Forensic antiquity: The unrevealed development of forensics from ancient time

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ABSTRACT

Forensic science combines principles and techniques from natural science to study criminal and civil laws, as well as to recognize, identify, individualize, and appraise physical evidence. Standardized forensic science procedures were absent in the ancient world, which let criminals avoid punishment. Oaths, confessions, and witness testimony were used in criminal investigations and court cases. Some civilizations used procedures like trial by ordeal to judge guilt or innocence in that era when a distinction between science and elements like religion, magic, and superstition hadn't yet been created. Nevertheless, numerous instances of old methods that predate forensic science theories were made possible by the scientific revolution decades later. These methods predated the scientific method and instead relied on practical experience and common sense rather than a modern grasp of science.

Keywords—Forensic, lie detection, ancient prints, friction ridges, documents, handwriting analysis, autopsy, forensic medicine.

I. INTRODUCTION

Forensic Science is a scientific discipline that uses methods and principles of natural science to investigate criminal and civil laws and the recognition, identification, individualization and evaluation of physical evidence. It is also known as criminalistics as it serves the purpose of administration of criminal justice. The word “Forensic” is derived from the Latin word “Forensis” which means “of or before the forum” “in open court” or “to the court of justice”.

From historical times, the world lacked any conventional practice of Forensic Science. Justice was searching for impartial and unbiased evidence and scientific methods or techniques, as against the traditional method of oral testimony for centuries. The witnesses brought for testimony were generally unobservant, hostile, unwilling, and even biased; this hindered the process of conviction. Criminal investigations heavily relied on confessions, pledges, or witnesses. In that era there was no clear distinction between science and superstition, beliefs, magic, culture or religion; yet some civilizations had judicial practice where the guilt or innocence of the accused was proven by exposing them to some dangerous, painful or unpleasant situation. Confession from the perpetrator was obtained by using several techniques that prognosticated some concepts of science; these techniques were not having a scientific understanding that the modern era holds; it was instead based on some practical experience or common sense. The development of medical science, and physical science has provided assistance to criminal investigation and helped provide justice.

II. FORENSICS IN ANCIENT TIMES

The earliest efforts to use of science to solve the cause of death or crimes like murder dates back to ancient Greek and Roman civilization. The contribution to the field of medicine and pharmacology has been the basis of modern medical, medicolegal aspects and toxicology. Egyptian civilization performed the first instance of an “Autopsy” back in 3000 BC. Other civilizations like Chinese civilization, Indus civilization and Indian medicine have profoundly used various processes for acquittal. A few traditional techniques are as follows:

A. *Lie detection*

For ages, human beings have always been in search of ways to verify the genuineness of any information received. Early techniques for lie detection were based on oaths, pledges, magic, attestation, etc but it got harder to differentiate innocence and guilt based on verbal affirmation, thus understanding the person through their behavior, physiological or bodily changes or facial expression became crucial.

The earliest known account for lie detection comes from ancient China, which corresponds to modern polygraph techniques, as it relied on physiological changes to certain situations. The suspects were asked to chew dry rice when they would be questioned for trials, and depending on how they spat the rice out, the suspect was proven innocent or guilty. If the rice is moist, then the suspect is considered innocent, while if the rice is still dry or it sticks to the tongue, then the suspect is considered guilty. The lie-detection technique is based on the production of saliva when a person is under stress it is believed that the flow of saliva is less or the person can't produce enough saliva and thus will have a dry mouth; this leads to rice being dry or just sticking to the tongue this proved innocence-guilt of the suspect. If someone is telling the truth then there would be no stress; this results in the production of enough saliva to convert dry rice into moist rice.

Around 500 BC in ancient India, suspects of theft or dacoity cases were tested by priests. Here the suspect was put into a dark cave or tent with a donkey whose tail was coated with soot, and the suspect was asked to tug the tail of that donkey but it was said that the donkey brays if a thief touches the donkey. If a suspect came out with a clean hand (without soot) it indicated that the suspect was afraid to touch the donkey for fear of being revealed as a thief by the donkey. Thus, the suspect was found guilty.

Some 2200 years ago, the ancient traditional Romans used brutal methods for challenging the suspect by ordeal. A heavy marble disc called the Bocca Della Verita, also known as the mouth of truth, had a head and face carved thereon, and the face belonged to the Titan God Oceanus. Ostensibly, the suspect was asked to take an oath or pledge. It was believed that if someone said the truth, he would be able to take out the hand from the disc easily, while someone who is lying would lose his hand by the bite of the God, or the hand would stay trapped forever. These rationales were based on the belief that God wouldn't let lies win over truth; thus, injustice won't prevail and the righteous men won't suffer. Based on the outcomes of such tests, the claim by the suspect was considered either true or false. Many other similar methods for the detection of lies were by using sacral meals; if the suspect lied, he would choke and die. This method existed till the 15th century, but gradually people realized that guilt or innocence can't be proven by such experiments which were merely based on divine forces or magic this led to the development of various scientific methods or techniques for the detection of crime and conviction of the criminals.

During the 1870s Franz Joseph Gall developed a discipline called phrenology. Phrenology is a study that involves the measurement of bumps on the skull or the conformation of the skull, which helped in predicting mental traits. This discipline is based on the brain which is the central organ, and it helps in perceiving various emotions of an individual. It also helps in determining the tendency of an individual to lie or engage in criminal behavior. Gall mapped the human skull and regions of the brain; this was the pseudoscientific approach to determine truth or lies. He demonstrated various bumps of skull among the criminals and he tried to determine liars among randomly chosen audiences. This specialty was very influential during the 19th century. Along with phrenology, another discipline called graphology emerged in 1875 and is yet to be considered as a scientific method of lie detection. Jean-Hippolyte Michon coined the term graphology, where an analysis of handwriting was done to determine an individual's personality traits. By the time of the First World War the use of graphology as a science to determine lie or guilt reduced, but later this formed basis of modern-day handwriting analysis. During the First World War, graphology was used for verifying the authenticity of documents and signatures, but it was not recognized as an appropriate tool for lie detection.

B. *Physical method*

The "Eureka" story attributed to Archimedes (287–212 BC), in which the philosopher demonstrated that a crown was not made entirely of solid gold by comparing measurements of its water displacement and weight, is a clear precursor to contemporary forensic engineering methods. The instance establishes the principles of density, buoyancy, force, and equilibrium as well as a turning point when quantitative approaches are crucial.

The story of Agrippina dating back to 66 AD, the Roman emperor Nero's mother, who requested the head of her adversary Lollia Paulina to confirm her death, marked the first instance of the use of forensic odontology in antiquity. Agrippina could make out a distinctly colored front tooth in Lollia's mouth, despite the face being deformed beyond recognition.

Modern voice recognition technology is a precursor to the Old Testament tale of the Shibboleth, in which the victorious Gileadites identified and slaughtered the defeated Ephraimites because they could not pronounce the word "shibboleth" correctly.

C. *Ancient prints*

The ancient humans were aware of fingerprints and may have understood that each person's fingerprint had a different pattern. However, they did not apply that information to criminal investigations (as is done in contemporary dactylography). Quintilian, a Roman lawyer, was able to acquit his client for murder in the first century BC by demonstrating that the suspect's hand did not match a bloody palm print found at the crime scene. Identification was more frequently accomplished using prints. As early as 2000 BC in Babylonia, handwriting and fingerprints were commonly used as signatures. China may have employed friction ridge skin impressions as identification evidence as early as 300 B.C., Japan as early as A.D. 702, and the United States as early as 1902.

At an archaeological site in northwest China, earthenware which is thought to be 6000 years old was recovered, and it was discovered to bear clearly visible friction ridge impressions. These prints are thought to be the oldest friction ridge skin impressions discovered to date, however, it is unclear if they were placed there by chance or on purpose, such as to make attractive designs or symbols. Friction ridges were left in other ancient materials during this same Neolithic time by builders. Construction workers carved impressions into the brick-making, clay, similar to what someone might leave an impression on concrete. There were other ancient objects discovered with ridge patterns that were obviously carved rather than simply left as impressions. Megalithic artworks in the tomb of Gavr'inis on an island close off the west coast of France and in the tomb at Newgrange in Ireland are two examples of ancient artefacts showcasing what might be called friction ridge designs.

Friction ridge imprints were reportedly originally employed as a form of identification by the Chinese. The very first example is from a Chinese record from the Qin Dynasty (221–206 B.C.) titled "The Volume of Crime Scene Investigation—Burglary". The document describes how handprints were utilized as an element of evidence. Clay seals were used, documents consisting of bamboo slips or pages were rolled with string bindings, and the strings were sealed with clay. The author's name, typically in the form of a stamp, would be imprinted on a single side of the seal, and the author's fingerprint would be imprinted on the opposite side. The seal was applied to a document to indicate who wrote it and to guard against tampering before it was sent to its intended recipient. It is generally acknowledged that the legitimacy of the document was provided by both the fingerprint and the name. The fingerprint that was imprinted onto the clay seal is unmistakably an example of friction ridges being intentionally reproduced as a method of individualization. Using friction ridge skin to sign documents became commonplace after the Chinese invented paper in 105 AD. All contract-type documents were required to have an impression, such as palmprints, phalangeal (lower finger joint) marks, or fingerprints. On land contracts, wills, and army rosters from the Tang Dynasty (617-907 AD), friction ridge skin imprints were still being used in China. It is possible that other Asian countries copied the technique after learning how the Chinese used friction ridge skin for individualization and trade. For instance, a "Domestic Law" enacted in Japan in 702 AD required the husband to sign with his own index finger, and if he couldn't write, he had to hire a man to do it. The Japanese may have understood the value of friction ridge skin for individualization, according to this evidence. There are also allusions to the nobility in India utilizing friction ridge skin as a signature. It is thought that the Chinese, who utilized prints on significant papers frequently, introduced the practice to India, where it was mostly employed for royalty.

In the Philosophical Transactions of the Royal Society of London, Dr. Nehemiah Grew provided the first thorough account of friction ridge skin in 1684. Anatomy of the Human Body, written in 1685 by Dutch anatomist Govard Bidloo, offered information on the skin and the papillary ridges of the thumb but did not address individualization or permanency. The purpose, form, and structure of friction ridge skin were covered in the 1687 publication Concerning the External Tactile Organs by the Italian scientist Marcello Malpighi. Malpighi is credited with using the newly created microscope for medical research for the first time. Malpighi wrote in his treatise that friction ridge skin improves traction for walking and grabbing because it increases friction between an object and the skin's surface. A layer of skin (stratum Malpighi) was named in honour of Malpighi's contributions. Even though friction ridge skin had long been examined, it wasn't until 1788 that its distinctiveness was acknowledged in Europe. The idea that friction ridge skin is distinctive was first put out by Mayer.

Dr. Johannes E. Purkinje (1787-1869), a professor at the University of Breslau in Germany, divided fingerprint patterns into nine categories and gave each one a name in his 1823 thesis, "Commentary on the Physiological Examination of the Organs of Vision and the Cutaneous System." Even though Dr. Purkinje only named the patterns, his work is essential because the Henry classification system was based on his nine pattern categories. German anthropologist Hermann Welcker (1822–1898), who worked at the University of Halle, was a pioneer in the study of friction ridge skin persistence. Welcker is credited with being the first to begin permanence research since he started by printing his right hand in 1856 and then again in 1897. The importance of friction ridge skin for individualization was initially written about by Henry Faulds in a scholarly publication. The first person to recognize the existence and placement of the volar pads on the hands and feet was Arthur

Kollman. The classification system devised by Juan Vucetich and the individualization of inmates through the analysis of their fingerprints represents the earliest applications of fingerprint science by law enforcement officials. Argentina becomes the first nation to rely only on fingerprints as a means of individualization with the Rojas murder case, a homicide that was solved in Buenos Aires. The author of the first book on fingerprints is Sir Francis Galton. The idea that friction ridges help with grasping was first recognized by David Hepburn. The first instance of fingerprint evidence being used to support a conviction was reportedly in a criminal case in Bengal in 1898. In 1903, the American Classification System was used to categorize all criminals in the state of New York, and after that, all criminals' fingerprints were taken for the purpose of creating criminal records.

D. *Documents*

Documents were frequently falsified in civilizations where the majority of people lacked literacy, and techniques for spotting or avoiding fraud were highly sought. In order to identify forgeries, officials in ancient Rome engaged handwriting analysts to compare scribes' writing styles.

In the 3rd Century Jurists established protocols for the identification of forgeries and the methods to be used in their detection. Byzantine emperor Justinian I from 529 to 565 Century developed the code of Justinian, formally Corpus Juris Civilis gave additional rules for the use of handwriting comparisons in court. The Judge may, at his discretion, require persons with special writing skills to examine writing that is under investigation and provide testimony regarding the veracity of the questioned document.

During the 1900s Daniel T. Ames, author of Compendium of Practical and Ornamental Penmanship was examiner of the disputed handwriting in the court. In 1910, Albert S Osborn gave “Questioned Documents”, a comprehensive text that focused not only on the examination of handwriting and signatures but also on other types of evidence appearing in documents, including paper, ink, type and correction. Albert S. Osborn began inviting other document examiners to his home in Upper Montclair, New Jersey during the early 20th Century. These meetings began the establishment of the American Association of Questioned Document Examiners (ASQDE). The ASQDE was formally founded under the leadership of Albert S. Osborn on September 2, 1942. The only way to join the group was through invitation. Meeting attendance annually as well as full participation in the program were requirements for a continued invitation, and its sessions were entirely instructional in nature. A significant number of individuals believe that the ASQDE is the primary national organization in the United States for disseminating research.

E. *Ancient forensic medicine*

The ancient times, as known to us were a time frame of people unaware of several facts. Even so, some literate civilizations existed with a great scientific perspective, which led to the formation of advanced methodologies in the present era. One such civilization originating across the Nile Valley was known as the Egyptians. Egyptians are widely known for their mythologies and mystic culture, but on the contrary, they had an immense knowledge of scientific technicalities. The Egyptian inscriptions and papyri, provide noticeable evidence proposing the vast knowledge of medicinal plants acquired by the First Pharaoh. "Menes" (also called Narmer). At a later stage, a much more organized and detailed knowledge of medical issues and their counter-medicines was possessed by Egyptian experts. Some papyri include "Ebers". "Edwin Smith" and "Hearst" had an extensive drug database that included poisons like copper, arsenic, and mercury that are of metallic origin as well as hyoscine, coniine, and a number of other poisons that are of plant origin. Specifically, the Edwin Smith papyrus comprised explicit anatomical facts about the human body, which during that era, was unimaginable. This was possible, as the religious factor preventing the dissection of the body after death (now known as an autopsy), was eliminated in their ideology due to which they discovered these anatomical facts way before other civilizations. Legal restrictions were imposed on medical practices, only citizens of a certain class and professional physicians were the legal exceptions. In order to be a physician, one had to study the medical books passed down by their predecessors. The concept of specialisation in various branches of medical expertise was also present, including issues related to the head, eye, teeth, intestines, etc. The era of King ‘Djoser’ (pronounced as zozer), holds a lot of gravity as the first medico-legal expert, “Imhotep” came into the picture who was the Grand vizier, Chief Justice and Physician of King Djoser. Although he is more famous for his architectural side, he was the one behind the construction of the first great pyramid at Sakkara. He was considered as the ‘Inventor of Healing’ and after approximately 2000 years, people started worshipping him as the ‘God of Medicine and Healing’. Even though there were a few medical advancements, religion was a dominant force during that period. People had an ideology that diseases were punishments given by God due to their evil deeds. The positive outlook was that this mentality resulted in developing a fear of committing ill acts; however, people started putting their faith in religion and magic for treating disease and would perform various magical practices with the intent to cure. Even in the Egyptian civilization, the influence of tradition, religion, and the belief in magic took over the medical aspect.

People started worshipping Imhotep as a God and believed that he had the power to cure every possible disease. The medical experts were then treated as magicians and the technicalities got associated with tradition and religion, resulting in somewhat of a downgrade of the Egyptian medical techniques.

In this conundrum of irrationality and rationality, the ancient Greek civilization opted for the latter. The major reason was the existence and contribution of a Greek physician, "Hippocrates" (now known as the Father of Medicine). Along with the medical sector, ancient Greece was also known for the emphasis on legality in its principles of living. As of now, no direct evidence has been found indicating the association of their legal systems with the medical practices, but given that the medical experts were treated with high societal status, there is less to no possibility that their expertise would be neglected by the authorities. Also, there is sufficient evidence showing the concern of Hippocrates and others towards some medico-legal issues like the degree of fatality based on the location of a wound, fake acts of illness for prevention from repercussions, duration of pregnancy, and many more. The Hippocratic oath(original), translated by Francis Adams in 1849, which was written by Hippocrates himself, included the lines portraying the message that an expert shall never provide any such harmful substance to the sufferer causing death, and he shall never contribute his knowledge for abortion. Undoubtedly, a significant emphasis is noticeable in developing a legally oriented medical expert in an oath written nearly two thousand years ago, which shows the strength of the legal grip along with the medical practices over the lifestyle of ancient Greek citizens.

Autopsies, which attempted to determine the cause of death of the deceased, have been attested since the early 3rd millennium BC, although it was highly opposed by various ancient societies as it was believed that autopsy and such disfigurement of the body of the deceased prevented them from entering the afterlife. Erasistratus and Herophilus of Chalcedon, who flourished in Alexandria during the third century B.C., were notable Greek autopsists, but autopsies were uncustomary in ancient Greece. Notably, a legally authorized autopsy was performed on Julius Caesar in 44 BC following his murder by competing senators, and the doctor's findings revealed that the second stab wound Caesar got was the one that ultimately proved deadly. According to some historians, the word "forensic" derives from the autopsy performed upon Caesar's assassination in the Roman Forum. The Hammurabi Law Code, which dates from 2900 BC and is the oldest known legal code, includes laws relating to the rights and obligations of medical professionals as well as establishing penalties for medical practitioners.

Since poisoning symptoms predominantly resembled those of natural seizures, ancient physicians found it difficult to identify poisoning as the cause of death. Ancient scientists were particularly interested in poisons, but their analytical techniques were still rather basic. Numerous of these were compiled in the writings of the renowned physician and poet Nicander of Colophon (c. 200 BC), but it wasn't until 1499 that his works were first printed.

In India, prominent treatises that were regarded as authoritative sources of legal counsel included the Arthashastra, which dates to 400 BC, and the Manusmriti, which dates to 100 BC. The Varna system, which is an older component of Indian civilization, is another topic covered in Manusmriti. The Arthashastra, the most comprehensive book on statecraft ever written, was authored by Chanakya and Vishnugupta. The book covers a wide range of subjects, including the king, the legal code, foreign affairs, obscure and esoteric activities, and more. The master strategist regarded as India's Machiavelli has been around for more than 2000 years, but he is still influencing modern-day spiritual gurus in the nation. According to Kautilya's Arthashastra, there are four methods to stop breathing: strangulation, hanging, asphyxiation, or drowning; two ways to cause bodily injury: being beaten or being thrown from a height; or poisoning: being bitten by a snake, being bitten by an insect, or taking narcotic medicines. The undigested portions of the meal were evaluated by feeding them to birds in cases where poisoning is suspected to be the cause of death. Investigations into hanging suicide cases were conducted in order to rule out the possibility of antemortem injuries. Similarly, to this, when a stranger's dead body was discovered, his clothing, accessories, and other personal items were inspected. In Kautilya's Arthashastra, it is explained that after smearing the body with oil to reveal bruises, swellings, and other injuries, an autopsy is required to determine the cause of death. The Vedas are an abundance of wisdom. The Atharva Veda provides information about charm-based treatments for a number of ailments. Charms to treat injuries, burns, poisons, snakebites, and insanity were available. During this time, deceased animals were dissected for the purpose of learning. The Charaka Samhita is regarded as the oldest and most reliable text on Ayurveda currently in existence. It also outlines the reasoning and philosophy of this medical approach. Regarding the education, obligations, privileges, and social standing of physicians, it laid out a detailed code. It might be viewed as the starting point for medical ethics. Around the sixth century BC, Susruta authored his Samhita, the most authentic literature on the practice of Ayurvedic surgery. Susruta is also known as the father of plastic surgery. The chapters on forensic medicine in the Samhita were so meticulously prepared that they are in no way inferior to the current understanding of the field. Additionally, a

separate chapter on toxicity is included. The toxins were divided into three categories: artificial, animal, and plant-based. Furthermore, the method of poison delivery, the personality of the poisoner, and the investigation of potentially dangerous materials were all discussed in depth, in addition to the symptoms, signs, and treatment of poisoning. A poisoner could be identified by his actions and demeanour; for example, he won't respond to inquiries, will remain silent, will engage in irrelevant conversation, and so on. Food, drinks, tooth sticks, oils and messaging materials, medications, bathwater, clothing, snuff, cigarettes, and surmas were all used as delivery methods for poisons. Emetics and its application are discussed. The chapters on injury, pregnancy, and delivery in Shusruta are distinctive. Types of weapons and foreign bodies, together with the bodily signs and symptoms they caused, have also been covered. Bone fractures and injuries have been categorized. Ancient Tamil hymns compare the relationship between a doctor and patient to the devoted devotion of a devotee to God. In ancient India, physicians were revered as men of wisdom. The Muslim sultanates and empires developed sharia during the Muslim invasions of the Indian subcontinent, most notably the Fatawa-e-Alamgiri of the Mughal Empire, which was put together by emperor Aurangzeb and many Islamic academics. One of the primary legal systems that evolved during the Middle Ages was Islamic law and jurisprudence. During the classical period of Islamic law and jurisprudence, Islamic jurists created a number of significant legal institutions, one of which was the Hawala, an early informal value transfer system that is described in writings of Islamic jurisprudence as early as the 8th century. Since the major tenets of sharia were transmitted directly from the Islamic prophet Muhammad; the Hawala itself later impacted the establishment of the Aval in French civil law and the Avallo in Italian law. Sharia is depicted in a legal treatise from the eighth century AD, written by Chanakya, the author of Ancient India and Sharia. Hindu custom and Islamic law were replaced by common law after British colonization when India joined the British Empire. Early incidences of custodial deaths were certified by medical professionals, the issuance of medical certificates and wound certificates, and medicolegal autopsies were documented in British India. Modern dactylography is India's most notable contribution to legal medicine at this time. According to records, India had a high rate of homicidal poisonings.

Forensic medicine in China has a long and rich history that could be traced all the way back to the Qin (also known as Chin) Dynasty (221-207 BC) or possibly earlier. Another illustration is the fact that Song Ci (also known as Sung Tzu, in 1247 AD), during the Song Dynasty in China, edited the world's first systematic book on forensic medicine, Xi Yuan Ji Lu (the Washing Away of Wrongs), which provided a structured methodology for investigations into deaths from various causes and manners. The only "expert" at most medieval Chinese inquests, aside from the judge himself, was the wu tso, or ostensor, a person of low social standing and little education. He may have had a great deal of experience handling corpses because he was frequently an undertaker in his own time, but he had no medical training or interests. The "old woman" (tso pho or wen pho) who helped in examining female corpses in medieval China was typically a midwife. Additionally, the formal adoption of the contemporary medicolegal examination process based on autopsies occurred in Republican China (1911–1949). Professor Lin Ji, who has become recognized as the founder of modern Chinese forensic medicine, established the country's first forensic medicine institute during this time and worked tirelessly to advance the use of cutting-edge forensic techniques and create a draft of the country's forensic medicine system.

III. CONCLUSION

Forensic science is an interdisciplinary subject which has its root in ancient sciences. Since antiquity Forensics has played an important role in providing justice, when there was no distinction between religion, magic and superstition, scientific methods were adopted by various civilizations to exonerate the innocent and convict the offender. Various techniques were lie detection techniques, physical methods for distinguishing objects, ancient prints, documents, etc. Ancient medical studies were important as to how autopsies were developed, and various pieces of evidences were collected from the deceased after death, to understand the cause of death.

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