Review
Concepts
Exam 1
CHS 3501
Chapter 1

• Key terms
• Forensic science – application of science to criminal and civil laws
• Algor mortis- cooling of a body following death
• Livor morits – pooling of the blood following death
• Rigor mortis – stiffening of the body following death
• Autopsy - medical dissection of a body
• Expert witness –an individual with knowledge relevant to the trial not expected of the average person
• Locards exchange principle – Two objects in contact with each other exchange material
• Frye vs United States – set guidelines for acceptance of scientific evidence (general acceptance)
• Daubert vs Merrell Dow Pharmaceuticals – Judges act as gatekeeper for scientific evidenc. Must decide if
  – Theory can 1) be tested, 2) is peer reviewed, 3) has a known error rate 4) has standards for calibration/testing 5) widespread acceptance
Sevices in a forensic Laboratory

- 5 basic services –
  - Physical sciences – drug analysis, arson, explosives, trace
  - Biology – Serology, DNA typing
  - Documents – handwriting analysis, ink analysis, obliteration, erasures
  - Firearms – bullet examinations, gunshot residues
  - Photography – record physical evidence, imaging, alternate light sources
Other Forensic Services

- Toxicology - determination the presence or absence of drugs and poisons in body fluids, DWI, cause of death
- Latent fingerprint – chemical and alternative means to develop fingerprints
- Polygraph - perform lie detector tests, applicant screening
- Voiceprint – analyze and match sound recordings
- Crime Scene investigation - sends trained personnel to the scene to collect evidence.
Forensic Science History

- Orfila – father of modern forensic toxicology, first treatise on poisons d1853
- Bertillon – Scientific system of personal identification (anthropometry) d1914
- Galton – first definitive study of fingerprints d1911
- Lattes – developed blood group typing of dried bloodstains d1954
- Goddard – Comparison microscopy for bullet test firing d1955
- Osborn – principles of document examination d1946
- McCrone – advancement of forensic microscopy d2002
- Gross - Scientific Principles to criminal investigation d1915
- Locard – exchange principle d1915
- Kirk – founded the first school of criminology d1970
- Jeffries – developed DNA testing
- Mullis – developed the PCR to copy DNA
Other forensic services

- Forensic anthropology – disposition of skeletal remains, mass disasters
- Forensic Entomology – insects and time of death
- Forensic Psychiatry – human behavior and legal proceedings
- Forensic Odontology – identification of victims/suspects through dental records
- Forensic Engineering – failure analysis, accident reconstruction
- Forensic Computer analysis- tracking criminal activities through recovery of computer files.
The Crime Scene CH 2

• Key terms
  – Buccal swab - collect cheek cells
  – Chain of custody – list of all people in contact with evidence
  – Finished sketch - precise rendering of crime scene
  – Physical evidence - objects that establish a crime has been committed and can link the crime to victim or suspect
  – Rough sketch – the draft of the finished sketch done at the scene
  – Standard/reference samples – evidence whose origin is known and can be compared to that at the scene
  – Substrate control – uncontaminated material near an area and representative of the location where physical evidence is recovered
Other concepts

- Anyone entering a scene could potentially destroy evidence
- Scene must be photographed in an unaltered condition
- Notes from scene should contain detailed description of allocation of evidence, identify who found it, how it was collected and where it was placed
- Items packaged might include clothing, fingernail scrapings, hairs, blood, bullets, hand swabs, rape kits
- Packaging must prevent change in evidence from the time it is removed to the time it is examined. It must also eliminate potential contamination
- Blood stained materials must be allowed to dry through storage in paper bags
- Chain of custody must be maintained
- Controls must be collected
- A case history aids in the analysis of evidence
Physical Evidence  CH 3

• Key Terms
  – Class Characteristics – properties of evidence associated only with a group
  – Individual characteristics - properties of evidence attributed to a single source with a high degree of certainty
  – Comparison – examining two objects to determine if they have a common origin
  – Identification - determining a physical or chemical uniqueness with near absolute certainty
  – Product rule – multiplication of individual frequencies of unlinked events – most commonly used with genetic markers
  – Reconstruction – a way to support a sequence of events based on physical evidence and witness statements
Key concepts

• The value of physical evidence is to corroborate witness statements and theories of events with physical data
• Common types of physical evidence – blood, semen, saliva, hair, fingerprints
• Documents, drugs, explosives, fibers, soil, paint, impressions, plastics, residues, vegetative matter
• Chemical and physical tests are used to determine class characteristics and/or identify a substance
• Comparisons are made between crime scene sample and reference samples, then potential for links between them is evaluated to establish origin
• Taken to extreme even items from the same location will show some differences
• For most items of evidence containing class characteristics it is very difficult to establish statistical weight to the evidence
• To assist the development of statistical weight to evidence, especially those with individual characteristics, databases are established
• Crime scene reconstruction involves evaluating physical evidence and comparing it with witness statements
Databases

- IAFIS – Integrated Automated Fingerprint Identification System – fingerprints and criminal history
- CODIS – Combined DNA Index System – DNA profiles of convicted offenders and samples from crime scenes
- NIBIN – National Integrated Ballistics information Network – digitized markings from bullets and cartridge casings – used to track weapons used in crimes
- PDQ - International Forensic Automotive Paint Data Query – chemical and color information on automotive paints – used in hit and run
- SICAR Shoeprint image capture and retrieval – capture and compare crime scene shoe prints
Key concepts

• First officer arriving at the scene must secure it
• Investigators at the scene must record, recognize and properly preserve physical evidence
• A search pattern can be used to collect the evidence
• Trace evidence which may only be properly examined at the lab must be collected
• Each item of evidence must be placed in a properly designed separate container. Protective clothing must be used to avoid contamination and to minimize biohazards – hepatitis and AIDS
• Chain of custody must be maintained when collecting evidence
• Proper reference samples and controls must also be collected
• Evidence may only be removed following proper protocols for search and seizure
• Search warrant not needed if emergency, threat of loss of evidence, collected during an arrest, permission of owner
Fingerprints  CH 14

• Key concepts
  – Anthropometry – Bertillon’s measurements of the body for ID
  – Arch – ridge lines entering from one side and flowing out to the other
  – Digital imaging – converting a picture to a series of dots known as pixels
  – Fluoresce – the emission of longer wavelengths of light when hit by shorter ones
  – Iodine fuming- the development of a latent print through adsorption of iodine vapors
  – Latent fingerprint – fingerprint invisible to the naked eye
  – Livescan- a way to capture digital prints directly without paper
  – Loop – ridge lines that enter from one side, curve around and exit the same side
  – Ninhydrin – chemical reagent that reacts with amino acids in prints to produce blue/purple color
  – Physical developer – based on silver nitrate and reacts with salts deposited with print on porous items
Key concepts – Cont.

- Plastic print – a print deposited on a soft surface
- Portrait parle’ – eyewitness verbal discription
- Ridge characteristics – endings, bifurcations, enclosures and other details which must match to ID a print
- Sublimation – change from solid to gas (iodine does this)
- Super glue fuming – print development in a chamber filled with cyanoacrylate
- Visible print – print in a visible material such as ink, dirt, blood and deposited on a surface
- Whorl – class of fingerprints with circular ridge patterns
Other concepts

- Know the three types of fingerprints
- Know the common ridge characteristics
- Know the different ways to develop latent prints
- Know how to preserve a latent print
- Understand the concept of lifting a print
- Understand digital imaging, its applications and its limitations
- Explain how prints are classified
- Explain how IAFIS collects and identifies prints
Serology CH 12

• Key terms
  – Acid phosphatase – enzyme in semen
  – Agglutination clumping of red blood cells by an antibody
  – Allele – alternative form of a gene – blood type A vs B
  – Antibody – protein that destroys an antigen by binding to it
  – Antigen – protein that stimulates the body to produce antibodies against it
  – Antiserum - contains specific antibodies
  – Aspermia- absence of sperm in sterile males
  – Chromosome – rodlike structure in the nucleus contains genes made up of DNA
  – DNA - carries body’s genetic information
  – Egg – female reproductive cell
  – Enzyme – protein that catalyzes chemical reactions
  – Ethrocyte- red blood cell
  – Gene – unit of inheritance composed of DNA on a chromosome
  – Genotype – combination of genes in an individual
More definitions

- Hemoglobin- red blood cell protein that carries oxygen
- Heterozygous – genes on two corresponding chromosomes (Mom, Dad) are different
- Homozygous - genes on two corresponding chromosomes (Mom, Dad) are the same
- Hybridoma cells – spleen tumor cells used to create monoclonal antibodies
- Isoenzymes – multiple forms of a particular enzyme each having similar activity
- Locus the location of a gene on the chromosome
- Luminol a very sensitive test for blood stains that emits light
- Monoclonal antibodies – identical antibodies that interact with a single antigen
- Oligospermia – low sperm count
- Polyclonal antibodies – series of antibodies that respond to a variety of sites on the antigen
- Polymorphism – multiple forms of a genetic trait
- Precipitin – antibody that forms a precipitate with its corresponding antigen
- Serology the study of antibody-antigen interactions
- Serum – liquid that separates from clotted blood
- Sperm – male reproductive cell
- X chromosome – female chromosome
- Y Chromosome- male chromosome
Concepts

• Understand ABO antigens and antibodies in the blood
• Describe how whole blood is typed
• List forensic tests to characterize blood
• Know difference between monoclonal and polyclonal antibodies
• Know the difference between chromosomes and genes
• Explain the concept of the punnett square
• List lab tests to characterize seminal stains
• Explain how blood and semen stains are properly preserved
• Describe how a physical evidence is collected in a rape investigation
Concepts

• Is it blood – what species – can it be associated with a particular person?
• Differences between Kastle Meyer, Precipitin, Luminol, and ABO tests
• Interpretation of blood stain and spatter evidence
• Identification and testing of seminal stains