



“After first year I was hooked – I knew Genetics was for me”

George Ffrench, BSc Genetics, graduated in 2009

“When I started out studying Science at UCD, I didn't have my heart set on any degree in particular. I am very inquisitive by nature – always wanting to know more about everything, from Physics, Chemistry, and Biology, to Psychology and Computer Programming. When choosing my modules in first year I chose from all these areas (thanks to the flexibility of the horizons programme), making sure to try my hand at everything until I found what I liked. After a module in first year on 'Cells, Genes & Microbes' I was hooked. I knew Genetics was for me. What could be more interesting than finding the answers to questions about life itself? How did we evolve from single celled organisms? How does incredibly stable DNA give rise to highly dynamic organisms? How do genes relate to disease? The latter is what I hope to study after finishing my degree.

“We actually know the genetic cause of many hereditary diseases. To cure many of them all that is needed is to insert a working copy of the gene behind the disease into the affected cells. However, in most cases we still need to develop a robust system of delivering the gene therapy. After my four years at UCD, I feel that I am well equipped to contribute to such a field.”

How do I find out more about this degree programme?

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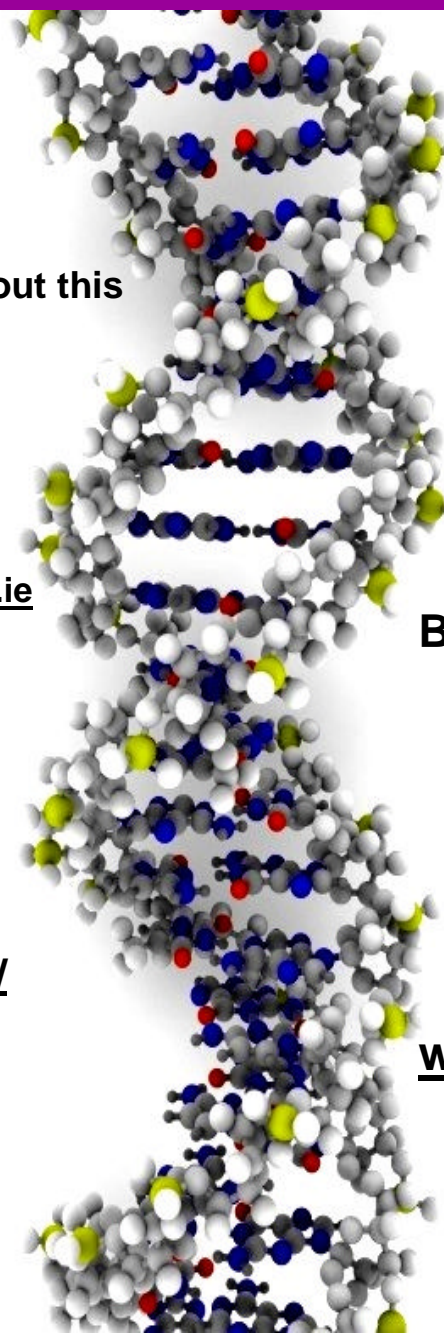
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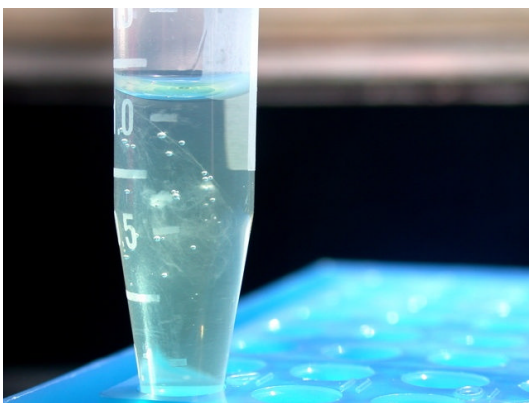
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BSc in Genetics

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Isolated plant DNA
(image from <http://www.flickr.com/photos/gravitywave/7715395/>)

What is Genetics?

Genetics is the scientific study of heredity – how information is passed from one generation to the next. Geneticists answer questions such as why some families are more prone to disease, and how to use biotechnology to produce drugs and other molecules.

Genetic manipulation of agricultural plants has been used to develop new crops, such as insect-resistant cotton, and to add characteristics important for disease-prevention, such as vitamin D-producing rice, which may help prevent blindness in developing countries. Genetics is also helping to address the consequences of climate change, through the development of biofuels.

Studying the inheritance and treatment of human disease impacts on all of society. There are more than 3,000 inherited diseases (e.g. cystic fibrosis and some forms of Alzheimer's disease), and many have been characterized at the genetic level. We are entering a new era of "personal genomics", where the DNA sequence of each person will be used to predict their risk of disease, and also to help determine suitable treatments.

Geneticists study evolution of all organisms, including humans. DNA sequences reveal the origins of species, and teach us about the movement of populations. We now know that humans arose in Africa and moved out to populate the rest of the world. DNA differences can help us trace our own family relationships, or can be used in forensic applications, such as DNA fingerprinting. The field of genetics is expanding rapidly in the 21st century, and you have an opportunity to be part of it.

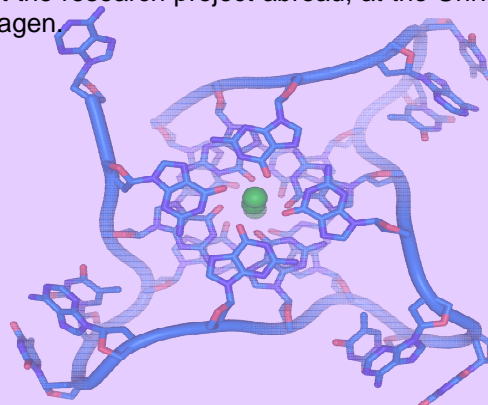
What will I study as part of my degree?

The BSc Honours Degree is taught over four years (stages). In Stage 1, students follow the general biology curriculum. This consists of three modules in Biology and two each in Chemistry and Mathematics. Students also choose up to three optional modules in science, and two elective modules. Some students choose all their modules from within science, and some take the opportunity to study other areas (e.g. a foreign language).

In Stage 2, students take 3 core modules in Genetics, covering Plant and Animal Genetics, and Molecular Genetics. Popular subjects to combine with Genetics include Biochemistry, Pharmacology, Microbiology and Zoology. There are also opportunities to take two elective modules, perhaps following up on subjects chosen in first year, or branching into new ones.

In Stage 3, students take at least 8 core and option modules in Genetics, including the Genetic Basis of Disease, Evolutionary Biology, Bioinformatics (Computational biology) and Genomics (the study of the entire DNA sequences of organisms). It is also possible to study abroad for a semester or for an entire year.

In Stage 4, students take 8 modules covering areas such as the genetics of behaviour, the use of model organisms, and the regulation of gene expression. A laboratory research project is a major component of the degree, and lasts for 10-12 weeks. It is also possible to carry out the research project abroad, at the University of Copenhagen.



DNA structure from the end of a human chromosome
Image from www.wikipedia.org



Sculpture of the human genome (Image from <http://www.flickr.com/photos/50815861@N00/855305262/>)

What are the opportunities for graduates in Genetics?

Genetics graduates work in many different areas, from government agencies to industry, and from hospitals to universities, both at home and abroad. Genetics has been described by Forfás as one of the key socio-economic transforming technologies for Ireland in the 21st century, and essential for the development of biotech industries.

Some graduates work in biotechnology and biopharmaceutical companies, such as Genzyme Ireland, or Wyeth Ireland. In the field of agriculture, genetics graduates are involved in developing new crops, such as blight-resistant potatoes. Others work in the food industry. In Ireland, IdentiGEN uses DNA-based methods to trace the source of meat products, from the farm to the supermarket.

In forensic labs, geneticists use DNA fingerprinting for identifying biological samples from crime scenes. Many countries have vast DNA fingerprinting databases, and these are growing all the time. In the medical field, geneticists are employed in diagnostic labs (e.g. to identify microbial organisms), and to characterise genetic changes in cancer and other disease. One growing area is "personal genomics" companies (such as 23andme), which provide individual information about disease risk and family relationships. Many graduates go on to study for higher degrees such as an MSc or PhD, and work in research labs in universities or other places. Some use their training in science as a springboard to develop other careers in the public or private sectors.