Programme Specification (PG)

Awarding body / institution:	Queen Mary University of London
Teaching institution:	Queen Mary University of London
Name of final award and title:	MSc Artificial Intelligence in the Biosciences
Name of interim award(s):	Postgraduate Certificate (PG Cert), PG Diploma (PGDip)
Duration of study / period of registration:	1 calendar year
Queen Mary programme code(s):	
QAA Benchmark Group:	not applicable
FHEQ Level of Award:	Level 7
Programme accredited by:	n/a
Date Programme Specification approved:	
Responsible School / Institute:	School of Biological and Behavioural Sciences

Schools / Institutes which will also be involved in teaching part of the programme:
School of Mathematical Sciences

Collaborative institution(s) / organisation(s) involved in delivering the programme:

Programme outline

The MSc program Artificial Intelligence in the Biosciences has been designed specifically to make Artificial Intelligence (AI) and related computational techniques (e.g., machine learning, analysis of large data sets) accessible to biology and biomedical graduate students without any prior experience in computational methods. The aim is to prepare students to become leaders in the application and development of AI methods in a bioscience workplace environment. Students therefore learn to use AI in the biosciences as a toolbox: how to judiciously pick and combine the right tools to achieve a given objective, how to handle these tools in practice, and what the strengths and limitations of different tools are. Since we do not assume prior experience with computational methods, the program begins in Semester A with modules on essential shell command and HPC usage, coding, its use for statistical data analysis, and then an introduction to AI concepts, while also discussing first applications in bioinformatics. Semester B then introduces students to the full range of applications of AI in the biosciences, covering both established methods and latest developments and trends. They are also introduced to modern computation intensive statistical methods. To develop their AI knowledge into professional AI skills, students do two group projects in Semester C, solving problems in the biosciences using AI methods. The task in the first project is well defined, so students can focus on learning how to structure a problem to approach it efficiently as a group. Emulating a typical work-place situation, students are given a more widely defined bioscience problem for the second project, and the judicious definition of the underlying data-analytics problem becomes part of the tasks.

Aims of the programme

Applications of Artificial Intelligence (AI) tools in the biosciences are rapidly expanding. The inherent `messiness' of biological systems makes the use of AI tools especially attractive. They provide the data processing power, repeatability, consistency and accuracy of computational science without relying on inflexible mathematical or symbolic model formulations. Methods and thinking in AI are, however, very different from those a typical biology graduate would have learned, which is why applications of AI in the biosciences do not currently unfold their full potential. This program aims to overcome this bottleneck by preparing bioscience graduates to become leaders in the application of AI methods in professional bioscience R&D workplace environments.

What will you be expected to achieve?

Students who successfully complete the programme will have demonstrated that they can confidently and professionally lead the application Artificial Intelligence (AI) methods to new problems in the biosciences. This includes achievement of the specific learning outcomes listed below.

Academic Content:	
A 1	Describe a wide range of existing applications of AI in the biosciences.
A 2	Identify, choose and combine appropriate AI methods to solve problems in the biosciences
A 3	Implement applications of AI on your own, especially in the biosciences
A 4	Quantify the performance of AI systems using established metrics

Disciplinary Skills - able to:	
B 1	Judiciously estimate hardware and data requirements of new AI solutions
B 2	Explain applications of AI in the biosciences to experts and non-experts
B 3	Anticipate upcoming developments in the application of AI in the biosciences

Attributes:	
C 1	Carve up problem tasks for efficient teamwork

C2	Communicate complex facts and ideas in speech and writing clearly and with confidence
C3	Contribute with your skills to a team to achieve a larger objective
C4	Identify ethical risks and limits to the applications of technology

How will you learn?

Learning and Teaching Strategies:

At the core of the program are two modules in which students learn in lectures about a wide range of applications of AI in the bioscience. A diverse selection of examples is studied in depth in both lectures, PC laboratories and independent study, addressing learning outcomes A1, A2, A4, B1, and C4. These two modules build on a range of preparatory modules teaching enabling skills, including essential shell command and HPC usage, coding, its use for statistical data analysis, computational statistics, and basic AI concepts. These are all taught in combinations of lectures, PC laboratory work and independent study. Literacy, creative thinking and communication skills (A1, A2, B2, C1, C2) are practiced in a seminar-style classes where students are instructed in lectures to then deliver group presentations and a report written in independent study. Practical skills of working independently as a team to plan and implement application of AI methods to new bioscience problems and reporting results (A2, B1, B2, C1, C2, C3) students learn in two group project modules, involving introductory lectures, drop-in group tutorials, independent study in PC laboratories, seminar group presentations, and a report written in independent study.

Learning Opportunities and Notional Study Time:

Throughout the program we place high emphasis on hands-on experience in computer labs and projects, to immediately put the material taught in lectures into practice. Many exercises will be done on Queen Mary's high performance computing cluster Apocrita. Next to the scheduled sessions of 10 modules you will need to spend time preparing for scheduled sessions, follow-up work, wider reading, research, revision, and project work. The typical total study time is 1800 hours. Our new Graduate Centre offers purpose-built spaces for self-study and an exclusive rooftop common room.

All modules are fully supported by Queen Mary's QMplus Virtual Learning Environment, providing opportunities for online learning and discussion. The two Semester 3 projects are done in groups of around 3-4 students for optimal group learning and teamwork experience.

How will you be assessed?

Continual assessment is used throughout the programme, with the specific mode of assessment for each module selected according to the nature of the module content. Most modules have two or three pieces of assessed coursework with feedback given in a timely fashion. Some Semester B modules have exams.

The programme will be assessed through an exciting and varied combination of essays, practical assignments, group projects, workshops and presentations.

The group projects are assessed on the data analysis code produced and the presentation of the project results in a report and an oral group presentation.

Students are advised to check the Academic Regulations for further details regarding assessments processes and re-sits.

Specific learning outcomes are assessed as follows:

A1, C4: unseen exam essays, group presentation, coursework essays

A2, B1: practical reports, project products, project reports, project presentations

C1, C3: project products, project reports, project presentations

A3 and A4: practical reports

B2, B3: exam essays, group presentations

C2: group presentation, coursework essays, reports

How is the programme structured?

Please specify the structure of the programme diets for all variants of the programme (e.g. full-time, part-time - if applicable). The description should be sufficiently detailed to fully define the structure of the diet.

Since we do not assume prior experience with computational methods, the program begins in Semester A with modules on essential shell command and HPC usage, coding, its use for statistical data analysis, and then an introduction to AI concepts, while also discussing first applications in bioinformatics. Modules in Semester A are block-taught because modules build upon each other. Each block consists of two teaching weeks and one assessment week where assessed material is prepared.

Semester B then introduces students to the full range of applications of AI in the biosciences, covering both established methods and latest developments and trends. They are also introduced to modern computation intensive statistical methods. Modules in Semester B run in parallel, giving students more opportunity to reflect upon and consider links between material taught in different modules.

To develop their AI knowledge into professional AI skills, students do two group projects in Semester C, solving problems in the biosciences using AI methods. The task in the first project is well defined, so students can focus on learning how to structure a problem to approach it efficiently as a group. Then, emulating a typical work-place situation, students are given a more widely defined bioscience problem for the second project, and the judicious definition of the underlying data-analytics problem becomes part of the tasks.

Academic Year of Study FT - Year 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Unix and Analysis of Large Genomic Datasets	BIO726P	15	7	Compulsory	1	Semester 1
Coding for Bioscientists	BIO722P	15	7	Compulsory	1	Semester 1
Statistics for Biologists	BIO724P	15	7	Compulsory	1	Semester 1
AI and Data Science in Biology	BIO720P	15	7	Compulsory	1	Semester 1
AI and data analytics in ecology and evolution	BIO728P	15	7	Compulsory	1	Semester 2
AI and data analytics in physiology and biomedicine	BIO729P	15	7	Compulsory	1	Semester 2
Research Frontiers of AI in the Biosciences	BIO734P	15	7	Compulsory	1	Semester 2
Computational Statistics with R	MTH791P	15	7	Compulsory	1	Semester 2

Programme Title: MSc Artificial Intelligence in the Biosciences

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Missing Biological Data Team Challenge	BIO732P	30	7	Core	1	Semester 3
Developing AI Solutions in the Biosciences	BIO730P	30	7	Core	1	Semester 3

What are the entry requirements?

Potential students are expected to have a minimum of a second class honours degree in a relevant subject such as biology, biochemistry, medicine, or genetics. Preference will be given to candidates with an upper second class or first class degree. Individuals with relevant professional qualifications or other relevant experience and qualifications will also be considered.

English Language proficiency is required at the standard level for PGT S&E entry (IELTS 6.5, TOEFL 92, PTE Academic 62).

How will the quality of the programme be managed and enhanced? How do we listen to and act on your feedback?

The Student-Staff Liaison Committee provides a formal means of communication and discussion between schools/institutes and its students. The committee consists of student representatives from each year in the school/institute together with appropriate representation from staff within the school/institute. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Student-Staff Liaison Committees meet regularly throughout the year.

Each school/institute operates an Education Committee which advises the School/Institute Director of Education on all matters relating to the delivery of taught programmes at school level including monitoring the application of relevant QM policies and reviewing all proposals for module and programme approval and amendment before submission to Taught Programmes Board. Student views are incorporated in the committee's work in a number of ways, such as through student membership, or consideration of student surveys.

All schools/institutes operate an Annual Programme Review of their taught undergraduate and postgraduate provision. APR is a continuous process of reflection and action planning which is owned by those responsible for programme delivery; the main document of reference for this process is the Student Experience Action Plan (SEAP) which is the summary of the school/ institute's work throughout the year to monitor academic standards and to improve the student experience. Students' views are considered in this process through analysis of the PTES and module evaluations.

What academic support is available?

(i) We begin with a substantive induction programme specifically for its MSc intake each year. This includes a briefing from the Program Director on matters relating to the requirements of the programme and conduct of research as well as a series of briefings, demonstrations and visits aimed at ensuring that students are aware of the range of facilities for the support of study and research in the School.

(ii) The Programme Director acts as the coordinator of all programme activities, supported by staff of the SBBS Administrative Office.

(iii) Module organisers are the first point of academic contact for advice and support during the taught component. The programme director is available for consultation by students on this programme on any matter that relates to or impacts upon their studies.

(iv) Project supervisors are allocated once project topics have been decided upon.

(v) If there is requirement for further advice or support, then one of the School's Senior Academic Advisors or the Director of Education may be consulted.

(vi) Each group project will be supervised either by the organiser of group project module, or by another member of academic staff under the guidance of the module organiser. The supervisor is primary source of guidance on all matters relating to a group project.

(vii) Students will have access to teaching staff on an individual basis for matters relating to individual modules, or to deal with specific academic problems.

(viii) Students will be made aware of a range of on-line documentation published by the University Registry, such as a Postgraduate Study Guide.

(ix) All MSc programme details and documentation will be available on QMplus.

(x) There are extensive library and IT facilities. This includes the main library, a subject librarian, the Student PC Service and the IT Services Help Desk.

(xi) Students will be made aware of IT Training Short Courses covering common software applications, operated by IT Services.

(xii) Students will be made aware of English Language & Study Skills Programme. This includes pre-sessional English language and academic skills for international students and an in-sessional Research Writing Workshop programme.

(xiii) Students will be encouraged to engage with the Post graduate Student-Staff Liaison Committee(s) (PG-SSLC) for discussion of, and feedback on, all matters relating to academic programmes and departmental teaching activities. PG-SSLC meetings are held in each semester and include a representative from each progamme of study. The committee is jointly chaired with the Director of Postgraduate Taught Programmes and an elected student representative. Both joint chairs will set agenda items, report back progress to the meetings, and will chair component parts of the meeting.

(xiv) Other support services for students include:
Advice & Counselling Service (for general advice, welfare information and counselling service).
Advice & Support service by the Queen Mary Student's union
Housing Services (for support in finding accommodation).
Disability and Dyslexia Service for students with disabilities/learning difficulties.
Language Learning Unit (for introductory courses in various modern European languages).
Careers and Enterprise service

Programme-specific rules and facts

The programme follows the standard QMUL regulations for postgraduate programmes.

How inclusive is the programme for all students, including those with disabilities?

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:
• Finding out if you have a specific learning difficulty like dyslexia
• Applying for funding through the Disabled Students' Allowance (DSA)
• Arranging DSA assessments of need
• Special arrangements in examinations
• Accessing loaned equipment (e.g. digital recorders)

- Specialist one-to-one "study skills" tuition
- Ensuring access to learning materials in alternative formats (e.g. Braille)
- Providing educational support workers (e.g. note-takers, readers, library assistants)
- Mentoring support for students with mental health issues and conditions on the autistic spectrum.

Links with employers, placement opportunities and transferable skills

Graduates from this program will find employment opportunities throughout the biotechnology industry, in governmental agencies, in NPOs, and as data scientists in a wide range of sectors.

Potential employers are invited to participate in the group project presentation seminars in Semester C both online and on campus, and arrangements are made for networking between employers and students after the presentations.

Programme Specification Approval

Person completing Programme Specification:	Dr Axel G. Rossberg
Person responsible for management of programme:	TBD
Date Programme Specification produced / amended by School / Institute Education Committee:	24 Feb 2022
Date Programme Specification approved by Taught Programmes Board:	