



NUI Galway  
O'É Gaillimh

# MSc in Genomics Data Science

Rapid advancements in high-throughput technologies used to sequence DNA have led to an unprecedented increase in the availability and use of genomics data, from fundamental scientific discovery in the life sciences to clinical applications in genomic and precision medicine. The analysis of the large, complex datasets generated using these cutting-edge techniques requires a new generation of highly-trained scientists who possess not only the necessary quantitative and computational skills but also a sound understanding of the underlying biological principles and technologies.

Combining elements of genetics, statistics, data analytics, machine learning, and computational biology, this exciting new programme will provide graduates with a highly marketable and transferable set of data science skills as well as specialist knowledge of and experience in the application of these skills to genomics data.

## Contact information / Enquiries to:

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## Genomics Data Science (MSc)

**Course level:** Level 9

**Duration:** 1 year

**Entry Requirements:**

Applicants must have achieved a first or strong second class honours degree in a quantitative discipline. Qualifying degrees include, but are not limited to, mathematics, physics, statistics, computer science, and engineering (biomedical or electronic/computer engineering).

**Fees:** See [nuigalway.ie/fees](http://nuigalway.ie/fees) for more information.

**Applying:** Applications are made through the NUIG postgraduate portal, see [nuigalway.ie/apply](http://nuigalway.ie/apply)

**Course Code:** GDS1

**Closing date:** Places will be allocated on a rolling basis and candidates are advised to apply as early as possible.

## Why study this programme?

This course will provide advanced postgraduate training in the use and development of computational techniques to analyse and understand genomic data, allowing graduates to enter the emerging field of genomic medicine.

## Programme Outline

The course comprises 90 credits; 60 credits are obtained from taught modules that provide both fundamental and advanced training in genomics data science, 30 credits are obtained from an individual research project.

During the first semester, students undertake a number of accelerated-format modules covering molecular and cellular biology, probability and statistics for genomics, programming for biology, genomics techniques, medical genomics, and genomics data analysis. Students also take part in a weekly seminar series which introduces them to the latest developments in genomics data science. Early in the semester, students select their research project topic and begin to engage with the associated scientific literature.

During the second semester, students take three core modules including further modules in medical genomics and genomics data analysis, as well as a module in genomics research methods. Students also choose three optional modules from a wide selection of topics across the life science, mathematical, and computational disciplines. These options include: applied and advanced immunology, optimisation, data visualisation, bioinformatics, probabilistic models for molecular biology, mathematical molecular biology, and web and network science. During this semester students complete the literature review component of their project.

Following semester two exams, students begin the research phase of their MSc where they work full-time on their research project. At the end of this period, each student submits a manuscript based on their research and gives an oral presentation.

## Career opportunities

Graduates of this programme will be well placed to seek employment in a wide range of growing industries that employ genomics technologies, including biotechnological and pharmaceutical research and development, as well as in clinical healthcare. Graduates will also have the option to pursue PhD research and may be particularly interested in the NUIG-led SFI Centre for Research Training in Genomics Data Science ([genomicsdatascience.ie](http://genomicsdatascience.ie)). Given the highly transferrable and sought after nature of the data science skills learned during the programme, graduates may also choose to enter data analyst or data scientist roles in non-genomics domains.

## Core Modules

- Statistical Computing in R
- Introductory Probability for Genomics
- Programming for Biology
- Genomics Techniques
- Genomics Research Methods
- Medical genomics I: Genomics of common diseases
- Medical genomics II: The cancer genome
- Genomics Data Analysis I: Fundamentals of Genomics Data
- Genomics Data Analysis II: NGS Applications

## Optional Modules

- Data visualization
- Optimisation
- Mathematical Molecular Biology
- Probabilistic Models for Molecular Biology
- Bioinformatics
- Web and Network Science

**Alan Barnicle,**  
*NUI Galway graduate and R&D  
Scientist at Cambridge Epigenetix,  
Cambridge, U.K.*



“I was recruited by Cambridge Epigenetix in the U.K., a start-up genomics company backed by Google Ventures, just after completing my Ph.D. in Bioinformatics at NUI Galway. It's an exciting place to be as we are working at the frontier of technology development. My job as an R&D scientist covers a whole range of activities, from working on innovative genomics techniques used to study individual samples, to the development of new bioinformatics tools necessary to interpret the resulting data. The new Masters programme at NUI Galway provides exactly the sort of skillset that genomics scientists need in this highly dynamic and hugely rewarding career - particularly for those graduates who may have no formal prior experience of molecular biology, but whose computational/mathematical skills will see them in high demand.”

<http://www.nuigalway.ie/courses/taught-postgraduate-courses/genomics-data-science.html>

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