

**Educational Objectives**

1. This course aims to provide an overall knowledge regarding the principles and widespread technical applications of Molecular Biology techniques in the field of Criminology. This course will enable the students to develop a greater understanding of
  - a. how to identify and sample biological evidence for DNA analysis – including the importance of evidence collection at the crime scene and how surfaces, materials and sources relate to sampling strategies – refresher on screening the biological evidence for source attribution
  - b. the scientific principles behind DNA analysis techniques (DNA extraction, quantification, instrument analysis, interpretation of STR and Y STR data, and the statistical analysis of both types of DNA profiles)
  - c. how forensic DNA testimony is given at the deposition level
  - d. How a forensic DNA laboratory functions, including the accreditation requirements for forensic DNA laboratories.

**Course Outcomes**

2. This course will help to gain scientific knowledge of the chemical and biological analytical techniques used to assist investigations. The course will develop the skills of students in applying analytical chemistry techniques and understanding of biological science through molecular biology and medical microbiology.

3. **Course Contents**

- a. Introduction to Forensic biology: A sub-discipline of forensic science
- b. Human remains: Decay, DNA, Tissues and Fluids
  - (1) The decay, discovery and recovery of human bodies
  - (2) The dead body
  - (3) The stages of decomposition
  - (4) Factors affecting the speed of decay

- c. Biological Evidence
  - (1) Crime scene investigation of Biological Evidence
  - (2) Crime scene blood stain pattern analysis
    - (a) Basic biological properties of human blood
    - (b) Formation of blood stains
    - (c) Analyzing spatter stains
    - (d) Types of blood stain patterns
  - (3) Sources of Biological Evidences
    - (a) Bodily fluids
    - (b) Cells
    - (c) Tissues (Skin, Hair, Bone, Teeth)
  - (4) Basic Techniques in Forensic Biology
    - (a) Basic principles and methods of Nucleic Acid Extraction
    - (b) DNA Quantification
    - (c) Amplification by Polymerase Chain Reaction
    - (d) DNA Electrophoresis
    - (e) Detection Methods
    - (f) Serology concepts and techniques
- d. Identification and Characterization of Biological Evidence
  - (1) Identification of blood, semen and saliva
  - (2) Species identification
  - (3) Identification of urine, sweat and fecal matter
  - (4) Blood group typing and protein profiling
  - (5) Variable number tandem repeat profiling
  - (6) Autosomal short tandem repeat profiling
  - (7) Sex chromosome haplotyping and gender identification
  - (8) SNP profiling
  - (9) Mitochondrial DNA profiling
- e. Science and the law: DNA Evidence and beyond
  - (1) Introduction
  - (2) Genetics and identity
  - (3) Cold hit cases

- (4) Confrontation clause
- (5) Chimerism
- (6) New investigative tools
- (7) Indictment by DNA Profile

### **Recommended Books**

1. **Forensic Biology**, Richard Li, 2008.
2. Butler's **Advanced Topics in Forensic DNA Typing: Methodology**
3. Watson et al's **Molecular Biology of the Gene**, 6th or 7th Edition
4. **Forensic Evidence: Science and the Criminal Law**, Second Edition by Terrence F. Kiely
5. **Essential Forensic Biology**, 2nd Edition by Alan Gunn , 2009
6. **Forensic Science: An Introduction to Scientific and Investigative Techniques**, Fourth Edition 4th Edition by Stuart H. James, Jon J. Nordby Ph.D. , Suzanne Bell