



**QUEEN'S  
UNIVERSITY  
BELFAST**

SCHOOL OF  
MEDICINE,  
DENTISTRY AND  
BIOMEDICAL  
SCIENCES



**JOIN THE OMICS  
REVOLUTION**

**MSc  
BIOINFORMATICS AND  
COMPUTATIONAL GENOMICS**

## Summary Entrance Requirements

A 2.1 Honours degree or equivalent qualification acceptable to the University in a Natural Science subject, Mathematics, Computer Science, Physics, Statistics or a relevant medical subject (eg Genetics, Molecular Biology, Biomedical Sciences). The programme is open to graduates in computer science, life sciences, physics or statistics. A medical (MD) or dental (BDS) degree is also considered.

## International Qualifications

For information on international qualification equivalents, please see: [go.qub.ac.uk/YourCountry](http://go.qub.ac.uk/YourCountry)

## English Language

Evidence of an IELTS\* score of 6.5, with not less than 6.0 in any component, or an equivalent qualification acceptable to the University is required.

\*Taken within the last 2 years.

For more information on English Language requirements for EEA and non-EEA nationals see: [go.qub.ac.uk/EnglishLanguageReqs](http://go.qub.ac.uk/EnglishLanguageReqs)

## Teaching

Morning/Afternoon

10–15 hours per week

We provide a range of learning experiences which enable our students to engage with subject experts, develop attributes and perspectives that will equip them for life and work in an advanced society and make use of innovative technologies and a world-class library that enhances their development as independent, lifelong learners.

Across a combination of morning and afternoon classes, examples of the opportunities provided for learning on this course are lectures, practical experiences, e-learning technologies, self-directed study and added value qualifications to enhance employability.

## Assessment

Assessment for the modules will be based on 100 per cent coursework/in-class tests/dissertation. Students who pass all of the taught modules but who fail to achieve a mark of at least 50 per cent in the dissertation are eligible for the award of a PG Diploma.

## Contact Us

[askmhs@qub.ac.uk](mailto:askmhs@qub.ac.uk)

## Further Information

[www.qub.ac.uk](http://www.qub.ac.uk)

# MSc BIOINFORMATICS AND COMPUTATIONAL GENOMICS

## Overview

The past decade has seen enormous advances in molecular and biomedical technology resulting in the 'omics' revolution.

Bioinformatics covers the application of mathematics, statistics and computing to biological and clinical scenarios. It involves the application and development of algorithms and software to understand and interpret 'Big Data', which is driving medical research, discovery and practice.

## What's Involved?

You'll be looking at clinical and omics data to find patterns that others can't see, which relate to patient response to treatments and prognosis.

You'll discover results that translate to the real world, through commercialisation or clinical trials to tackle diseases.

You'll use your vision to find unique solutions to clinical and biological problems, and by the end of the degree you'll be ready to work within a multidisciplinary team alongside bioinformaticians, biologists and clinicians, dissemination and application of cutting edge research, knowledge transfer and the commercialisation of research ideas and innovations.

<https://www.qub.ac.uk/research-centres/centreforcancerresearchcellbiology>

The research projects are mainly split between the Centre for Cancer Research and Cell Biology, and the Centre for Experimental Medicine. You'll be working with supervisors who are actively conducting research into the causes and treatments of disease. There are also opportunities to work on research projects with our industrial partners.

## Content

A fascinating and challenging set of subjects, this Masters degree will provide students with a background in computational or life sciences, to move across to an exciting new area of discovery, technology and applications.

We provide a broad learning base and offer training in open-source programming languages commonly used in academia and industry.

## Modules

The Master's consists of an introductory short course (two weeks at the beginning of the first semester) in Cell Biology, followed by modules in:

### Digital Pathology (Blended Learning)

The module will cover modern aspects of digital pathology in education, research and diagnostic practice. It will cover technical aspects of whole slide scanning, instrumentation, optics, image formats and software for digital slide creation, management and web-based sharing. The course will also cover in detail the full spectrum of image analysis techniques ranging from morphological analysis, DNA ploidy analysis, pattern recognition, machine vision, quantitative IHC and FISH analysis.

## Applied Genomics

This module examines the practical challenges in generating different "Omics" datasets, the important implications of how this is conducted when analysing such datasets and gives practical experience of dealing with resulting datasets using relevant tools, examining the challenges presented.

## Analysis of Gene Expression

This module will provide the practical molecular biological knowledge required to develop the most effective and useful computational tools for analysis of gene expression data.

## Genomics and Human Disease

This module explores rapidly advancing fields that are moving from specialised research areas to mainstream medicine, science, and public arenas. The principles of genomic medicine will be discussed alongside bioinformatics approaches for identifying 'causative genes' for human disease.

## Research Project: Dissertation

On completion of this module you will be able to summarise the contents of research literature and assess published research in a specialised field. You will write scientific documentations utilising a variety of research techniques and evaluate research data, explaining research findings to a wider audience. This will result in a written paper of 15,000-20,000 words.

## Scientific Programming and Statistical Computing

This module covers the fundamental elements of the statistical framework R and the programming language Python. It gives an introduction to parallel processing applications and implementation and how to leverage modern big-data problems through HPC computing.

## Biostatistical Informatics (Blended Learning)

The core of this module will highlight the analysis of different "-omics" data including pre-processing, normalization and quality control. The module will also provide an introduction to carrying out statistical tests in the R Statistical programming language and other common software.

## Why Queen's

You'll be involved with our Centre for Cancer Research and Cell Biology, who work with partners around the world in developing cancer treatments and pioneering advances in patient care.

The Centre has an international reputation for successful dissemination and application of cutting edge research, knowledge transfer and the commercialisation of research ideas and innovations.

## Careers

The rapid production of 'omics' data within medicine and the life sciences has meant that individuals with analytical experience in this field are highly sought after. Recent graduates have gone on to work in industry in companies such as Almac Diagnostics, Biokinetic Europe and Fios Genomics and some have gone onto further PHD level research.

