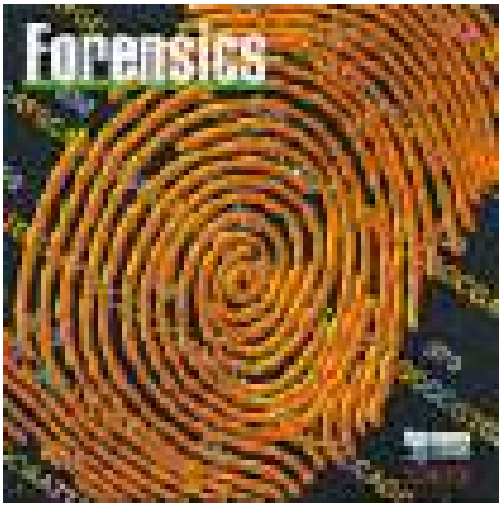
Introduction to Forensics



WELCOME TO THE FASCINATING WORLD OF FORENSIC SCIENCE

1. What is Forensics Science?

The word **forensic** comes from the Latin word *forensis*: public; to the forum or public discussion; argumentative, rhetorical, belonging to debate or discussion.

From there it is a small step to the modern definition of **forensic** as belonging to, used in or suitable to courts of judicature, or to public discussion or debate.

Forensic science is science used in public, in a court or in the justice system. **Forensic science is any science used for the purposes of the law.**

2. History and Development of Forensics Science

Forensic science was used as far back as the 700s! The Chinese actually used fingerprints to establish identity of documents and clay sculpture. The major advances were made later in the 1800s and 1900s, and it is still advancing today.

FORENSICS SCIENCE TIMELINE	
BC	**Fingerprints** were found in early paintings and in rock carvings of prehistoric humans.
700s	**Chinese used fingerprints** to establish identity of documents and clay sculpture, but without any formal classification system.
ca. 1000	Quintilian, an attorney in the Roman courts, showed that **bloody palm prints** were meant to frame a blind man of his mother's murder.
1248	A Chinese book, Hsi Duan Yu (the washing away of wrongs), contains a description of how to **distinguish drowning from strangulation**. This was the first recorded application of

	medical knowledge to the solution of crime.
1784	In Lancaster, England, John Toms was convicted of murder on the basis of the torn edge of wad of **newspaper** in a pistol **matching** a remaining piece in his pocket. This was one of the first documented uses of physical matching.
1813	****Mathiew Orfila****, a Spaniard who became professor of medicinal/forensic chemistry at University of Paris is considered the **father of modern toxicology**. He also made significant contributions to the development of tests for the presence of blood in a forensic context and is credited as the **first to attempt the use of a microscope in the assessment of blood and semen stains**.
1823	John Evangelist Purkinji, a professor of anatomy at the University of Breslau, Czecheslovakia, published the first paper on the **nature of fingerprints and suggested a classification system** based on nine major types. However, he failed to recognize their individualizing potential.
ca. 1830s	Adolphe Quetelet, a Belgian statistician, provided the foundation for Bertillon's work by stating his belief that **no two human bodies were alike**.
1835	Henry Goddard, one of Scotland Yard's, first used **bullet comparison** to catch a murderer.
1836	James Marsh, a Scottish chemist, was the first to use toxicology (**arsenic detection**) in a jury trial.
1839	H. Bayard published the first reliable procedures for the **microscopic detection of sperm**. He also noted the different microscopic characteristics of various different substrate fabrics.
1853	Ludwig Teichmann, in Kracow, Poland, developed the first microscopic crystal **test for hemoglobin**.
1863	The German scientist Schönbein discovered the **first presumptive test for blood.**
1864	Odelbrecht first **advocated the use of photography for the id of criminals** and the documentation of evidence and crime scenes.
1877	Thomas Taylor, microscopist to U.S. Department of Agriculture **suggested that markings** of the **palms** of the hands and the **tips of the fingers** could be used for identification in criminal cases.
1879	****Bertillon**** began to develop the science of anthropometry, a systemic procedure of taking a series of **body measurements as a means of distinguishing** one individual from another.
1891	Hans Gross, examining magistrate and professor of criminal law at the University of Graz, Austria, published Criminal Investigation, the first comprehensive description of **uses of physical evidence in solving crime**. Gross is also sometimes **credited with coining the word *criminalistics*.**
1892	****Francis Galton**** undertook the first definitive **study of fingerprints**.
1900	Karl Landsteiner first **discovered human blood groups** and was awarded the Nobel prize for his work in 1930. He continued work on the detection of blood, its species, and its type which formed the **basis of all-subsequent work**.

1903	**The New York State Prison system** began the first systematic use of fingerprints in United States for criminal identification.
1905	President Teddy Roosevelt established the FBI.
1912	Masaeo Takayama developed another microscopic crystal test for hemoglobin.
1913	Victor Balthazard, professor of forensic medicine at the Sorbonne, published the **first article on individualizing bullet markings.**
1918*	****Edmond Locard**** suggested **12 matching points as positive fingerprint id.**
1921	John **Larson** and Leonard **Keeler** designed the portable polygraph.
1923	**Vittorio Siracusa**, working at the Institute of Legal Medicine of the R. University of Messina, Italy, developed the **test for ABO blood typing of stains**.
1924	August **Vollmer**, as chief of police in Los Angeles, implemented the first U.S. police crime laboratory.
1927	**Landsteiner and Levine** first detected the M, N, and P blood factors leading to development of the MNSs and P typing systems.
1928	****Locard's Exchange Principle** Whenever two objects come into contact there is always a transfer of material. The methods of detection may not be sensitive enough to detect this or the decay rate may be so rapid that all evidence of transfer has vanished after a given time. Nonetheless, the transfer **has** taken place.
1940	**Landsteiner and A.S. Wiener** first described Rh blood groups.
1941	**Murray Hill** of Bell Labs initiated the study voiceprint identification.
1945	Frank **Lundquist**, working at the Legal Medicine Unit at the University of Copenhagen, developed the acid phosphatase test for semen.
1946	**Mourant** first described the Lewis blood group system.
1950	M. **Cutbush**, and colleagues first described the Duffy blood group system.
1951	F. H. **Allen** and colleagues first described the Kidd blood group.
1960	**Lucas**, in Canada, described the application of gas chromatography (GC) to the identification of petroleum products in the forensic laboratory and discussed potential limitations in the brand identity of gasoline.
1971	**Culliford** published The Examination and Typing of Bloodstains in the Crime Laboratory.
1974	The detection of gunshot residue (GSR) using scanning electron microscopy with electron dispersive X-rays (SEM-EDX) technology was developed by Aerospace Corporation.
1977	Masato **Soba,** a latent print examiner was the first to develop latent prints intentionally by "**Superglue(r)" fuming**.
1977	Masato **Soba,** a latent print examiner was the first to develop latent prints intentionally by "**Superglue(r)" fuming**.

1986	First use of DNA to solve a crime
1987	DNA profiling was introduced for the first time in a U.S. criminal court.
1991	**Walsh Automation Inc**., in Montreal, launched **development of an automated imaging system** called the Integrated Ballistics Identification System, or IBIS, for comparison of the **marks left on fired bullets, cartridge cases, and shell casings**. This system was subsequently developed for the U.S. market in collaboration with the Bureau of Alcohol, Tobacco, and Firearms (ATF).
ca. 1994	**Roche** Molecular Systems (formerly Cetus) released a set of **five additional DNA markers** ("polymarker") to add to the HLA-DQA1 forensic DNA typing system.
1998	An **FBI DNA database, NIDIS**, enabling **interstate cooperation** in linking crimes, was put into practice.
2000	**CODIS** - **COmbined DNA Index System** Identification system used tracking suspects by DNA profiling.

Most Famous Contributors to Forensics Science:

1. **1813 Mathiew Orfila**, a Spaniard who became professor of medicinal/forensic chemistry at University of Paris is considered the **father of modern toxicology**. He also made significant contributions to the development of tests for the presence of blood in a forensic context and is credited as the **first to attempt the use of a microscope in the assessment of blood and semen stains**.

2. **1835 Henry Goddard**, one of Scotland Yard's, first used **bullet comparison** to catch a murderer

3. **1853 Ludwig Teichmann**, in Kracow, Poland, developed the first microscopic crystal **test for hemoglobin**

4. **1879 Bertillon**** began to develop the science of anthropometry, a systemic procedure of taking a series of **body measurements as a means of distinguishing** one individual from another.

5. **1891 Hans Gross**, examining magistrate and professor of criminal law at the University of Graz, Austria, published Criminal Investigation, the first comprehensive description of **uses of physical evidence in solving crime**. Gross is also sometimes **credited with coining the word *criminalistics***

6. **1900 Karl Landsteiner** first **discovered human blood groups** and was awarded the Nobel prize for his work in 1930. He continued work on the detection of blood, its species, and its type which formed the **basis of all-subsequent work**

7. **1928 Locard's Exchange Principle** Whenever two objects come into contact there is always a transfer of material. The methods of detection may not be sensitive enough to detect this or the decay rate may be so rapid that all evidence of transfer has vanished after a given time. Nonetheless, the transfer **has** taken place.

8. **1977 Masato Soba,** a latent print examiner was the first to develop latent prints intentionally by "**Superglue(r)" fuming**.

9. **1998** An **FBI DNA database, NIDIS**, enabling **interstate cooperation** in linking crimes, was put into practice.

10. **2000 CODIS – COmbined DNA Index System.** Identification system used tracking suspects by DNA profiling.

3. What Do Forensic Scientists Do?

The forensic sciences form a vital part of the entire justice and regulatory system. Some of the different divisions, or disciplines, of forensic science have become identified primarily with law enforcement — an image enhanced by television and movies. This is misleading because forensic scientists are involved in all aspects of criminal cases, and the results of their work may serve either the defense or the prosecution. **The forensic scientist's goal is the evenhanded use of all available information to determine the *facts* and, subsequently, the *truth*.**

a. Work The work of the forensic scientist may reduce the number of cases entering our overloaded court system by assisting the decision-makers before a case reaches the court. The facts developed by forensic scientists, based on scientific investigation, not circumstantial evidence or the sometimes unreliable testimony of witnesses, may convince prosecuting or defense attorneys, a grand jury, or a judge that an issue does not merit a court hearing.

The work of the forensic scientist at times proves the existence of a crime or makes connections to a crime. The forensic scientist provides information and expert opinion to investigators, attorneys, judges, and juries which is helpful in determining the innocence or guilt of the accused.

The forensic scientist is entirely responsible for the work he performs; no one else can write his report nor testify to his opinion. However, it takes teamwork to solve a crime. Scientists work closely with police officers, sheriff's deputies, prosecuting and defense attorneys, DEA, CIA, and FBI agents, immigration workers, and crime scene investigators, to name a few.

There is a strong requirement for accurate record keeping, chain-of-custody documentation, stringent quality control, and data management. Chain-of-custody guarantees that the integrity of evidence is maintained at all times. The time, date, location, and signature are required when transporting a piece of evidence within the laboratory or to an outside facility.

b. Ethics The forensic scientist, no matter where or by whom he is employed, works only for truth. He must make sure that the examination is complete, the tests performed are done correctly, the interpretation of the data is thorough, the written report is correct and easily understood by a non-scientist, and the testimony is complete and truthful. Anything less is not acceptable.

c. Testimony Testimony is the verbal statement of a witness, under oath, to the *trier of fact*, that is, the judge and/or jury. The ordinary witness can testify only on the basis of personal knowledge of a situation gained through the use of his five senses. He may not express opinions formed on any other basis.

The forensic scientist, on the other hand, can testify not only on the basis of personal knowledge, but also in the form of opinion based on his informed evaluation of the evidence presented and scientific tests performed and interpreted within the bounds of his skills, experience, and ability. He is an **"expert" witness** as opposed to an ordinary or "fact" witness.

There are **four criteria** that are generally required to qualify a person as an expert witness. They are: educational degrees received, number of years of occupational experience in the field, membership in professional organizations, and professional articles or books that the person has published.

The forensic scientist, as an expert witness, must be able to explain complex chemical reactions, the working of scientific instruments, or medical conditions in simple everyday language understandable to anyone. This is not easy. It is so difficult that before a new scientist is allowed to testify, a mock court is held so the scientist can learn how it feels to testify, and how to convert his hard-earned scientific knowledge into simple terms.

The forensic scientist must be impartial and unbiased. The forensic scientist must tell all of the truth, "the whole truth," no matter what it is or whom it hurts or helps. An expert opinion can be offered only if there are scientific facts upon which to base it.

In court, the work of the forensic scientist is carefully examined to find any flaws, whether in the test performed, the interpretation of the results, or the science upon which opinion is based. Whether the prosecution or defense hires the forensic scientist "expert", the opposing attorney will try to undermine or discredit testimony, which is against his client.

The forensic scientist often spends long hours testifying clearly and concisely in judicial proceedings concerning scientific information and what it means. Throughout he must be professional.

4. The Organization of a Crime Laboratory:

The development of crime laboratories in the United States has been rapid with lack of national and regional planning. At present there are 320 public crime labs at various levels of government. This is more than a three-fold increase since 1966.

There is no typical crime lab. The majority of crime labs function as a part of the police department. Some are under the direction of the medical examiner/coroner's office, or under the prosecution or district attorney's office, and fewer still are affiliated through universities. Lab staff size ranges from one person to more than 100 people.

The Supreme Court decisions of the 1960's are responsible for the police placing greater emphasis on securing scientifically evaluated evidence. The Miranda rights have all but eliminated confessions. Crime rates have increased creating a need for crime investigation. The ability to do DNA profiling has lead to growth and maturation of crime labs.

a. Services of the Crime Lab: There are many reasons for the variations in total services offered in different communities, some of which are: (1) variations in local laws, (2) the different capabilities and functions of the organization to which the lab is attached, (3) budgets and staffing limitations.

Basic Services Provided by Full-Service Crime Labs:

1. **Physical Science Unit**- applies principles and techniques of chemistry, physics and geology to the ID and comparison of crime-scene evidence.

2. **Biology Unit** – applies knowledge to the ID and DNA profiling of dried blood stains and other bodily fluids. This unit compares hairs and fibers.

3. **Firearms Unit**- examines firearms, shells, discharged bullets, cartridges. Garments are examined to detect firearm residue. Bullet markings are compared.

4. **Document Examination Unit**- examines Handwriting and typewriting analysis on questioned documents for authenticity. Analyzes paper and ink, erasures and burned or charred documents.

5. **Photography Unit**- records physical evidence, makes prepared exhibits for courtroom presentations.

Optional Services Provided by Full-Service Crime Labs:

1. **Toxicology Unit** – Body fluids and organs are examined for the presence or absence of drugs and poisons. Unit is responsible to train operators on field instruments to detect alcohol abuse and to maintain this equipment.

2. **Latent Fingerprints Unit** - responsible for processing and examining evidence of latent fingerprints.

3. **Polygraph Unit** – the lie detector has come to be recognized as an essential tool to the criminal investigator, not the forensic scientist.

4. **Voice Analysis Unit** – Telephone threats, tape-recorded messages may need to be tied to a particular suspect. A sound spectrograph transforms speech into a voiceprint.

5. **Evidence Collection Unit** – This unit dispatches specially trained personnel to the crime-scene to collect and preserve physical evidence that will later be processed at the lab.