

MEDICAL FORENSICS

Levels: 11-12
Units of Credit: 1.0
CIP Code: 51.1004
Prerequisite: Biology
Skill Certificates: #7xx

COURSE DESCRIPTION

This year-long course is designed to create an awareness of the branch of health science relating to medical forensics. This course focuses on introductory skills and assessment in order to develop the ability to identify, analyze, and process logically using deductive reasoning and problem solving. Medical forensics involves many aspects of health science instruction including laboratory skills and safety, microscopy, toxicology, measurement, physical evidence identification, pathology, anthropology, entomology, psychology, blood spatter analysis, and career exploration.

CORE STANDARDS, OBJECTIVES AND INDICATORS

STANDARD 1

Introduction to Medical Forensics – Students will explore the fundamental aspects of Medical Forensics.

OBJECTIVE 1: Detail the history and development of medical forensics.

- a. Create a historical timeline
- b. Discuss the federal programs established in the United States to investigate crimes.
- c. Explore a variety of careers associated with medical forensics professions.
 - Crime laboratory analyst
 - Clinical laboratory technician
 - Microbiologist
 - Fingerprint analyst
 - Criminalist
 - Crime scene photographer
 - Phlebotomist
 - Forensic serology DNA criminalist
 - Serology technician
 - Forensic psychologist
 - Mental health counselor
 - Toxicologist
 - Biochemist
 - Pharmacologist
 - Geneticist
 - Medical examiner

OBJECTIVE 2: Discuss the organization of the crime laboratory and detail the functions it serves.

- a. Describe the organization of the Utah Crime Lab.
- b. Compare and contrast the Utah Crime Lab with a crime lab from another state and an international crime lab.

OBJECTIVE 3: Describe the importance of physical evidence.

- a. List the types of evidence (eyewitness, class evidence, and physical evidence).
- b. Discuss how evidence is used to convince a jury of guilt.

STANDARD 2

Fundamental Laboratory Skills – Students will explore essential laboratory safety skills and fundamental skills related to microscopy and measurement.

OBJECTIVE 1: Demonstrate appropriate use of personal protective devices.

- a. Describe how personal protective devices protect the evidence and the lab worker.
- b. Demonstrate how to properly use personal protective devices (e.g., lab coats, gloves, safety glasses).
- c. Demonstrate safe removal of gloves.

OBJECTIVE 2: Exhibit appropriate behavior in the lab.

- a. Explain the dangers of evidence contamination through food, drink, cosmetics, lotion, eye drops, and contact lenses.
- b. Follow proper disposal and clean-up procedures with respect to chemicals and laboratory equipment.
- c. Demonstrate proper hand washing technique.

OBJECTIVE 3: Use laboratory equipment correctly and safely.

- a. Demonstrate the proper use of equipment (micropipette, centrifuge, spectrophotometer, electrophoresis apparatus—DNA, thermocycler, microscope, balance, water baths, Vernier calipers, glassware (metric units), rulers/measuring tapes).
- b. Demonstrate proper use and handling of a compound microscope and a stereoscope.

OBJECTIVE 4: Follow laboratory procedures.

- a. Understand the purpose of individual steps within a protocol.
- b. Perform the steps of laboratory protocols accurately and in sequence.

OBJECTIVE 5: Comply with policies and requirements for maintaining a lab manual.

- a. Follow standard operating procedures for maintaining a lab manual.
- b. Document laboratory work following the steps of the Scientific Method (objectives, material, procedures, data/results, and conclusion).

OBJECTIVE 6: Demonstrate proper handling of chemicals.

- a. Communicate the rationale for laboratory labeling procedures.
- b. Recognize and comply with the labeling of chemicals used in a laboratory setting for safe handling and storage (flammability, corrosiveness, biohazards, toxicity, etc.).
- c. Reference and interpret the guidelines in Material Safety Data Sheets (MSDS).

STANDARD 3

Students will identify and analyze trace evidence.

OBJECTIVE 1: Examine trace evidence using a microscope, chromatography, and other techniques.

- a. Define and list examples of trace evidence.
- b. Collect and analyze various types of trace evidence (dust, pollen, fiberglass, etc.)

OBJECTIVE 2: Identify microbes using measurement and microscopy techniques in a simulated professional setting.

- a. Define and identify a variety of microbes.
- b. Use a compound microscope to identify microbes.

STANDARD 4

Fingerprint Identification – Students will explore fingerprint identification.

OBJECTIVE 1: Describe fingerprint classification.

- a. Describe the 3 fundamental principles of fingerprinting (first, second, and third principles).
- b. Identify the degrees of fingerprinting (first, second, and third degrees).

OBJECTIVE 2: Identify and classify fingerprint and ridge patterns.

- a. Classify fingerprints into three basic patterns (loops, whorls and arches).
- b. Classify fingerprints using the Ten Print System.
- c. Identify individualization of fingerprints (ridge characteristics & ridge count).
- d. Describe the AFIS System of fingerprint identification.

OBJECTIVE 3: Compare and contrast latent, plastic, and visible fingerprints.

- a. Develop latent fingerprints using dusting, staining, and chemical fuming.
- b. Develop a plastic fingerprint using a mold (wax, soap, putty, etc.).
- c. Create and document visible fingerprints using digital photography.

STANDARD 5

Hair and Fiber Analysis – Students will examine hair and fibers in relation to physical evidence

OBJECTIVE 1: Examine and analyze the forensic aspects of hair.

- a. Describe the microscopic structure of hair (shaft, root, and follicle).
- b. Describe the general biological make-up and functions of hair (shape, growth, and function).
- c. Characterize the attributes of hair in regards to chemical absorption (root and scalp oil).
- d. Compare and contrast a variety of hair samples from different human races and different types of animals.

OBJECTIVE 2: Examine and analyze the forensic aspects of fibers.

- a. Identify and compare natural and synthetic fiber types by using physical (microscopic) and chemical (burn, acid, base, acetone) testing methods.
- b. Compare and contrast common fiber weave patterns (plain, twill, satin, knitted).
- c. Summarize systematic procedures for collection and identification of hair and fiber evidence.

STANDARD 6

Serology – Students will investigate the characteristics of blood, blood testing, and bloodstain analysis.

OBJECTIVE 1: Identify the components and chemical properties of blood.

- a. List the components of blood.
- b. Identify the antigens and antibodies that determine ABO blood types and the Rh factor.

OBJECTIVE 2: Determine genetic probabilities using blood types.

- a. Use a Punnett Square to determine blood type probabilities.
- b. Apply the use of a Punnett Square to solve paternity questions.

OBJECTIVE 3: Examine and analyze blood spatter.

- a. Illustrate size, shape, and directionality of blood spatter in a laboratory experiment.
- b. Compare and contrast low, medium, and high velocity blood spatter.
- c. Examine different types of blood spatter patterns (drip, castoff, transfer, swipe, spurt, expired).

OBJECTIVE 4: Describe proper procedures for blood stain evidence collection, presumptive testing (Kastle-Meyer), and preservation.

- a. Describe how to collect a wet stain and a dry stain.
- b. Demonstrate how to collect a large object in reference to blood evidence collection (i.e., sheets, blankets, clothing, etc.).
- c. Properly perform and explain a presumptive blood test.

STANDARD 7

Mortality – Students will investigate various aspects of death.

OBJECTIVE 1: Describe correct anatomical position and the role it plays in human anatomy.

- a. Describe anatomical position
- b. Apply body planes and directional terms related to the body(sagittal, frontal, transverse, superior, inferior, anterior, posterior, dorsal, ventral, medial, lateral, proximal, distal, deep, superficial, parietal, visceral, supine, prone).

OBJECTIVE 2: Locate the body cavities, quadrants, and body regions and identify the major organs within each.

- a. Dorsal cavity (cranial, spinal).
- b. Ventral Cavity (thoracic, abdominal, pelvic).
- c. Abdominal quadrants (RUQ, RLQ, LUQ, LLQ).
- d. Body regions (right hypochondriac, epigastric, left hypochondriac, right lumbar, umbilical, left lumbar, right inguinal, hypogastric, left inguinal).

OBJECTIVE 3: Compare and contrast the manner and method of death.

- a. Define and list manners of death.
- b. Define and list methods of death

OBJECTIVE 4: Identify the steps of an autopsy procedure and determine cause of death.

- a. List the steps of an external examination.
- b. Describe the proper technique to perform a Y-shaped incision.
- c. List the steps of an internal examination.
- d. Determine the cause of death using evidence from an autopsy.

OBJECTIVE 5: Identify the stages of decomposition to determine approximate time of death.

- a. Define taphonomy and describe the stages of decomposition (fresh, putrefaction, black putrefaction, butyric, dry).
- b. Compare and contrast algor mortis, rigor mortis, and livor mortis.
- c. Identify common insects associated with decomposition (blow fly, carrion beetle, etc.) and diagram their life cycles.

- d. Identify various environmental factors related to time of death (temperature, humidity, cause of death, etc.)

STANDARD 8

Forensic Psychology – Students will explore aspects of the criminal mind.

OBJECTIVE 1: Locate and identify the major organs of the nervous system.

- a. Brain (cerebral cortex, cerebellum, lobes, brainstem).
- b. Spinal cord.

OBJECTIVE 2: Describe the importance of the role of membranes in the nervous system.

- a. Describe the three layers of meninges (dura mater, arachnoid mater, pia mater).
- b. Identify the three types of hemorrhage involving the meninges.

OBJECTIVE 3: Identify and describe offender profiling procedures.

- a. Profiling input
- b. Decision process models
- c. Crime assessment
- d. Criminal profile
- e. Investigation
- f. Apprehension

OBJECTIVE 4: Identify psychological testing processes and procedures used to study the criminal mind.

- a. Describe the tests used to determine the cognitive and personality types of offenders.
- b. Discuss the problems with psychometric tests.

OBJECTIVE 5: Compare and contrast neurobiological brain abnormalities and mental conditions related to abnormal psychology and the criminal brain and technical instrumentation used to diagnose these abnormalities.

- a. Describe brain abnormalities, genetics, and environmental factors related to the criminal mind.
- b. Compare and contrast a PET Scan and a MRI in diagnosing brain abnormalities.

OBJECTIVE 6: Compare and contrast the use of a polygraph machine with the physiological workings of the mind and body.

- a. Describe the physiological functions measured by a polygraph machine.
- b. Interpret data collected from a polygraph.

OBJECTIVE 7: Explore the psychological aspects of a serial killer.

- a. Define serial killer.
- b. Explore the motives of serial killers
- c. Compare and contrast the types of serial killers.

STANDARD 9

Identification of Physical Evidence and Remains – Students will explore characteristics of physical evidence and remains.

OBJECTIVE 1: Identify the basic bones of the skeleton.

- a. Cranium
- b. Vertebrae
- c. Sternum
- d. Xiphoid process
- e. Ribs
- f. Humerus
- g. Radius
- h. Ulna
- i. Carpals
- j. Metacarpals
- k. Phalanges
- l. Pelvis
- m. Femur
- n. Patella
- o. Tibia
- p. Fibula
- q. Tarsals
- r. Metatarsals
- s. Phalanges.

OBJECTIVE 2: Use skeletal remains to determine the physical characteristics of an individual.

- a. Determine the sex of an individual based on skull, jaw, brow ridge, pelvis, and femur.
- b. Determine the ancestry of an individual.
- c. Estimate the age of an individual.
- d. Estimate the height, build and handedness of an individual.

OBJECTIVE 3: Identify injuries, bone diseases, and possible causes of death using bone characteristics.

- a. Compare and contrast pre and postmortem bone injuries (i.e., fractures).
- b. Identify bone patterns indicating disease (i.e., arthritis).
- c. Identify bone markings that could indicate cause of death (stab wound, bullet hole, blunt force trauma, etc.).

OBJECTIVE 4: Describe how teeth are used in forensic identification.

- a. Name and number deciduous (baby) and permanent teeth.
- b. Employ dentition patterns as a means for bite mark identification.
- c. Compare and contrast bite mark patterns antemortem and postmortem.
- d. Describe the use of forensic dentistry in regards to mass disasters and body identification.

STANDARD 10

Toxicology – Students will develop an understanding of the adverse effects of drugs and be acquainted with the laboratory investigation of the most common poisonings.

OBJECTIVE 1: Identify the parts of the circulatory and excretory systems.

- a. Cardiovascular System: (heart (aorta, superior vena cava inferior vena cava, atria, ventricles), lungs (left and right, thymus gland, thyroid gland) arteries, capillaries, veins).
- b. Digestive System: (esophagus, stomach, liver, spleen, pancreas, small intestine, large intestine).
- c. Urinary System: (kidneys, ureters, bladder, urethra)

OBJECTIVE 2: Compare and contrast laboratory procedures used for measuring the concentration of alcohol in the bloodstream.

- a. Describe techniques used to measure the blood alcohol content (BAC) through blood.
- b. Describe techniques used to measure the blood alcohol content (BAC) through the breath (infrared spectrophotometry and electrochemical fuel cell technology).

OBJECTIVE 3: Identify the five schedules of drug types and classify according to the effects that they have on the body.

- a. Describe the five schedules of drug types (schedules 1-5).
- b. Classify the types of drugs based on the physiological effects on the body (stimulants, depressants, narcotics).

OBJECTIVE 4: Relate the signs and symptoms of an overdose and poisoning with a specific class of drugs or toxins.

- a. Hallucinogens (MDMA, mescaline, LSD, PCP).
- b. Narcotics (opium, heroin, codeine, morphine, methadone, oxycodone).
- c. Stimulants (amphetamines cocaine, crack, methamphetamines).
- d. Anabolic steroids
- e. Depressants (including alcohol).
- f. Bacterial Toxins (botulism, tetanus)
- g. Heavy metals and pesticides (lead, mercury, arsenic, cyanide, strychnine).

OBJECTIVE 5: Discuss chemical agents that may be used for bioterrorism.

- a. Ricin (castor beans)
- b. Anthrax (*Bacillus anthracis*)

OBJECTIVE 6: Compare and contrast methods used to collect and package drug evidence.

- a. Identify procedures used to collect and package plant substances.
- b. Identify procedures used to collect and package liquids.
- c. Identify procedures used to collect and package biohazards.

STANDARD 11

DNA Evidence – Students will investigate the importance of DNA evidence.

OBJECTIVE 1: Identify the structure and function of a DNA molecule.

- a. Describe the structure of DNA.
- b. Describe the function of DNA.
- c. Compare and contrast nuclear DNA and mitochondrial DNA.

OBJECTIVE 2: Describe advancements in technology used to obtain a DNA fingerprint.

- a. Discuss the purpose of PCR.
- b. Define RFLP and discuss how it relates to forensic identification.
- c. Define STR and discuss how it relates to forensic identification.

STANDARD 12

Medical Forensics Investigation – Students will describe techniques used to process a homicide crime scene and preserve the evidentiary value of the scene.

OBJECTIVE 1: Describe how various medical forensics professionals process a crime scene.

- a. Responding officer
- b. Crime Scene Investigator
- c. Medical Examiner

OBJECTIVE 2: Identify how a crime scene and evidence may be compromised.

- a. Contamination (family, law enforcement, crime scene workers, etc.).
- b. Chain of custody (evidence lost, etc.).
- c. Environmental conditions (temperature, moisture, etc.).
- d. Preservation of the scene (value of evidence, etc.).
- e. Processing at the lab