# . - 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 understand the molecular bases and possible applications, with particular attention to the food sector.

At the end of the course, the student will know the main molecular mechanisms of nucleic acid metabolism, will acquire theoretical and laboratory skills for the extraction of genomic or plasmid DNA, for cloning and for the application of polymerase chain reaction (PCR)-based techniques. The student will be familiar with the main techniques for the production of genetically modified organisms, and for their monitoring by molecular methods. He/she will also acquire skills in the latest sequencing techniques, the study of gene expression and genome editing, as well as notions of bioinformatics relating to the retrieval and interrogation of information in biological databases and the analysis of a bacterial genome.

COURSE CONTENT

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|  | ECTS |
| Historical background on the development of biomolecular techniques; Recalls on the genetics of prokaryotes and eukaryotes: metabolism of nucleic acids; DNA purification from cells: DNA extraction methods, nucleic acid quantification, electrophoresis. | 1.0 |
| The polymerase chain reaction (PCR); qPCR and its applications in the food industry; digital PCR; DNA-based techniques (molecular typing and fingerprinting); identification of bacterial species by 16S gene amplification and sequencing. | 1.0 |
| The manipulation of purified DNA: restriction enzymes, ligation; DNA cloning: bacterial transformation, transfection, cloning vectors; expression of heterologous proteins. Electrophoresis, Nucleic Acid Hybridisation Techniques, Northern Blot and Southern Blot. | 1.0 |
| Biotechnological applications of cloning; Cloning in agriculture: GMOs; Methods for GMO detection, identification and quantification in food samples. | 1.0 |
| Sequencing of genes and genomes; sequencing methods; assembly, annotation and searching for genes of interest;  Genome analysis; gene expression study; genome editing with CRISPR-CAS technology. | 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.

T.A. BROWN, *Biotecnologie molecolari. Principi e tecniche,* terza edizione, Zanichelli, 2022.

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

TEACHING METHOD

1) Theoretical lectures in which the main themes of the course will be addressed, with the support of Power Point presentations.

2) Group work on topics proposed by the lecturer for discussion in the classroom.

3) Laboratory exercises 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.

Prof. Daniela Bassi receives students after class hours at the Agricultural, Food and Environmental Microbiology section of the Department of Food Science and Technology for a Sustainable Food Supply Chain (DiSTAS) or by appointment on dates to be agreed (daniela.bassi@unicatt.it).