**Course Description:**

Students gain knowledge and skill in genetic principles and molecular methods of analysis. Topics include enzymology, protein purification, and gene expression and organization. Students perform bio-molecular applications using knowledge of nucleic acid structure and function, DNA replication, transcription, translation, chromosome structure and remodeling and regulation of gene expression in prokaryotes and eukaryotes. Additionally, students will use electrophoresis to separate nucleic acids and proteins to determine molecular weight.

**Strand 5. Bioscience Research and Development**

Learners will demonstrate the skills and knowledge of interpreting laboratory requests, using protective clothing and hazardous material containment, specimen collection procedures, a variety of laboratory testing and techniques and maintenance of laboratory equipment and supplies.

**Outcome: 5.4. Molecular and Genetic Technology**

Perform molecular and genetic applications using knowledge of nucleic acid structure and function, DNA replication, transcription, translation, chromosome structure and remodeling and regulation of gene expression in prokaryotes and eukaryotes.

**Competencies**

5.4.1. Predict and explain offspring genotypes and phenotypes using basic mode of genetics.

5.4.2. Identify complex gene expression and transmission patterns.

5.4.3. Explain and model the structure of DNA from nucleotide to chromosome.

5.4.4. Model the Central Dogma Theory.

5.4.5. Describe the processes involved in gene regulation.

5.4.6. Identify and isolate peptides and proteins.

5.4.7. Summarize the steps in creating a recombinant DNA molecule.

5.4.8. Isolate and purify nucleic acids, including chromosomal and extra‐chromosomal DNA molecules.

5.4.9. Compare nucleic acids and chromosomal DNA molecules using a sequence database.

5.4.10. Perform and interpret the results of restriction enzyme digests.

5.4.11. Apply concepts of a pedigree.

5.4.12. Perform and interpret the results of a polymerase chain reaction.

5.4.13. Use electrophoresis to separate nucleic acids and determine molecular weight.

5.4.14. Explain results from the Human Genome project and other sequencing projects and explain how gene sequencing is performed.

5.4.15. Perform gene analysis to determine the source of an isolated pathogen.

5.4.16. Explain the role of RNA and its role in gene expression.

*An “X” indicates that the pathway applies to the outcome.*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pathways** |  | Health Information Management | X | Medical Bioscience | X | Allied Health and Nursing | |  | Exercise Science and Sports Medicine |  | Therapeutic Services |
| **Green Practices** |  | Green-specific |  | Context-dependent | | X | Does not apply | | |  |  |

**Outcome: 5.5. Laboratory Standard Operational Procedures**

Perform methods and techniques using protocols in order to conduct an experiment.

**Competencies**

5.5.1. Follow standard operating procedure (SOP) to aseptically collect and prepare dry and wet samples for analysis.

5.5.10. Use aseptic laboratory techniques while working.

5.5.12. Comply with industry‐based and required regulatory quality‐assurance practices (e.g., quality control [QC], Good Laboratory Practice [GLP], Good Manufacturing Practice [GMP]) for documentation.

*An “X” indicates that the pathway applies to the outcome.*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pathways** |  | Health Information Management | X | Medical Bioscience | X | Allied Health and Nursing | |  | Exercise Science and Sports Medicine |  | Therapeutic Services |
| **Green Practices** |  | Green-specific |  | Context-dependent | | X | Does not apply | | |  |  |

**Outcome: 5.6.**  **Culturing**

Perform experimental techniques used in cell biology to study cell growth, manipulation, and evaluation.

**Competencies**

5.6.8. Explain Koch’s Postulates and their use in determining primary and secondary pathogens.

5.6.9. Describe how vectors are used to transform host and microorganisms.

5.6.15. Explain how cell cultures can be used to assay viability and cytotoxicity.

5.6.16. Demonstrate cryopreservation techniques by freezing and thawing cells.

*An “X” indicates that the pathway applies to the outcome.*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pathways** |  | Health Information Management | X | Medical Bioscience | X | Allied Health and Nursing | |  | Exercise Science and Sports Medicine |  | Therapeutic Services |
| **Green Practices** |  | Green-specific |  | Context-dependent | | X | Does not apply | | |  |  |

**Outcome: 5.8. Biotechnology Research and Experiments**

Conduct a problem-based study, applying scientific methodology and using descriptive statistics to communicate and support predictions and conclusions.

**Competencies**

5.8.8. Compute measures of central tendency and dispersion to interpret results and draw conclusions.

5.8.9. Describe the relationships among variables using correlations and draw conclusions.

*An “X” indicates that the pathway applies to the outcome.*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pathways** |  | Health Information Management | X | Medical Bioscience | X | Allied Health and Nursing | |  | Exercise Science and Sports Medicine |  | Therapeutic Services |
| **Green Practices** |  | Green-specific |  | Context-dependent | | X | Does not apply | | |  |  |