.
A7. An understanding of the theory and principles which underlie computing, so that

students can appreciate the current state of these subjects and can adapt to continued rapid developments throughout their subsequent careers.

A8. Knowledge of an up-to-date programming language.

Teaching and Learning Methods

Fundamental and specialist knowledge (A1-A8) are imparted largely through direct student contact (lectures and tutorials), supplemented by practical sessions that may take the form of computing sessions (A7-A8), problem solving and assessed coursework, and project proposals. Student understanding and learning is enhanced by the use of computing and numerical exercises, problem solving, literature reviews, teamwork and practical work (in the research thesis in particular) and production of a project proposal. Independent learning is encouraged through the provision of reading lists, literature reviews and critical analysis of research papers, and ready access to online information resources. Adequate time is provided in all modules for private study for independent learning.

Assessment Strategy

Formative strategies are used to assess problem solving and programming skills, group work and literature review exercises. Extra formative assessment is included to provide student feedback throughout the course, without contributing to module marks. Formal feedback is provided for each piece of assessed coursework in the form of an individual proforma and a review session in subsequent lectures (A1-A8). Summative strategies, in the form of examinations, are used assess a students learning achievements, for key modules.

Intellectual Skills

On completing the programme students should be able to:

B1. Propose, carry out and write up an extended research project involving, where appropriate, a literature review, problem specifications, design, implementation, and analysis.

B2. Design and implement new software packages, and compositions of existing packages

B3. Apply their knowledge of specific computational, mathematical and statistical techniques to the storage and analysis of biological data.

B4. Have expertise in the use and applicability of up-to-date bioinformatics software tools.

B5. Construct and analyse appropriate predictive models of biological systems

Teaching and Learning Methods

Intellectual skills (B1-B5) are imparted by a combination of lectures, practicals, case studies and an in-depth research project tailored to individual interests. Optional modules also permit a student to tailor their degree content. Optional modules are delivered in the form of ‘short fat’ modules that reduce the emphasis on formally taught material and instead adopt a more directed self-learning approach, including the use of interactive tutorials (both tutor and student led), self-directed study, laboratory practicals, problem-based learning and investigative work. The use of short fat modules in the second semester has several advantages: (i) key skills development and deep learning is enhanced due to increased student participation and interest; (ii) learning is concentrated, allowing the student to focus in depth on one subject at a time; (iii) modules can be made available to bioinformatics courses aimed at continuing professional development (for industry or academia); and (iv) enables future extension of module choices. Practical sessions and problem-solving exercises are used to develop programming and analytical skills (B2-B3). Tutorials are used to focus on specific research topics in detail, to carry out problem solving exercises (B1) and critical analysis of the current software tools (B4), analytical techniques (B3) and research literature, to ensure up-to-date knowledge of subject-specific research fields.

Assessment Strategy

Intellectual skills (B1-B5) are assessed by written examinations and continuously-assessed material that includes written reports, practical write-ups, literature reviews, group projects, oral presentations, a poster presentation and a research thesis. The assessment methods aim to evaluate the students' understanding and ability to apply the computational and statistical techniques that form the basis for the interdisciplinary science of bioinformatics.

Practical Skills

On completing the programme students should be able to:

C1. Utilise the resources necessary to critically evaluate research and literature relating to bioinformatics.
C2. Solve computational problems.
C3. Present, store, model and handle quantitative information.
C4. Demonstrate appropriate bioinformatics solutions applied to analytical and information handling problems.

Teaching and Learning Methods

Critical evaluation of current research will be developed through literature searching, through coursework exercises and in the research project in particular (C1). The ability to solve computational and numeric problems in bioinformatics (C2) will be acquired through practical sessions and self-directed learning. Tutorials and group discussion will be used to reinforce specific computational and numeric methodology (C4). Problem solving exercises and case studies will be used to improve student skills in the application of appropriate solutions to biology data handling and analysis (C3,C4).

Assessment Strategy

Practical skills (C1-C4) are primarily assessed continuously in the form of individual reports from practical studies, literature reviews, tutorial exercises, group project reports and the project dissertation. Data and information handling and interpretation are a strong component of many modules and are also assessed through the use of examinations and continuously assessed problem solving exercises.

Transferable/Key Skills

On completing the programme students should have:

D1. The ability to communicate orally
D2. Written communication skills
D3. The ability to use computer based literacy resources
D4. The ability to work as part of a team
D5. Creativity skills

Teaching and Learning Methods

Oral presentation skills are exercised by group discussions in tutorial sessions, by communication during group exercises, and by the preparation of oral presentations on specific research topics (D1). Written communication skills are developed during independent study, the preparation of coursework, web page design, poster presentation and through the completion of the research project proposal and the project thesis (D2). Formal lectures and practical's address the use of online literacy resources and research techniques, reinforced through the use of practice exercises (D3). Group project and student-led tutorials are used to develop team skills (D4). The preparation of web pages and poster presentations are used to enhance writing and creativity skills (whilst also improving computing skills) (D5).

Assessment Strategy
Written communication skills are assessed by report preparation, the research thesis and literature reviews. Oral communication skills are assessed in oral presentations. The ability to use computer-based literacy resources is assessed through the preparation of literature reviews and through self-assessment. Team work is formally evaluated using small group-based problem solving and data analysis exercises. Independent work is assessed in literature reviews and research projects. Creativity is assessed through problem-solving exercises and poster preparation. The production of web pages is included in some modules to assess students' abilities to provide synopses of information in a scientific but creative fashion.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

This is a one year, full time, intensive modular programme. The programme consists of two parts: a ***taught component*** that runs for 6 months and a ***research project*** of 6 months duration, for which a thesis is submitted. The programme is centred in the School of Computing Science, where the students will be based. Due to the interdisciplinary nature of the course, some optional modules are delivered by members of other Schools.

The programme consists of mandatory modules, optional modules, and the major individual project and dissertation. The programme provides a comprehensive training in interdisciplinary aspects of Computing Science and Statistics. The taught component of the course accounts for 90 credits and the Research Project 90 credits.

The ***taught component*** of the course is split across semester 1 and semester 2.

Semester 1 modules build the basic grounding in, and understanding of, bioinformatics theory and applications, and predictive biology together with necessary computational and numeric understanding to undertake more specialist modules. Four mandatory modules (50 credits total) run from week 1 to week 12. An additional 10-credit module is selected from one of two options to provide students with the opportunity to begin to tailor their degree content depending on their previous scientific background. These modules are examined in January at the end of semester 1. The numerical skills mandatory module starts in semester 1 and runs through until week 9 of semester 2.

Semester 2 introduces modules that build key research skills (generic and specialist) and impart deep learning by building on, and applying, the fundamental knowledge gained in semester 1.

Semester 2 modules occupy weeks 1 to 6 (with the research project starting in week 7) and taught in intensive three-week periods sequentially. The first 10-credit module is mandatory.

The second 10-credit module is selected from a set of four options. The availability of these options is subject to sufficient demand as determined by student registration at reading week in semester 1. The use of optional modules supports two distinct themes to allow tailoring of the specialist learning. This second semester optional module set provides a choice between a computational/numerical theme or a more biologically-oriented theme. Students often fall into two classes based on preference for numerical/computational or biological modules (see 'A Review of Bioinformatics Education in the United Kingdom', http://www.hgmp.mrc.ac.uk/~dcounsel/education.html) and this mechanism allows their degree's content to be tailored accordingly. However, the choice of one theme or the other is not mandatory.

The remaining 5-credit component of the numeric skills module and a compulsory 5-credit module devoted to building generic key skills, including literature searching, a group project and presentation exercises are also delivered in week 1 to 6 of semester 2.

Preparation for the research project (see below) begins in week 7 of semester 2.

Research project. The 90-credit research project is of six months duration. The research project may be based in a research group from one of the Schools that offer bioinformatics-related research training, including the Schools of Computing Science, Mathematics and Statistics, Biology and Cell and Molecular Biosciences. Each student will begin preparatory work on their selected research project (literature search, background reading) during semester 2 as part of their transferable skills module, and will produce a research proposal with a workplan in the style of a standard research council grant application and give a presentation on their research plans, again as part of the research skills module. A website will also form a requirement of the research project, together with the completion of the finished research thesis.

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

This programme is distinctive for a number of reasons. Firstly, the programme is very research focussed. The use of short fat modules in semester 2 allows hands-on, real-world research training scenarios to be delivered. Secondly the programme offers a high degree of training in the area of predictive biology and modelling; students with these kinds of skills are currently in high demand by both academia and industry. Thirdly, the programme caters for students from a range of backgrounds and offers a high degree of choice, allowing students to tailor their degree programme to suit their match their training needs with their career aspirations. Finally, the programme is managed and delivered by a team of genuinely multidisciplinary researchers, with an excellent track record in bioinformatics research and training.

Programme regulations (link to on-line version)

5198F: -R5198F

13 Support for Student Learning

Generic information regarding University provision is available at the following link.
Generic Information

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.
Generic Information

Accreditation reports
This programme is not accredited by any professional body.

Additional mechanisms
Turnitin is routinely used by the school to detect plagiarism when appropriate.

15 Regulation of assessment

Generic information regarding University provision is available at the following link.
Generic Information

In addition, information relating to the programme is provided in:
The University Prospectus: http://www.ncl.ac.uk/postgraduate/courses 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.