

ACADEMIC YEAR: 2019/2020

COURSE: Genetic authentication and traceability of food products

TYPE OF EDUCATIONAL ACTIVITY: Free choice

TEACHER: Prof.ssa Gioia Tania

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Language: English

ECTS: 6

(5 lessons and 1
tutorial/practice)

n. of hours: 56

(40 lessons and 16
tutorials/practice)

Campus: Potenza

School: Scuola di Scienze Agrarie,
Forestali, Alimentari ed Ambientali
- SAFE

Program: Msc Food Science
Technology

Semester: I

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

This is an advanced course in Genetic authentication and traceability of food products with the aim of providing food technologists with the theoretical knowledge and technical skills of the main genetics and molecular methods to apply for food traceability and security. This will be done with an emphasis (in a first section) on the concepts relating to the various molecular tools for markers assisted selection and genetic-molecular methods for the characterization and identification of species, plant cultivars and animal breeds, with particular regard to the description of those most useful for the evaluation of species used for human food. The second section dealt with the application of methods for genetic characterization and traceability of raw materials suitable for food production, by applying conventional and advanced techniques of analysis and data processing in the food chain; and the identification and analysis of food fraud and GMOs.

Knowledge and understanding: Acquiring knowledge and understanding of the importance of preserving, analyzing and exploiting genetic resources and their variability for food and feeding. Knowledge of genetic and molecular methodologies for controlling the quality of food. Knowledge of methodologies for the identification and certification of raw materials and derived food products. Knowledge of genetic transformation methodologies for qualitative and quantitative detection of genetically modified organisms.

Applying knowledge and understanding: Ability to integrate the acquired genetic and molecular knowledge to investigate the safety and quality of raw materials and finished food products and to recognize their strengths and limitations. Capability of evaluate the potentiality of innovative molecular techniques for traceability of food. Ability to use software for processing data obtained from genetic and molecular analysis.

Making judgments: Ability to understand and describe in an autonomous way the genetic mechanisms that regulate the expression of quantitative-qualitative traits of agri-food interest. Ability to understand and manage the genetic methodologies to be applied for the quality and safety of raw materials and derived food products.

Communication skills: Ability to communicate with a technically and scientifically correct language. Ability to interact and communicate with food business operators. Ability to communicate clearly to non-technical audiences.

Learning Skills: Acquire the ability to develop and update competences autonomously through the search of material in scientific articles and through the consultation of databases reporting validated analytical methods for molecular traceability of foods.

PRE-REQUIREMENTS

Basic knowledge of genetics and biochemistry.

SYLLABUS

Unit 1 (8 h, lectures)

Overview on genetic resources, their conservation and importance for agriculture and food production.

Unit 2 (8 h, lectures)

Genomics and molecular methods, including a view on the main 'omics' techniques (genomics, transcriptomics, proteomics and metabolomics) to apply for the analysis of genetic resources for food science and for food traceability and food safety and quality

Unit 3 (8 h, lectures)

Genomics, genome structure and organization, molecular markers and genome analysis, nucleic acid extraction's methodologies, advanced DNA sequencing and amplification's technologies, molecular techniques and omics technologies for the analysis of seeds, plants, and derived products. Data analysis through statistical methods and models and interpretation of the results.

Unit 4 (8 h, lectures)

Genetic-molecular identification of species by DNA profiling with RFLP and PCR-derived markers (SSR), and cpDNA and mtDNA barcoding; determination of genetic diversity, similarity and identity statistics, genetic differentiation and gene flow, genetic distance parameters, estimates of homozygosity and heterozygosity useful for the genetic characterization and identification of plant cultivars (hybrids, pure lines, and clones), and animal races and breeds; implementation of molecular diagnostic assays for the genetic traceability of agri-food products by means of DNA fingerprinting, SSR genotyping and SNP haplotyping (e.g. authentication of species, varieties, populations and individuals).

Unit 5 (8 h, lectures)

Genetically modified organisms (GMO). Methods of genetic transformation of plants and animals. Analysis of GMOs and traceability of their food derivatives by using Real-Time PCR assays. Legal aspects related to the production of GM plants and animals, and to the commercialization of GMO-derived products.

Unit 6 (16 h, practices)

Case studies: several examples of application of the most advanced technologies, the omics approach, in food science will be illustrated through theoretical lessons, laboratory practical classes, discussions on scientific articles, seminars and visits. Examples include:

- Authenticity of Cereals and Cereal-based Products: Protecting Tradition in Bread and Pasta-making with Modern Analytical Techniques.
- DNA-based Methods for authentication of meat and meat Products.
- DNA Tracking for the Authentication of Edible Plant Oils.
- Authentication and Traceability of Fish and Seafood Species by Means of Molecular Tools.

TEACHING METHODS

The course includes 56 hours of teaching between lessons and tutorials/practice. In particular, they are divided into 40 hours of frontal lectures and 16 hours of tutorials/practice in the laboratory tutorials and in the computer lab. The topics of the course will be treated with the help of multimedia equipment. During the tutorials/practice hours students actively participate in laboratory experiments that aim to provide the basic genetic tools useful in the agro-food sector.

EVALUATION METHODS

Both written test (in progress) and oral examination (at the end of the course).

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- Food Authentication Using Bioorganic Molecules. Editore Stefano Sforza, Ph.D., University of Parma
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- Genetica e genomica, Volume III. Barcaccia G., Falcinelli M. Liguori Editore.
 - Biotecnologie e genomica delle piante. Rao R, Leone A. Idelson – Gnocchi Editore.
 - Lecturer's note of the course and PDF files, reprints, etc.
 - Scientific articles provided by the teacher during the course.
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INTERACTION WITH STUDENTS

At the beginning of the course, after describing the objectives, program and test procedures, teacher collects the list of students together with name and email.

The teacher receives generally on Monday and Friday from 9.00 to 11.00 in the teacher's room (SAFE 4th floor-3A 412 room, Viale dell'Ateneo Lucano, Potenza) and she is available at all times for a contact with the students, through its e-mail, telephone, Skype, or Whatsapp.

EXAMINATION SESSIONS (TENTATIVE)¹

07/01/2020, 21/02/2020, 06/03/2020, 03/04/2020, 08/05/2020, 05/06/2020, 03/07/2020, 17/07/2020, 04/09/2020, 02/10/2020, 06/11/2020, 04/12/2020, 08/01/2021, 05/02/2021

EXAMINATION BOARD

Tania Gioia (President commission), Giuseppina Logozzo (member), Pierluigi Spagnoletti Zeuli (substitute)

SEMINARS BY EXTERNAL EXPERTS YES X NO

FURTHER INFORMATION

¹Subject to possible changes: check the web site of the Teacher or the Department/School for updates.