

Name: Key

## Final Exam Study Guide - Forensics

Be able to define:

Anthropology - bones

Odontology - teeth

Ballistics - guns; shell casings

Pathology - disease, cause of death

Documents Analysis - counterfeit/documents

Toolmarks - indentations

Entomology - insects

Serology - blood

Toxicology - alcohol/drugs

Arson - fire

Forensic Psychology - profiling

Who was Henry Locard? What was the *Locard-Exchange Principle*?

Discovered first crime lab. His principle states that "every contact leaves a trace."  
(France)

What is the job(s) of a forensic scientist?

Analyze evidence and testify in court.

For evidence to be admissible in court it must be both competent and relevant.

Explain the significance of the outcome of these three cases:

*Daubert v. Merrel Dow*

(Pregnant women taking pills). Added 4 things to Frye standard  
① Falsifiability ② Known error rate ③ Peer review ④ General acceptance

*Frye v. United States*

(Blood pressure test) Determines admissibility of evidence in court. "Junk science"

*Miranda v. Arizona*

mentally disturbed man was let off because he was not made aware of his rights. "You have the right to remain silent..."

Explain the difference between **expert** witnesses and **lay** witnesses.

↓  
Qualified/experienced in some area of expertise.  
Can offer opinions.

↘  
Non-expert. Cannot give opinion. Only what they experienced with 5 senses.

## EVIDENCE:

What kind of evidence should be packaged in

A paper bag/box? Anything living (plants, blood)

A plastic bag/box? powder or trace evidence

A paint can? accelerants, fire residues

Define **class evidence** and **individual evidence**.

Class evidence belongs to a group and the origin is unknown.

Individual evidence can be traced to the origin or source

↳ blood belonging to a specific individual.

On the line provided for the items in the following list, place a C to indicate **class evidence** and I to indicate **individual evidence**.

I Latent Fingerprint

C Animal Hair

C Tool mark, assumed to be left by murder weapon

C T-shirt piece

I T-shirt scrap that matches a missing piece from suspect's shirt

I Several fibers that match the suspect's shirt

→ class until proven a match

Explain chain of custody. Why is it important?

A log maintained for each piece of evidence that documents who handled it and when. If broken, can prove evidence inadmissible.

What is the difference between a hot search and a cold search?

Prep is present ←      ↳ Perp is gone

What does it mean for a piece of evidence to be considered inadmissible? Give an example.

It is not allowed in court as evidence. ↳ Murder weapon's chain of custody is broken ∴ not allowed in court.

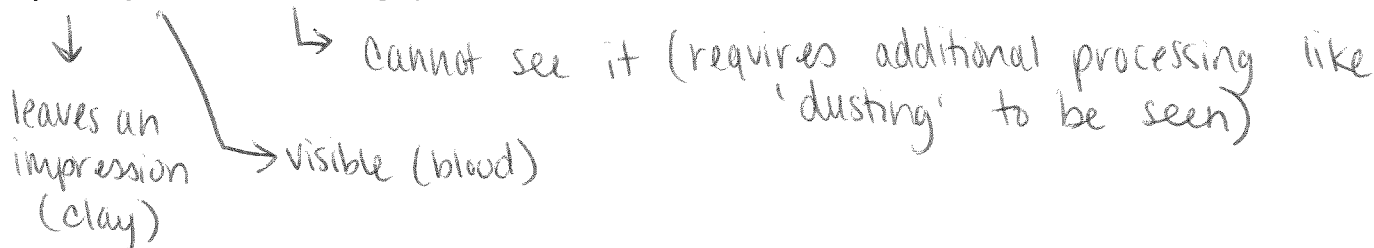
What does voluntariness mean in reference to a criminal act?

You must be acting on your own free will for it to be considered a criminal act. For example, if a gun is held against your head and you are forced to do something illegal, you are acting without free will.

## FINGERPRINTS:

Be able to identify ridge characteristics (*minutae*) and fingerprint patterns.

Identify **plastic, patent, and latent** fingerprints.



How a print is developed depends on the surface it is on.

Define **pattern area**.

The part of the loop, arch, or whorl that contains individual minutiae (aka minutiae)

List 4 fingerprint lifting tests. Which is best used to develop protein residues?

1. lifting powder / dusting
2. Ninhydrin\*
3. Iodine Fuming
4. Silver Nitrate
5. Superglue Fuming

What are the three main ridge patterns called? Draw a sketch of each one.

1. Loops



2. Arch



3. Whorl



## IMPRESSIONS:

What is odontology?

The study of teeth and impressions (used mostly for human identification.)

Explain the first recorded case of identification by forensic dentistry.

Agrippina (Roman emperor) identified head by discolored front tooth. Or Paul Revere and denture

What does postmortem mean? Antemortem?

↓ after death  
↳ before death

List 5 details for comparison with bite impressions.

1. Fillings
2. Surface structure
3. Adjacent teeth
4. Tooth size/shape
5. Position between teeth

### SEROLOGY:

What are the four components of blood?

① cells    ② enzymes    ③ proteins    ④ inorganic substances

List the ~~six~~<sup>8</sup> possible blood types.

A+, A-, B+, B-, O+, O-, AB+, AB-

Which blood type is the universal donor? Universal recipient? What does that mean?

O- ← can give to everyone  
↳ AB+, can accept blood from anyone

Sarah has AB- blood type. Could she receive blood from the following people?

- |                |  |   |
|----------------|--|---|
| John: Type O-  | <input checked="" type="radio"/> Yes or No | Why? <u>O- gives to all, absent of all proteins</u>         |
| Tyler: Type A+ | Yes or <input checked="" type="radio"/> No | Why? <u>Tyler has Rh protein, Sarah cannot receive it</u>   |
| Sam: Type B-   | <input checked="" type="radio"/> Yes or No | Why? <u>Sarah has B proteins and can receive B proteins</u> |

Explain the effect of height on diameter of a blood drop.

As height ↑, diameter ↑ (no change in diameter after 7ft)

What can angle of impact reveal about a crime?

The direction of travel, location of origin. →

What property of blood allows it to remain in a spherical shape as it falls?

Surface tension

What does Luminol do?

Locates traces of blood, even if it has been cleaned or removed. Solution is sprayed over suspected area

**DNA:** and positive test turns blue (False positives  $\Rightarrow$  metal, paints, cleaning products, Destroys other evidence)

Define:

**Phenotype:** Physical characteristics (blue eyes)

**Genotype:** Genetic code made of alleles inherited by parents

**Electrophoresis:** Separates DNA to create a "fingerprint"

**Autoradiogram:** Displays results of electrophoresis (genetic fingerprint)

**Complete Dominance:** One gene dominates over another (blue eyes)

**Incomplete <sup>Co-</sup>Dominance:** Genes mix and co-exist (AB blood type)

What is DNA fingerprinting? What is its purpose?

A breakdown of a person's basic structure in DNA. It allows us to identify if DNA matches a sample of DNA.

List and explain the 3 steps for DNA fingerprinting:

1. Extraction - takes DNA out of cells
2. Amplification - makes copies of DNA so testing can be done
3. Electrophoresis - DNA gets separated within agarose gel or capillary tube

What is mtDNA? Why is it unique.

Mitochondrial DNA is found in hair, bones, and teeth. It is unique because it can be recovered from old skeletons when no other DNA is available. It is also inherited only from the mother.

## TOXICOLOGY:

Define:

**Toxicology:** identification and quantification of drugs and toxic materials

**BAC:** Blood alcohol concentration

What part of the body is most strongly affected by alcohol in the blood?

Blood & brain (central nervous system, or where water has higher affinity).

Be able to read a BAC chart to determine alcohol content of a given person's blood.

What 5 factors determine alcohol's effect on the body?

- ① sex
- ② weight
- ③ amount drank
- ④ Time
- ⑤ food eaten

What is the legal BAC limit to drive?

0.08

What are presumptive tests vs. absolute (definitive) tests?

↓ Testing done at a lab to confirm the exact substance  
Determines if it's possible a substance could be present (could have false positives)

Explain effervescence and fluorescence. Which drug fluoresces under UV light?

↓ CO<sub>2</sub> bubbles      ↳ Glowing      Most hallucinogenic drugs fluoresce. (LSD, cocaine, heroine)

What is the difference between over-the-counter, controlled, and illicit drugs?

Can be obtained without a prescription      ↳ illegal drugs  
↓  
Held under strict gov't control due to strong potential for abuse/addiction

## Trace Evidence:

Define trace evidence.

Small evidence that would be observed under a microscope (hair, fibers, DNA, ...)

What percentage of fibers are gone from the crime scene in the first 24 hours? 95%

What type (*class* or *individual*) of evidence is hair? Fibers?

Hair is individual because DNA can be pulled. Fibers are mostly class evidence

What about hair would make it individual? What about fibers would make it individual evidence?

↳ contains DNA

↳ If a torn piece of shirt fits perfectly to the shirt it came from and all fabric and weave patterns match.

How are fibers collected?

Tape lift, forceps, vacuum

What method of testing is used for trace evidence? microscope (sometimes light, burn, extractions) for DNA

Give two examples of each:

#### *Synthetic Fibers*

Rayon, polyester, nylon

#### *Natural Fibers*

Animal - wool, cashmere

Plant - cotton, hemp

What are the four characteristics of hair?

① appendage of the skin ② Grows out of hair follicle

③ length extends follicle → shaft → tip ④ Root (follicle) contains DNA

What two types of evidence allows hair to become individualized evidence? Where does it come from?

Nuclear DNA (from root) and mtDNA (from shaft)

How much does hair grow per month? Why is that important to forensic scientists?

1.3 cm/month. Timeline helps calculate exposure to toxins or poison (or nutrients).

## **BALLISTICS:**

What three things can firearm examiners help determine?

① Analyze bullets and shell casing determine type of weapon

② Crime scene reconstruction

③ match bullet or shell casing to a particular weapon.

Name and describe the **marks of interest** left on shell casings:

1. Impression of firing pin (self explanatory)
2. Breechblock patterns (back wall of firing chamber)
3. Headstamps (stamp made by manufacturer - logo)
4. Extractor/ejector marks (unique scratch marks)

Define the following:

**Caliber:** internal diameter of barrel

**Gauges:** measure of internal diameter with # of lead balls/lb.

**Land:** Ridges in a barrel that are raised } helps bullet spin  
**Groove:** Ridges in a barrel that are cut }

Generally, entrance wounds are smaller than exit wounds.

How can 'wiping a serial number' be reversed?

magnaflex, chemical/electrochemical etching, ultrasonic cavitation

**DEATH:**

Describe the following

	Description	Examples
<b>Manner</b>	means by which they died	Natural, accident, suicide, homicide
<b>Cause</b>	reason they died	Heart disease, cancer, accident, hanging
<b>Mechanism</b>	Specific body failure	loss of blood, heart stopping
<b>Time of Death</b>	when they died	Livor, rigor, or algor mortis (color) (stiffness) (heat/cooling)

What 6 factors affect rigor mortis?

1. Ambient temperature (air temp)
2. weight
3. clothing
4. Illness
5. Physical activity before death
6. Sun exposure

On average, a body cools at 1° F per hour



## CADAVER DOGS:

What are the limitations to using cadaver dogs to solve cases?

They can give false positives. Factors that impact their results include wind, air conditions, dog behavior/personality, nearby distractors (graveyard)

How are cadaver dogs most efficiently trained?

In a lab with yes/no sniff tests.  
After consistent positive results, move to the field.

## ANTHROPOLOGY:

There are 206 bones in the body.

**Pelvic Girdle:** List the differences between male and female pelvic bones.

Female: Iliac bones more flared, broader hips, pubic arch angle is greater, more distance between ischial spines and tuberosities, sacral curvature shorter, flatter, lighter bones

What can bones tell us?

1. Gender
2. Approx. age
3. Height
4. Approx. weight
5. Race

**Height:** Which bones are used to determine height?

Femur, tibia, humerus, radius

**Gender:** Which bones are used to help us determine gender?

Pubic bones, sacrum, ilium, skull, jaw, occipital protuberance

**Age:** What is used to determine the age of a skeleton? How is it used?

Calcium levels, brittleness of bones, epiphyses (growth plates) sutures (coronal, lamboid, sagittal) on skull

## ARSON:

Define the following:

- Flash Point:** lowest temperature to which a substance must be heated in order to give off flammable vapors.
- Point of Origin:** location where fire started.
- Burn Patterns:** noticeable patterns created by fire as it burns
- Accelerants:** substances that accelerate burning process (gas, paint thinner, etc...)
- Char Patterns:** created by very hot fires that move very quick with sharp lines.
- V Patterns:** Fire burns up, creates V-shape and points to origin.
- Chimney Effect:** super heated gases from a fire rise upward to form a fireball, burns a hole in the ceiling. The origin is below the hole.

What are the differences between an accidental fire and arson?

- Accidental
- caused by children
  - appliances
  - faulty wiring
  - lightning
  - smoking

- Arson
- cover other crimes (murder)
  - insurance fraud
  - mentally disturbed
  - odors/gasses
  - furnishings, pictures missing
  - Trailers leading from one location to the next

## VIDEO CAMERAS:

What are the limitations to using video cameras to solve cases?

- Videos can be inaccurate (important to talk to witnesses)
- Could have wide-angled lens, sensitive to light, etc...
- A video is just a series of photos (not motion) and the frames per second can be the difference between 2 gunshots and 10.
- Video reconstructions can be interpreted incorrectly to display wrong heights/distances

## FORENSIC PSYCHOLOGY:

Define the following:

- Mass Murder:** Killing several people (more than 4) in one area all at one time
- Spree Murder:** one or 2 suspects killing multiple people at different locations with little time in-between
- Serial Murder:** Killing multiple people with "cool off" time between murders.
- Modus Operandi (M.O.):** A criminal's way of working (ex: strangles, then shoots)
- Signature:** "calling card" - goes beyond what is necessary to commit crime
- Geographical Profiling:** locations of a single person and their crimes/murder
- Geographical Mapping:** locations of crimes in an area for several criminals
- Psychopathy:** (organized) lack of attachment and empathy. In touch w/ reality
- Psychosis:** (disorganized) mental illness like schizophrenia. out of touch w/ reality.

Criminal profiling is the process of identifying:

- 1. Personality traits
- 2. geographical locations
- 3. behavioral tendencies
- 4. demographic/biographic descriptors of offenders

What is the goal of profiling?

Narrow the group of people that investigators need to comb through for suspect and possibly predict/prevent crime.

What 4 things must be **TRUE** in order for profiling to be possible?

- 1. Crime scene reflects personality of offender
- 2. M.O. remains similar in all other crimes
- 3. Signature remains the same for all other crimes
- 4. offender's personality does not change over course of time while committing crimes.

Describe the difference between an **organized** crime and a **disorganized** crime.

Commits crime out of need for control ↙

- planned
- victim targeted
- body hidden
- crime scene reflects overall control

↳ crime committed out of passion, compulsion, frustration, anxiety.

- spontaneous offense
- crime scene is random/sloppy
- body left in view

