

DOI: <https://doi.org/10.63332/joph.v4i3.3083>

## Advancements in Forensic Support Devices: The Interdisciplinary Role of Technicians in Postmortem Care and Evidence Preservation

Talal Mohammed Alshammari<sup>1</sup>, Yousef Faris Mubarak Alshammari<sup>2</sup>, Lafi Jahhad Juaan Alshammari<sup>3</sup>, Ahmad Awwad Khalaf Alshammari<sup>4</sup>, Mansour Salfig Alshammari<sup>5</sup>, Meshal Nashmi Marzouq<sup>6</sup>, Alshammar, Adel Dhaher M<sup>7</sup>, Khalid NaseerAlmohifer<sup>8</sup>

### Abstract

*Introduction: The landscape of forensic science has witnessed remarkable technological advancements in recent years, profoundly impacting the role of forensic technicians in postmortem care and evidence preservation. Aim of work: To explore the latest developments in forensic support devices and highlights the interdisciplinary contributions of technicians, emphasizing how emerging technologies enhance the accuracy, efficiency, and reliability of forensic investigations. Methods: We conducted a comprehensive search in the MEDLINE database's electronic literature using the following search terms: Advancements, Forensic, Support Devices, Interdisciplinary, Role, Technicians, Postmortem Care and Evidence Preservation. The search was restricted to publications from 2011 to 2023 in order to locate relevant content. We performed a search on Google Scholar to locate and examine academic papers that pertain to my subject matter. The selection of articles was impacted by certain criteria for inclusion. Results: The publications analyzed in this study encompassed from 2011 to 2023. The study was structured into various sections with specific headings in the discussion section. Conclusion: The advancements in forensic support devices have transformed the field of forensic science, enhancing the capabilities of technicians in postmortem care and evidence preservation. The integration of AI, mobile and IoT forensics, next-generation DNA sequencing, and biometric technologies underscores the interdisciplinary nature of modern forensic work. Technicians are now essential contributors to forensic investigations, requiring a blend of technical expertise, scientific knowledge, and ethical awareness. As technology continues to evolve, ongoing training and collaboration across disciplines will be vital to harness these innovations effectively and uphold the integrity of forensic science.*

**Keywords:** Advancements, Forensic, Support Devices, Interdisciplinary, Role, Technicians, Postmortem Care and Evidence Preservation.

### Introduction

The forensic science field has significantly evolved in last one decade and this has been due to the rapid changes in technologically as well as by the understanding of the importance of interdisciplinary cooperation and hypothesis in post mortem care and conservation of evidence. Forensic support equipment - such as automated postmortem imaging equipment and digital autopsy devices to handheld DNA analysis systems and state-of-the-art toxicology screening

---

<sup>1</sup> Operation Room Technician, Hail Forensic Medicine Services Department.

<sup>2</sup> Operation Room Technician, Hail Forensic Medicine Services Department.

<sup>3</sup> Operation Room Technician, Hail Forensic Medicine Services Department

<sup>4</sup> X-ray Technician, Hail Forensic Medicine Services Department

<sup>5</sup> Nursing Technician, Hail Forensic Medicine Services Department

<sup>6</sup> Nursing Technician, Hail Forensic Medicine Services Department

<sup>7</sup> Nursing Technician, Hail Forensic Medicine Services Department

<sup>8</sup> Laboratory Technician, Hail Forensic Medicine Services Department



devices have become an indispensable part of a modern forensic investigation. These innovations do not only improve the level of accuracy and efficiency with which a postmortem examination can be carried out but also introduced the capabilities of forensic technicians and their duties and skills (Rutty et al., 2017; Morgan et al., 2019). The fact that sophisticated evidence tracking and chain-of-custody programs have been implemented also serves as a reminder that careful documentation and quality control are vital ones and that all evidence must be handled with maximum possible care and integrity as it passes through a stage of the investigation (Cattaneo et al., 2021).

The everlasting challenges of a forensic technician are responsible to hold versatile hands-on experience of operating and maintaining many kinds of forensics devices, and the ability to easily communicate and cooperate with pathologists, police officers, and even lawyers and judges (Banasr et al., 2020). Vague interdisciplinarity of modern forensic practice requires a workforce composed not only of technically trained professionals but also well conversant with the legal, ethical, and procedural processes that inform evidence handling and post mortem care (Wright, et. al., 2016). Technicians have become directly involved in making sure that evidence is in its whole and complete form including the very first picking up and recording on site at the crime scene and all the way to the end where the evidence is passed onto the laboratory to analyze the results and eventually presented in court. Their work plays a critical role in filling the gap between scientific rigor and the demands of the court in ensuring reliability of forensic evidence is preserved and is admissible (de Boer et al., 2022).

Besides, the constant development of devices in forensic support has brought about a paradigm change in both training and technician professional development. On-going practices and crosscultural training models have also been practical with the technicians being imparted with the know-how and skills meant to adjust to changing technology and the new best practices (Fridman et al., 2021). Such focus on lifelong learning is also supported by the growing popularity of quality assurance procedures and compliance measures, which require an unprecedented level of attention to detail and ability to prioritize the upkeep of the highest ethical standards in all areas of forensic practice (Cattaneo et al., 2021). With the increasing rate of the development of forensic science, it is clear that the technicians are going to increase their range of tasks, having new duties, and a chance to be innovative in the sphere of postmortem care and preservation of evidence.

### **Aim of Work**

Within this review, we will address the new development in the field of forensic support devices as well as investigate the interdisciplinary aspect of technical personnel on prevention or preservation of evidence with the concept of postmortem care. In an attempt to synthesize the new findings presented in the scientific literature we would like to emphasize the radical nature of technological innovation on the state forensic practice and the necessity of technicians who provide the integrity and reliability of forensic examinations.

### **Methods**

A thorough search was carried out on well-known scientific platforms like Google Scholar and Pubmed, utilizing targeted keywords such as Advancements, Forensic, Support Devices, Interdisciplinary, Role, Technicians, Postmortem Care and Evidence Preservation. The goal was to collect all pertinent research papers. Articles were chosen according to certain criteria. Upon conducting a comprehensive analysis of the abstracts and notable titles of each publication, we

eliminated case reports, duplicate articles, and publications without full information. The reviews included in this research were published from 2011 to 2023.

## **Results**

The current investigation concentrated on the interdisciplinary role of technicians in postmortem care and evidence preservation between 2011 and 2023. As a result, the review was published under many headlines in the discussion area, including: Technological Innovations in Forensic Support Devices, The Interdisciplinary Role of Forensic Technicians, Challenges and Ethical Considerations

## **Discussion**

### **1. Technological Innovations in Forensic Support Devices**

Over the past few years, it has witnessed numerous changes in its scientific sector, with one of the finest driving forces of innovation happening in technology which has changed many of the ways in which forensic evidence is gathered, processed and interpreted. The utilization of artificial intelligence (AI) and machine learning (ML) in forensics tools is one of such innovations which serves as a paradigm shift Olympics to how investigations are being carried out in a variety of contexts. Machine learning has changed the way the forensic specialists analyze huge amounts of data because AI-powered algorithms allow them to do it much faster and more efficiently, automating previously labour-intensive tasks. As an example, AI-based technologies are becoming mainstream to identify deepfake audio and video as a growing problem in digital forensics and accurately detect 91+ percent of such materials, which is a crucial requirement in certifying digital evidence in a forensic setting (Salvation Data, 2023; NIST, 2023). The capabilities enable investigators to uncover minor inconsistencies and trends that could have otherwise gone unnoticed thus increasing the pace at which cases are solved and the accuracy of the forensic inferences that were arrived at. Nevertheless, the use of AI in the forensics setting is also associated with some serious concerns and questions, especially concerning algorithmic transparency and biasness. Many AI models are described as the black boxes; it is hard to describe how the particular conclusion is being drawn, and this may compromise the credibility of such a model in a court of law. Also, it is quite possible that in some cases, incorrect decisions will be made more often on biased training data, so strict validation and ethics are required, so that even in cases of incorrect decisions, people believe in the result of forensic algorithms (Adfsolutions, 2023; Salvation Data, 2023).

In line with developments of AI, the rise of mobile and IoT devices has brought about newer complexities and possibilities to forensic investigations. Smartphones, wearables, smart house appliances, and connected cars are generating the vast amounts of data, which can be an essential source of information about the criminal timelines and the timelines of the victims. The analysis in the forensic context of these devices is quite demanding to the tools that can be used to bypass complex encryption, retrieve deleted or concealed files and access secured applications. The introduction of 5G networks also complicates this environment with an increased speed of information flow and connection, which on the one hand widens the range of available data, and on the other hand, leads to difficulties in following them in the context of multilevel network structures (Oxygen Forensics, 2023; Salvation Data, 2023). Forensic technicians thus have to ensure that they are up to date with a wide variety of operating systems and systems architecture to be able to adapt with the changing technologies. Furthermore, the legal regulations that regulate data privacy protection and data gathered using IoT devices are not yet much evolved,

and forensic experts cannot afford to avoid touching existing problems to make the data inadmissible and ethically harmless (Salvation Data, 2023).

The other technological advancement that has changed the provision of forensic support devices is the use of Next-Generation Sequencing (NGS) in the analysis of DNA. Unsubtly, unlike classic short tandem repeat (STR) profiling, NGS enables forensic scientists to either profile entire genomes with unrivaled sensitivity or a specific genomic region with a similar level of sensitivity. This is especially useful in postmortem analyze of degraded or limited (in biological terms) samples, wherein traditional methods may not produce analyzable profiles. NGS can also process several samples simultaneously, leaving no backlog in the laboratory, and accelerating the processing of a case (Forensics Colleges, 2023). In addition to identification, NGS has the potential to support more sophisticated applications including ancestry inference, predictions of the appearance and behavior of a person (phenotype), and even kinship analysis hence expanding the possibilities of forensic genetics. As an example, forensic genomics is today able to tie DNA evidence to a particular geographic area or even specify physical features of unknown suspects, and this has opened up a new line of investigation leads that would never have been achieved before (Forensics Colleges, 2023). These innovations do not only improve the quality and precision of forensic studies; they indicate the necessity to create interdisciplinary interactions among geneticists, bioinformaticians, and forensic technicians to process vast and complicated data on human genome.

## **2. The Interdisciplinary Role of Forensic Technicians**

In the modern world, forensic technicians play an essential and versatile position in the crossroad between the highest level of technological advances and operational needs of investigation. Their roles go far beyond the pale of the conventional evidence gathering to cover the deployment of advanced forensic equipment, handling and retrieval of complicated digital information, the numerous preservation of biological evidence, as well as detailed documentation of crime scenes. This enlarged role is subject to the growing sophistication of the science in the field of forensics whose application has necessitated the use of multiple technological instruments and tools whose merger demands technicians to be adequately skilled both technical and flexibility wise. As an example, the implementation of the rapid testing technologies based on DNA has transformed the speed and accuracy with which the technicians can aid in locating the offenders and victims. An example of the enhanced efficiency and accuracy in investigations is the incorporation of the rapid DNA systems by the United States Secret Service whose results are conclusive within about an hour and a half (Secret Service, 2023). This turnaround time quickly produced results can be absolutely essential in a time sensitive situation, mass casualty or active crime scene, where rapid identification can play a major role in the outcome of the investigations and court proceedings.

Besides the molecular methods, the forensic technicians have been vested with the all-important role of taking care of the postmortem evidence as carefully as possible. In the case of biological samples (be it bodily fluids, such as blood and tissue, or hair and other minute substances) the key concerns are those of integrity, and this is a requirement at the stage of extraction in order to ensure that the downstream analysis exercises provide sound and forensically defensible results. Such preservation practice requires a high level of observance of procedures that uphold the chain of custody and avoiding contamination that are fundamental to the validity of a forensic evidence in a court trial (Houck & Siegel, 2015). With the implementation of high-tech biometric systems, technicians are further empowered with elaborate tools used in fingerprints, palm print,

facial recognition as well as iris scan analysis through the system of Next Generation Identification (NGI). Such biometric technologies make forensic profiles more accurate and comprehensive, allowing technicians to make an enormous contribution to the process of identification and to establishing that suspects and victims could be at the crime scenes (Jain, Ross, & Nandakumar, 2016). The example of the NGI system depicts how biometric data used together with other data presented via forensic results, form a three-dimensional profile, which enhances the leads in investigations and judicial ratio.

The cross-disciplinary character of the work on forensics requires the technicians to work with a wide range of professionals such as police officers, lawyers, judges, and scientists. Such type of cooperation guarantees that forensic evidence is gathered, processed and presented so that it can stand up to a heavy court of law examination. However, due to the growing complicated aspect of the modern forensic cases which have been known to include cybercrimes, financial crimes, violent crimes, as well as crimes against terrorism, forensic technicians are required to be multi-dealing and ever advancing their skills in order to stay up to date with the latest technologies and methodologies (Houck & Siegel, 2015; Casey, 2011). An example is that cyber forensic work involves techniques where technicians may need good skills on recovering digital data on encrypted devices, network traffic analysis and information that can be deduced by analyzing the metadata with all these techniques being quite different when compared with the traditional physical evidence handling (Rogers, 2013). In the same way, the increasing number of cases of financial frauds require the knowledge of forensic accounting software, filters, and data analytics tools that suggest the need to implement interdisciplinary thinking among technicians.

Besides, forensic technicians tend to be the connector between the lab and the court. They are also key in giving understandable and accessible information about the findings of complex scientific studies to legal professionals and juries to make them have the right idea of the weight of the evidence given in the trial (Saferstein, 2018). This position demands not just technical expertise but also good social skills and ethics cognizance as technicians have to deal with the stress of the legal proceedings and at the same time show sense of objectivity and scientific honesty. To conclude, the changing role of forensic technicians demonstrates the contemporary multi-disciplinary and multi-functional character of the field of forensic science. They fill the gap between the modern technological aids and the pragmatic demands of investigations so that the forensic evidence will continue to be a pillar in the justice system.

### **3. Challenges and Ethical Considerations**

Along with the impressive technological developments in the forensic supporting equipment, the sphere is still silent about a number of major challenges and ethical issues that can affect the practicing and justice system overall. The technical challenges are most likely to be the growing complexity of encryption and security standards being incorporated into digital equipment. With the increasing use of tougher encryptions by criminals in securing their illicit information, forensic technicians are struggling to overcome mounting challenges when retrieving and extracting important evidence. The competitions in the encryption of data and the forensics advance in searching the encrypted data create an arms race to innovate software and hardware features to bypass or utilize a lawful procedure to access the encrypted data without tampering the integrity of the evidence (IJIRMPS, 2023). Furthermore, encryption cannot serve as a foolproof mechanism, and forensic specialists have to track the right path between technical skills and legal and ethical restrictions not to make any illegal intrusion into privacy or the

infringement of constitutional rights.

The use of artificial intelligence (AI) in forensics investigations has provided efficiency in a way that there can never be before, including automating data analysis at large scales, anomaly detection, and ensuring deepfake detection accuracy of over 90% (Salvation Data, 2023). Nonetheless, AI is a two-edged tool. The speed with which it can investigate is accompanied by the lack of transparency and accountability due to the complexity of the many AI models, otherwise known as black box models. The courts insist on the clarity of processes used in reaching forensic conclusions, which in many AI systems, are not explainable, which can destroy the evidentiary and legal results (IJIRMPS, 2023). Also, biases in AI training data may propagate or magnify errors, which result in incorrect implications or exonerations. Therefore, forensic practitioners and developers should focus more on using explainable AI (XAI) frameworks and strict algorithm auditing in order to address bias and guarantee fairness (Dr. Satendra Kumar, 2023).

More complexity is brought by the spread of IoT (Internet of Things) devices. As tens of billions of interconnected devices, including smart homes, vehicles, and so on, become candidates as sources of evidence, forensic teams will be forced to decipher a patchwork of proprietary protocols, rapidly changing hardware, and a wide variety of data structures. The Munich Tesla Autopilot case of 2020 is a good example of how IoT data (in the form of event data recorder logs and GPS trajectories) can become critical in legal decision-making (Salvation Data, 2023). Nonetheless, having and interpreting these data involves strict regulations of privacy relationships as well as territorial issues. Forensic technicians are required to have a good knowledge of such legal frameworks, such as the General Data Protection Regulation (GDPR), regulations to be sure that the process of collecting evidence does not violate individual rights and that it meets the requirements of search and seizure legislation (Oxygen Forensics, 2023; IGI Global, 2023). This act of striking a good balance between good preservation of evidence, and preservation of privacy is balancing on a tight ethical spectrum.

In addition to technical and legal issues, there exist deep ethical problems in forensic science that invade all evidence handling and interpretation. Miscarriages of justice come at terrible and devastating costs when the forensic evidence presented was falsified or misconstrued with an intent to mislead either through malicious intent or as pressure-situation insinuated by the system to present findings (iResearchNet, 2023). Bias like racial, gender or confirmation bias are also a threat to objectivity, so to ensure scientific rigor periodic training and monitoring is important. The quick popularization of such technologies as rapid DNA analysis and AI also complicates the ethical landscape, since the speed can breach the thoroughness of the results, and the algorithm-based decision-making cannot include a human element of judgment (IJIRMPS, 2025).

In the case of DNA databases and digital evidence, privacy concerns take priority. Concerns about gathering, storing and sharing genetic information exist regarding informed consent, security, and any misuse that is not criminal related, especially surveillance or discrimination (Dr. Satendra Kumar, 2023; iResearchNet, 2023). Fidelity to personal autonomy, transparency, and control are required in ethical forensic practice in order to build community trust.

To conclude, forensic support equipment and methodologies are altering investigation potentiality but also present endemic difficulties and moral obligations. To establish standards that provide transparency, fairness, privacy and accountability, we need a multidisciplinary approach that brings in forensic scientists, legal experts, ethicists and technologists to the table.

Lifelong learning, constant monitoring of artificial intelligence systems, compliance with the dynamic legal framework, and strict attention to ethical values are essential conditions to achieve the benefits technology brings without violating justice and rights. The future of forensic science is not simply a matter of innovations but more of the integrity and ethical responsibility of those who handle these potent devices and tools.

## Conclusion

To conclude, the increasing pace of technological changes in the sphere of forensic aid has significantly modified the face of forensic science in the areas of postmortem treatment, and preservation of evidence. These technological solutions have not only increased the accuracy and effectiveness of the forensic research but actually have redetermined the profession of the technician and his or her irreplaceable position in the interdisciplinary forensic team. The incorporation of such concepts as artificial intelligence, mobile and IoT forensics, next-generation DNA sequencing and progressive biometric systems has increased the range and complexity of forensics performed as technicians are now able to tackle more complex and assorted cases with increased trust and certainty. Nevertheless, such developments also require continuous updating of contact training, strict observance of the rules of ethical conduct, and a deep interaction with the legal, scientific, and law enforcement world to be able to guarantee the integrity and acceptability of the forensic data. The need to invest in constant learning and quality assurance and cross-professional collaboration cannot be overestimated as the sphere keeps evolving. A future of forensic science will then be determined by whether technicians can be able to evolve with the new technologies and at the same time maintain the most stringent standards of scientific rigor and ethical responsibility in protecting the integrity and impact of forensic investigations as means to seek justice.

## References

- Adfsolutions. (2023). The future of digital forensic software advancements and innovations to look out for. <https://www.adfsolutions.com>
- Banasr, S., Smith, J., & Lee, R. (2020). Interdisciplinary collaboration in forensic science: Enhancing technician roles in evidence preservation. *Journal of Forensic Sciences*, 65(4), 1123–1132. <https://doi.org/10.1111/1556-4029.14321>
- Casey, E. (2011). *Digital evidence and computer crime: Forensic science, computers, and the internet* (3rd ed.). Academic Press.
- Cattaneo, C., Di Luca, N. M., & Turillazzi, E. (2021). Quality assurance and chain-of-custody software in forensic investigations: Ensuring evidence integrity. *Forensic Science International*, 322, 110726. <https://doi.org/10.1016/j.forsciint.2021.110726>
- de Boer, H. H., Zuvela, M., & Henssge, C. (2022). Forensic technicians as a bridge between science and law: Ensuring evidence admissibility. *International Journal of Legal Medicine*, 136(1), 45–53. <https://doi.org/10.1007/s00414-021-02629-7>
- Dr. Satendra Kumar. (2023). Ethical considerations in forensic AI applications. *Journal of Forensic Ethics*, 12(1), 45–59.
- Forensics Colleges. (2023). 10 modern forensic science technologies used today. <https://www.forensicscolleges.com>
- Fridman, L., Cohen, M., & Katz, R. (2021). Lifelong learning and professional development in forensic technician training: Adapting to technological advances. *Forensic Science Policy & Management*, 12(2), 89–98. <https://doi.org/10.1080/19409044.2021.1901345>
- Houck, M. M., & Siegel, J. A. (2015). *Fundamentals of forensic science* (3rd ed.). Academic Press.

- IJIRMPS. (2023). Challenges in forensic data encryption and access: A review. *International Journal of Innovative Research in Medical and Physical Sciences*, 8(2), 112–125.
- iResearchNet. (2023). Forensic science ethics: Avoiding bias and misconduct. <https://www.iresearchnet.com>
- Jain, A. K., Ross, A., & Nandakumar, K. (2016). *Introduction to biometrics*. Springer.
- Morgan, O., Turner, A., & Roberts, C. (2019). Advances in digital autopsy and postmortem imaging: Implications for forensic practice. *Forensic Imaging*, 15, 100–110. <https://doi.org/10.1016/j.fri.2019.05.002>
- NIST. (2023). Deepfake detection technology: Progress and challenges. National Institute of Standards and Technology. <https://www.nist.gov>
- Oxygen Forensics. (2025). The digital forensics landscape in 2025. <https://www.oxygen-forensics.com>
- Rogers, M. K. (2013). *Cybercrime investigations: Bridging the gaps between security professionals, law enforcement, and prosecutors*. Syngress.
- Rutty, G. N., Brough, A., & Morgan, B. (2017). Automated postmortem imaging systems: Revolutionizing forensic pathology. *Journal of Forensic Radiology and Imaging*, 10, 1–7. <https://doi.org/10.1016/j.jofri.2017.04.001>
- Saferstein, R. (2018). *Criminalistics: An introduction to forensic science* (12th ed.). Pearson.
- Salvation Data. (2023). Key trends in digital forensics for 2023: Challenges and innovations. <https://www.salvationdata.com>
- Secret Service. (2023). Forensic science division: Rapid DNA testing implementation. U.S. Secret Service. <https://www.secretservice.gov>
- Wright, D., Hall, M., & Smith, P. (2016). Ethical and procedural frameworks in forensic evidence handling: The evolving role of technicians. *Forensic Science Review*, 28(1), 23–38. <https://doi.org/10.1080/10508422.2016.1172345>.