

Introduction to Forensic Science



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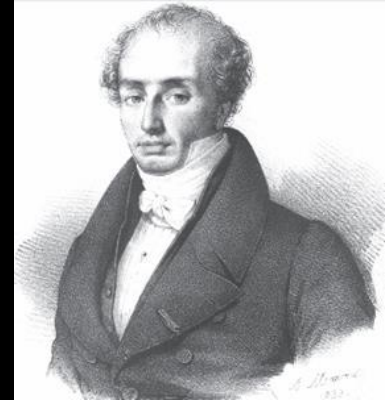
Tiruchirappalli, Tamil Nadu

What exactly is Forensic Science?

- Forensic science is application of science to the law
- Forensic science applies the knowledge & technology of science for the definition & enforcement of such laws
- Forensic science is the application of science to those criminal and civil laws that are enforced by police agencies in a criminal justice system

The History of Forensics

- Mathieu Orfila (Spain)
 - “Father of Forensic Science”(1787-1853)
 - Established the science of Forensic Toxicology, by studying the effects of toxins on animals
- Alphonse Bertillon (France) (1853-1914)
 - Developed the science of Anthropometry – a way of taking extensive body measurements to identify people. This technique of personal identification was considered extremely accurate for 2 decades and was eventually replaced by fingerprinting.



A black and white photograph of two women in a post office. The woman in the foreground stands with her back to the camera, wearing a light-colored blouse and a long, dark, patterned skirt. She is holding a small object. The woman in the background is seated at a desk, also with her back to the camera, wearing a light-colored blouse and a dark skirt. The room is filled with rows of mailboxes or filing cabinets.

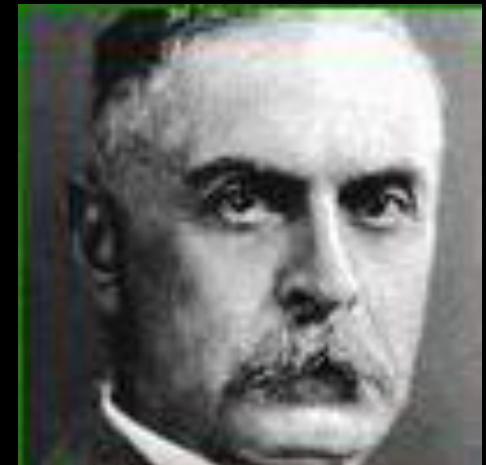
No. <u>1</u>		Height <u>5' 8"</u>	Weight <u>155</u>	Age <u>36</u>	Birth <u>1898</u>
Date <u>1-15</u>		Complexion <u>Dark</u>	Build <u>Medium</u>	Occupation <u>Police</u>	Education <u>High School</u>
Name <u>John</u>		Address <u>1234</u>	City <u>Chicago</u>	State <u>Ill.</u>	Country <u>U.S.A.</u>
Race <u>White</u>		Religion <u>Catholic</u>	Marital Status <u>Single</u>	Previous Arrests <u>None</u>	Previous Convictions <u>None</u>




The first criminal identification card filed by the New York State Bertillon Bureau.

More important people!

- Francis Galton (1822-1911)
 - Proved the uniqueness of human fingerprints and published a book called “Finger Prints”. Current fingerprinting techniques are based on his research.
- Leone Lattes (1887-1954)
 - Devised a technique to determine the blood group of a dried bloodstain and applied the technique to criminal investigations. (The ABO blood groups were discovered by a Dr. Karl Landsteiner in 1901)



- Calvin Goddard (1891-1955)
 - Used microscopy to determine if a bullet was fired from a particular gun, and if that compares to the suspect's weapon and a crime scene bullet. Modern firearms examiners still use his techniques.
- Albert S. Osborne (1858-1946)
 - Published a book "Questioned Documents", and was responsible for the acceptance of documents as scientific evidence by courts. Modern document examiners still use his book as primary reference.



Albert S. Osborn

- Walter C. McCrone (1916-2002)
 - Did extensive work with microscopy to examine forensic evidence.



- Hans Gross (1847-1915)
 - The first person to write about marrying all arms of science (Botany, anthropology, chemistry, physics, mineralogy, etc.) into one unified investigative science: Forensics.



- Edmond Locard (1877-1966)
 - Established “Locard’s Exchange Principle” which state that, whenever 2 objects come in contact with each other, there will be an exchange of materials between the two.

Therefore, when a criminal comes in contact with an object or a person, a cross-transfer of evidence occurs. So you can find something of the criminal on the victim and vice versa.



Basic services provided by full-service crime labs

- **Physical science unit:** applies principles and techniques of chemistry, physics & geology to evidence evaluation; examinations of soil, drugs, glass, paint, explosives etc are examined
- **Biology unit:** applies principles and techniques to identify DNA for profiling, stains & body fluids, hair & fiber comparison, wood and plants

Basic crime lab.....

- **Firearms unit:** examination of firearms, discharged bullets, cartridge cases, shot gun shells, ammunitions, garments and other objects examined to detect discharge of residues etc.
- **Document examination unit:** handwriting and typewriting on questioned documents studied; analysis of paper & ink; erasures, obliterations, document charred or burned

Basic crime lab....

- **Photography:** examine and record evidence; digital imaging, infrared, ultraviolet, and X-ray photography techniques make invisible information visible; court room presentations



Optional services provided by full-service crime labs

- **Toxicology unit:** body fluids & organs examined determine presence or absence of drugs & poisons often this is shared with the medical examiner's or coroner's office
- **Latent fingerprint unit:** examination of latent fingerprints submitted with other lab examinations

Optional services provided by full-service crime labs

- **Polygraph unit:** polygraph or lie detector used primarily as a tool of the criminal investigators
- **Voiceprint analysis unit:** cases involving telephone threats, tape-recorded messages may use unit to identify persons
 - ❖ Sound patterns are suppose to be unique to the person & and are captured on a voiceprint

Optional services provided by full-service crime labs

- **Evidence-collector unit:** special trained personnel collect & preserve physical evidence collected at the crime scene



Specialized Forensic Services

These are provided by specialized individuals, and are not usually a part of a full-service crime lab.

- Forensic Pathology
- Forensic Anthropology
- Forensic Entomology
- Forensic Psychiatry
- Forensic Odontology
- Forensic Engineering



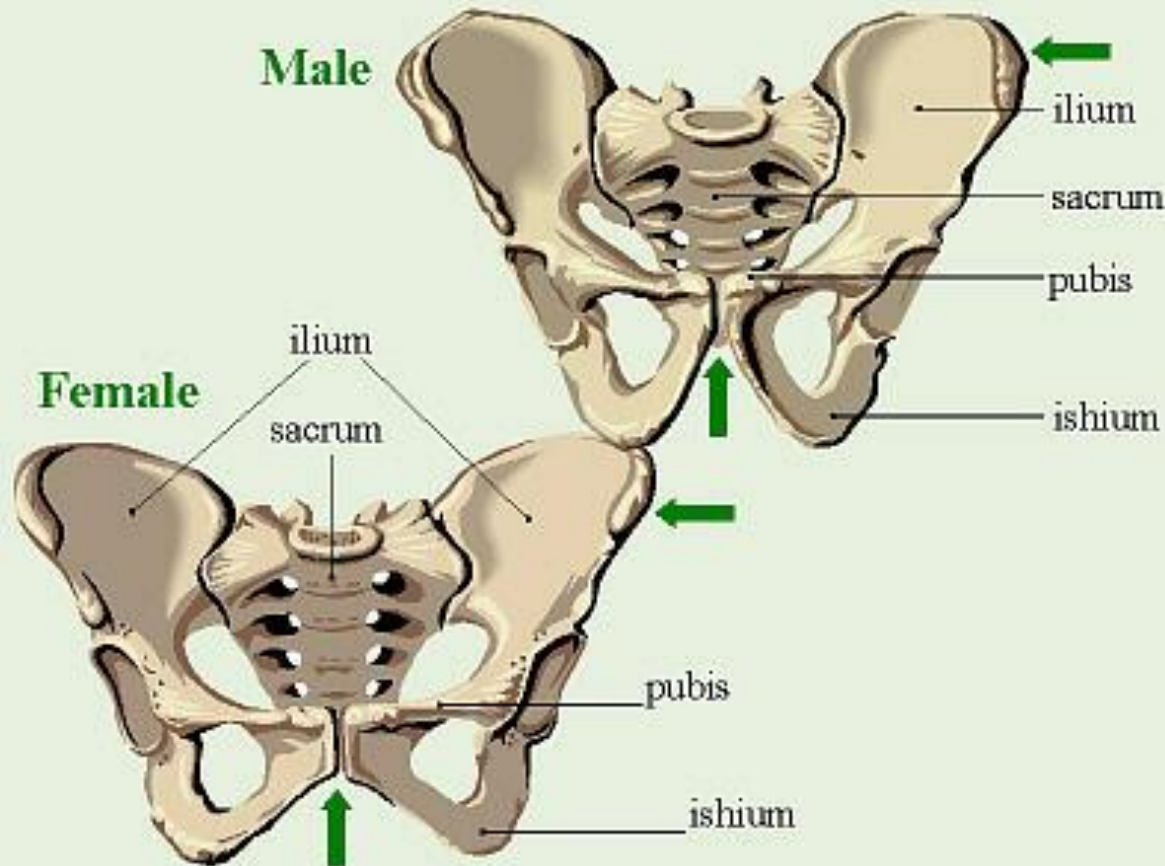
Ways to tell male pelvis from female:

spread of ilium: female more flared and cradle-like with anterior iliac spines farther apart vs. more straight “up-and-down” in male

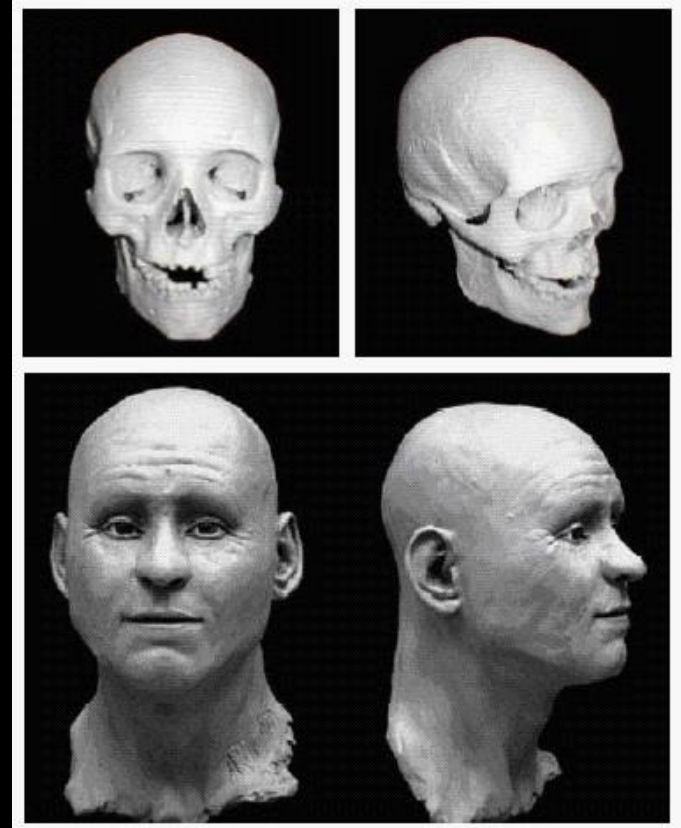
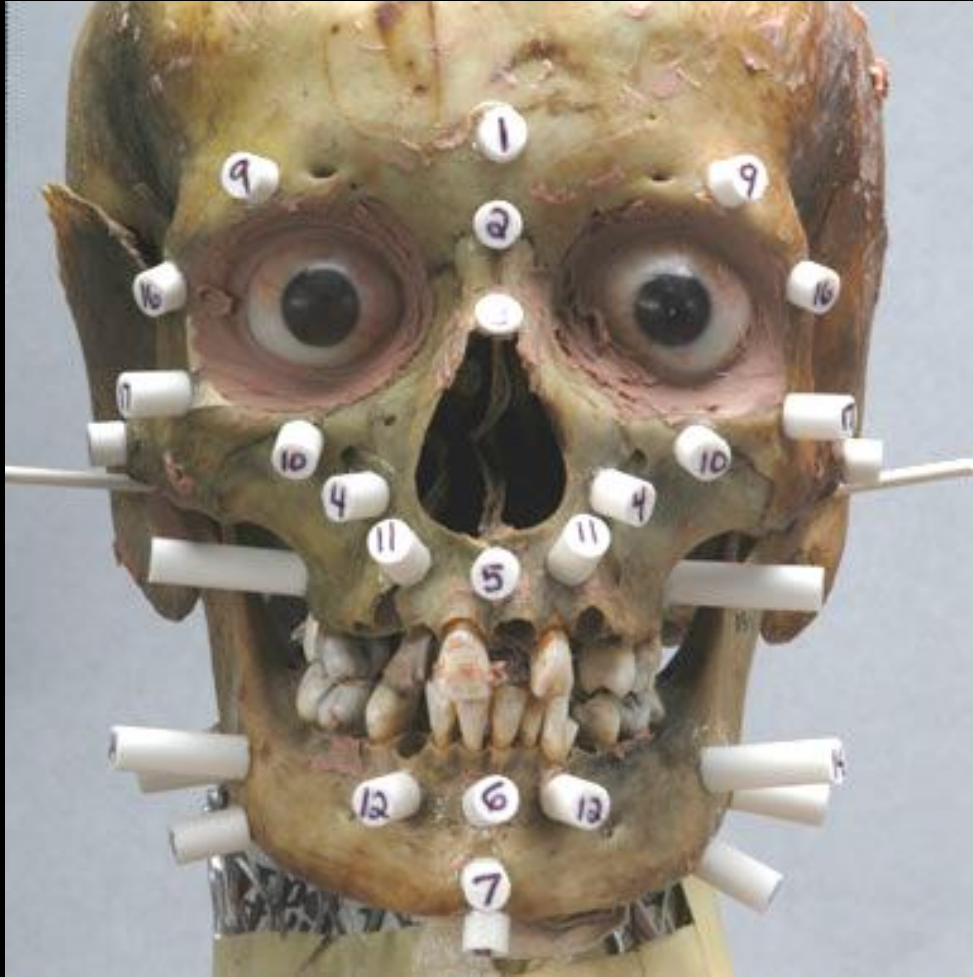
shape of hole in ischium: smaller and triangular in female vs. larger and rounded in male

angle across pubic symphysis: pubic arch: less than 90° (acute angle) and more sharply angled in male, greater than 90° (obtuse angle) and more rounded in female

inner diameter and distance between ischia: larger in female--big enough for head of baby to pass through



- Sometimes forensic anthropologists have to use Facial Reconstruction artists to help identify the remains.



Forensic Entomology

- Identification of specific insects present in body and approximate how long body left exposed by examining the stage development of fly larvae; weather conditions and geography affects results



Blowfly and its maggots



Typical Primary Smooth Maggot

Typical Hairy Maggot



Forensic Odontology

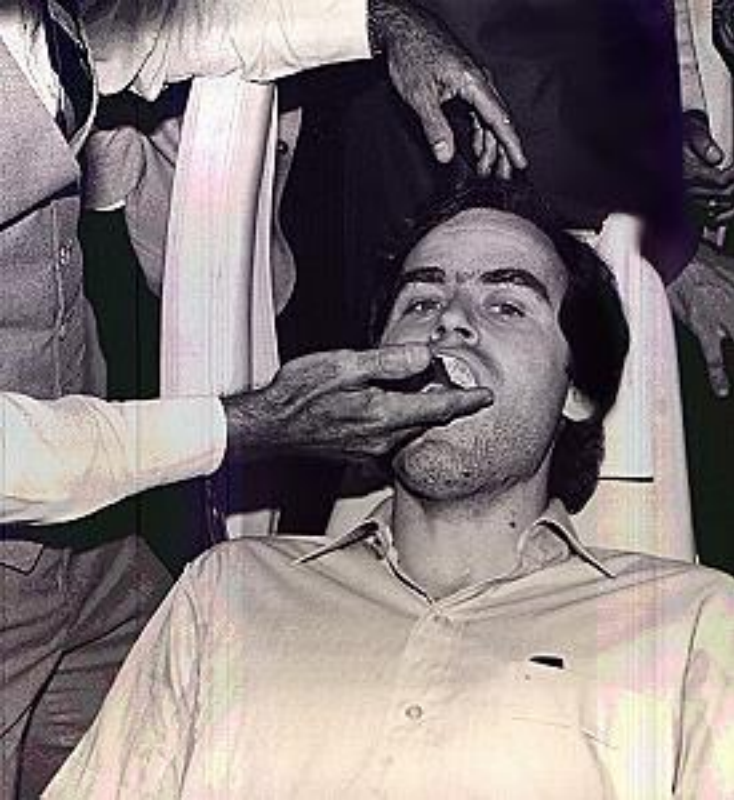
Using teeth to identify remains.

Tooth enamel is the hardest substance in the body and usually the last to decompose.

So teeth can be used (and old dental records such as X-rays and casts) to identify a body in an unrecognizable condition.

- Use bite marks in some cases like assault





Dental Impressions and Casts



Forensic Engineering

- Failure analysis, accident reconstruction and causes and origins of fires or explosions; auto, plane and others involved
- **On 17 July 2014 Malaysia Airlines flight MH17 was brought down over eastern Ukraine. The flight was on its way from Amsterdam to Kuala Lumpur. On board were 283 passengers and 15 crew members. Among the passengers were 196 Dutch nationals. In the aftermath the government set three priorities: repatriating and identifying the victims, establishing the cause of the crash and conducting a criminal investigation.**

How a Russian missile launcher and crew shot down Malaysia Airlines Flight 17 on Thursday, according to Ukraine officials.

1 am

Ukraine time: Buk-M1 missile-launching system secretly crosses Russian border into eastern Ukraine, near city of Sukhodolsk.



9 am

Launcher arrives in rebel city of Donetsk, then moved to smaller village.

Intercepted telephone conversations describe the arrival:

Rebel fighter: "Where should we load this cutie?"

Russian military officer: "Is it what I'm thinking about?"

Fighter: "Yes. Buk. Buk."

Kiev

UKRAINE

Sukhodolsk

Donetsk

Crimea

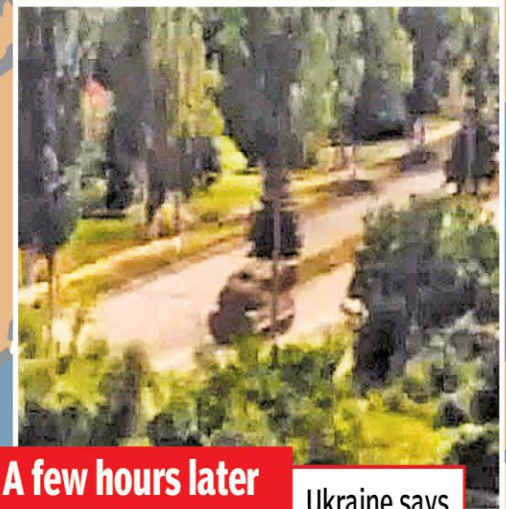
Black Sea

RUSSIA



4:10 pm

Radar system detects large aircraft. Russian operator reports it to junior rebel officer, who gives order to fire.



A few hours later

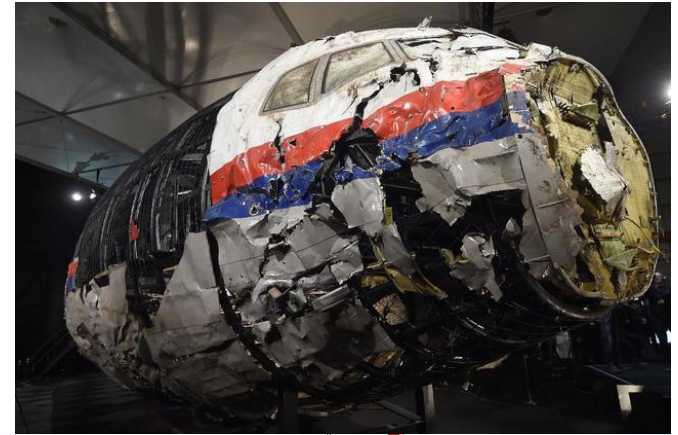
Ukraine says it spotted launcher being hauled back to Russian border.

MALAYSIAN AIRLINES FLIGHT 17

Flight 17 crashed after being hit by a Buk missile over eastern Ukraine.



SOURCE USA TODAY research
Janet Loehrke, USA TODAY



Acknowledgement

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- ❖ Thanks are due to all those original contributors and entities whose pictures used for making this presentation.