Chapter 1.2: Brief History of Forensics Science

Forensic science can be briefly defined as the application of scientific methods and principles to the investigation of crimes and criminals. In fact, the word “forensic” derives from the same Latin root as the word “forum”, since it was in the ancient Roman forum that justice was commonly meted out. It is founded in the basic sciences of chemistry, biology, physics, anthropology, and mathematics. It is also correctly considered to be an applied science since it uses the fundamental principles and methods from the basic sciences to answer questions of a more practical nature – in forensic science that means trying to answer questions dealing specifically with legal issues. Forensic science is often closely affiliated with a field called criminalistics, defined by the US National Institute of Justice as “the science and profession dealing with the recognition, collection, identification, individualization, and interpretation of physical evidence, and the application of the natural sciences to law-science matters.”

Modern forensic science draws upon many aspects of the natural and applied sciences to help answer six basic questions of crime: who, what, when, where, why, and how.

“Figure 1.2.1. Ancient handprints in aboriginal paintings (archaeologynewsnetwork.blogspot.com/2010/09/secrets-behind-ancient-red-fingerprints.html).”

Throughout the ages, observant people have used “forensic” techniques to help solve crimes. As far back as thousands of years BCE, it appears that humans recognized the unique character of fingerprints for personal identification in cave paintings and pottery. The early Romans and Greeks clearly used their understanding of the natural world to deduce logical arguments related to criminal prosecutions. In fact, some credit Archimedes as the “father of forensic science” and there are a number of instances where he certainly used science to unravel difficult legal questions, including his most famous “case” concerning the question of cheating in the creation the emperor’s crown (Chapter 11). The homicide investigation of Julius Caesar employed a detailed autopsy to determine which was the fatal blow. Much later, Quintillian, a Roman attorney, used a bloody hand print to show that someone was trying to frame an innocent blind person in the homicide of his mother.
The first real attempt at a comprehensive “forensic science textbook”, called *Hsi Duan Yu* ("Washing Away of Wrongs" or "Injustices Rectified"), was published around 1248 by a Chinese magistrate named Sung T’ze. In this book, designed to help other magistrates to investigate crimes, he collected many historical cases, along with his personal experiences, in an effort to avoid “injustices” that might lead to bloody revenges and tragic feuds based upon unfounded suspicions and wrong conclusions. His text, published in the thirteenth century in fifty-five volumes, details many aspects of forensic science including examining injuries and wounds, conducting post mortem autopsies, collecting evidence, and the logical analysis of the information gathered. For example, in his text he reports the first clear use of forensic entomology to solve a murder case where a worker in the rice fields had been murdered by means of a harvest scythe. Through physical inspection, such as looking for blood and identifying marks, no evidence could be found linking any possible assailants with the crime. To solve the case, however, T’ze ingeniously had all the suspects line up before him in the hot afternoon sun while holding their scythes. Curiously, only one of the scythes attracted a swarm of blowflies to the blade – the one with invisible, minute traces of blood remaining on the blade. The owner later confessed to the crime based upon the “fly” evidence. This use of forensic entomology to solve a dead-end case was brought about by an understanding of how the natural world works, a basic tenant of forensic science.

From the seventeenth century

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**Early Development of Forensic Science**

- **BCE**: Fingerprints appeared as part of prehistoric paintings and pottery to reflect the individual identity of each artist;
- **2650 BCE**: Grand Vizier Imhotep in Egypt uses medical ideas to investigate crimes;
- **44 BC**: Antistius performed a detailed autopsy on Julius Caesar to help solve his murder;
- **7th Centur AD**: Soleiman used fingerprints to validate borrowers and lenders;
- **10th Century AD**: Quintillion used handprints to exonerate a framed person;
- **1248 AD**: Sung T’se published the first manual on criminal investigations;
- **1530**: *Constitutio Criminalis Carolina* (Holy Roman Empire) gave courts the power to investigate crimes based solely upon the facts of the case;
- **1813**: Mathiew Orflia published the first true forensic toxicology treatise;
- **1835**: Henry Goddard first used ballistics information in a criminal case;
- **1836**: James Marsh presented the first toxicology test to a jury trial;
- **1856**: Sir Wm. Herschel used fingerprints to identify people in the Indian Civil Service;
- **1883**: Alphonse Bertillion developed a system of anthropometry to help identify criminals by physical features;
- **1891**: Hans Gross published book describing how science can broadly be used in criminal investigations and coined the term “criminalistics”;
- **1896**: Sir Edward Henry developed the fingerprint classification system adopted throughout a large part of the world;
- **1900**: Karl Landsteiner discovered human blood groups and methods to type them;
- **1903**: New York State prison system adopted fingerprinting for inmate identification;
- **1910**: Edmund Locard established the world’s first crime laboratory;
- **1924**: First US Police Crime Laboratory (LA California);
- **1932**: FBI laboratory founded;
- **1987**: First use of DNA in courtroom;
- **1996**: FBI introduced AFIS computer program for fingerprint comparisons.
through the early nineteenth century, a number of attempts were made to use forensic evidence to aid in criminal cases. The eighteenth century, however, with the Age of Enlightenment encouraging the use of reason and the burgeoning of scientific thought, brought the focus of science into the area of legal investigation. During that time, all sorts of scientific investigations probed the workings of nature and, not surprisingly, the fruits of these studies began to impact legal cases. Books were written on basic forensic anatomy, document examination, toxicology and other related areas, although the use of these methods in the courtroom was still rather sporadic and unsystematic.

The basis of modern forensic science really began to unfold, however, in the early to mid 1800’s. Mathew Orfila published a very detailed account of his work in forensic toxicology in 1813 and was the first person to attempt to identify blood on pieces of evidence using chemical tests. In 1835, Henry Goddard of Scotland Yard used bullet and firearm comparisons to trace bullets found in victims to the individual weapons that fired them, thereby tying the victim and the weapon together. Shortly afterwards, James Marsh used his newly discovered test for arsenic in a jury trial while Jean Servais Stas reported a way to find plant poisons in a person’s body. In 1856, Sir William Herschel used fingerprints on Indian civil service papers to verify identify for those who were illiterate. His work was followed by others, such as Henry Faulds (Scotland), Juan Vucetich (Argentina), Francis Galton (UK), Edward Henry (UK), and Henry DeForrest (US), who developed systems for classifying fingerprints for personal identification based upon similarities in patterns found in each print’s details.

By the late 1800s, people increasingly began to recognize that physical traits, such as fingerprints, bones, and blood, could be used to help identify a person. This idea led to a the work of the French Police Officer Alphonse Bertillion who developed a detailed system involving the measurement of anatomical features which he believed could be used to identify a particular person, a field called anthropometry. Bertillion also photographed and recorded “mug” shots, tattoos, birthmarks, and scars to provide further identification aids. Prior to Bertillion’s work (and before fingerprints became widely

### Locard’s Exchange Principle

Edmund Locard had an intense interest in furthering the use of science in criminal investigations. He believed that whenever two objects came into contact, physical matter was exchanged between the two. Applying this idea to evidence simply requires the investigator to locate and identify the exchanged material to show that the two objects had indeed come into contact. For example, during the First World War, Locard analyzed stains and dirt from the uniforms of soldiers to help the French Secret Service determine how and where the soldiers had died. He also analyzed. Locard also identified metal fragments in the clothing of coin counterfeiters that led to their confessions. He continued his work throughout his life and published his massive, seven-volume Treatise on Criminalistics in 1918.

Locard, often called the “French Sherlock Holmes” had much in common with the fictional detective. Locard, just ten when the Holmes series began, often pointed to the methods of Holmes. For example, Locard wrote: “I hold that a police expert, or an examining magistrate, would not find it a waste of his time to read Doyle’s novels. For, in the adventures of Sherlock Holmes, the detective is repeatedly asked to diagnose the origin of a speck of mud, which is nothing but moist dust. The presence of a spot on a shoe or pair of trousers immediately made known to Holmes the particular quarter of London from which his visitor had come, or the road he had traveled in the suburbs.” Locard used many of Holmes’ techniques – for example, he was able to correctly identify the job of 92 of 100 individuals just through an analysis of the dust gathered from their eyebrows (“flour in the baker’s, soot in the chimney sweep’s, iron filings in the locksmith’s”).
accepted around 1900), it was exceptionally difficult to identify criminals, especially repeat offenders who simply changed their names. Identification at the time was largely based upon eyewitness identification - a very flawed system. However, despite its innovation, most of Bertillion’s system was abandoned by the early 1900’s, primarily because of three reasons - two police officers making the same measurement often came up with quite different values, physical features change with age, and the advent of quicker and more reliable fingerprinting systems. Bertillion’s system, however, did inspire people to make detailed measurements of the human body – the forerunner of today’s field of biometrics.

A few years after Bertillion, in 1889, Alexandre Lacassagne founded the first school to train people in the developing subfields of forensic science, helping to standardize practice in the different disciplines. He helped lay the groundwork for a number of forensic disciplines including blood pattern analysis and firearms examination. This was soon followed in 1893 by the publication of Criminal Investigation by Hans Gross – the first book devoted to the application of scientific methods to criminal investigations and the first coining of the term criminalistics.

In the early years of the 1900s, Edmund Locard served as an assistant to Prof. Lacassagne in Lyon and to Bertillion in Paris where he applied his training in medicine and law to criminal investigations. In 1910 he left Lacassagne after persuading the French City of Lyon Police Department to give him space in the attic and two assistants to set up what became the world’s first police crime laboratory. As a result of his research, he formulated the basis for a principle today bearing his name that is fundamental to all of forensic science today – **Locard’s Exchange Principle**. Locard wrote that:

“**Wherever he steps, wherever he touches, whatever he leaves, even without consciousness, will serve as a silent witness against him. Not only his fingerprints or his footprints, but his hair, the**

**Figure 1.2.2.** Bertillion’s system of anthropometry for classifying nose types (images.wikia.com/psychology/images/2/2f/The_speaking_portrait.jpg).

**Figure 1.2.3.** 1910 head-measuring device which Bertillion used in his system of anthropometry.
fibers from his clothes, the glass he breaks, the tool mark he leaves, the paint he scratches, the blood or semen he deposits or collects. All of these and more, bear mute witness against him.” (Edmund Locard)

This principle, first called the Exchange Principle in 1940, simply states that “a criminal leaves something behind at a crime scene and also takes something away with them” – evidence is transferred and exchanged between the crime scene and the criminal. The difficulty, of course, is to find the transferred evidence and to properly identify it. Success in this task, however, often sheds light on the central legal issue of placing a suspect firmly at the crime scene. Locard’s work led to the establishment of crime labs around the world and the rapid advance in the widespread application of scientific inquiry to criminal cases.

The first crime labs in the United States began appearing in the early 1920s, with the very first formally opened in 1924 by the Los Angeles Police Department. The Federal Bureau of Investigation (FBI), founded in 1905 by President Theodore Roosevelt, established their crime lab in 1932. Today, the FBI crime laboratory is the largest in the world, performing well over one million analyses annually. Other labs around the world soon followed suit and have largely been modeled upon the FBI’s structure and organization.

Crime labs worldwide have experienced periods of rapid growth and development in the past half-century. Specifically contributing to this growth has been the worldwide battle against illicit drug use and the advent of DNA technology.

In the 1960s especially, large-scale efforts to try to stamp out illicit drug use through criminal detection and prosecution were begun. Increased regulation, accompanied by the overwhelming connection of drugs and alcohol with crimes (nearly 80% of all crime are estimated to have...
some drug or alcohol connection), has required the rapid and accurate analysis of samples for possible drug content. In the late 1980s, DNA technology revolutionized personal identification of biological samples. While advances in technology have enormously improved our ability to analyze DNA rapidly and accurately, there remains a mountainous backlog of samples awaiting analysis. With our growing reliance upon science to shed light on criminal investigations comes, therefore, a far greater need for the enhanced capabilities and even greater centrality of the crime laboratory. Today, crime laboratories across the world seek to employ state-of-the-art instrumentation and best-known practices for evidence analysis. At the same time, they are subject to tighter controls and stricter standards than ever before as they concurrently deal with an ever-increasing caseload of work.

More recently, the role of crime laboratory and forensic expert has evolved to encompass both new and “traditional” roles. While analysts are still called upon to examine evidence from the results of criminal behavior, they are increasingly asked to analyze evidence with broader implications. The FBI’s Chemical-Biological Sciences Unit conducts forensic examination of chemical, biological, radiological, and nuclear materials that may be involved in terrorist activities. The FBI’s Terrorist Explosive Device Analytical Center provides analysis supporting the agency’s fight against terrorism. The 21st century brings the inescapable certainty of new challenges and the prospect of far better tools with which to meet them to the world’s forensic laboratories.

From a recent exhibit at the The National Library of Medicine at the National Institutes of Health: “In the 19th and 20th centuries, glowing newspaper and magazine accounts of forensic technologies, real and imaginary, fueled public support for scientific crime detection. Edwin W. Teale's series of illustrated articles, published in Popular Science Monthly in 1931, conveys some of the enthusiasm for scientific crime detection. "Working slowly, painstakingly, utilizing every branch of science at hand," Teale rhapsodizes, "modern man-hunters are arriving at astonishing solutions in baffling crimes. Their work is analytical, methodical; but their results are amazing, magical."