

# Department of Food Technology, Food safety and Health

Within the Department of Food Technology, Food safety and Health research and services to externals are performed taking into account and integrating diverse aspects of food sciences and nutrition in order to answer questions and challenges from the food industry (and related sectors) e.g. innovation, product development, product technology, packaging, shelf life, avoiding food losses, quality assurance, food safety policy, relation food and health, sustainable entrepreneurship, etc...

Students in the Master of Science in Bioscience Engineering : Food Science & Nutrition or Master of Science in Food Technology or Master of Science in Nutrition & Rural Development : Human Nutrition can take up a master dissertation within the diverse domains of food sciences and nutrition.

The focus of the master dissertation is to understand the processes taking place in the food chain and their relation to quality and/or food safety or consumer and/or population health and to describe those processes quantitatively, to predict them and to optimize them within the framework of a well-defined economic context.

Upon completion of the master dissertation graduates are able to solve problems in a competent and creative manner within the food sector (or their suppliers), to support policy makers, inspection and control through scientific research or to feed the debate in the civil society related to sustainable food and health issues.

## Food Technology

The research within the domain of food technology focuses on the development of innovative food structures in order to fulfill the demand of the consumer for tasty, safe and sustainable foods. The food technologist tries to get insight in the nano- and microstructure of foods and uses this insight as a starting point to create new structures who are healthier, more stable or more functional.

Within the department several research groups are specialized in **technology of oils and fats, chocolate, confectionary and dairy** (Campus Coupure), **cereals, bakery products and animal feed** (Campus Schoonmeersen). More specifically research is done towards healthier fats for margarines and bakery products within the Vandemoortele research centre, innovative and qualitative chocolate products in collaboration with the UGent Cacaolab, new sweeteners and sugar replacers, applicability of insect oils and proteins in 'food & feed', alternative and gluten free cereals for the creation of healthier bakery products and the valorization of waste streams in 'food & feed'. The researchers can make use of an extended tool box with e.g. (1) pilot scale equipment to simulate the complete processing line on lab scale (from 'cocoa bean to bar' or from 'cereal to bread or pellet'), (2) state-of-the-art analysis equipment for **microstructure research**, such as cryo-SEM, XRD, rheology etc. and (3) UGent **Sensolab** for sensorial profiling of newly developed foods.

## Food Chemistry

By better understanding the chemistry of foods we can better monitor and control their quality in the agro-food chain. As such safe, tasty and nutritious foods can be brought on the market while reducing food losses. The chemical composition and chemical transitions in food stuffs are mainly studied through chromatographic methods. It is evident that this type of research is also related to research on packaging and chemical risk analysis within the department (see further). Actual research topics are (1) to study **oxidation phenomena** in food stuffs, (2) to study the interaction between lipid oxidation components and proteins, (3) to study the formation of **process contaminants** in food stuffs, and (4) to follow up **migration of packaging components** towards food stuffs.

## Food Microbiology and Food Preservation

This research group, present on the 3 campuses of the faculty, tries to formulate answers on civil challenges related to providing safe food world wide and to reducing food losses through studying the behavior of micro-organisms during transformation and storage of food stuffs. It is a unique feature that the research focuses both on **microbial safety** (including viruses) as on **microbial spoilage** (including spoilage caused by moulds). The study of the mechanisms of microbial spoilage and the metabolites produced by specific spoilage organisms allow to develop more adequate conservation techniques. Therefore the problems are tackled in a quantitative way resulting in **predictive models** for the behavior of microorganisms. A lot of attention is also paid to the development and validation of appropriate **detection and identification methods** (culture methods, molecular techniques, cell cultures) for microbial analysis of foods.

Another spearhead of the research group is research related to the prevalence and transmission routes of **pathogens, their virulence factors** and the study of **microbial toxins** and how these have an effect on the human metabolism. The laboratory is equipped with specific infrastructure to evaluate the efficiency of production processes (packaging, drying, steaming, plasma,...) on growth inhibition or inactivation of microorganisms.

Although a broad range of food stuffs are subject of study, special attention is paid to the evolution of the microbial ecology and the growth and survival during the **processing of fresh vegetables**, potatoes and fruit and the eventual possibility to reuse **washing water** after suitable purification or disinfection. At Campus Kortrijk pilot infrastructure is available (**Veg-i-tec**) to simulate industrial production of above mentioned products and research is done on **fermentation** of vegetable products and valorization of waste streams.

## Nutrition and Health

The research within the unit **nutrition and health** comprises of two complementary pillars. In the pillar **food epidemiology** the effects of nutrition on the human being are investigated through controlled and randomized intervention research and through observational studies. Examples of studies are (1) the effects of additional energy and nutrients during pregnancy on the health of infants, (2) the effect of higher (agro)biodiversity on healthiness of eating patterns, and (3) the effect of contaminants in child nutrition.

These studies extend our knowledge on the role of nutrition on the prevalence/prevention of human diseases, but do not give any insight in the mechanisms at the basis of those effects. The latter are studied in the second pillar '**biochemical, cellular and molecular nutrition**', where the mechanisms are investigated through which bioactive components, derived from our food, from plant extracts or chemical synthesis, are digested, absorbed and metabolized in the human body. Therefore we use *in vitro* and molecular/cellular driven research. Some examples of ongoing research are (1) new sugars and diabetes, (2) red meat and colon cancer, (3) polyphenols and cardiovascular diseases, (4) curcumin analogues and bioactivity, (5) carotenoids and vitamin A deficiency, and (6) toxicity of bioactive proteins.

## Food Safety Management and Risk Analysis

Quality assurance and risk assessment comprises of two complementary research lines. **Quality assurance** is situated on the level of companies and organisations active in the agro-food chain. The elaboration and implementation of a fit-for-purpose quality assurance system allows to finetune on company level, via preventive and corrective measures, the processes and products within certain specifications. Our research focuses at one hand on the development of methods to measure the performance of a quality assurance system or to further extend them with new needs (e.g. in the

framework of food donations, circular economy, pressure of food fraud) and at the other hand on the human aspect of quality assurance, the so-called food safety culture and the influence it can have on the finally delivered hygiene, safety or quality of a food stuff.

**Risk analysis (risk assessment, communication and management)** is the (quantitative) process that is gone through in order to calculate the impact of risks related to food safety (e.g. pathogens, chemical contaminants) on population level. In this research line a production chain is unraveled step by step and transformed into mathematical models in order to estimate the final exposure of consumers towards a certain risk. Via scenario-analysis eventual mitigation strategies (e.g. the introduction of a legal limit, the introduction of an alternative production technology) can be assessed according to an eventual improvement of the situation. Such research can be used by risk managers to draw policy lines. These policy lines serve again as input for companies and organisations in the agro-food chain to improve their own quality assurance system in order to improve the final quality and safety of food stuffs.

## Packaging technology

Within the research domain of packaging technology the relation between the desired shelf life of food stuffs and the required composition of packagings, including a strong link to circular packagings, is placed in a central position. The focus of the research is on the study of less complex, better **recyclable packaging materials**, as well as on **bioplastic** based packagings, produced from renewable resources, and their effect on the quality and safety of food stuffs. Also factors affecting the migration of components from packaging towards food stuffs are investigated.

For the research we dispose of several packaging machines as well as diverse methods to analyse the **quality and safety of packed food stuffs**, in close collaboration with the other research groups within the department. The research is mainly driven by needs from the packaging industry through the strong connection with Pack4Food, a spin-off consortium grown at our department grouping more than 60 companies and research institutes working on innovative packagings.

## Entrepreneurship, innovation management, intellectual property and valorization

Food2Know is the **excellence centre on animal feed, human nutrition & health**, and brings together the scientific expertise within Ghent University, Free University Brussels, University of Antwerp and the Institute for Agronomy and Fisheries Research (ILVO). Via **Food2Know** companies, the professional field, consumer organisations or governmental institutions have a direct link to top expertise and advanced available equipment, as well for the execution of analysis, for scientific or business advise, as for setting up research projects. Food2Know organises courses on entrepreneurship, corporate management, innovation management, intellectual properties and valorization. Researchers are guided and sustained for the **development of project proposals**, financing possibilities on national and international level, as well as for spin-offs and the conception of license agreements with industrial partners. **Students can perform a thesis research on one of the above topics.**