SCIENCE

Sector Background

Science is a large and varied career sector and incorporates many distinct yet often overlapping disciplines. Here the sector is divided into Biological and Biomedical Science, Chemical and Pharmaceutical Science, Physical and Mathematical Science, Geological and Environmental Science, and finally Food Science.

Biological and Biomedical Science

Biological Science is a broad term covering a range of disciplines of study such as molecular genetics, cell biology, gene regulation, evolutionary biology, ecology, palaeontology, and marine, freshwater and plant biology. The term 'Biomedical' refers to the combination of biology and medicine towards maintaining and improving both animal and human health.

Biotechnology covers any technological application that uses biological organisms or derivatives of organisms to make or modify products or processes for a specific use. Careers are correspondingly diverse, and include work in the food and brewing industry, the waste management sector, the production of clinical diagnostic products and medicine.

Graduates of Biological and Biomedical Science courses find employment in both public and private laboratories. These can range from clinical laboratories where molecular biologists are employed in areas such as the identification of disease-causing pathogens and the characterisation of genetic changes in cancer cells, to diagnostic and forensic laboratories and genomics companies.

A career in research is a natural progression for many of the graduate students of these disciplines who go on to pursue MSc and PhD research in hospital and university laboratories around the world. Biological Scientists are researchers, with a focus on advancing *theoretical knowledge*. They investigate samples of tissue and body fluids in order to diagnose disease and monitor the treatment of patients, animals and plants alike.

Chemical and Pharmaceutical Science

The Chemical and Pharmaceutical Sciences are rapidly developing fields within in the sciences. They are also significant industries and employment sectors, both in Ireland and worldwide. Career opportunities and occupations in this sector span from how to make medicines and control the quality of those medicines, to the research and development of new drugs and therapies.

The constant demand for efficient, light-weight and robust consumer products is never ending. To meet this demand, companies such as Intel rely on the knowledge of chemists to formulate novel materials with unique electrical, optical and magnetic properties. The sustainable and renewable energy economy is booming with projected global employment of over 100 million.

Ireland is one of the leading locations for the pharmaceutical industry in Europe. Many of the top ten global companies have substantial operations based in the country including GlaxoSmithKline, Pfizer and Merck.

Physical and Mathematical Science

Physics is defined as the study of matter and energy, and the interaction between them. What that really means is that physics is about asking fundamental questions and trying to answer them by observing and experimenting.

About 50% of physics graduates pursue further study or research after graduation. Of the remaining graduates, approximately 10% make the transition to the financial sector and the same proportion work in the education sector. Employment in scientific and technology industries, the energy and environment sector and information technology accounts for the career paths of about 15% of graduates *[Source: Institute of Physics].*

Mathematics is the oldest and most fundamental of all the sciences. Mathematicians use mathematical theory, computational techniques, algorithms, and the latest computer technology to solve economic, scientific, engineering, physics, and business problems. The work of Mathematicians falls into two broad classes—theoretical (pure) mathematics and applied mathematics. These classes, however, are not sharply defined and often overlap.

Theoretical mathematics involves working with pure and abstract theories to advance mathematical knowledge, exploring existing maths in a new way and possibly leading to the development of new principles or. Such pure and abstract knowledge has been instrumental in producing or furthering many scientific and engineering achievements. Many theoretical Mathematicians are employed by university faculties, dividing their time between teaching and conducting research.

Applied mathematics uses theories and techniques, such as mathematical modelling and computational methods, to formulate and solve practical problems in business, government, and the engineering industry. Applied Mathematicians may analyse the most efficient way to schedule airline routes between cities, the effects and safety of new drugs, the aerodynamic characteristics of an experimental automobile, or the cost-effectiveness of alternative manufacturing processes.

Applied Mathematicians working in industrial research and development may develop or enhance mathematical methods when solving a difficult problem. They are required to collaborate with other workers in their organisations to achieve common solutions to problems. Some of the career titles in this area include actuary, operations research, analyst or statistician.

Geological and Environmental Science

The increasing demands of environmental and conservation legislation have led to a surge in demand for graduates of Environmental Biology, Zoology and Plant Biology. Many graduates of Environmental Science courses are employed as wildlife officers and conservation biologists, environmental consultants, scientific and technical officers, and aquaculture and fisheries managers.

In the search for new oil and gas resources, there is a global demand for bright graduates with an understanding of geological processes, a training in field geology and an ability to visualise the subsurface. There are exciting career opportunities in a vibrant international industry.

Renewable, or green energy is a fast-growing area in Ireland requiring new skills and expertise. Renewable energy includes Biofuels, Biomass, Geothermal, Hydro, Marine, Solar and Wind Energy.

Food Science

Food science is concerned with all of the technical aspects of food, beginning with harvesting or slaughtering, and ending with its cooking and consumption. It is considered one of the agricultural sciences, and is usually distinguished from the field of nutrition.

The Agri-Food Sector is very strong in Ireland with excellent employment opportunities for Food Science graduates with technical abilities. Examples of the activities of food scientists include:

- The development of new food products and the design of processes to produce these foods
- Shelf-life studies and the choice of packaging materials
- Sensory evaluation of the product with trained expert panels or potential consumers
- Microbiological and chemical testing

Food scientists at universities may study more fundamental phenomena that are directly linked to the production of particular a food product and its properties. Two national research policy areas currently prioritised are Sustainable Food Production and processing, and Food for Health. New innovations such as the partnership between Kerry Group and UCD Research Department represent a major investment in food science for third level graduates. The National Agri-Food strategy *Food Wise 2025* is available here.

Typical Roles

Some roles in these various disciplines in the Science Sector include;

Biological and Biomedical Science • Microbiologist • Clinical Cytogeneticist • Biotechnologist • Medical Laboratory Scientist • Toxicologist	***Chemical and Pharmaceutical Science*** • Analytical Chemist • Crystallographer • Pharmacovigilance Officer • Research Chemist • Biochemist
Physical Science • Materials Scientist • Medical Physicist • Meteorologist • Astrophysicist	***Mathematical Science*** • Statistician • Actuary • Data Scientist • Financial Modelling Analyst
Geological and Environmental Science • Oceanographer • Environmental Scientist • Soil Scientist • Metallurgist • Geologist	***Food Science*** • Food Scientist • Food Technologist • Food Safety Consultant • Food Chemist

Entry Routes

Undergraduate Study

Entry routes vary depending on the career a potential candidate wishes to pursue. The minimum requirement is a science degree, but many science graduates will pursue postgraduate study before entering employment. Most science Bachelor Degree courses in Ireland allow students to study a broad range of science modules in first year and often second year. Students are then offered a choice of degree options in second or third year. Qualifax can be used to search for courses.

Postgraduate Study

A Master's Degree, where students choose to specialise in a certain area, is almost the standard for working in a large proportion of scientific jobs. Relevant work experience will increase the chances of a job offer; many third-level institutions have links with industry to arrange internships and often students will be offered full-time employment on the basis of a successful work experience. See gradireland.com and UCD Graduate Courses for more information about postgraduate study.

A PhD is valued by many employers but is particularly relevant if you aspire to a career in academic research and teaching. However, there are many other careers for which a research degree is desirable or essential, for example working as a scientific researcher for a pharmaceutical company, or commissioning editor for a specialist academic journal. In some very high-tech areas, such as medical research, a postgraduate research qualification is often considered mandatory.

Because of the technical nature of most jobs in the science sector, employers will specify the qualifications, skills and personal qualities that they require. Most industries require those working in scientific areas to possess good organisational and planning skills; communication and team working skills; IT skills; flexibility and adaptability; the ability to work quickly, accurately, and independently; and logical and critical thinking.

Once in employment, joining a professional body such as the Institute of Physics or the Institute of Chemistry in Ireland can enhance career prospects.

Relevant Bodies & Professional Associations

Science Foundation Ireland	Environmental Health Officers' Association
Biotechnology Ireland	EPA - Environmental Protection Agency
Irish Society of Clinical Microbiologists	Department of Environment, Heritage & Local Governmen
Molecular Medicine Ireland	Marine Institute
The Irish Crystallographic Association	Food Safety Authority of Ireland
Forensic Science Laboratory	Irish Agriculture and Food Development Authority –
The Institute of Chemistry in Ireland	Teagasc
Irish Research Council (Chemistry)	Dept. of Agriculture, Food & The Marine
	Irish Food Board - An Bord Bia
Institute of Physics	
Collaborative Centre for Applied Nanotechnology	Irish Statistical Association
Materials & Surface Science Institute	Institute of Investing and Financial Trading
	Statistical and Social Inquiry Society of Ireland