

# The Shadow of Evidence: Forensic Medicine is Challenging the Perception of 'Unsolvable' Cold Cases

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## Introduction

For decades, cold cases-unsolved criminal investigations-have remained shrouded in mystery, often becoming forgotten relics of the past. For years, detectives, police officers and prosecutors comb through files, revisiting crime scenes and re-interviewing witnesses in hopes of uncovering new evidence or leads. But for many cases, the passage of time renders solutions increasingly elusive. Cases that may have seemed unsolvable, however, have recently experienced a resurgence thanks to forensic medicine-a powerful, evolving discipline that is reshaping the investigative landscape. Forensic medicine, an intersection of medicine and law, has long played a critical role in criminal investigations. Through cutting-edge technologies, the retrieval and analysis of minute pieces of evidence have allowed investigators to unlock the secrets of cold cases once believed to be beyond resolution [1].

One notable example of DNA evidence solving a cold case is the 1976 murder of 15-year-old Michelle Martinko in Cedar Rapids, Iowa. Despite an exhaustive investigation, the case remained open for over 40 years, with no strong leads. However, in 2018, DNA from the crime scene was re-examined and compared to genetic profiles from public databases. The match led investigators to Jerry Burns, who was arrested and eventually pled guilty. This case demonstrated the transformative power of DNA analysis in giving long-awaited answers and bringing closure to victims' families. Furthermore, DNA evidence can also help exonerate the wrongly convicted, as demonstrated by the Innocence Project, an organization that works to exonerate individuals wrongfully convicted through DNA testing. Many of these cases are decades old and forensic medicine has played an instrumental role in overturning convictions based on unreliable evidence or faulty investigations [2].

## Description

Forensic medicine combines medical knowledge with legal principles, typically with a focus on post-mortem investigations. Pathologists, toxicologists and other medical experts involved in forensic medicine help uncover the cause of death, any signs of foul play and potential evidence that could lead to the identification of a perpetrator. Over the years, the field has expanded to include a variety of techniques such as DNA analysis, ballistics, forensic odontology (dental identification), toxicology and forensic anthropology. All these methods are invaluable when re-examining cold cases. Cold cases are typically classified as criminal investigations that have remained unsolved for a year or more. Despite their complexity, these cases often remain open in the hopes of new evidence or breakthroughs. Historically, solving cold cases was a daunting challenge due to the limited resources and technological capabilities available at the time of the investigation. However, advancements in forensic medicine have begun to bridge this gap and offer new hope. Among the most revolutionary advancements in forensic medicine is DNA analysis. In

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the past few decades, the application of DNA profiling in forensic science has led to dramatic breakthroughs in both contemporary and cold cases. DNA, as a genetic fingerprint, offers a unique means of identifying individuals, even long after a crime has occurred. The precision of DNA matching, whether from blood, hair, skin, or saliva, has been instrumental in solving cases that had remained unsolved for years or even decades [3].

Forensic pathology is another integral component of forensic medicine that has assisted in the revival of cold cases. Forensic pathologists perform autopsies to determine the cause of death, establish timelines and gather evidence such as foreign substances (e.g., drugs, poisons) or trauma. With the passage of time, these findings may appear to become less useful. However, technological advances in post-mortem techniques allow pathologists to uncover fresh insights. However, advancements in forensic pathology allowed investigators to re-examine the original autopsy reports and findings. By reviewing the cases with modern forensic techniques-such as advanced microscopic analysis and the study of tissue samples-investigators found new clues. Though the case remains open, it illustrates the potential of forensic pathology in uncovering critical evidence even after years of inactivity. Forensic anthropology plays an essential role in identifying victims and providing crucial insights into the circumstances surrounding a death, especially in cases where the body is decomposed or skeletal remains are all that remain. Forensic anthropologists can analyze bone fragments to determine age, sex, ancestry and even the cause of death, providing key information to help solve cold cases. One striking example of forensic anthropology's impact was the identification of "Baby Jane Doe," the name given to the remains of a newborn girl discovered in a suitcase in Tampa, Florida, in 1982. Despite decades of investigation, the child's identity remained unknown. However, the case was reopened in the 2010s using modern forensic anthropological techniques, including facial reconstruction and re-assessing old evidence. Eventually, investigators were able to identify the mother and uncover new details, shedding light on this long-forgotten case [4].

Forensic toxicology is another critical field within forensic medicine, particularly in cases involving poisoning, drug overdoses and intoxication. Advances in toxicology, including the ability to detect trace amounts of drugs, poisons and chemicals, have provided crucial insights into cold cases. In the past, toxicology testing was often limited by available technology and the difficulty of identifying substances that were not yet well-known. Today, however, forensic toxicologists can test for a wider variety of substances, even those that were previously undetectable. For instance, a 1970s cold case involving the suspected poisoning of a wealthy couple in California remained unsolved until modern forensic toxicologists revisited the case using contemporary techniques. By re-analyzing tissue samples, they identified rare toxins that had not been detected at the time of the investigation. This led to the identification of the perpetrator, demonstrating the power of new toxicological methods. Moreover, technology has also played a significant role in advancing forensic medicine. The use of 3D imaging and digital modeling has allowed investigators to recreate crime scenes and even visualize injuries in unprecedented detail. This technology can breathe new life into old cases, providing a clearer understanding of the circumstances and opening new avenues for investigation [5].

## Conclusion

Forensic medicine is challenging the age-old perception that cold cases are unsolvable. With each new technological advance and scientific discovery, previously "unsolvable" mysteries are being pieced together in ways that were

once unimaginable. DNA analysis, forensic pathology, anthropology, toxicology and genetic genealogy all offer powerful tools to solve cases that have long remained in the shadows. As more cold cases are revisited and reexamined with these techniques, there is hope that justice will be served for victims who have waited for answers for years. Forensic medicine is at the forefront of a revolution in criminal investigations. It is not only changing the way cold cases are solved but also reshaping our understanding of what is possible in criminal justice. Thanks to these advancements, the long-standing belief that some cases are forever unsolvable is being challenged. Each breakthrough serves as a reminder that even the most elusive cases can be brought into the light, offering closure, justice and, ultimately, peace to those who have suffered the most.

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## Conflict of Interest

The author declares there is no conflict of interest associated with this manuscript.

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