# . - Biomolecular Techniques

## Prof. Daniela Bassi

COURSE AIMS AND INTENDED LEARNING OUTCOMES

The course aims to teach students the main molecular biology techniques, to enable them to then understand the molecular bases and possible applications, with particular attention to the food sector.

At the end of the course, students will know the main molecular mechanisms of nucleic acid metabolism and possess the theoretical and laboratory skills for genomic or plasmid DNA extraction, cloning, and the application of PCR and qPCR techniques. Students will know the main techniques for the production of transgenic organisms and for their monitoring through molecular methods; they will also be able to understand the current legislation and documentation for the registration of GMOs in Italy and in Europe. They will additionally acquire bioinformatics skills related to finding and querying information in biological databases, and will know how to analyse a bacterial genome and understand the main DNA sequencing technologies. Finally, they will be able to understand the latest genome editing technologies through CRISPR-CAS and the related ethical and legal implications.

COURSE CONTENT

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|  | ECTS |
| Historical notes on the development of biomolecular techniques; review of prokaryote and eukaryote genetics: metabolism of nucleic acids; purification of DNA from cells: genomic, plasmid and viral DNA. | 1.0 |
| Purified DNA manipulation: restriction enzymes, ligation; DNA cloning: bacterial transformation, transfection, cloning vectors. | 1.0 |
| PCR; identification of bacterial species by amplification and sequencing of the 16S gene.  RAPD and de-replication techniques; qPCR and its applications in the food industry; electrophoresis, Pulsed Field Gel. Electrophoresis, Nucleic Acid Hybridisation Techniques, Northern Blot and Southern Blot. | 1.0 |
| The sequencing of genes and genomes; sequencing methods; assembly, annotation and research into genes of interest.  Genome editing with CRISPR-CAS technology; study of gene expression. | 1.0 |
| Risk assessment and analysis of recombinant DNA in food. Methods for detection, identification and quantification.  The regulatory framework for GMOs in Europe: Directive 2011/18/EC and EC Regulation 1829/2003.  The GMO registration dossiers. | 1.0 |
| Tutorials. Extraction and purification of genomic and plasmid DNA. Gel electrophoresis and restriction maps. Cloning of a DNA fragment in *E. coli*. qPCR. | 1.0 |

READING LIST

F. AMALDI, P. BENEDETTI, G. PESOLE, P. PLEVANI, *Tecniche e metodi per la biologia molecolare,* Casa Editrice Ambrosiana, 2020.

TA BROWN, *Biotecnologie molecolari. Principi e tecniche,* Second edition, Zanichelli, 2017.

MM COX, J. DOUDNA, M. O'DONNELL, *Biologia molecolare. Principi e tecniche*, Zanichelli, 2013.

TEACHING METHOD

1. Theoretical frontal lectures in which the main topics of the course will be addressed, with the support of PowerPoint presentations.
2. Laboratory tutorials on the application of biomolecular techniques.

ASSESSMENT METHOD AND CRITERIA

A final oral exam. The exam consists of at least three questions aimed at ascertaining the student's level of knowledge, understanding and linking skills regarding the topics covered. Students must demonstrate an ability to correctly use the language and scientific terminology of the discipline. The final mark will be based on the average of the marks obtained for each of the questions.

NOTES AND PREREQUISITES

During the course further reading indications and website information will be provided.

There are no prerequisites for the course.

Should the health situation relating to the Covid-19 pandemic not allow face-to-face teaching, remote teaching in synchronous or asynchronous mode will be guaranteed; this will be communicated in good time to students.

Information on office hours available on the teacher's personal page at http://docenti.unicatt.it/.