



OVERVIEW

Key Concepts of Forensic Science

- Applications of a scientific method, tool, or technique to aid an investigation or judicial proceeding
- Used to support or refute hypotheses about how an event occurred
- Results integrated into the investigation, part of a larger story
- Many subdisciplines

Forensic laboratory



Medical examiner



Characteristics of Forensic Data and Results

- Specific and complete, including caveats or limitations
- Reproducible; another forensic scientist provided with the same evidence and information should obtain the same results
- **Falsifiable**; results must be stated such that they can be tested for accuracy and completeness. A specific DNA profile or a specific blood alcohol measurement is falsifiable because the results can be confirmed by scientific testing
- Relevant to the case at hand. The analysis of a bloodstain sample would be done to obtain the DNA profile; cholesterol level in the blood is irrelevant

Selected Historical Figures

- Alphonse Bertillon (1853–1914; French)
 - Used measurements of physical features for identification called **anthropometry** or **Bertillonage**. Replaced by fingerprinting
- Francis Galton (1822–1911; English)
 - Fingerprints
- Alexander Gottler (1883–1968; American)
 - Forensic toxicology. Performed chemical analysis for the New York Office of Chief Medical Examiner (OCME)
- Calvin Goddard (1891–1955; American)
 - Comparison microscopy and firearms
- Hans Gross (1847–1915; Austrian)
 - Coined the term **criminalistics**

- Alice Jefferys (1950–; English)
 - Developed early DNA testing methods
 - First to use DNA typing in a criminal matter (Colin Pitchfork case)
- Paul Kirk (1902–1970; American)
 - Generalist and educator
- Edmond Locard (1877–1966; French)
 - Trace evidence. Opened an early forensic laboratory
 - Credited for Locard's Exchange Principle, paraphrased as "every contact leaves a trace"
- Charles Norris (1867–1935; American)
 - Physician. Early head of the OCME
- Mathieu Orfila (1787–1853; Spanish)
 - Worked in Italy and France. Forensic toxicologist and educator
 - Utilized the Marsh test for arsenic in the LaFarge case
- Bernard Spilsbury (1877–1947; English)
 - Physician and forensic pathologist

Bias and Human Error

- **Bias** can cause results of a forensic analysis to be influenced by factors other than evidence and testing results
- Usually unintended and unconscious
- Can be caused by **contextual information** irrelevant to the case
- **Confirmation bias** can occur if a specific result is anticipated or expected
- Prosecutorial bias/defense bias favors a specific side in the dispute

Interface with the US Legal System

- US legal system**
- Legal system designed to settle disputes
 - **Adversarial**: based on comparing competing arguments
 - Criminal cases
 - Accused/defendant vs. government (local/state/federal)
 - Prosecution vs. defense
 - **Burden of proof** on prosecution
 - Standard of proof: beyond a reasonable doubt
 - Civil cases
 - Individual vs. individual, corporations, companies, etc.
 - Plaintiff vs. defense

Quality assurance/quality control (QA/QC)

- Practices and procedures used to ensure that forensic data are relevant and trustworthy
- Cradle-to-grave process—from evidence creation to final disposition
 - Forensic laboratories can be **accredited**
 - Analysts may be **certified** in some disciplines

- Burden of proof on prosecution
- Standard of proof: preponderance of evidence
- **Jurisdiction**: the entity empowered to hear a case—local (town, city, county), state, and federal
- Decision rendered by **trier of fact** (judge or jury)
- Relies on precedent—rulings by previous courts

US Rules of Evidence

- Process to allow evidence to be presented in a legal proceeding
- Evidence is admissible if it meets **admissibility standards**
- Applies to forensic results and data
- Admissibility standards vary across jurisdictions
- **Frigo standard**
 - Informally called **general acceptance** admissibility standard
 - 1923 ruling
 - Decision to reject admission of polygraph (lie detector) test
 - Court ruled that to admit new type of test, it must have been accepted within that scientific discipline
- Federal Rules of Evidence
 - Congressionally enacted 1975
 - Frequently updated
 - Applies to federal jurisdictions
 - Adopted by other jurisdictions
 - Guidelines for expert testimony
- **Daubert standard**
 - Informally called **gatekeeper** standard
 - 1993 ruling in civil case
 - Trial judge to make admissibility decision; judge as **gatekeeper**
 - Ruling provided guidelines for making this decision
 - Included general acceptance, validation of method, standards, limitations, and potential errors
 - Part of **Daubert trilogy** of cases
- **Joiner decision**
 - Second of **Daubert trilogy**
 - 1997 ruling in civil case
 - Scientific evidence must be directly relevant
- **Kumho decision**
 - Third case of **Daubert trilogy**
 - 1999 ruling in civil case
 - Extended definition of expert beyond traditional sciences

- Methods executed by **standard operating procedure (SOP)**
- **Traceability**: ability to trace result directly to nationally/internationally accepted standard
- **Control samples** analyzed with evidence
- Results reviewed by colleagues (**peer review**)
- Data reviewed and confirmed

Laboratory accreditation



Analyst certification

- Identify issues
- Implement corrective action
- Prevent future occurrences

Forensic Science Study Guide

Michael Rajnik



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sep 14 2022 axolotls should be housed in a 15-20 gallon fish tank to ensure they have enough space the fish tank will also need a secure lid so they don't try and jump out the fish tank should be kept out of direct sunlight at a temperature of between 14 and 20 degrees celsius 57 and 68 degrees fahrenheit

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apr 14 2022 axolotls should not have any tank mates at all in the wild axolotls live a solitary life and prey on any fish or invertebrates that can fit into their mouths there are several reasons why you should never keep your axolotl in a community tank they exhibit predatory behavior to others axolotls will eat anything small enough to fit in their

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mar 21 2022 keeping your axolotl well fed is important as hungry axolotls are exponentially more likely to see each other as a snack where can you buy axolotls axolotls are often available in larger pet shops that stock reptiles and fish and from specialist retailers and breeders such as you can find online

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sep 18 2023 opt for the biggest tank you can fit into your home a 20 gallon 76 liter tank is a good size for an axolotl 1 fill the aquarium with water completely the way you would fill it for fish tap water is safe to use if you condition it as you would for a freshwater fish tank

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aug 18 2023 regular water changes and tank maintenance are necessary to keep axolotls happy and healthy axolotls are sensitive to stress and should be handled with care to avoid injury providing hiding spots and a suitable substrate in the tank is important for axolotls comfort and natural behavior

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one axolotl should live in a 15 gallons if you add another axolotl you should increase this tank size by 10 gallons for each individual added tank floor space is more important than height so a 15 gallon long fish tank is better than a tall one water temperature should remain between 60

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the axolotl is carnivorous consuming small prey such as mollusks worms insects other arthropods and small fish in the wild axolotls locate food by smell and will snap at any potential meal sucking the food into their stomachs with vacuum force use as a model organism

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sep 4 2023 the key to keeping your axolotl happy and healthy is to replicate the warm waters of their natural habitat as closely as possible here are some parameters to follow water temperature 60 f to 64 f is ideal this is a good cold water species

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aug 9 2023 axolotls are carnivores in the wild eating worms insects small fish and generally anything they can fit into their mouths and swallow whole when you re keeping axolotl as pets you should be feeding a similar diet you can feed them a variety of live and dead foods including earthworms live nightcrawlers bloodworms frozen brine

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oct 25 2023 keep the tank in a cool room away from bright sunlight with the water temperature between 57 and 68 degrees fahrenheit 14 and 20 degrees celsius don t allow it to get above 75 degrees fahrenheit 24 degrees celsius no special lighting is required for axolotls unlike many reptiles

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apr 1 2023 the larva form of a frog is a tadpole an axolotl is a type of water salamander that is stuck in its larval stage like a

permanent tadpole never growing up to be an adult in the wild many did grow up to be adult water salamanders completing the cycle but in captivity it is very very rare for an axolotl to fully complete its difficult

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jan 5 2021 put the axolotl in the container and cover it with a towel to keep light out once you put your axie in the fridge change the water every day take old water out and replace it with refrigerated dechlorinated water keep the axolotl in the refrigerator until it recovers

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