



SYRACUSE UNIVERSITY

CHE 113
Forensic Science
2019-2020
(4 credits)

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Chemistry 113, Forensic Science, is focused upon the application of scientific methods and techniques to crime and law. Recent advances in scientific methods and principles have had an enormous impact upon law enforcement and the entire criminal justice system. This course is intended to provide an introduction to understanding the science behind crime detection. Scientific methods specifically relevant to crime detection and analysis will be presented with emphasis placed upon the techniques used in evaluating physical evidence. Topics include blood analysis, organic and inorganic evidence analysis, microscopic investigations, hair analysis, DNA, drug chemistry and toxicology, fiber comparisons, paints, glass compositions and fragmentation, fingerprints, soil comparisons, and arson investigations. Laboratory exercises will include techniques commonly employed in forensic investigations.

Final grades will be assigned based upon the hourly exams, the comprehensive final examination, and the laboratory. The laboratory is available from Chemical Education Resources (www.cerlabs.com).

Course Outline

Introduction: Definition and scope of forensic science, history and development of forensic science, the organization of a crime laboratory, services of the crime laboratory, the functions of the forensic scientist, other forensic science services.

The Crime Scene: Processing the crime scene, legal considerations at the crime scene.

Physical Evidence: Common types of physical evidence, the significance of physical evidence.

Physical Properties: The metric (SI) system, physical properties of glass and soil, comparing glass fragments, glass fractures, collection and preservation of glass evidence, forensic characterization of soil, collection and preservation of evidence.

Organic Analysis: Elements and compounds, selecting an analytical technique, chromatography, spectrophotometry, mass spectrometry.

Inorganic Analysis: Evidence in the assassination of President Kennedy, the emission spectrum of elements, atomic absorption spectrophotometry, the origin of emission and absorption spectra, neutron activation analysis, X-ray diffraction.

The Microscope: The compound microscope, the comparison microscope, the stereoscopic microscope, the polarizing microscope, the microspectrophotometer, the scanning electron microscope (SEM).

Hairs, Fibers and Paint: Morphology of hair, identification and comparison of hair, collection of hair evidence, types of fibers, identification and comparison of man-made fibers, collection of fiber evidence, forensic examination of paint, collection and preservation of paint evidence.

Drugs and Medicinal Chemistry: Drug dependence, narcotic drugs, hallucinogens, depressants, stimulants, anabolic steroids, drug-control laws, drug identification, collection and preservation of drug evidence.

Forensic Toxicology: Toxicology of alcohol, the role of the toxicologist, techniques used in toxicology, the significance of toxicological findings, the drug recognition expert.

Forensic Aspects of Arson and Explosion Investigations: The chemistry of fire, searching the fire scene, collection and preservation of arson evidence, analysis of flammable residues, types of explosives, collection and analysis of explosives.

Forensic Serology: The nature of blood, forensic characterization of bloodstains, stain pattern of blood, principles of heredity, forensic characterization of semen, collection of rape evidence.

DNA Evidence: What is DNA? DNA at work, replication of DNA, recombinant DNA: cutting and splicing DNA, DNA typing, mitochondrial DNA, the combined DNA index system, the collection and preservation of biological evidence for DNA analysis.

Fingerprints: History of fingerprinting, fundamental principles of fingerprints, classification of fingerprints, automated fingerprint identification systems, methods of detecting fingerprints, preservation of developed prints, digital imaging for fingerprint enhancement.

Firearms, Tool Marks and Other Impressions: Bullet comparisons, cartridge cases, automated firearm search systems, gunpowder residues, primer residues on the hands, serial number restoration, collection and preservation of firearm evidence, tool marks, other impressions.

Document and Voice Examination: Handwriting comparisons, collection of handwriting exemplars, typewriting comparisons, photocopies, printer and Fax examination, alterations, erasures and obliterations, other document problems, voice examination.

Forensic Psychology: A brief exploration of the many aspects of forensic psychology.

Laboratory

Experiments involve techniques frequently encountered in forensic investigations. These experiments will include: safety practices in the chemistry laboratory, separating and identifying food dyes by paper chromatography, identifying a solid by its density, classifying carbohydrates, enantiomeric purity of commercial ibuprofen, qualitative tests for amino acids and proteins, DNA extraction, nine bottles: an adventure in chemical identification, the crime scene (analysis of evidence).

Textbook: James T. Spencer, "Introduction to Forensic Science: The Science of Criminalistics" (ca. 900 pages), Cengage Learning. Access text and lab manual online through Moodle, free of charge.