

UK Food Science and Technology Industry

Introduction and overview – helping to be the guardians of our food future



Q: What is the largest and most important economic activity in the world?

A: The production and distribution of food

The health and welfare of people everywhere depend on good agricultural yields and on the reliable storage, successful processing and safe handling of all types of food. Future food scientists will be the guardians of the safety of the food we eat and they will be working on food security, conducting research on how the food we eat impacts on our health, and advising food companies on the

development of new products linked to optimal nutrition.

Food and Drink manufacturing is the single largest manufacturing sector in the UK, employing approximately 500,000 people and second in terms of world productivity, behind Canada. The sector is one of the only ones in the UK to have been creating jobs consistently through the economic downturn. However, the UK Food and Drink industry will need around 137,000 new recruits over the next decade, with 45,000 of those jobs requiring high level skills. (Improve – Food and Drink Sector Skills Council, 2009).

Food is under attack, and food scientists and technologists have the vital responsibility of being in the frontline of our defence against risks from:

- Pests – e.g. vermin, weeds
- Microorganisms – e.g. salmonella, E.Coli
- Chemical contaminants – e.g. mercury, allergens
- Zoonotic diseases – e.g. BSE

(Institute of Food Science & Technology, 2005)

The knowledge of food scientists and technologists is applied to the practical treatment of food materials to convert them into food products. They minimise the risks of food contamination by ensuring that food safety systems are in place. These products have to be quality assured, and packaged and distributed in a sustainable way so as to meet the needs of consumers for safe, wholesome, nutritious and attractive foods. The roles can be as diverse as testing products in a laboratory to monitor chemical and microbiological changes during cooking and storage; developing new products to meet changing consumer demands; creating low-fat, ready-to-eat meals for airlines; experimenting with new ways of preventing fruit from rotting.

As well as maintaining the standards of current food products, food scientists and technologists are also responsible for new products. Creating a new product is at the cutting edge of the industry. For example a new product needs to be investigated for taste, quality and ingredients before releasing it for mass production. This process involves a set of tests and the completion of checks and documentation to ensure they are of the required standard.

Structure of the Industry

Food science is the scientific understanding of the nature and composition of food materials, and their behaviour under various conditions to which they may be subject. This is a multidisciplinary subject involving knowledge of elements including:-

- interaction of food components with each other, with atmospheric oxygen, with additives and contaminants, and with packaging materials
- the chemical composition of food materials, and the physical, biological and biochemical behaviour of foods
- human nutritional requirements and the nutritional factors in food materials
- the microbiology of foods, and the nature and behaviour of enzymes
- the effects of various manufacturing operations, processes and storage conditions
- the use of statistics for designing experimental work and evaluating the results
- quality assurance to ensure the safety of food products

Examples of activities undertaken by food scientists include:

- Trying out different ingredients that do not cause allergies in foods, and carrying out subsequent tests to see how this alters the product
- Making sure the labelling on a product has the correct warnings for those who suffer from certain allergies
- Investigating how to replace the harmful fats in food with other fats that do not contribute to obesity
- Using their knowledge of the way food behaves under certain conditions, such as freezing, to devise ways of keeping food fresh, safe to eat and attractive to the senses
- Reducing the impact of food manufacturing on the environment by looking at the way food is produced
- Enforcing government regulations, inspecting food processing areas and ensuring that sanitation, safety, quality, and waste management standards are met
- Testing the quality of raw materials and finished products

Case study



Sophie Heyes

Ingredients Scientist, United Biscuits (UB)

“Having graduated with a Masters degree in Chemistry from Liverpool University, I chose to apply to United Biscuits as it seemed a great opportunity to use the skills I had acquired whilst studying in a fast-paced and professional company.

United Biscuits has an impressive portfolio of well-known brands and products, and this also attracted me to the company. During the recruitment process I was able to meet many people who became my colleagues and formed new friendships. Despite the size of the company, it struck how open and welcoming everyone is.

As an Ingredients Scientist, most of my day-to-day work is centred on trialling alternative ingredients for both new and established products. This involves running test bakes, contacting suppliers and liaising with factories about implementing possible changes. The graduate programme has also helped me to develop key skills that are important to my role and allowed me to concentrate on my personal development.

*What I particularly enjoy about my role is the fact that **it gives me a chance to understand the products I work with in much finer detail, and seeing what impact the changes I make to the recipes have on the final product.***”

Food Technologists

Food technology is the application of food science to the processing of food materials into safe, nutritious, flavoursome and attractive food products. An important aspect of this work is liaising with other functions such as buying, marketing and sales, and also with official inspection and hygiene agencies. Technologies included in the area are:-

• Packaging

Why are foods packaged? Today foods originate all over the world. The functions of packaging have multiplied and foods must be protected and kept in good condition during transport and storage. Packaging ensures ‘safe delivery to the consumer in prime condition at an economic cost’. The process of ‘lightweighting’ involves using more efficient materials for packaging. A key element of packaging is the ‘3 R’s’ of environmental packaging law and practice – Reduce, Re-use and Re-cycle. Glass, tinsplate and aluminium can be re-cycled to reduce overall energy usage. *The challenge is to work to make packaging lighter, which is cheaper and uses less fuel to transport.*

• **Engineering can be split into several specialist areas:**

Chemical engineer – helps to develop and design processes and equipment used to make, mix, cook and package ingredients and products

Environmental engineer – makes sure all processes are efficient and environmentally friendly, which includes reducing waste and pollution, and trying to save energy

Packaging engineer – needs to make sure food does not get damaged when it is transported, and making sure it is attractive enough to buy

Biochemical engineer – hygiene is extremely important when making food and biochemical engineers use scientific principles to make sure food is not contaminated by bacteria during production

Case study



Paul McKnight

Research and Development Manager, Macphie Of Glenbervie

“My passion for food began at an early age. I studied for a BSc in Consumer Product Management at Robert Gordon University, Aberdeen, and worked as a chef to pay my way through my course.

I worked in product development for a number of food companies before joining Macphie as a food technologist seven years ago. Macphie is committed to innovation and invests heavily in the pursuit of new ideas, ingredients and technologies. I enjoy working in this fast-paced environment, creating the next generation of exciting food products, packaging and processes.

My role involves tackling diverse technical challenges including new products, packaging and process development. *Every project is unique and no two days are the same.*

I work alongside our pilot plant, bakers, chefs, marketing, quality and production colleagues. Macphie has a number of collaborative projects with academic and research institutes, allowing us to ensure our research and development captures external insight and cutting edge science – I manage a number of these.

I love seeing products I have developed on the shelf. My proudest achievement has been developing our new Devilishh range of desserts.

I have been able to develop my career within Macphie gaining new skills and food technology expertise. I now manage two research and development technologists. I would thoroughly recommend the food industry to anyone considering their career options.”

Entry routes and the importance of STEM subjects

Graduate entry – over recent years student interest in food-related science-based subjects has decreased significantly. This is illustrated by a marked drop in applications and acceptances to university in science and food science courses. The decline in graduates in these disciplines poses a threat to the future development of the industry as there are insufficient food scientists and technologists to promote the growth of the food and drink industry in the future.

A food-related degree is the preferred qualification for entry into this area of work. The following subjects in particular are relevant:

- Food science/technology
- Food, nutrition and health
- Food safety and quality management
- Applied science (food science)

Other science subjects are relevant and include physical, mathematical, life and medical science, in particular:

- Nutrition
- Microbiology
- Applied chemistry

Undergraduate Degree Courses related to Food Science & Technology (England and Wales):

Bath Spa University – BSc Food with Nutrition

Coventry University – BSc Nutrition & Food Science

Huddersfield University – BSc Food, Nutrition & Health

Leeds University – BSc Food Science; BSc Food Science & Nutrition

Lincoln University – BSc Food Manufacture

Liverpool John Moores University – BSc Food & Nutrition

London Metropolitan University – BSc Food & Consumer Studies; BSc Human Nutrition

London South Bank University – BSc Applied Science (Food Science & Technology); BSc Food & Nutrition; BSc Food Science

Manchester Metropolitan University – BSc Food Technology

Newcastle upon Tyne University – BSc Food & Human Nutrition

Northumbria University – BSc Food Science & Nutrition

Nottingham University – BSc Nutrition & Food Science; BSc Food Microbiology; BSc Food Science; BSc Microbiology

Reading University – BSc Food Science; BSc Food Science with Business; BSc Food Technology with Bioprocessing; BSc Nutrition & Food Science; BSc Nutrition with Food Consumer Sciences

Sheffield Hallam University – BSc Food & Nutrition; BSc Food Marketing Management

Surrey University – BSc Food Science & Microbiology; BSc Nutrition & Food Science

Teeside University – BSc Food, Nutrition & Health Science

University of Wales Institute, Cardiff – BSc Food Science & Technology

Warwickshire College – BSc Food Safety & Quality Assurance

For full details of Food Science & Technology degree courses access:-

www.ucas.co.uk

For entry onto these degree courses, many require three A levels and five GCSEs (A*–C). Subjects such as chemistry and biology may be needed and equivalent qualifications are often considered – applicants are strongly advised to check exact requirements with individual institutions. With the technological advances within the industry, it is an advantage if young people can also develop IT, mathematical and statistical skills.

A Higher National Diploma (HND) in one of the relevant subjects is another entry pathway and usually require at least one A level and three GCSEs (A*–C) – for course entry details access:- www.ucas.co.uk

Foundation Degrees are available in food science and technology related areas, and are a work-related higher education qualification. A full time foundation degree course generally takes two years. Further information can be accessed via <http://fd.ucas.com/FoundationDegree/About.aspx>

The Diploma in Manufacturing and Product Design may help prepare students for a degree or career in this area of work. Information about the diploma is available from <http://www.manufacturingandproductdesigndiploma.co.uk/>

Entry to food science and technology can also be made through the **technician or laboratory assistant route**. Employers usually look for applicants with at least four GCSEs (A*–C) or equivalent qualifications, usually including English, maths, biology and chemistry (or a double award in science). Opportunities to enter the industry are also offered via the **Apprenticeship (Level 2)** or **Advanced Apprenticeship (Level 3) in Food Manufacture** – further information from <http://www.apprenticeships.org.uk> Progression to food scientist or technologist positions may then be possible with further experience, training and qualifications.

As well as having appropriate qualifications to become a food scientist or food technologist, employers are also looking for the following:-

- Knowledge of a range of sciences and their applications to food e.g. microbiology, chemistry, nutrition
- Creative flair e.g. if working in new product development or marketing
- The ability to communicate confidently both verbally and in writing

Gaining an insight into the industry through work experience is also very beneficial, and an *industrial placement provides an insight into the various roles available in the food industry*. There are a wide range of possible employers, from food or drink manufacturers, large retailers or supermarket chains to Government research establishments, local authorities or universities.

Mythbusters

The sector has poor salary rates

Not true – in fact the sector provides above average pay and relatively long tenure in employment. The image of work in the food and drink industry is one of temporary and relatively low paid employment. Yet this myth is shattered by the fact that *the weekly earnings of employees are above those of the economy as a whole* and job tenure is over nine years on average for employees of food and drink manufacturers with only 6% temporary workers.

Starting salaries for graduates range between £18,000 and £26,000, (*Prospects Graduate Careers, June, 2010*) and rapid promotion prospects exist with typical salaries with experience ranging from £30,000 to £45,000 (*Prospects Graduate Careers, June, 2010*). Salaries at senior management level can reach £65,000. The job of a food technologist for instance has recently been listed within the top 20 careers with the best long-term future.

Does packaging waste materials and energy?

In fact packaging reduces waste. Most packaged fresh and processed foods have had the non-edible material (e.g. husks, peels, vegetable tops, bones of animals and fish etc.) removed during preparation. As a result, those materials are used for animal feed or other purposes instead of going into domestic waste. Likewise, energy is saved by not having to transport that inedible material through the distribution and retail chain to the consumer. A *World Health Organisation study* has shown that without good packaging food wastage in the less developed regions of the world can reach between 30 and 50% while with good packaging it is rarely more than 2 – 3%.

A Look into the Future



The Office for National Statistics results show that *where all other sectors have struggled in 2010, Food and Drink is growing* – over the last two years food and drink producers have maintained the most consistently stable levels of production of all the manufacturing sectors, and there will also be a need to replace many skilled workers in the food and drink industry that are due to retire over the next five years. Due to the highly competitive nature of the industry, there are over 1,500 new products introduced each quarter. *The future is an*

exciting time for this sector as the country's age and ethnic profile changes, matched by constantly changing consumer demands.



Demand for healthier foods:

A consumer trend has been an increasing demand for healthy food. The industry will continue to respond to this trend through ensuring ethical manufacturing, environmentally friendly production methods, organic production and authentic regional ingredients. Careers in food safety, ingredient science and nutrition, laboratory analysis and sensory testing are growing. Food scientists and technologists work to help individuals get the nutrients they need to stay healthy, which should ultimately reduce healthcare costs, including obesity.

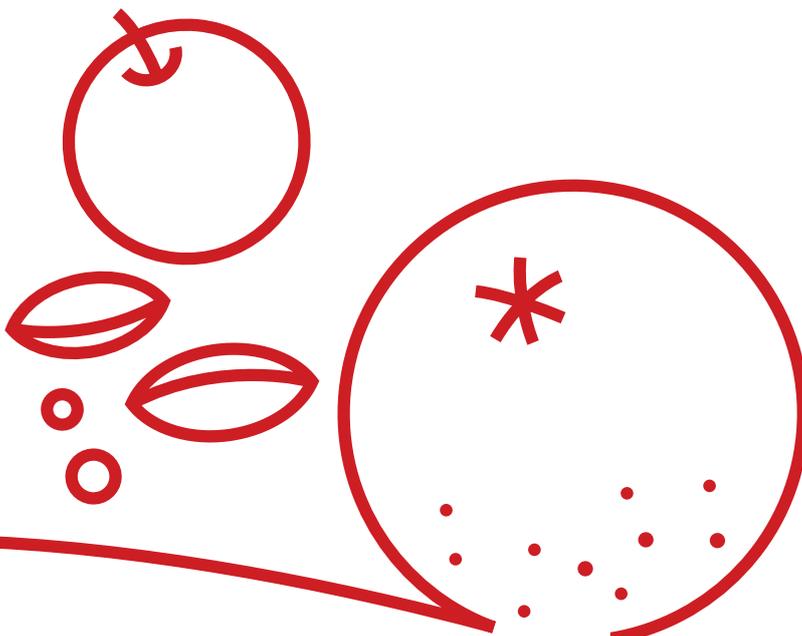
Reducing carbon emissions:

Food scientists and technologists are at the forefront of seeking solutions to the problems of reducing carbon emissions whilst maintaining production. Challenges include reducing global transportation logistics, working with the agricultural sector to reduce their emissions and working with consumers to reduce packaging waste. The industry are likely to feel the full force of increasing environmental regulation and declining oil availability leading to greater pressure for more local production and less global sourcing of food.

The impact of changing technology and automation:

“New materials based on nanotechnology, with increased strength, offer the potential to reduce packaging waste” (The Royal Society of Chemistry) by allowing packaging to be made thinner and lighter. Nanotechnologies in the future could also enable the use of sensors in the packaging which may detect deterioration in food quality resulting in more accurate sell by dates for perishable foods, which would improve food safety and reduce wastage.

The National Skills Academy for Food and Drink Manufacturing indicate that the one consistent trend in the food industry is the increase in automation by stating that *“Many jobs within the industry are increasingly about automation and that, in turn, is driving up the need for multi-skilled engineers” to maintain plant and equipment.*



Websites and links to classroom resources

Improve (Sector Skills Council for the Food & Drink industry) –

www.improveltd.co.uk – The careers section of the website includes information on the industry, entry qualifications, and job seeking tips. Contains a careers planning tool ('Durkan') to help with decisions regarding careers within the food and drink industry, job profiles, advice on funding and courses. There is also a research section including labour market information and case studies.

Food and Drink Federation – www.fdf.org.uk –

The voice of the Food and Drink industry. Provides an overview of the industry, and includes an 'Education' section.

Institute of Food Science & Technology (IFST) – www.foodtechcareers.org –

This site contains an 'Information for Teachers' section, as well as 'Why Food Science', 'Careers' and 'Courses' sections, including case studies.

Food Standards Agency (FSA) –

<http://www.food.gov.uk/aboutus/publications/schoolinitiatives/> –

FSA is an independent government department set up to protect the public's health and consumer interests in relation to food. A wide range of publications relating to the food industry are available free of charge from FSA Publications – foodstandards@ecgroup.co.uk including 'Myfoodspace teachers' notes' and 'Small Steps for Life classroom poster'.

British Nutrition Foundation (BNF) – <http://www.nutrition.org.uk> – BNF is a scientific and educational charity which interprets and translates complex scientific information on nutrition, diet and lifestyle. The Foundation has created an education programme for schools – *Food – a fact of life* www.foodafactoflife.org.uk – which contains a wealth of free resources to stimulate learning, ensuring that consistent and up-to-date messages are delivered.

Careers in Food and Drink – <http://www.careersinfoodanddrink.co.uk> – This site enables access to the latest food and drink related jobs, and also includes careers advice, employer profiles, and case studies.

teachers.tv – <http://www.teachers.tv/subjects/secondary/food> – Provides a series of videos for use in Key Stages 3 and 4 food technology lessons.

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