Module 1
Pioneers of forensic science

Objectives

• Understand that like policing, forensic science has a developmental history

• To be aware that the use of forensic science can be traced back to 3000BC and perhaps even earlier

• To be aware that the techniques of forensic science are continually developing

• To have an awareness of the pioneers of forensic science

The increasing popular interest in forensic science and crime scene investigation, fuelled by television shows such as 'CSI' and 'Waking the Dead' might well lead to the assumption that forensic science is a modern development, a child born of contemporary technology. The evidence in respect of the history of forensic science shows that such an assumption may be in error. Like modern policing modern forensic science has a long and chequered history. In order to understand how and why forensics enjoys such great prominence in modern crime investigation it is necessary to accept that forensic science is both young and old. As an organised profession shaped by strict quality management standards and higher educational requirements, forensic science is very young, but many of the most commonly practised techniques have a long history of development and research that is often forgotten even by forensic science practitioners themselves.

It has been argued that the use of forensic science can be traced back 3,000 years to ancient China. (Ricciuti 2007 p6) There are records dating back 1700 years of a Chinese doctor, Wu Pu, settling legal cases by presenting medical testimony. The classic text on forensics, the Xi Yuan Ji Lu, (1248), "Collected Cases of Injustice Rectified" written by the eminent judge and physician Song Ci, probably documents the first use of medical knowledge in the solving of homicides. In this book the author gives advice on determining the difference between a drowning and a strangulation victim. The book also chronicles an early use of entomology to find the killer of a man who had been murdered with a scythe and also outlines autopsy procedures.
The word forensics comes from the Latin word *forensis*, which means of or before a forum. In ancient Rome, when an individual was charged with a crime, he and his accuser were brought before a public forum. Each would tell his side of the story, and the one who had the sharpest debating skills and the most compelling story would win the case. It is not surprising then that there is a record of a forensic autopsy performed on Julius Caesar in 44 B.C. Antistius, a doctor who may have been Caesar's personal physician, was summoned to conduct a post mortem examination. According to his autopsy report, perhaps Europe's first recorded application of medical knowledge to a homicide investigation, only one of Caesar's 23 stab wounds had proved fatal, although it is now impossible to verify Antistius's conclusions. (Erer, Duzbakar, Demirhan & Erdemir 2006).

The authors suggest that with the adoption of Christianity as the official religion of Rome, religious considerations preventing the mutilation of a corpse may have acted as a break on the development of autopsy procedures.

**Ambroise Paré**

In the 1540s, the 19 year old, uneducated son of a country artisan travelled to Paris where he became a surgical student at the Hôtel Dieu hospital. Paré was born in an era in which physicians considered surgery well beneath their dignity; they left all cutting to the lowly barber-surgeons. After attaining the rank of master barber-surgeon in 1536, he joined the army as a regimental surgeon. It was during the siege of Turin in 1536-37 that Paré made his first great medical discovery. Gunshot wounds, a new medical condition, were considered to be poisonous and were routinely treated by cauterisation with boiling oil. When Paré ran out of oil during the siege, he turned instead to simple dressings and soothing ointment, and immediately noted the improved condition of his patients. Paré popularised this revolutionary treatment in his *Method of Treating Wounds* in 1545. Paré's second critical contribution to medicine was his promotion of ligature of blood vessels to prevent haemorrhage during amputations. Paré's classic *Treatise on Surgery*, written in 1564, disseminated knowledge of this life-saving technique. In this book, Paré also included large parts of Andreas Vesalius's authoritative work on anatomy, translated from the original Latin into the vernacular French. This dramatically opened the doors of anatomical knowledge to the barber-surgeons of Paré's time, who like Paré, were unable to read Latin and were scorned and left untrained by establishment physicians. The impact of Paré's writings on the development of forensic pathology should not be ignored.

**Mathieu Orfila (1787-1853)**

Mathieu Orfila has had a considerable influence on the study of toxicology. His massive treatise on poisons appeared in three languages in the second decade of the nineteenth century, and immediately propelled the medical, biological, chemical, physiological, and legal sciences in new directions. (Firth A. 2007)

From 1804 to 1807, he attended courses in medicine at the University of Valencia and chemistry at the University of Barcelona. He won a scholarship to the University of Madrid to study chemistry and mineralogy, but instead travelled to Paris in June 1807, where he studied medicine and pharmacy. Orfila was influenced by the work
of pharmacist and chemist Louis-Nicolas Vauquelin and chemist Louis-Jacques Thenard. At the outbreak of the Peninsular War (1808–1814) Orfila was threatened with expulsion, but Vauquelin interceded on his behalf and Orfila was allowed to remain in Paris.

After receiving his medical degree from the Faculté de Médecine de Paris in 1811, Orfila continued working with Vauquelin and Thenard. He succeeded Thenard as professor of chemistry at L'Athénée in 1817 and became a naturalised French citizen in 1818. He was named professor of legal medicine at the Faculté de Médecine in 1819, and succeeded Vauquelin there as professor of medical chemistry in 1823. He became dean of the Faculté de Médecine in 1831 and in 1834 was created a Knight of the Legion of Honour.

Orfila's first book, his masterpiece, 'A General System of Toxicology, or, a Treatise on Poisons, Drawn from the Mineral, Vegetable, and Animal Kingdoms, Considered as to their Relations with Physiology, Pathology and Medical Jurisprudence' which was published in two volumes in Paris in 1814–1815 was translated by John Augustine Waller in London in 1816–1817.

Orfila's other major works includes 'Elements of Medical Chemistry' published in two volumes in 1817 and translated in 1818. Another is 'A Popular Treatise on the Remedies to be Employed in Cases of Poisoning and Apparent Death, Including the Means of Detecting Poisons, of Distinguishing Real from Apparent Death, and of Ascertaining the Adulteration of Wines', published in 1818. He also wrote 'Lessons in Legal Medicine', which appeared in three volumes from 1821 to 1823, and 'Treatise on Juridical Exhumations', published in 1831, as well as several later works, specifically about arsenic, the poison of choice for murderers at that time, and commonly referred to as 'inheritance powder'. Arsenic had been used so successfully because the person poisoned passed out and died apparently from natural causes. The work of Orfila in France and James Marsh in Scotland was to change all that. (Fisher, Fisher & Kolowski 2007)

Orfila was the founding editor of two important medical journals, ‘Journal of medical chemistry, pharmacy and toxicology’ in 1824 and ‘Chronicles of public hygiene and legal medicine’ in 1829. He founded the Society of Medical Chemistry in 1824, the Museum of Pathological Anatomy, known as the Musee Dupuytren, in 1835, and the Museum of Comparative Anatomy, now called the Musee Orfila, in 1845. 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.

Serving as an expert witness in several famous legal proceedings further enhanced his reputation. Using his own improvements on the arsenic detection methods of James Marsh, Orfila helped to uncover the truth about the murders of Nicolas Mercier in 1838 and Charles LaFarge in 1840.

Monumental advances in forensic science were being made at the beginning of the 19th century by such towering figures as Orfila. (Wilson & Wilson 2003)
James Marsh (1794–1846)

With a distinguished career as an English chemist in the 1830s and 1840s, James Marsh (1794–1846) is historically well-known for the research and development of a dependable, simple laboratory test for the identification of minute traces of arsenic (Firth A. 2007).

The Marsh test (or the Marsh Arsenic test), as it is known today, involved the testing of given samples of food, fluid, or deceased human tissue by forensic toxicologists from the middle part of the nineteenth century to well into the latter half of the twentieth century. In fact, the test was often used by Mathieu Orfila. The Marsh test gave experts an effective and accurate way to detect small amounts of arsenic, a sometimes fatal chemical contaminant when placed accidentally or intentionally within the body. The development of the Marsh test and accompanying apparatus helped to promote the scientific advancement of poisoning investigations, greatly assisting in the prosecution at several notable murder trials.

His scientific abilities were probably first noticed in 1836 when leaders of the town of Plumstead asked his advice with regard to the possible reason of arsenic poisoning within the deceased body of a local leader. As a qualified chemist who was familiar with the accepted German methods of testing autopsies, Marsh applied yellow precipitates, ammonia solvents, and various other laboratory materials to the tissues of the dead body and to the coffee that was alleged to have contained the poison. Marsh presented his evidence at the inquest, which clearly identified arsenic in the victim’s body. However, at the trial the jury did not understand his technical testimony and acquitted the accused, the grandson of the descendent. (The grandson later confessed to the crime after being convicted of a different offence.)

Because of his inability to convince the jury, Marsh became determined to develop new laboratory tests that could prove the presence of even small traces of arsenic and produce universally understandable results. Basing his investigations on the previous work (of transforming arsenic to a related gas called arsine) by Swedish scientist Karl Wilhelm Scheele (1742–1786), Marsh produced hydrogen from a reaction of adding solid zinc metal to a glass receptacle containing either dilute sulphuric acid. When Marsh added tissue or body fluid to the hydrogen-generating container, its reaction with the zinc and acid would create hydrogen gas. If any type of arsenic was present, the hydrogen gas when heated by Marsh would react with it to produce arsine gas, which fumed off to deposit a silvery-black film, that is, metallic arsenic, on a porcelain bowl. (Evans C 2007)

Marsh was able to produce visible stains on the bowl when only very small amounts of arsenic were present. In fact, as little as 0.1 milligrams of arsenic could be detected by using his test. Eventually he designed a U-shaped glass tube with a narrowed nozzle at one end to provide a controlled reaction and to help ignite the exiting gas. Marsh wrote a report based on his pioneering research and resulting test which was published in the Edinburgh Philosophical Journal in October 1836. Two other pieces followed in 1837 and 1840.

Publication of the articles encouraged toxicologists and other scientists around the world to experiment with his data. French toxicologist Orfila, already famous in his
own right, made important improvements to the Marsh test such as recommending that all reacting chemicals be shown free of arsenic before being used in an investigation. In 1840, the Marsh test was instrumental in securing a conviction in a major murder case, one that was decided by a report by Orfila. Specifically, Orfila applied the Marsh test to decide the controversial trial of Marie Lafarge, who was charged with murder by the arsenic poisoning of her husband. Based on his results, Lafarge was found guilty and sentenced to death (which was later reduced to life in prison). Due to the scientific work of Orfila and his expert application of the Marsh test, procedures were first formalised for proving cases of poisoning in court by the use of toxicological analysis.

Throughout his career, Marsh worked at the Woolwich arsenal where he was employed in the fields of electromagnetism and artillery technology. The Marsh test is still applied by forensic toxicologists today but in the latter half of the 20th century it began to be replaced by more technically advanced methods of instrumental analysis such as atomic absorption spectroscopy and x-ray fluorescence spectroscopy. (Fisher, Fisher & Kolowski 2007).

**Bergeret d’Abois (1822 -1895)**

In 1855, French doctor Bergeret d'Arbois was the first to use insect succession to determine the post mortem interval of human remains. A couple renovating their Paris home uncovered the mummified remains of a child behind the mantelpiece. Suspicion immediately fell on the couple, though they had only recently moved into the house.

Bergeret, who carried out an autopsy on the victim noted evidence of insect populations on the corpse. Using methods similar to those employed by forensic entomologists today, he concluded that the body had been placed behind the wall years earlier, in 1849. Bergeret used what was known about insect life cycles and successive colonisation of a corpse to arrive at this date. His report convinced police who then charge the previous tenants of the home. They were subsequently convicted of the murder.

**Jean Pierre Megnin (1828-105)**

As a French army veterinarian Jean Pierre Megnin spent years studying and documenting the predictability of insect colonisation in cadavers. He published many articles and books on various subjects including the books *Faune des Tombeaux* and *La Faune des Cadavres*, which are considered to be among the most important forensic entomology books in history. In his second book he did revolutionary work on the theory of predictable waves, or successions of insects onto corpses. In this work he asserted that exposed corpses were subject to eight successional waves, whereas buried corpses were subject to only two waves.

In 1878, the mites found in the mummified body of a newborn baby girl in Paris, France, were studied by acarologist and forensic entomologist Mégnin, who estimated around 2.4 million mites in the skull and identified them as *Tyroglyphus longior* (Gervais). He suggested that the arrival of these mites at the corpse would have occurred by phoresy on carrier insects, roughly five months before the autopsy.
There is no doubt about the identification of the mites as Mégnin was a highly respected acarologist. Mégnin made many great discoveries that helped shed new light on many of the general characteristics of decaying flora and fauna. His work and study of the larval and adult forms of insect families found in cadavers sparked the interest of future entomologists and encouraged more research in the link between arthropods and the deceased, and thereby helped to establish the scientific discipline of forensic entomology. Modern forensic entomology draws on the observations and studies of all these pioneers. (McBrewster 2009)

**Alphonse Bertillon (1853–1914)**

In 1879, after completing his military service, Bertillon took a minor clerk's job with the Paris Prefecture of Police. One of his duties was to copy onto small cards the recorded descriptions of the criminals apprehended each day. Bertillon realised that the short descriptions he was laboriously re-recording were practically useless for the purpose of identifying recidivists, or criminal re-offenders. He had a general familiarity with anthropological statistics and anthropometric techniques because of the work of his father and his elder brother Jacques, a doctor and statistician. Bertillon devised a system of identification of criminals which relies on 11 bodily measurements and the colour of the eyes, hair, and skin. He added standardised photographs of the criminals to his anthropometric data. He first described his system in *Photography: With an Appendix on Anthropometrical Classification and Identification* (1890). The Bertillon system proved successful in distinguishing first-time offenders from recidivists, and it was adopted by all advanced countries.

In 1888 the Department of Judicial Identity was created for the Paris prefecture of Police, and Bertillon became its head. He invented many techniques useful to criminologists. His use of photography was especially effective, and he did much to improve photographic techniques in criminology. Around the turn of the century, fingerprinting began to replace the Bertillon system and has now superseded it throughout the world. (Wilson C & Wilson D 2003).

**Hans Gross (1847-1914)**

In 1893 Gross published his work, *System Der Kriminalistik*, in English *Criminal Investigation*. The book had long sections on footprints, fibres, wood fragments, dust and hairs. In this book Gross cites the case of the use of microscopic examination in a case of indecent assault. He tells of three small girls who were taking their dog for a walk by the sea when they were accosted by a stranger who gave them sweets and took them on the sandhills where he sexually assaulted them. The children told their parents what had happened and the matter was reported to the police. The clothing worn by the children was immediately seized. The pants of all three children showed semen stains inside the crotch. Next day one of the little girls was out walking with her mother on the sea front when she spotted the stranger who had assaulted them. The mother called the police and the man was arrested. Examination of his trousers revealed seminal stains on the outside of the flies, substantiating the children’s statements that he had exposed his penis and place it inside their pants. Dog hairs identical to those of the children’s pet and coloured woollen fibres identical to those from a dress worn by one of the children were also
found. Although Gross does not confirm it, it is believed that this evidence led to a successful conviction. (Wilson & Wilson 2003)

Sir William Herschel (1833-1918)

Sir William James Herschel, Chief Magistrate of the Hooghly district in Jungipoor, India, first used fingerprints on native contracts in 1858. On a whim, and without thought toward personal identification, Herschel had Rajyadhar Konai, a local businessman impress his hand print on a contract.

The idea was merely "... to frighten [him] out of all thought of repudiating his signature." The businessman was suitably impressed, and Herschel made a habit of requiring palm prints - and later, simply the prints of the right index and middle fingers - on every contract made with the locals. Personal contact with the document, they believed, made the contract more binding than if they simply signed it. Thus, the first wide-scale, modern-day use of fingerprints was predicated, not upon scientific evidence, but upon superstitious beliefs.

As his fingerprint collection grew, however, Herschel began to note that the inked impressions could, indeed, prove or disprove identity. While his experience with fingerprinting was admittedly limited, Sir William Herschel's private conviction that all fingerprints were unique to the individual, as well as permanent throughout that individual's life, inspired him to expand their use. (Beavan C 2003).

Henry Faulds (1843-1930)

Faulds was born on 1 June 1843 in Beith, North Ayrshire. He went to work in Glasgow as a clerk, and then decided to study medicine. He became a missionary and in 1873 he was sent to Japan where he founded and then became the surgeon superintendent of Tusukiji Hospital in Tokyo. He became fluent in Japanese, taught at the local university and was also responsible for founding the Tokyo Institute for the Blind.

In the late 1870s Faulds became involved in archaeological digs in Japan and noticed on shards of ancient pottery the fingerprints of those who had made them. He began to study modern fingerprints and wrote to Charles Darwin with his ideas. Darwin forwarded them to a relation, Francis Galton. In 1880 Faulds published a paper in 'Nature' magazine on fingerprints, observing that they could be used to catch criminals and suggesting how this could be done. Shortly afterwards Sir William Herschel, published a letter in 'Nature', where he explained that he had been using fingerprints as a method of signature.

In 1886 Faulds returned to Britain and offered his fingerprinting system to Scotland Yard, who declined the offer. Two years later, however, Galton delivered a paper to the Royal Institution, stating that Herschel had suggested forensic usage before Faulds, under the erroneous impression that his article had been the earlier of the two. This prompted a battle of letters between Faulds and Herschel that would continue until 1917, when Herschel conceded that Faulds had been the first to suggest a forensic use for fingerprints.
After his return from Japan, Faulds worked in London and then as a police surgeon in Staffordshire. He died in March 1930, bitter at the lack of recognition he had received for his work. (Wilson C & Wilson D 2003).

**Francis Galton 1822–1911**

Although Galton was not the first to propose the use of fingerprints for identification he was the first to place their study on a scientific basis, and so lay the groundwork for their use in criminal cases. He was able to collect a large sample of prints through his anthropological laboratories, eventually amassing over 8,000 sets. His study of minutiae in prints provided the foundation for meaningful comparison of different prints, and he was able to construct a statistical proof of the uniqueness, by minutiae, of individual prints.

Galton published a book *Finger Prints* in 1892 proposing that all fingerprint patterns could be put into one of three categories:

- loops
- arches
- whorls

He also asserted that fingerprints were unique and did not change throughout life. He also provided the first workable fingerprint classification system, which was later adapted by E. R. Henry for practical use in police forces and other bureaucratic settings.

Most of all, Galton's extensive popular advocacy of the use of prints helped to convince a sceptical public that they could be used reliably for identification. (Siegel J. 2009)

**Juan Vucetich (1858-925)**

The Argentinian Juan Vucetich made the first criminal fingerprint identification in 1892. He was able to identify Francis Rojas, a woman who murdered her two sons and cut her own throat in an attempt to place blame on another. Her bloody print was left on a door post, proving her identity as the murderer. Vucetich based his fingerprint classification system on that devised by Galton. Unlike Galton who used only the prints from the forefinger, he used the prints from all ten digits. (Beavan C. 2003)

**Edward Richard Henry 1850-1931**

Sir Edward Richard Henry, 1st Baronet GCVO KCB CSI KPM (1850–1931) was the Commissioner of Police of the Metropolis from 1903 to 1918. He is best remembered for his significant advancements in the use of fingerprints as a tool to forensic science. He is responsible for developing the fingerprint identification system that is used throughout Europe and North America. In conjunction with his research, Henry published *Classification and Uses of Finger Prints*. As the head of Scotland Yard, he also led the transition from anthropometry to fingerprint
identification. While working as inspector general of the Bengal Police, Henry began to study how fingerprinting was and could be used as a way to identify criminals. He discussed the matter frequently with fellow English scientist Sir Francis Galton and reviewed research conducted by William Herschel and Henry Faulds. In 1896, Henry instituted the use of fingerprint impressions on criminal record forms in Bengal. Later that year he developed a fingerprint classification system that allowed fingerprints to be filed, searched, and traced against thousands of others. Within a year, Henry's system was being used throughout British India. Within ten years, the system was being used by authorities throughout Europe and North America. (Beavan C. 2003)

Alexandre Lacassagne (1843-1924)

Lacassagne is regarded as the first scientist to try to match an individual bullet to a gun barrel. He did this by examining the bullet’s striations, counting and comparing the number of lands and grooves. In 1889, he published the article “La Deformation des Balles de Revolver”, (Deformation of Revolver Bullets) in the Archive de Antropologie Criminelle et des Sciences Penales, outlining his findings regarding bullet markings. While he didn’t come up with a system to classify these markings, Lacassagne’s research and study is considered the beginning of the science of ballistics.

He was also one of the first scientists to study and report on the significance of bloodstains left at a crime scene, and what they could indicate about the nature of the crime committed. In particular, he conducted research on the relation between the shape of blood spots and the position of the victim. (Wilson C & Wilson D 2003)

Max Ritcher

In 1901, Karl Landsteiner was awarded the Nobel Prize for discovering human blood types. In 1902 Max Richter tried testing dried bloodstains to ascertain their blood group. He discovered that this became much more difficult if the stains were more than a few weeks old. (Wilson C & Wilson D. 2003)

Georg Popp

In October, 1904, Georg Popp, a chemist, microscopist, and earth scientist in Germany, was asked to examine the evidence in a murder case in which a seamstress named Eva Disch had been strangled in a bean field with her own scarf. A filthy handkerchief had been left at the scene of the crime and the nasal mucus on the handkerchief contained bits of coal, particles of snuff, and most interesting of all, grains of minerals, particularly hornblende. A prime suspect was known to work both in a coal-burning gasworks and at a local gravel pit. Popp found coal and mineral grains, including hornblende, under the suspect’s fingernails. It was also determined that the suspect used snuff. Examination of soil removed from the suspect’s trousers revealed that minerals in a lower layer in contact with the cloth matched those of a soil sample taken from the place where the victim’s body had been found. Encrusted on this lower layer, a second soil type was found. Examination of the minerals in the upper layer revealed a mineralogy and size of particles, particularly crushed mica grains that Popp determined were comparable with soil samples collected along the
path that led from the murder scene to the suspect’s home. From this data it was concluded that the suspect picked up the lower soil layer at the scene of the crime and that this lower and thus earlier material was covered by splashes of mica-rich mud from the path on his return home. When confronted with the soil evidence the suspect admitted the crime, and the Frankfurt newspapers of the day carried such headlines as, “The Microscope Detective”. (Wilson C & Wilson D 2003)

Victor Balthazard (1872–1950)

In the early 1900s Victor Balthazard worked as a professor in forensic medicine at the Sorbonne University in Paris, France. Together with the French physicist Pierre Curie (1859–1906) and his Sorbonne colleague Charles Bouchard (1831–1915), they collaborated on the physiological action of radium (radon) emanation on mice and guinea pigs. Balthazar conducted research into how body hair carries pieces of circumstantial forensic evidence and suggested that the identification of a suspect might eventually be possible through particular characteristics such as hair dyes or hair diseases. Together with Marcelle Lambert he published the first comprehensive hair study “Le poil de l'homme et des animaux” (“The hair of man and animals”), which includes numerous microscopic studies of hairs from most animals. As a result in 1910, during one of the first legal cases ever involving hairs, French citizen Rosella Rousseau was prompted to confess to murder.

Balthazard is credited for his statistical model of fingerprint individuality, published in 1911. His model was simplistic and ignored some relevant information, but is the foundation for later improved statistical models. Balthazard's work was the basis for Locard's Tripartite Rule, referring to statistical models supporting quantifiable thresholds for friction ridge individualisation.

In 1912 Balthazard asserted that machine tools used to make gun barrels never leave exactly the same markings. After studying images of gun barrels and bullets, he reasoned that every gun barrel leaves a signature set of etched grooves on each bullet fired through it. Another milestone in firearms identification history occurred when Balthazard devised a number of procedures to match fired bullets to the firearms from which they were fired by taking an elaborate series of photographs of test fired bullets from the firearm as well as evidence bullets. The photographs were then carefully enlarged, and the observed markings compared. Balthazard applied these same specialised photographic techniques to the examination and identification of cartridge casings using firing pin, breech face, ejector, and extractor marks, and he was among the first to attempt to individualise a bullet to a weapon.

In the early 1920s Balthazard's work had evolved so much that court cases and literature continued at a fast pace. In 1922 two articles were published in the recognised French Comptes Rendus de l'Academie des Sciences describing the perfected technique for determination of the identification of projectiles. A year later, other articles appeared in the French journal Annales de Medicine Legale investigating fissures of the skull caused by revolver bullets fired at short range, and the identification of fired bullets and shells. Eventually, ballistics was formally established in 1923 in crime investigation, and the United States Bureau of Forensic Ballistics was established in 1925. (Wilson C & Wilson D 2003)
Sir Bernard Spilsbury (1877–1947)

Famous for his involvement in the cases of Dr Crippen and the Brides in the Bath murders, the pathologist Sir Bernard Spilsbury has been hailed as 'our greatest medico-legal expert', 'the founder of forensics' and even 'the living embodiment of mythical Sherlock Holmes'.

The case that brought Spilsbury to prominence was the trial of Doctor Crippen in 1910, in which he gave forensic evidence about the likely identity of the human remains found in Crippen's house. Spilsbury concluded that a scar on a small piece of skin from the remains pointed to Mrs Crippen as the victim.

He gave evidence at the trial of Herbert Rowse Armstrong, the solicitor convicted of poisoning his wife with arsenic.

It was Spilsbury who provided convincing evidence of how three women were murdered in their baths, and so helped convict a serial killer in the Brides in the Bath trial. He also gave evidence in the Brighton Trunk Murders and although the accused man, Antoni (Tony) Mancini, in whose flat the body of a murdered prostitute was found, was acquitted at the trial, he confessed to the killing just before his own death, many years later, so vindicating Spilsbury's evidence.

Working with minimal remains, such as in the "Blazing Car Murder" in 1930, when an almost completely destroyed body was found in the wreck of a burnt-out car near Northampton, Spilsbury gave evidence of how the victim, who was never identified, had died, and so helped convict Alfred Rouse. During his career Spilsbury performed thousands of autopsies, not just on murder victims but also on executed criminals. (Evans C. 2007)

Edmund Locard (1877-1966)

Famous for his articulation of what is often called the “Locard Exchange Principle”. French scientist Edmond Locard believed that when a criminal came into contact with another person or place, small items such as hairs or fibres would be left by one person and perhaps picked up by the other. The "Locard Exchange Principle" can be stated as;

"When any two objects come into contact there is always a transfer from one object to the other."

“Wherever he steps, whatever he touches, whatever he leaves, even unconsciously, will serve as a silent witness against him. Not only his fingerprints or his footprints, but his hair, the fibres 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. This is evidence that does not forget. It is not confused by the excitement of the moment. It is not absent because human witnesses are. It is factual evidence. Physical evidence cannot be wrong, it cannot perjure itself, it cannot be wholly absent. Only its interpretation can err. Only human failure to find it, study and understand it can diminish its value." (Edmund Locard) (Wilson C & Wilson D 2003)
John Larson

John Larson, a police sergeant with the Berkley police department and a graduate of the University of California, is generally credited with the creation of the first modern lie detector, the first "polygraph" in 1921. His lie detector equipment was a simple variation on the equipment doctors still use today for testing blood pressure. Larson also recognised the importance of the order of the questions and the words used in interrogation as being the key to lie detection, rather than the apparatus itself.

Larson called his invention, a "cardio-pneumo-psychogram," and it documented blood pressure, pulse rate and respiratory rates, all on a drum of paper. It was essentially a “multi-channelled polygraph,” since it could read several physiological responses at the same time. (Wilson C & Wilson D 2003)

Luke Sylvester May

Luke Sylvester May was known as America’s Sherlock Holmes. For all intents and purposes, he was the first to apply the scientific methods portrayed by Arthur Conan Doyle in real life criminal cases in the United States. May owned and operated an independent, private scientific investigative agency, applying such forensic disciplines as questioned documents, fingerprints, trace evidence, and firearm and toolmark identification. He provided services to law enforcement in the early decades of the twentieth century – long before such agencies established their own laboratories. May’s unique skills and expansive body of knowledge regarding the most advanced methods for solving crime were of great interest to the United States government.

According to his granddaughter, May “disappeared” into intelligence work immediately after the bombing of Pearl Harbour. To this day, the May family does not know where he went or what he did. All they know is that he left to serve in World War II as a Lieutenant Commander in the Naval Reserve and returned home as a full Commander. May died after a long battle with Leukemia in 1965, but his impact during the earliest years of forensic science survived long after his passing. (Crime Lab Report 2009)

John Glaister (1892-1971)

John Glaister, Jr. was the second son of John Glaister, an eminent Scottish professor of forensic medicine, and Mary Scott Clarke. In 1916, upon receiving his bachelor of medicine and bachelor of surgery degrees from the University of Glasgow, he joined the British army, serving in the Royal Army Medical Corps in Palestine. He returned to Glasgow in 1919 to enter private practice and to join the Department of Forensic Medicine at the University of Glasgow as an assistant, working under his father.

In 1925 he obtained his doctorate in medicine and in 1927 the degree of D.Sc. (doctor of science). In the same year, he became a barrister, lectured on forensic medicine to the Glasgow Police Force, and acted as medico-legal examiner and adviser to the Corporation of Glasgow. In 1928 Glaister replaced Sydney Smith as the chair of forensic medicine in Cairo at the University of Egypt and became medico-legal advisor to the Egyptian government. He returned to Glasgow in 1931
to succeed his father in the Regius Chair of Medical Jurisprudence at the university and held that post until 1962.

His most important publication, the textbook *Medical Jurisprudence and Toxicology*, was initiated by his father, but Glaister, Jr. substantially revised it with the help of Dr. Edgar Rentoul; it went on to be published in many subsequent editions. His other publications include: *Legal Medicine* (1922); *Medico-Legal Aspects of the Ruxton Case* (1936), written with James Couper Brash, Professor of Anatomy, University of Edinburgh; *Recent Advances in Forensic Medicine* (1939); *A Study of Hairs and Wools Belonging to the Mammalian Group of Animals, Including a Special Study of Human Hair* (1937); *The Power of Poison* (1954); and his autobiography, *Final Diagnosis* (1964).

As Medico-Legal Examiner to the Crown, Glaister worked mainly in western Scotland, but also did some work in England, most famously on the Buck Ruxton case. Over the course of his career, he was often consulted as a medical examiner, forensic pathologist, serologist, and expert on hairs and fibres.

> "The avenue of medico-legal investigation demands an exhaustive study of animal and human hairs. For the purpose of identification, it is essential that the examiner should have at hand a comprehensive collection of known hairs for comparison." John Glaister, Jr., 1931

(Wilson C & Wilson D 2003)

**Douglas M. Lucas**

In 1960 Douglas M. Lucas was the first forensic scientist to utilise the technique of gas chromatography as a means of identification of petroleum products used as accelerants in suspected cases of arson. In so doing, he recognised the inherent difficulties in attempting to minutely identify accelerants by brand type or commercial manufacturer.

In forensic fire investigations (suspected arson, acts of terrorism, etc.) it is extremely important to analyse the explosion, blast, or fire debris for the presence of small amounts of suspected volatile accelerants, which can be used to prove that the fire or blast was caused intentionally. (Frith A 2007)

**Matsumur & Soba**

In 1977, Fuseo Matsumur was preparing microscope slides for an investigation being conducted by the Japanese National Police Agency. The crime involved the murder of a taxi driver, and Fuseo’s task was to glue hair samples from the crime scene to glass slides for later microscopic examination. While carrying out this routine task, Matsumur made a seemingly simple observation: the fumes from the Superglue (cyanoacrylate adhesive) he was using caused his fingerprints to become visible on the glass slides.

Fingerprint "dusting", the print retrieval technique commonly seen on television, is somewhat limited in its use, because the perspiration which forms a fingerprint
evaporates rather quickly, leaving nothing to attract and hold the dusting powder. Long after the moisture in a fingerprint has evaporated, however, the amino acids found in human sweat remain behind, sometimes for months. These amino acids attract the fumes from Superglue and other brands of cyanoacrylate adhesive, forming a sticky image of the latent print, which is then dusted and lifted with a wide piece of transparent tape.

While Matsumur knew none of the science behind what he had observed, he recognised its potential importance in the field of criminology. Matsumur quickly relayed his observation to Masato Soba, a print examiner at the agency, who began exploring the technique further. Soba’s subsequent work, along with that of researchers in other organisations, has led to numerous advances in this technique, though the basic concept remains unchanged. A typical analysis today involves placing the exhibits inside a sealed box with an open container of cyanoacrylate. The glue is heated to release its fumes, and after about 15 minutes, when the prints have become clear, the box is pumped clear and the objects are removed and dusted. Prints discovered using this method can be removed with tape and placed on a transparent plastic card. (Frith A 2007) (Encyclopedia.com 2010)

**Foster & Freeman**

In 1987 the British Engineers Foster and Freeman built the first Electro Static Detection Equipment. The ESDA machine is the size of a desktop copying machine. The blank page is covered with a cellophane material and is subjected to a repeated high voltage static charge. Black toner is cascaded over the cellophane surface. This technique is extremely sensitive and clearly reveals indented writing on a blank writing pad. (Frith A 2007)

**Sir Alec Jeffries**

In 1984 Sir Alec Jeffries, the British geneticist discovered the DNA fingerprint. His accidental revelation made it possible to identify people by detecting variations in their genes, changing forensic science, criminal justice and paternity cases around the world. Jeffries is a research professor at the University of Leicester. (Frith A 2007)

**John Coe**

In 1989 American Doctor John Coe, a medical examiner of Hennepin County, Minneapolis discovered that as the red blood cells break down in the process that produces liver mortis, they release potassium. This diffuses into the liquid inside the eyeball (the vitreous humor). Taking a sample from the victim’s eyeballs and determining the percentage of potassium in the liquid may provide the most accurate estimate of time of death yet discovered. (Frith A 2007)

With ever greater advances in technology and medical science, the commission of the perfect crime becomes increasingly more remote. Those who currently carry out forensic investigations are but the latest practitioners of a long tradition.
Key points

- Forensic science is both young and old
- As an organised profession shaped by strict quality management standards and higher educational requirements, forensic science is very young, less than 30 years old
- Many of the most commonly practised techniques have a long history of development and research.
Glossary

Acarology: The study of mites and ticks.

Accelerants: Any chemical that can start fires and explosions quickly.

Amino acids: Amino acids play central roles both as building blocks of proteins and as intermediates in metabolism.

Anatomy: The science that studies the structure of the body.

Anthropology: The scientific study of the origin, the behaviour, and the physical, social, and cultural development of humans.

Anthropometry: The measurement of the size and proportions of the human body.

Autopsy: A special surgical operation, performed by specially-trained physicians, on a dead body. Its purpose is to learn the truth about the person’s health during life, and how the person really died.

Ballistics: The study of the functioning of firearms, the flight of the bullet, and the effects of different types of ammunition.

Cauterisation: The application of heat, mechanically or chemically, to prevent or stop bleeding.

Chromotography: A method of separating and identifying the components of a complex mixture by differential movement through a two-phase system, in which the movement is effected by a flow of a liquid or a gas (mobile phase) which percolates through an adsorbent (stationary phase) or a second liquid phase.

Cyanoacrylate: Superglue

DNA: The complex chemical that makes each person unique.

Forensic entomology: The use of the insects and their arthropod relatives that inhabit decomposing remains to aid legal investigations.

Forensic science: The scientific analysis and documentation of evidence suitable for legal proceedings.

Grooves and lands: A barrel for rifles and pistols is equipped with lands and grooves, wherein the greatest measure of the groove calibre of the barrel corresponds with the minimum measure of the diameter of the projectile, and the land calibre amounts to about 96 percent of the groove calibre. The grooves are the spaces that are cut out, and the resulting ridges are called lands. It is the lands that cut into the bullet and impart spin.

Haemorrhage: Bleeding.
**Ligature:** A cord, wire, or bandage used for tying or binding.

**Liver mortis:** Also known as lividity or hypostasis. It is a term used to describe the draining of the blood to lower portions of the body due to the influence of gravity. The body develops a patchy discolouration within 1-2 hours of death and the process is complete within 6-12 hours.

**Palynology:** The scientific study of spores, pollen and certain algae.

**Pathology:** The scientific study of the nature of disease and its causes, processes, development, and consequences.

**Phoresy:** A relationship between two different species of organisms in which the larger, or host, organism transports a smaller organism, the guest.

**Polygraph:** A machine that measures a person's reactions, sometimes known as a lie detector.

**Post mortem:** An examination of a corpse in order to determine cause of death.

**Precipitates:** Solids formed in a solution or inside another solid during a chemical reaction.

**Serology:** The study and examination of bodily fluids that is used in forensic science as a means of segregating fluids excreted by assailants or attackers in varying criminal acts. These acts can range from physical assault to sexual assault, right through to the act of murder and all of them will have an element of fluid secretion attached to them.

**Spectroscopy:** The measurement of the absorption, scattering, or emission of electromagnetic radiation by atoms or molecules.

**Striation marks:** Marks on a spent bullet.

**Toxicology:** The science dealing with poisons and their effects and with antidotes for poisons.

**Suggested reading**

Absolute Astronomy (2010) Collected Cases of Justice Rectified available on line @ http://www.absoluteastronomy.com/topics/Collected_Cases_of_Injustice_Rectified


Bibliography

www.absoluteastronomy.com/topics/Collected_Cases_of_Injustice_Rectified


Module 1
Pioneers of Forensic Science Activities

Activity 1 Complete and submit the Pioneers of Forensic Science Quiz Check Sheet

Activity 2 Complete and submit the Pioneers of Forensic Science Knowledge Check Sheet

Forensic Pioneers Quiz Sheet
(To be submitted for assessment)

1. The classic text on forensics, the Xi Yuan Ji Lu, (1248) was written by
   (a) Wu Pu
   (b) Song Ci
   (c) Bert Kwok
   (d) Masato Soba

2. Mathieu Orfila is famous for his contribution to the field of
   (a) Forensic science
   (b) Pathology
   (c) Toxicology
   (d) Anthropology

3. The Marsh test can prove the presence of
   (a) Diamorphine
   (b) Cyanide
   (c) Arsenic
   (d) Heroin

4. Which of the following was a French Army Veterinarian, acarologist and forensic entomologist?
   (a) Bergeret d’Arbois
   (b) Jean Pierre Megnin
   (c) Edmund Locard
   (d) Francis Crick

5. The features of a gun barrel which cut into a bullet and impart spin are called:
   (a) Bumps
   (b) Slots
   (c) Lumps
   (d) Land
6. Individualisation of a person can be best achieved by
   (a) Autopsy
   (b) Hair Analysis
   (c) Fingerprinting
   (d) Photography

7. The Henry Classification of fingerprinting is named after
   (a) William Henry Herschel
   (b) Sir Edward Richard Henry
   (c) Henry Faulds
   (d) Lennie Henry

8. The first scientist to try to match an individual bullet to a gun barrel by examining the bullet’s striations, counting and comparing the number of lands and grooves was
   (a) Sir Bernard Spilsbury
   (b) Douglas M. Lucas
   (c) Alexandre Lacassagne
   (d) Sir Edward Richard Henry

9. The geneticist who discovered the DNA fingerprint in 1984 was
   (a) Sir Alec Jeffries
   (b) Doctor John Coe
   (c) John Glaister, Jr.
   (d) Jean Pierre Megnin

10. The British Engineers who built the first Electro Static Detection Equipment were
    (a) Foster and Freeman
    (b) Foster & Allen
    (c) Canon and Ball
    (d) Crick and Watson
**Pioneers of Forensics**  
**Knowledge Check 2 (To be submitted for assessment)**

In not less than 100 words each, describe the contribution made to forensic science by the following individuals:

<table>
<thead>
<tr>
<th><strong>Victor Balthazard (1872–1950)</strong></th>
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<tr>
<td><strong>Georg Popp</strong></td>
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<tr>
<td><strong>Edward Richard Henry (1850–1931)</strong></td>
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<tr>
<td><strong>Sir Bernard Spilsbury (1877–1947)</strong></td>
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<tr>
<td><strong>Edmund Locard (1877-1966)</strong></td>
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