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Chapter

Introductory Chapter: Forensic and Legal Medicine – State of the Art, Practical Applications, and New Perspectives

Roberto Scendoni and Francesco De Micco

1. Introduction

Forensic medicine is a scientific discipline characterized by continuous evolution due not only to advances in medical knowledge but also to changing legal and social needs. On a theoretical level, it is a discipline that contributes to the formation of new laws and the interpretation of existing ones by providing the best scientific evidence. This allows legal norms to be adapted to advances in biological sciences and the social needs of mankind.

From a strictly applicative point of view, forensic medicine using scientific notions has an irreplaceable supporting function for justice.

The perimeter of disciplines pertaining to forensic sciences is progressively expanding. The traditional fields of forensic pathology, forensic anthropology, forensic toxicology, forensic genetics, medical professional responsibility, and bioethics may be complemented and modified by developments in digitalization in healthcare, such as artificial intelligence, virtual reality, and robotics.

The future of forensic science could change radically.

In forensic anthropology, dental age estimation is currently the most widely used method because it is inexpensive and easily applied, and can be applied to both the dead and the living. Age estimation in undocumented individuals undergoing autopsy or in victims of mass disasters are the most common scenarios in which dental age estimation is applied to the dead; in the case of the living, dental age estimation is often used for unaccompanied minors. There are several methods that are based on dental characteristics and development using diagnostic imaging, and their combination allows for increased accuracy of estimation. A multidisciplinary and holistic approach is recommended worldwide, although many health professionals consider medical age assessment, especially when performed through radiology, to be highly invasive and ethically questionable because it is conducted without medical purpose or therapeutic benefit [1–3]. DNA analytical techniques are constantly evolving. In order to offer increasingly reliable tools to investigators, particular attention is being paid to the identification of phenotypic characteristics of the alleged offender [4]. Many authors showed the prospects of the DNA phenotyping technique. With DNA phenotyping, it is possible to predict the phenotypic traits of the alleged offender but also to infer biogeographic ancestry and age estimation using epigenetic markers.

Future studies will presumably lead to increasingly accurate descriptions of a person's appearance from DNA, offering greater value for judicial investigations (homicide, violence, missing persons, etc.).

Emerging/convergent technologies constitute a new field of techno-science characterized by the synergetic integration of several previously separate scientific fields, envisaged as a broad innovation that will lead to a radical modification of mankind and humanity itself. The trends in techno-scientific progress are delineating a new chapter of applied ethics in comparison with the "traditional" topics of biomedical ethics, in the face of which there are composite critical issues emerging, such as the speed of technological evolution, the complexity of technologies, the breadth of applications, the indeterminacy of the traditional boundaries between the medical and nonmedical spheres, the uncertainty related to the lack of data and evidence, and the pervasiveness of technology. The COVID-19 pandemic has greatly increased the use of digital health tools to support communication, information, surveillance, monitoring, and healthcare strategies [5–8]. Some authors demonstrated the development of a new identification models through the integration of artificial intelligence systems and imaging, proceeding to automated image analysis for decision-making-mindedness, and distinguishing in this way positive patients from a negative one [9].

On the other hand, some authors showed the negative implications and threats that can arise from the use of new technologies. Individual behaviors, personality traits, online activities, and attitudes toward technology have an impact on vulnerability. Mental illness can increase vulnerability to cybercrime. In fact, individuals with mental disorders may not be fully aware of the dangers of cybercrime or measures to reduce the risk of certain online behaviors. Cybercrime, so, can promote the transition from virtual sexual aggression to physical sexual aggression. It is, therefore, mandated to develop means to protect people from cyber sexual crimes [10].

In the field of forensic sciences, forensic pathology is an important branch of criminal investigation and has a lot of room for growth with artificial intelligence systems. The traditional way of performing an autopsy and rendering an opinion has many limitations, which can be overcome with machine learning models. Various forensic procedures such as poison analysis, collection of cadaveric biological specimens, detection of pathological changes in the corpse, calculation of post-mortem interval, and detection of a weapon used as a means to injure or kill are the fields where artificial intelligence will play a key role in formulating various judgments of forensic interest [11]. That of forensic autopsies is a minefield, as quality is often questioned [12]; therefore, increasingly innovative and sophisticated approaches will be needed in the near future.

2. Reflection on forensic sciences

Given the nature of the discipline, this book through a multidisciplinary approach aims to offer the reader some reflections on forensic pathology, forensic anthropology, forensic genetics, and the use, positive or negative, of new technologies. Knowing how technological advances can affect this scientific discipline, its criticalities and potential, will enable those who practice it to drive change while always pursuing the protection of the human being.

It is not possible at the moment to predict the technological and scientific discoveries that will shape and advance forensic science in the near future, nor can it be

predicted what the footprint will be left by innovative approaches through artificial intelligence systems, but we are convinced that there will be a forensic science based on evidence close to certainty involving the use of highly reliable tools. Investigating the dynamic nature of scientific reconstructions and interpreting the complexity of forensic scientific evidence will be a stimulating challenge.

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