Miami Dade College

Course Description

BSC2427 | Biotechnology Methods and Applications 2 | 3.00 credits

This course addresses advanced principles, concepts and techniques of biotechnology necessary for an understanding of the field, and effective work in a pharmaceutical-biotechnology-and/or research-laboratory setting(s). The following areas of contemporary biotechnology are covered: forensics, bioremediation, and animal-, plant-, and marine biotechnology. Prerequisites: BSC2426, 2426L, Corequisite: BSC2427L

Course Competencies

Competency 1: The student will demonstrate knowledge of forensic applications of biotechnology by:

1. Describing the use of biotechnology in forensic applications
2. Describing the nature of repetitive and satellite DNA
3. Describing alleles, single-and multi-locus tandem repeats, and how they are used in the study of population genetics
4. Summarizing the methods used in DNA profiling
5. Describing Restriction Fragment Length Polymorphism Analysis (RFLP)and its applications in typing forensic evidence, establishing familial relationships, and epidemiology investigations
6. Describing protocols for sample collection and manipulation for forensic analyses
7. Discussing the admissibility of scientific evidence in a court of law
8. Explaining principles of forensic archaeology
9. Analyzing the ethical implications of DNA typing and profiling

Competency 2: The student will demonstrate knowledge of medical applications of biotechnology by:

1. Describing the use of biotechnology in medicine
2. Defining gene therapy
3. Exhibiting applications of gene therapy
4. Listing examples of gene therapy, including first gene therapy and treatment of lung disease- cystic fibrosis, liver disease
5. Recognizing potential limitations of gene therapy and new/alternative approaches
6. Explaining the principles of clinical trials
7. Explaining the concept of stem cells
8. Contrasting the various types of stem cells
9. Describing principles of vaccine development
10. Defining the application of tissue engineering and Xeno transplantation
11. Summarizing ethical issues related to medical biotechnology

Competency 3: The student will demonstrate knowledge of animal biotechnology by:

1. Explaining how the principles of biotechnology are being applied to address animal health issues
2. Describing types and uses of animals in biotechnology
3. Explaining how to generate gene knockouts and chimeras and how they can be used in research
4. Describing gene transfer methods and contemporary tools employed for animal propagation
5. Discussing the limitations encountered in the cloning of animals
6. Explaining the role of biotechnology in conservation biology
7. Describing the governmental regulation pertaining to the utilization of animals in research and patent ability of genetically engineered animals
8. Listing alternatives to the utilization of animals in research
9. Summarizing ethical issues concerning the utilization of genetically engineered animals in research

Competency 4: The student will demonstrate knowledge of plant biotechnology by:

1. Describing the basic anatomy of a plant and the cell types that make up specific tissues of the plant body
2. Explaining the function of plant hormones in plant growth and development
3. Defining plant genetic engineering and its applications
4. Describing methods for plant transfection
5. Illustrating plant tissue culture use for micropropagation, somatic embryo production, production of different chemicals, protoplast fusion, soma clonal variations, and germplasm storage
6. Listing examples of genetically engineered plants or plant products
7. Explaining the governmental regulations associated with the genetic manipulation of plants
8. Summarizing health and environmental issues associated with plant biotechnology

Competency 5: The student will demonstrate knowledge of applications of biotechnology used for bioremediation by:

1. Defining bioremediation and its relevance to the earth's sustainability
2. Describing the major environmental pollutants and identify clean-up strategies for their removal
3. Identifying the advantages of bioremediation approaches over alternative cleaning methods
4. Explaining the relevance of redox reactions in bioremediation procedures carried out by microorganisms
5. Comparing and contrasting aerobic, anaerobic, and phytoremediation as environmental clean-up methods
6. Describing the utility of genetically modified organisms in bioremediation approaches
7. Summarizing the approaches for bioremediation of soil, groundwater, and wastewater

Competency 6: The student will demonstrate an understanding of marine biotechnology by:

1. Explaining the applications of marine biotechnology
2. Describing the usage of aquaculture
3. Evaluating the utilization of transgenic fish
4. Describing how biofilms form and how scientists explore the utilization of marine organisms to minimize biofilm naturally
5. Summarizing the utilization of marine organisms for environmental damage detection and environmental pollution remediation

Competency 7: The student will demonstrate knowledge of ethical implications associated with the practice of biotechnology by:

1. Identifying potential ethical issues associated with biotechnology
2. Selecting questions and approaches that address the issues identified
3. Discussing the necessary interaction between science, economics, communication, and public policy

Learning Outcomes:

- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information