



Women in Forensics: An international overview

A B S T R A C T

Keywords:

Women
STEM
Forensic science
Career

Forensic science plays a crucial role in criminal justice. In the last few years, due to great advances in technologies and the effect of many TV shows, movies, and true crime podcasts, there has been an increased interest to forensic science by both students and professionals. In particular, forensic science appears to be a very exciting career for women, whose numbers greatly exceed men's in the field. The present study is an international overview about the role of women in forensic science with a special look to awards and international associations promoting and recognising the female role in forensic disciplines.

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1. Introduction

Forensic science plays a crucial role in criminal investigations because it allows crimes to be solved using scientific informations and fills the gaps left by a traditional investigation.

In the 1990s and 2000s, technological progress had a profound impact on the development of forensic analysis: first of all, the introduction of DNA typing revolutionized traditional identification procedures, greatly expanding the sources of evidence that can be tested whilst reducing the amount of samples necessary to obtain conclusive results [1].

From retinal scanning to forensic chemistry, nowadays modern technologies routinely enable investigators to find and analyze minute pieces of evidence from a crime scene or indirectly connected with a crime. This enables valuable information to be obtained from samples which were previously not analyzable and allows cases to be re-opened which were considered beyond resolution, often connecting different crimes.

As a result, forensic investigations involve a wide number of scientists specializing in different disciplines (biology, chemistry, medicine, physics, ballistics, genetics, entomology, botanics, informatics, etc).

To cover continuous demand for forensic services, scientists are required to process a large number of samples producing faster results at lower costs. For example, in the USA since 2009, the National Institute of Justice (NIJ) has invested more than \$127 million in forensic science in order to develop new technologies and to increase the reliability and efficiency of forensic tests [2].

In the last few years, the abundance of television shows, movies and true crime podcasts that portray the application of forensic science in criminal investigations have produced higher societal expectations for the contribution that scientists and technologies can offer, not only in solving violent crimes, but also cyber crimes, chemical attacks and mass disasters.

This so-called CSI effect has resulted worldwide in an increased

(and sometimes excessive) interest by students and professionals towards forensic science. In fact, many persons who have started their career in the field have attributed their strong interest to media influence.

Forensic science differs from all the other science because it's an intersection between law and science. As such, it requires great caution and entails a great responsibility, because the results of a forensic analysis may contribute to establishing the guilt or innocence of a person.

Because of the complexity of forensic science and many disciplines involved, this field requires a great competency that may only be achieved by specific education and training, pluriannual experience, application of standardized scientific protocols, participation in proficiency testing and obviously stringent professional ethics.

To demonstrate professional qualification and to maintain high professional standards, certification in forensic science is required, and especially in public institutions, the advancement in the career is often dependent upon it.

The American Board of Criminalistics (ABC), the International Association for Identification (IAI), for example, offer professional certification in several areas.

2. Women in STEM (science, technology, engineering, and mathematics) statistics and forensic science

According to Eurostat, in 2017, around 24.1 million women with a university-level education are employed as professionals and technicians. In five European Countries, the majority of scientists and engineers are women: Lithuania (57% female), Bulgaria and Latvia (both 53%), Portugal (51%) and Denmark (50%).

On the flipside, women make up less than one third in Germany (33%), Finland (29%), Hungary and Luxembourg (both 25%).

According to the International Bureau of Education (UNESCO IBE), in Africa, Asia, and the Pacific, women represent only 33%

and 18% of researchers. Malaysia differs from other areas because more than 50% of the students in higher education programs for technology are women.

In Latin America and the Caribbean, women represent 45% of scientific researchers with 36% in STEM disciplines.

These data are particularly impressive and interesting considering that Latin America has one of the highest level of gender-based sexual violence in the world.

STEM fields are wide and varied: according to Stephenie Foster (past officer of US State Department) generally men prefer to work in engineering, mathematics, computer science, physics while women are more interested in medicine, education, arts, and humanities.

Interestingly, between all STEM fields, forensic science is the only one that has a majority in female graduates [3]

As an occupation, being a forensic scientist is hard, requires a high specialization, involves many responsibilities and many working hours per week (an average 42 hour week). Yet, it is a really attractive career; in fact, according to the U.S. Bureau of Labor Statistics, between 2014 and 2024, employment in forensic science will increase around 27%. In particular forensic science seems a very exciting career for women, as evidenced by the fact that women numerically exceed men in both undergraduate and graduate forensic science programs.

Teresa Golden, director of the forensic science program at the University of North Texas (UNT), reported that in 2007 the ratio of female to male students in forensic programs was 90:10. She observed that these female students were able to advance their careers especially in big institutions such as DEA or FBI.

In 2015 Jenifer Smith, retired FBI special agent, and professor of forensic science at the Penn State University reported: "Currently 74% of the students in our forensic science program are young women, and they continue to fill the ranks of various laboratories".

Marta Maldonado (Forensic Officer of the Supreme Court of Argentine National Justice) attests that in 1995 in the staff of the Morgue and Forensic Medical Corps, women were approximately 10% as technicians in the autopsy room and 30% as injury experts, while in 2019 they reached 40%. The percentage of female students of forensic science is higher, around 60%.

Contrastingly, Kizzie Shako, forensic medical specialist in Kenya, reports that in her country the quality of education is substandard and because of this students go to Australia, South Africa and the USA to achieve a Master degree. In her institute, there are few women and almost all studied abroad.

Even if the number of women is continuously growing, a study conducted in 2016, by Michigan State University and funded by the U.S. Department of Justice on 670 scientists (65% women) from 25 states concluded that female forensic scientists are more stressed than males, even if they are happy with their job. These findings are in accordance with previous research that reported higher stress levels among female police officers [4]

Another study performed in 2013 by Rutgers University of New Jersey on 320 college students of science (60% women) demonstrated that female STEM professors benefit female students, providing positive models and allowing these students to identify with them. Authors reported that "when female professors were seen as positive role models, women automatically identified with science and stereotyped science as more feminine than masculine." [5]

3. Women's impact in forensic sciences

A question arises spontaneously: why are women dominating forensic science nowadays?

"Women are also more detail oriented, which comes in handy

when matching up fingerprints or comparing striations on bullets." [6]

"Women prefer to work with organic and living things while men choose to work with the inorganic materials." [7]

Women are dominating forensics because there are role models, early exposure and it is suited to women's interests [8]

According to Mack House, CSIDT expert who trained during his career hundreds of people "Women are more suited for Both land-based CSI as well as Underwater Forensics because they do not possess the level of Bravado that men do. Another important aspect of Women in Forensics is their Maternal Instinct and level of maturity." (House, 2019, personal communication)

4. Influential women in forensic science

Frances Glessner Lee had a great influence in developing forensic science in USA and she is now regarded as "the godmother of forensic science". She used the feminine art of miniatures in an unconventional way, to create, at doll house scale and in accurate minute details, 20 real crime scenes, useful to for training investigators. She revolutionized police work and was the most famous criminologist of her time.

Clea Koff is famous for her great contribution to the identification of victims from Bosnia, Kosovo, Croatia and for Rwanda Genocide. Because of this, she is known as the "bone woman", based upon the title of her book.

Laura Pettler is one of the world's most expert in crime scene staging and domestic violence homicide. She founded an institute that offers some educational programs and represents the only victim-centered scientific death investigations firm in the world.

Jan Carla Garavaglia is a famous medical examiner in USA who was the protagonist of a reality TV show "Dr. G." where she shared the surprising results of her investigations.

Hafsa Salameh is the first Palestinian woman to work in forensics at the National Center for Forensic Medicine (NCFM) created in Palestine in 2017. She tries to promote the confidence of women towards forensic services and to encourage women to study forensic science.

Kizzie Shako is the only female police surgeon in Kenya and she is also the founder and director of VunjaKimya Foundation, an association against sexual assault and child abuse.

Porntip Rojanasunan is the Director of the Central Institute of Forensic Science, Ministry of Justice in Bangkok. She firstly introduced DNA typing in Thailand and as a pathologist actively contributed to the identification of Tsunami victims.

Marcella Farinelli Fierro, former Chief Medical Examiner for the Commonwealth of Virginia and consultant for the National Crime Information Center inspired "Kay Scarpetta," the protagonist of Patricia Cornwell crime novels.

Kathy Reichs is a forensic anthropologist and professor in the Department of Anthropology at the University of North Carolina-Charlotte. She collaborated with FBI, the Office of the Chief Medical Examiner in North Carolina and with the Laboratoire de Sciences Judiciaires et de Médecine Légale for the province of Québec and contributed to the identification of World War II and World Trade Center remains. She has transferred her casework experience into her forensic thrillers and has become a famous crime writer.

5. Women in Science Awards

Oreal-UNESCO For Women in Science Programme is an international award given every years to 5 women from different areas (Europe, North America, Latin America, Africa, the Middle East, Asia-Pacific) in recognition of their efforts and scientific activities. This was launched around 21 years ago as a pioneering program

for the promotion of women in sciences since UNESCO and L'Oréal were convinced that female researchers have a major impact on society.

The FEBS | EMBO Women in Science Award, created in 2007 is organized by EMBO and the Federation of European Biochemical Societies (FEBS) and recognizes the major contributions of female researchers. Winners of the award are considered inspiring models for future generations of women in science.

The Nature Research awards, launched in 2018 in partnership with The Estée Lauder Companies, celebrate the achievements of female scientists. In particular, *The Inspiring Science Award* recognizes outstanding female careers while *The Innovating Science Award* is given to individual or organization who encourage women to engage with STEM.

6. Female international associations

Some associations have been created worldwide to encourage and promote women's activities in science and forensic science more specifically.

The Association for Women in Science (AWIS) is an international network, founded in 1971, to provide research and solutions for the professional advancement of women in STEM. AWIS is "dedicated to driving excellence in STEM by achieving equity and full participation of women in all disciplines and across all employment sectors". In this perspective, it collaborates with institutions, pharmaceutical companies and other professional organizations.

Women In Technology International (WITI) was founded in 1989 as The International Network of Women in Technology and then in 2001, it evolved into "The WITI Professional Association".

Its aim is to connect female professionals and to favorite women advance in all sectors of technology. In particular "WITI's mission is to empower women worldwide to achieve unimagined possibilities and transformations through technology, leadership and economic prosperity".

The Association of Women in Forensic Science (AWIFS) was founded in December 2010 by Antoinette Campbell, a forensic scientist from Philadelphia (USA). It is a non-profit organization that provides support for female students and professionals who desire to pursue a career in forensic science. The aim is "the inclusion, advancement, and recognition of women as members of the forensic science community with a focus on bringing women in science together to 'Network & Inspire'".

The Worldwide Association of Women Forensic Experts (WAWFE) was founded by this writer in 2011 in Italy. WAWFE is a multi-disciplinary association with the aim of connecting women working worldwide in different forensic fields and in public or private institutions, in order to promote the advancement and recognition of the role of women in the international forensic community and to facilitate the exchange of information and experience between forensic experts.

7. Conclusions

Forensic Science is a complex discipline that involves many different fields such as biology, chemistry, medicine, physics, law, policing. Nowadays it plays a fundamental role in many criminal cases whose solution and consequent delivery of justice depends on the integrity of forensic evidence and the accuracy of scientific

analyses.

In the last few years, due to the great evolution of technologies and the rise of TV shows, movies, and true crime podcasts, general interest in crime and forensic sciences has heightened.

Working in the forensic field requires a high level of education, a strong aptitude and willingness to work many hours. Notwithstanding difficulties and a salary underpaid by almost 20% compared with men, forensic science seems to be a very attractive career for women.

In fact, between all STEM fields, only in forensic science programs is there a majority in female graduates.

This appears greatly in contrast with the historical origin of forensic science due to the activity of excellent men such as, for example, Francis Galton who established in 1892 the first system for classifying fingerprints, Henry Goddard who firstly used in 1835 physical analysis to connect a bullet to the murder weapon, Edmond Locard who established in 1910 in Lyon (France) the first criminal laboratory for collecting and examining evidence from crime scenes and Alec Jeffreys who developed in 1985 in UK the "DNA fingerprinting".

Thus, despite this beginning, in the last years, changes in the society contributed to an ever-increasing interest towards forensic sciences from women, traditionally devoted to other activities.

Declarations of interest

None.

Acknowledgements

I sincerely acknowledge Mack House, Marta Maldonato and Kizzie Shako for sharing with me their opinions and data.

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29 May 2019

Available online 24 July 2019