The Examination of Physical Evidence

- Physical evidence is usually examined by a forensic scientist for identification or comparison.
- The goal of identification is the determination of the physical or chemical identity or a substance with as near absolute certainty as existing analytical techniques will permit.
- To obtain a positive identification, two requirements must be met:
1. Test results that are an exact match for a known sample of that substance.
2. The substance must undergo sufficient number and type of tests to exclude all other possible matches.

- A **comparison** analysis subjects a suspect specimen and a standard/reference specimen to the same tests and examinations for the ultimate purpose of determining whether they have a common origin.
- Forensic comparison has 2 steps:
  - 1. Combinations of select properties are chosen from the suspect and the standard/reference sample.
  - 2. Drawing a conclusion based on the properties chosen in step 1.
- Comparison is not an exact science. If all selected properties match, does that imply that the two items have a common origin? Not necessarily.
- To consider the value of a comparison, one must consider **probability**.
- Probability is the frequency of occurrence of an event.
  - If a coin is flipped 100 times, in theory we can expect heads to come up 50 times.
  - In other words, probability defines the odds that a certain event will occur.
- Evidence that can be associated with a common source with an extremely high degree of certainty is said to possess **individual characteristics**.
  - Examples: ridge characteristics of fingerprints, random striations on bullets or tool marks, handwriting characteristics, the fitting together of irregular edges of broken objects.
- The probability of two said characteristics that match having a common origin are so high as to be incomprehensible.
- Evidence is said to possess **class characteristics** when it can be associated only with a group and never a single source.
- This is one limitation of forensic analysis.
  - Examples: Single-layer automobile paint chips, blood typing.
- The product rule is a formula for determining how frequently a certain combination of characteristics occurs in a population.
  - To find the total probability of that combination: multiply the probabilities of each individual characteristic.
  - The product rule can be useful in blood and DNA analysis.

**The Significance of Physical Evidence**
- Most items of physical evidence cannot be linked definitively to a single person or object.
- This is because the chances of finding evidence with class characteristics is much greater than finding evidence with individual characteristics.
- The weight or significance given to physical evidence is a determination left entirely to the jury-a group of laypeople selected to make the final decision in a case.

**Forensic Databases**
- **IAFIS** - Integrated Automated Fingerprint Identification System
  - A national fingerprint and criminal history system maintained by the FBI and launched in 1999.
  - Contains fingerprints and criminal history for 50 million people!
  - These records are submitted voluntarily by state, local, and federal law enforcement agencies.
- **CODIS** - Combined DNA Index System
  - Enables federal, state, and local crime labs to electronically exchange and compare DNA profiles, linking crimes to each other and to convicted offenders.
  - CODIS has profiles for both offenders and unsolved crime scene evidence.
- **NIBIN** - National Integrated Ballistics Information Network
  - Allows firearms analysts to acquire, digitize, and compare markings made by a firearm on bullets and cartridge casings recovered from crime scenes.
  - Currently holds nearly 900,000 documented pieces of crime scene evidence.
Crime-Scene Reconstruction

- **Reconstruction** is a method used to recreate a likely sequence of events at a crime scene by observing and evaluating physical evidence and statements made by those involved with the incident.
- Often, crime scene reconstruction requires the input of several experts: the investigator, a medical examiner, a criminalist, and a team of forensics experts.