GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2020-2021

Biochemical and Functional Analysis of Foods (I002670)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size *(nominal values; actual values may depend on programme)*

Credits 5.0 **Study time 150 h** **Contact hrs** 50.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	Dutch	Gent	lecture	25.0 h
			practicum	15.0 h
			lecture: plenary exercises	5.0 h
			self-reliant study activities	5.0 h

Lecturers in academic year 2020-2021

De Meulenaer, Bruno	LA23	lecturer-in-charge
Messens, Kathy	LA25	co-lecturer
Rajkovic, Andreja	LA23	co-lecturer
Uyttendaele, Mieke	LA23	co-lecturer

Offered in the following programmes in 2020-2021	**crdts**	**offering**
Master of Science in Bioscience Engineering: Chemistry and Bioprocess Technology	5	A
Master of Science in Bioscience Engineering: Food Science and Nutrition	5	A

Teaching languages

Dutch

Keywords

PCR, sequencing, omics, chromatography, cell assays, cytotoxicity, extraction, detection, method validation, DNA, RNA, proteins, GMOs, biomarkers, pathogenes, virulence genes, toxines

Position of the course

This course unit aims to provide the student with insights in the principles and the application of different molecular, biochemical and cellular techniques in order to analyze food products in the framework of research on food safety, food integrity and the relation between food and health. The course unit comprises the description of some analytical techniques to detect or quantify biological macromolecules, such as proteins and nucleic acids. This concerns for example applications in molecular biology-based research, rapid detection or subtyping of biological agents, as well as quantification of molecules in complex food matrices or clinical samples. Besides, some instrumental analytical techniques are highlighted, for example to detect toxins, metabolites or biomarkers. Finally, the principles to work with cellular techniques by means of cell assays are illustrated as cel model systems and to measure functionality, particularly biological activity and/or toxicity of (synthetic or natural) bio-molecules or (food) extracts.

Contents

1. Basic terminology (glossary)
2. Principles of the various analytical techniques
- Separation and extraction methods:
  · Chromatography techniques
  · electrophoresis-based techniques
- Receptor-based methods:
  · ligand-binding tests (ELISA), precipitation tests, agglutination

- Spectroscopic methods:
· NMR, Raman, IR, UV, MS (such as LC-MS MS , GC-MS, MALDI-TOF MS)
- Molecular techniques:
· DNA or RNA detection methods: (real-time) PCR, reverse transcriptase PCR, gel-electrophoresis
· DNA (sub)typing methods: restriction analysis, PFGE, MLST, SNPs, etc.
· DNA sequence analysis
- Cellular techniques:
· Cel models for human health
· Basic cell assay methods and Good Laboratory Practices
· Bioassays (enzymatic tests and stains) for cell growth and toxicity (MTT, SRB, NR), oxidative stress (ROS, glutathion)

3. Practical considerations when implementing test methods
- Accreditation of laboratories (ISO17025) and/or GLP requirements, lab notebooks, LIMS, etc
- Importance and impact of sample preparation and (DNA) extraction in context of food analysis
- Use of adequate controls & method validation:
· specificity, selectivity, LimitOfDetection, LimitOfQuantification, repeatability, accuracy
· (intra or inter-lab) reproducibility, measurement uncertainty, matrix-effect (robustness)

4. Critical reflection on the use and selection of methods (including extraction methods) for detection or quantification of specific macromolecules via case studies:
· Analysis of microbiological agents in food products: e.g. rapid pathogen detection, whole genome subtyping, microbiome studies
· Analysis of eukaryotic DNA in food products: e.g. GMO detection, food authenticity
· Analysis of proteins in food products: e.g. allergens, mycotoxins
· Use of cell assays to evaluate functionality of bio-analytics: eg. Toxicity assays, gut barrier as gate-keeper for uptake of nutrients and contaminants.

Exercises
Lab practical exercises
1. qPCR analysis
2. immunological technique
3. instrumental chemical analysis
4. cell assays

Class exercises
Calculation of performance characteristics (LOD, LOQ) of methods based on given datasets.
Exercise on bio-informatics
Either external (ISO17025) lab visit or guest lecture on a contemporary topic of food analysis by stakeholder

Independent work:
Analysis of strengths/weaknesses of research article related to 'selection of method' for a given (research) problem and reflections on an alternative methodological approach.

Initial competences

This course unit further builds upon end competences obtained in the previous course units biochemistry, molecular biology, microbiology, and chemical analytical techniques (gravimtery, volumtery, electrochemical methods, molecular spectroscopy and basic mass spectrometry and molecular separation techniques); or the end competences were obtained on an alternative way.

Final competences

1 - is able to make a motivated choice for an appropriate method to analyse biomolecules in the framework of food science and nutrition.
2 - Has knowledge of good laboratory practices, the use of adequate controls and method validation

3 - Can argument on an adequate sample preparation for the set-up of an analytical method for biomolecules.
4 - Is able to interpret the results of given molecular, biochemical or cell assay techniques within the context of food analysis.
5 Can communicate in a transparent way on the strengths and weaknesses of different types of analytical techniques.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, practicum, self-reliant study activities, lecture: plenary exercises

Extra information on the teaching methods

During the lectures, first the basic terminology and basic principles of the techniques are explained. After this, the theory is illustrated by means of concrete case studies (applications) and these are discussed in an interactive way with the students (plenary exercises).
The lab practical exercises are arranged to get familiar with the several techniques by performing the techniques themselves.
Class exercises are provided to practice method validation and understand the principles of lab accreditation
The self-reliant study activity has the purpose that the students themselves look into a certain 'selected method' for a given (research) problem, with focus on strengths and weaknesses.

Learning materials and price

The course material is made available at the beginning of the semester (when necessary via UFORA). Additional supporting material will be provided via UFORA.
Besides the course material, there are no additional costs.

References

Course content-related study coaching

Questions can be asked to the lecturers and assistants before and after each lecture.
Lecturers and/or assistants can also be contacted by mail.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, oral examination

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, oral examination

Examination methods in case of permanent evaluation

Participation, assignment, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

continuous assessment:
- Participation: during ALL lab practical and class exercises, there is a mandatory presence of all students. A non-legitimate absence will be taken into account for the end evaluation.
- Reports: a report is made for each practical.

Calculation of the examination mark

Period-aligned evaluation accounts for 67 % of the end evaluation of this course unit.
The continous assessment (reports and assignment) account for 33 % of the end evaluation of this course unit.
Students who eschew period aligned and/or non-period aligned evaluations for this course unit will be failed by the examiner.
Students need to participate to all evaluations and assignments in order to pass this

course, both with respect to period-alligned evaluations and the continuous assessment. If a student is not participating in one of these parts or if a result lower then 8/20 (not round up) is obtained for one of the parts, the student cannot pass for this subject: even if the overall average is 10 (or more) on 20, the final score will be fixed at 9/20.