

## Biotechnology at UFV

### Undergraduate Courses

#### **ADM 392. Entrepreneurship**

##### Course Overview

Entrepreneurship: profile and characteristics. Innovation and creativity. Identification, Analysis and Selection of business opportunities. Preparation of the Business Plan. Financial and managerial support system for small business owners. Creation and development of Startups.

#### **ADM 393. Administration and Entrepreneurship**

##### Course Overview

The entrepreneur and entrepreneurship. Opportunity: idea and feasibility. Marketing plan. Structure and operations. Financial plan. Formalizing the business.

#### **BIO 270. General and Molecular Virology**

##### Course Overview

General properties of viruses. Structures and morphology of viruses. Virus-cell interaction: adsorption and penetration. Replication of RNA genome animal viruses. Reverse transcription and integration. Replication of DNA genome animal viruses. Intracellular transport of viral components and assembly of virions. Exit and maturation of viral progeny. Replication of bacteriophages. Immunity against viruses. Insect viruses. Plant viruses. Fungal viruses and parasitic microorganisms. Evolution of the virus.

#### **BIO 311. Molecular Biology I**

##### Course Overview

Introduction to molecular biology. Structure and properties of nucleic acids. DNA replication. Transcription. Protein biosynthesis. Organization and control of gene expression in prokaryotes. Organization and control of gene expression in eukaryotes. Recombinant DNA technology. Methods for studying DNA, RNA and Proteins.

#### **BIO 312. Molecular Biology II**

##### Course Overview

General molecular biology laboratory procedures. Theory on nucleic acid extraction. Principles of nucleic acid electrophoresis. Theory on DNA cloning.

## **BQI 204. Fundamentals of Biosafety**

### Course Overview

Conceptual bases of biosafety, history and legislation. Risk concept. Chemical, physical, biological and radioactive risks. Biosafety levels. Biosafety standards and legislation. Waste management. Biosafety in human, animal and plant experimentation. Biosafety when working with laboratory animals. Biosafety when working with genetically modified organisms. Architecture principles in biosafety. Good practices in the laboratory. Conduct in case of accidents. Transport of samples and biological, chemical and radioactive substances.

## **BQI 430. Biochemistry of Nucleic Acids**

### Course Overview

Structure of nucleic acids. Degradation and modification of nucleic acids. Eukaryotic genome: chromosome organization. DNA replication. DNA repair, recombination, and rearrangement. RNA biosynthesis. Transcription control. RNA processing and post-transcriptional control. Protein biosynthesis.

## **BQI 432. Biotechnology**

### Course Overview

Recombinant DNA technology (TDR). Expression of heterologous proteins. Gene therapy. Transgenic animals. Stem cells. Monoclonal antibodies. Plant breeding methods. Genetic transfer in plants. Plant pharming. Bioremediation. Biosensors. Bioprocessing. Synthetic biology. Biofuels. Biopharmaceuticals. Forensic medicine. Technological innovation and intellectual property.

## **BQI 433. Entrepreneurship in Biotechnology**

### Course Overview

Characterization of entrepreneurship in biotechnology. Entrepreneur profile. Legislation, intellectual property, and regulatory frameworks in Biotechnology. Regulatory agencies in Biotechnology. Fundraising for technology-based companies. Construction of a network of relationships in Biotechnology. Social networks and their importance in entrepreneurship. Development policies, innovation, identification of market trends and opportunities. Business plan.

## **BQI 460. Bioinformatics**

### Course Overview

MBI 300. Bacteriology Introduction to bioinformatics. Linux environment and basic programming. Introduction to biological databases. Sequence alignment techniques. Introduction to genomic analysis. Comparative genomics and phylogenetic analysis. Introduction to transcriptomic analysis. Introduction to proteomic and metabolomic analysis. Introduction to systems biology and molecular biological networks. Introduction to mathematical modeling of biological data. Introduction to structural bioinformatics.

## **ENF 414. Forest Improvement and Biotechnology**

### Course Overview

Important species and provenances for forest improvement programs in Brazil. Review of basic genetics and its interaction with forestry improvement. Population Genetics. Inbreeding, Heterosis and Hybridization. Genetic Conservation. Improvement methods. Guidelines, goals and strategies for a forest improvement program. Progeny test. Genetic analyzes in Selegen software. Formation of hybridization orchards in pots and in the field. Induction of early flowering in forest species. Genotype x environment interaction. Clonal Tests. Large-scale clonal strategy. Improvement of native species. Forest Biotechnology. Forest Improvement Strategies in different countries around the world. Legislation on the production of forest seeds and seedlings.

## **FIT 370. PLANT BREEDING**

### Course Overview

Importance of plant breeding and its objectives. Modes of reproduction of higher plants. Genetic resources: centers of diversity of cultivated plants and germplasm banks. Selection in autogamous plants. Hybridization in the improvement of autogamous plants. Methods for improving autogamous plants. Selection in allogamous plants. Endogamy and heterosis. Hybrid cultivars. Recurring selection. Biotechnology in plant improvement (transgenics). Registration and protection of cultivars. Improvement practices in vegetable crops, fruit plants and large crops. Experimental practices in plant breeding.

## **FIT 371. Plant Biotechnology**

### Course Overview

Introduction to plant biotechnology. Feature discovery. Product development. Biosafety and regulatory affairs. Case Study.

## **FIT 372. Genetically Modified Crops**

### Course Overview

Biotechnology. Transgenic Varieties. Biosecurity. Management of Transgenic Varieties. Intellectual property. Bioethics.

## **MBI 300. Bacteriology**

### Course Overview

Classification and phylogeny of bacteria. Metabolic diversity of prokaryotes. Diverse bacterial groups. Principles of microbial ecology. Mechanisms of bacterial pathogenesis. Control of bacterial growth. Adaptation of prokaryotes to external environments. Genomic analysis of prokaryotes.

## **MBI 310. Physiology of microorganisms**

### Course Overview

Structures of prokaryotic and eukaryotic microorganisms. Metabolism of microorganisms. Metabolic diversity among microorganisms. Biosynthesis pathways. Metabolic regulation. Nutrition of microorganisms. Growth of microorganisms and their control.

### **MBI 320. Genetics of Microorganisms**

#### Course Overview

Properties of genetic material. Replication. Cell cycle. Extrachromosomal elements. Mutations. DNA repair mechanisms. Recombination in bacteria. Recombination in fungi. Recombinant DNA technology.

### **MBI 390. Laboratory of Physiology and Genetics of Microorganisms**

#### Course Overview

Microorganism isolation techniques. Microbial growth. Microbial enzymes. Mechanisms of enzyme induction and repression. Isolation of mutants. Conjugation. Transduction. Extraction of nucleic acids. Molecular cloning.

### **MBI 440. Industrial Microbiology and Biotechnology**

#### Course Overview

The microbiology of fermentative processes. The cultivation of microorganisms of interest to industries. Microbial biosynthesis: products, mechanisms of action and regulation. Bioconversions. Biosafety in biotechnology. Legal protection in biotechnology.

### **MBI 461. Environmental biotechnology**

Bacterial Growth. Stoichiometry and Bacterial Energetics. Microbial Kinetics. Biofilm Kinetics. Microbial Processes in Reactors. Effluent Treatments by Activated Sludge. Effluent Treatment in lagoons. Treatment of Effluents by Biofilms. Nitrification. Denitrification. Phosphorus Removal. Drinking Water Treatment. Treatment of Sludge and Solid Waste in Anaerobic Systems. Detoxification of Dangerous Chemical Compounds. Bioremediation.

### **TAL 415. Industrial Biochemical Processes**

#### Course Overview

Contextualization in Industrial Biochemical Processes. Biochemistry of fermentations. Preparation (Upstream) and recovery and transformation (Downstream) processes. Kinetics of microorganisms. Enzymes in biochemical processes. Recombinant DNA technology: applications and concepts. Fermented foods. Fermentation technology.

### **TAL 416. Kinetics of Biochemical Processes**

#### Course Overview

Generation and analysis of data in kinetic studies. Kinetics of chemical reactions. Analysis and design of bioreactors. Cell growth kinetics. Enzyme kinetics. Simulation of biological systems. Immobilized biocatalyst systems.

### **TAL 417. Enzyme Catalysts in Bioprocesses**

#### Course Overview

Historical context and perspectives on the use of biocatalysts in Biotechnology. Structural and kinetic characteristics of enzymatic biocatalysts. Immobilization: supports, methodologies, enzyme reactors and immobilized cells. Industrial applications of enzymes: lipases, cellulases, amylases, proteases, pectinases, glucose oxidase, lactase

and glucose isomerase. Enzyme biosensors. Enzyme engineering - Recombinant DNA technology for improving enzymes.

### **TAL 418. Microbiology of Food Processes**

#### Course Overview

Microbial ecology of food. Importance of the spatial distribution of microorganisms in food. Effect of food processing steps on microorganisms. Cooling and freezing. Microbiology of aseptic processing. Microbiology of non-thermal processing. Microbiology of milk and dairy products processing. Microbiology of meat and meat products processing. Microbiology of fruit and vegetable processing. Microbiology of cereal processing. Microbiology of fish, eggs and honey. Notions of predictive microbiology in food processes.

### **Facilities at UFV**

NMM - Microscopy and microanalysis Center - <https://nmm.ufv.br/>

NUBIOMOL - Biomolecule analysis Center - <https://nubiomol.ufv.br/>

### **Parque Tecnológico de Viçosa – Technology Park of Viçosa – UFV**

TecnoPARQ - <https://centev.ufv.br/en/>



### **Institutes**

Bioagro - Institute of Biotechnology Applied to Agriculture - <https://bioagro.ufv.br/> and INCT - National Institute of Science and Technology in Plant-Pest Interactions - [http://estatico.cnpq.br/programas/inct/apresentacao/inct\\_planta\\_praga\\_ing.html](http://estatico.cnpq.br/programas/inct/apresentacao/inct_planta_praga_ing.html)





### **Expertise areas at Bioagro/UFV**

1. Animal Biotechnology
2. Crops/ Plant Biotechnology
3. Environmental Biotechnology
4. Microbial Biotechnology

### **Undergraduate at Bioagro/UFV**

- . Internships
- Supervised internship; voluntary internship.
- . Scientific research

### **Research/ Graduate Programs developed at Bioagro/UFV**

- . Applied Biochemistry
- . Entomology
- . Genetics and Breeding
- . Plant Physiology
- . Phytopathology
- . Agricultural Microbiology
- . Veterinary Medicine