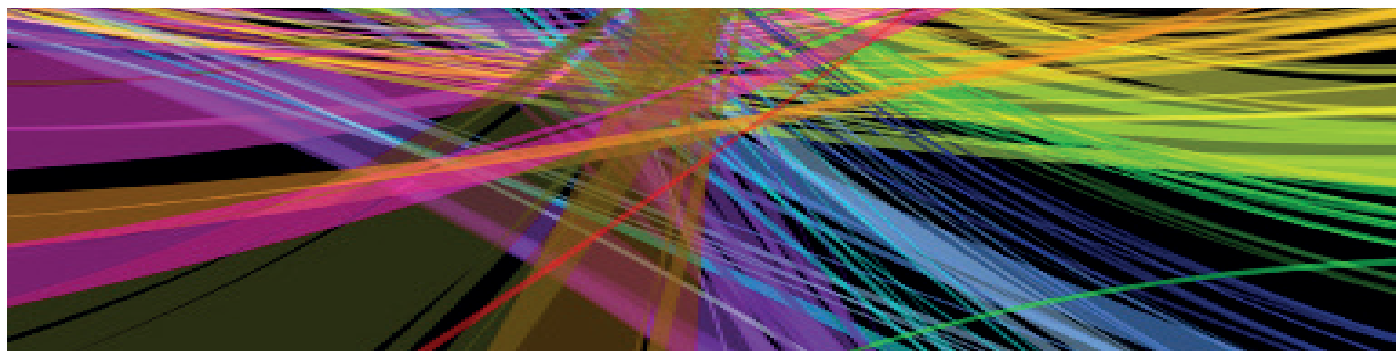# Applied Bioinformatics
MSc

Over the past few years, bioinformatics has become the most exciting field in biology. This MSc course provides a unique hands-on learning experience in bioinformatics skills, by combining the latest advances in analysing high-throughput genomic, transcriptomic and metabolomics data.

Cranfield's Bioinformatics MSc is the first of its kind in the UK. With more than 200 alumni over the past 10 years, it has become the most popular postgraduate course in Bioinformatics in Europe. As Cranfield is a solely postgraduate university it means that every taught module of the Applied Bioinformatics MSc is at Masters-level, which is why it is the award-winner of the BBSRC's Masters Training Grant (MTG) for best course in life sciences. Our taught modules cover in great depth a plethora of programming languages typically applied in bioinformatics, such as Perl, Java, R and SQL; as well as modern Web technologies such as JavaEE, NoSQL and JavaScript. Furthermore, we have two dedicated taught modules focusing on established bioinformatics protocols for the latest Next Generation Sequencing (NGS) and 3rd Generation Sequencing (3GS) technologies.

Who is it for?

This course aims to equip graduate scientists with the computational skills and awareness needed to process, analyse and interpret the vast amounts of biological data now becoming available. This course is equally suitable for candidates from life sciences disciplines who aim to gain relevant programming and computational skills, and graduates with an IT/computer science background who want to gain the molecular biology understanding to become bioinformaticians.

On completion of this course, you will be able to apply information technology and computational techniques to process genomic and genetic data, as well as developing novel drug discovery and diagnostic tools.

Additionally, you will gain the skills to design and implement software tools and databases using the latest advances in standalone and web-based technologies to fulfil the need of the research community.

Course structure

- Eight taught modules (40%),
- Group project or dissertation: (20%),
- Individual research project (40%).

Informed by industry

Cranfield University benefits from the input of a group of world-renowned experts in a range of applied sciences including bioinformatics. We lead and collaborate in diverse research and consultancy projects, both nationally and internationally.

Our collaborators include:
- GlaxoSmithKline
- London School of Hygiene and Tropical Medicine
- Queen Mary University of London
- Unilever
- Sanofi Aventis
- Rothamsted Research
- The European Bioinformatics Institute
- London School of Hygiene and Tropical Medicine
- University of Athens
- Cambridge University.

Future career

Our MSc opens doors to careers in industry, public research establishments and university research.The multidisciplinary nature of our course has allowed our students to follow diverse career paths in various medical-related sectors.

Successful graduates have been able to pursue or enhance careers in a variety of key areas such as Pharmaceutical and Biotech companies, plant research institutes, food sector, public Institutions, bioinformatics, IT companies.

Key information

Duration:
MSc: one year full-time, two to three years part-time.

Start date:
Full-time: October.
Part-time: October.

Qualification:
MSc.

Location:
Cranfield campus.

Entry requirements
A first or second class UK Honours degree (or equivalent) in a life science, computer-science subject or candidate with appropriate professional experience.

Overview of taught modules

Example modules
Modules form only part of the course content with the projects and theses making up the balance. Please see the course structure for details.

The list below shows the modules offered in the 2021/2022 academic year, to give you an idea of course content. To keep our courses relevant and up-to-date, modules are subject to changes - please see the webpage for the latest information.

Compulsory modules
(all the modules in this list need to be taken as part of this course).

Advanced Sequencing Informatics and Genome Assembly
This module aims to develop a system-level view of biological systems and their response to various internal and external factors, through the integration of advanced NGS and 3GSsequencing data with functional annotation using established concepts of graph theories widely applied for various assemblers such de-Brujin and Overlap-layout consensus. This module gives an insight on the details of omic-scale/big-data-driven life science making use of core platform technologies.

Application of Bioinformatics in Epigenetics, Proteomics and Metagenomics
You will be provided with the knowledge of the current trends in analysing epigenomic, proteomic, and metagenomic data and to demonstrate its principles, challenges, and complexities in bioinformatics.

Data Integration and Interaction Networks
Data integration represents a major challenge for bioinformatics research. This module covers the most popular data management, integration and visualisation tools within the bioinformatics community as well as the main concepts of databases design and normalisation.

Exploratory Data Analysis and Essential Statistics using R
This module aims to provide you with an overview of important concepts in statistics and exploratory data analysis. The module introduces the main concepts in analysing biological datasets using the R environment, as well developing bespoke scripts for multivariate analysis such as principal component analysis and hierarchical clustering.

Introduction to Bioinformatics using Python
This module provides a general introduction to bioinformatics and fundamentals of programming. The module covers the programming basics required by students in order to program in Python, which is nowadays becoming one of the most popular programming languages in the bioinformatics community; and its application in retrieving, parsing and visualising biological sequence data.

Machine Learning for Metabolomics
During this module you will learn about the main aspects related to the analysis of the metabolic profile in living organisms and explore statistical and computational techniques that are central to the field of metabolomics with particular emphasis to machine learning. Machine learning is a rapidly expanding form of artificial intelligence (AI) which has found many applications in the field of metabolomics. Examples include explanatory analysis of complex biological systems, novel biomarker discover and prediction modelling.

Next Generation Sequencing Informatics
Will introduce you to the techniques that have given rise to the genomic data now available, and develop skills and understanding in the bioinformatics approaches that facilitate evaluation and application of these data. Over the past decade, Next-generation DNA Sequencing (NGS) technology has been a huge stimulus for a lot of breakthrough discoveries in biology. This module provides you with an overview of many core types of NGS projects, including latest protocols in genomic and transcriptomic analyses, genotyping and variant calling as well as detailed hands-on practical sessions of our best practice data-analysis workflows.

Programming Using Java
This module will introduce you concepts of object oriented programming using Java. Java is the pre-eminent programming language for serious application development on the Internet. The module covers Java data objects of primitive and reference data types and introduces you to the basic fundamentals of programming in Java, with hands-on practical sessions on implementing simple programs using calculations, variables, control statements and loops.

Group project
Working in project teams is part of everyday working life. It requires not only your individual expertise but also an appreciation of the skills of the other members of the team. This part of the course gives you the opportunity of working as part of a team on a group project. This is an invaluable experience that will help you to recognise and implement the differing contributions that colleagues bring to team work, and the different roles that we can choose to play within a team.

Individual project
A four-month thesis project carried out either at Cranfield or an external research establishment or commercial organisation within the UK or Europe. This gives you the chance to concentrate on a subject area of particular interest to you, perhaps in collaboration with the type of organisation that you are hoping to find employment with.

Contact details

T: +44 (0)1234 758082
E: studyagrifood@cranfield.ac.uk

For further information please visit
www.cranfield.ac.uk/bix