

**J. Sargeant Reynolds Community College  
Course Content Summary**

**Course Prefix and Number:** BIO 253      **Credits:** 3

**Course Title:** Biotechnology Concepts

**Course Description:**

Explores the growing field of biotechnology ranging from basic cellular and molecular biology concepts to both basic and advanced laboratory techniques. Emphasizes the application of biotechnology to medicine, agriculture, environmental science, and forensics. Includes discussion of the business, regulatory/legal, ethical, and societal issues of this topic as well as the growing field of bioinformatics. Lecture 3 hours. Total 3 hours per week.

Prerequisites: BIO 101 with a C or better, or Dean/Program Head permission. Corequisites: BIO 250 3 credits

**General Course Purpose:**

The purpose of this course is to provide the student with an opportunity to apply basic biological concepts to the applied field of biotechnology, preparing them to pursue entry-level, technical-level, or professional-level careers in bioscience. Students will review the fundamentals of cell and molecular biology and then use this knowledge to understand the science involved in the many biotechnology techniques and applications. In addition, this course is designed to be interdisciplinary, integrating the science with the business of biotechnology (i.e. bringing biotech products to market), the laws and policies regulating this industry, and the ethics of performing bioscience research. This course will be an introduction to the biotechnology field and serve as the prerequisite to other biotechnology courses in Protein Applications in Biotechnology (BIO 251) and DNA methods (BIO 252).

**Course Prerequisites and Co-requisites:**

Prerequisites: BIO 101 with a C or better, or Dean/Program Head permission. Corequisites: BIO 250

**Student Learning Outcomes:**

Upon completing the course, the student will be able to

- Define biotechnology and provide numerous examples of how biotechnology is being applied in different sectors including the medical field, agriculture, environmental science, and forensics
- Describe key concepts in cell biology, biochemistry, and genetics and their significance in biotechnology research and product development
- Describe the structure of DNA, sources of DNA, and how DNA is manipulated in biotechnology applications
- Define genetic engineering and identify products created with this technology
- Describe the structure and function of proteins and how proteins are studied
- Detail the process of bio-manufacturing, from research and development to scale-up to sales and marketing

- Discuss the importance of plant biotechnology in creating new and novel crops and plant-products
- Explain the importance of medical biotechnology, including in pharmacogenomics and immunology
- Summarize the regulations governing the biotech industry
- Describe HIPPA compliance for individuals, institutions, professionals, businesses, academics, research
- Discuss the bioethical issues involved in different biotechnology applications
- Give examples of careers and job responsibilities associated with this field
- Describe Quality Control Systems role in laboratory techniques
- Define techniques for product integrity and risk- management
- Describe the difference between corrections and corrective actions.

**Major Topics to Be Included:**

- An overview of biotechnology (definitions, history, job opportunities, and the different sectors)
- The biology of biotechnology: cell structure, cell culture, macromolecules, recombinant DNA
- The scientific method and how it is applied in biotechnology industry
- Chemistry for biotechnology: volume, mass, concentration, pipettors, solution preparation and dilution
- An introduction to studying DNA
- An introduction to studying proteins
- Identifying a potential biotechnology product
- Spectrophotometers and concentration assays
- Recombinant DNA technology
- Bio-manufacturing
- The business of biotechnology: marketing, sales, and regulatory issues
- Plant biotechnology
- Agricultural biotechnology
- Medical biotechnology
- Other biotechnology applications (forensics, bioremediation, etc.)
- Advanced biotechnology techniques
- Ethical/regulatory issues in biotechnology
- HIPPA
- Bioinformatics

**Effective Date/Updated: August 28, 2023**