NOVA COLLEGE-WIDE COURSE CONTENT SUMMARY
BIO 252 - NUCLEIC ACID METHODS (4 CR.)

Course Description

Provides students with advanced laboratory skills needed for employment in the biotechnology industry. Focuses on use of basic and specialized lab equipment and techniques such as solution chemistry, cell culture, DNA extraction and analysis, protein extraction and analysis. Emphasizes lab safety, documentation, quality control, and use of standard operating procedures. Lecture 3 hours. Laboratory 3 hours. Total 6 hours per week.

General Course Purpose

This course is designed to provide an introduction to nucleic acids and the many techniques that are used to study DNA. Students will be re-introduced to the basic concepts of molecular biology including DNA structure and function, as well as the process and controls on gene expression. The basic tools and techniques of DNA science will be covered including DNA isolation and purification (including plasmid DNA), gel electrophoresis, DNA restriction/fingerprinting analyses, and cloning (transformation and screening of clones). A significant portion of time will also be spent covering newer DNA technologies including the polymerase chain reaction (including real-time PCR), DNA sequencing, DNA fingerprinting (using AFLP and microsatellite techniques) and microarrays. Students will be expected to integrate these techniques into a group research project using a DNA Sequencer/Analyzer. Students will be introduced to the field of bioinformatics. The application of these DNA techniques to different fields of biotechnology (i.e. forensics, medicine, environmental science, etc.) will be discussed.

Course Prerequisites/Corequisites

Prerequisites: BIO 250 and BIO 253 with a “C” or better or biotechnology program head permission

Course Objectives

Upon completing the course, the student will be able to:

- Detail the structure and function of DNA
- Describe the central dogma of molecular biology, namely the relationship between cellular DNA, RNA, and protein oncentrations.
- Understand the process and controls on gene regulation/expression.
- Explain the difference between DNA and RNA and how each might be used in nucleic acid research.
- Compare the fundamental features of prokaryotic and eukaryotic genes/genome.
- Define “recombinant DNA” and “cloning” in both a scientific and societal context.
- Describe the basic tools and techniques of DNA science including DNA isolation, restriction analyses, and cloning.
- Describe the recent methodological developments in biotechnology pertaining to DNA.
- Describe the polymerase chain reaction (PCR) and how it is used in biotechnology.
- Describe the methodology of DNA sequencing including whole-genome approaches.
- Understand the role of microarrays in gene expression studies.
- Understand the applications of DNA methods have to the fields of human medicine, namely in finding human disease genes, understanding the genetic basis of cancer, and in pharmacogenomics.
- Understand the role that DNA analyses have in forensics, agriculture, and environmental science.
- Use computer resources to analyze and compare genomes/genes from different organisms.
- Describe how bioinformatics is used to study the relationship between gene sequence and gene function.
- Work safely in a lab environment.
- Integrate basic lab techniques into the experimental design of a research project.
- Proficiently demonstrate basic lab skills including documentation, aseptic technique, pipetting, cell culture, and solution preparation and dilution.

Major Topics to be Included

- Introduction to DNA structure and the history of DNA science
- Information flow from DNA to protein
- Control of gene expression
- Basic tools and techniques of DNA science
- Methods for finding and expressing important genes
- Modern methods for analyzing whole genomes
- Basic and applied research with DNA microarrays
- The DNA science of cancer
- Applying DNA science to human genetics
- Other applications of DNA technologies
- Bioinformatics: analysis of gene sequences, genome expression, and the whole genome perspective