College of San Mateo
Official Course Outline

1. **COURSE ID:** BIOL 124 **TITLE:** Seminar in DNA and Applications in Biotechnology
   Units: 1.0 units **Hours/Semester:** 16.0-18.0 Lecture hours; and 32.0-36.0 Homework hours
   Method of Grading: Letter Grade Only
   Recommended Preparation:
   It is advised that students have the ability to read and write using standard English at a college level and perform basic high school math.

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   Seminar covering biological and chemical aspects of Nucleic Acids (DNA & RNA) with a focus on applications in biotechnology. Course can be taken on its own but is intended as a theoretical support for applied skills learned in BIOL123 Biotechnology Workshop in Polymerase Chain Reaction (PCR). Anyone interested in furthering their theoretical or practical understanding of nucleic acids to support their educational or career goals is encouraged to take this course.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. Demonstrate an understanding of the chemical properties of nucleic acids (DNA and RNA)
   2. Demonstrate an understanding of the biochemistry of nucleic acids (DNA and RNA) and their role in cell biology.
   3. Describe the different types of nucleic acid analysis.
   4. Describe the applications of nucleic acid biotechnology.
   5. Understand and discuss ethics in the field of biotechnology.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   1. Outline the basic chemistry of nucleic acids and how chemical structure explains function in a cell.
   2. Describe processes and illustrate with diagrams the functioning of nucleic acids in cells under normal or dysfunctional situations.
   3. Explain different applications of DNA analysis and provide examples to illustrate
   4. Explain different applications of nucleic acid biotechnology and provide examples to illustrate.
   5. Discuss ethical considerations in DNA analysis and biotechnology in both scientific research and business applications.

6. **COURSE CONTENT:**
   Lecture Content:
   1. DNA structure and chemistry
   2. Human, bacterial and viral genomes
   3. DNA replication
   4. Central Dogma of Biology: DNA transcription to RNA and translation to protein
   5. Virus lifecycles and replication
   6. Mutations
   7. Applications overview; tools of the trade, analysis and biotechnology
   8. Analysis of DNA; fingerprinting, sequencing, DNA annotation, metagenomics
   9. Analysis of gene expression (RNA & proteins)
   10. Bioinformatics
   11. Exchange of genetic material between cells
   12. Research Applications of Biotechnology
   13. Manufacturing applications of Biotechnology
   14. Ethical considerations of biotechnology
   15. Application of course material to needs in the marketplace

   Lab Content:

This course has no lab.

TBA Hours Content:

This course has no TBA.

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**

Typical methods of instruction may include:

A. Lecture
B. Discussion
C. Guest Speakers
D. Individualized Instruction
E. Other (Specify): Third party simulations and animations

8. **REPRESENTATIVE ASSIGNMENTS**

Representative assignments in this course may include, but are not limited to the following:

Writing Assignments:

Summaries of research articles that include evaluation of science presented and assessment of author credentials.

Reading Assignments:

Textbooks and scientific research articles.

Other Outside Assignments:

Modeling assignments to demonstrate comprehensive understanding of the chemistry and biochemistry of nucleic acids.

Case-study review and written or oral analysis of nucleic acid-based diagnostic strategies and approaches in research, clinical, and industrial applications.

Design theoretical strategies for analysis of DNA, RNA (and proteins) in a normal and disease state.

9. **REPRESENTATIVE METHODS OF EVALUATION**

Representative methods of evaluation may include:

A. Class Participation
B. Class Work
C. Exams/Tests
D. Homework
E. Oral Presentation
F. Papers
G. Quizzes
H. Simulation
I. Written examination

10. **REPRESENTATIVE TEXT(S):**

Possible textbooks include:

A. Alberts, B., et al.. *ESSENTIAL CELL BIOLOGY*, 5th ed. Garland Science Publishers, 2019
B. A. Parker, N., Schneegurt, M., Thi Tu, A., Lister, P. , Forster, B.M.. *Microbiology*, 2018 ed. OpenStax, 2018

Possible software includes:

A. JALVIEW. University of Dundee School of Life Sciences, 2019 ed. ed.
Jalview is a free, open source program developed for the interactive editing, analysis and visualization of multiple sequence alignments. It can also work with sequence annotation, secondary structure information, phylogenetic trees and 3D molecular structures.
B. Phylogeny.fr Robust Phylogenetic Analysis For The Non-Specialist. Réseau National des Génopoles (RNG), 2021 ed.
Phylogenetic analysis software.
C. Clustal Omega. EMBL-European Bioinformatics Institute, 2021 ed.
DNA sequence analyzer.

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Course Originator: Christopher Smith