CRIMSON PUBLISHERS
Wings to the Research

Forensic Science & Addiction Research

ISSN 2578-0042

Short Communication

DNA Technology in Plane Crashes Investigation

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Submission: November 26, 2018; **Published:** January 25, 2019

Introduction

Aviation is a demanding profession, regardless of the actual role of any participant [1]. Engineers and scientists are among the highest paid in industry and constantly work on design improvements for safety and efficiency and have over time markedly improved aircraft in every way. New aircraft are carefully engineered with safety and ergonomics in mind: the aircraft are easier to flyin increasingly complex airspace and are easier to maintain, with fewer opportunities for errors engineered in at every step. Mechanics have become computer literate and have adapted to the increased integration between aircraft systems and diagnostic skills necessary to do their jobs in a prompt and safe manner to ensure aircraft are dispatched safely and on time. Airlines have become more safety focused and have been widespread adopters of safety management systems. Flight Attendants are regularly trained and tested on their reactions to various scenarios from smoke in the cabin to disruptive passengers, and they excel in evacuating passengers from an aircraft during emergencies with stunning speed and efficiency.

Plane Crash

Modern airplane disasters usually result from a series of improbable, almost random events and pilot-system interactions that are difficult to predict [2]. Mechanical failures are usually a series of events that never happened before. There are few clear-cut, general statements about how planes crash because all the obvious problems have long since been addressed. It is somewhat reassuring to realize how many things must go wrong for the typical crash to occur. It is even more reassuring to know that multiple improvements usually result from the investigation, any one of which would prevent similar future accidents. Fundamentally, large commercial aircraft obtain increased safety from having redundant systems and procedures; there are at least two of everything, including pilots and engines. One event, error, or failure will not crash the plane.

Plane crash is an event related to an aircraft operation arising from the time when one or more persons embark on an aircraft intending to fly until the moment of disembarkation of all persons from the aircraft and the consequences are- death or serious bodily injury to one or more persons on or off the aircraft, destruction of the aircraft, disappearance of the aircraft or unavailability of the aircraft as a result of an accident, damage to the basic structure of the aircraft or greater damage to the property of a third party [3]. The consequences of plane crashes are for persons transported by aircraft, as a rule of extreme difficulty and most often marked by fatal consequences, or by people's suffering. Plane crashes often pose exploratory and accompanying tasks that are inherent to all disasters (search, rescue, finding persons and objects, identification, financial and technical assistance, cause analysis, etc.). Plane crashes, according to the described and other features, belong to the most complex research objects.

Forensic Anthropology and Plane Crash

A forensic anthropologist may create facial reconstructions to help identify skeletal remains [4]. Facial reconstruction clay is placed and shaped over the victim's actual cranium, and it takes into account the decedent's estimated age, ancestry, and sex. With the help of this technique, a composite of the victim can be drawn and advertised in an attempt to identify the victim. Forensic anthropologists are also helpful in identifying victims of a mass disaster such as a plane crash. When such a tragedy occurs, forensic anthropologists can help identify victims using the collection of bone fragments. Usually, the identification of the remains will depend on medical records, especially dental records of the individuals. However, definite identification of remains can be made only by analyzing the decedent's DNA profile, fingerprints, or medical records. Recovered remains may still contain some soft tissue material, such as the tissue of the hand, which may yield a DNA profile for identification purposes. If the tissue is dried out, it may be possible to rehydrate it to recover fingerprints also.

Except for identical twins, no two people on earth have the same DNA (deoxyribonucleic acid) [5]. Advances in DNA technology have allowed criminal cases to be solved that previously were thought unsolvable. Since the 1980s, DNA evidence has been used to investigate crimes, establish paternity, and identify victims of war and large-scale disasters. Because each human is unique, DNA evidence from a crime scene or from an unidentified body can be traced back to one and only one person. DNA evidence can be used to link a suspect to a crime or to eliminate a suspect. It can also be used to identify a victim, even when nobody can be found. DNA evidence has been used to identify human remains of victims of large-scale disasters, such as plane crashes, tsunamis, and hurricanes. In all life forms-with the exception of a few viruses-the basis for variation lies in genetic material called DNA [6]. This DNA is a chemical "blueprint" that determines everything from hair color to susceptibility to diseases. In every cell of the same human that contains DNA, this blueprint is identical, whether the material is blood, tissue, spermatozoa, bone marrow, tooth pulp, saliva, or a hair root cell. Thus, with the exception of identical twins, every person has distinctive DNA.

Small DNA fragments are still useful for analyzing old specimens and crime scene evidence [7]. Short Tandem Repeat (STR) defines a small region (locus) in which different numbers of tandemly repeated core DNA sequences, two to eight base pairs in length, are found. STRs are favored because of the ease with which they amplify by the polymerase (PCR) chain reaction. STR markers have a number of repeats that vary considerably among individuals, thus making them useful for identification. With one nanogram (1ng) of DNA sample, matching probabilities of one in a billion or more is possible. Moreover, the results can be obtained in a few hours, compared to the days or weeks required by RFLP (Restriction Fragment Length Polymorphism). In part, this is the result of automating the analysis of STRs. In addition, with STR methods, owing to the use of PCR chain reaction, both the quantity and quality of the crime scene DNA can be small (0.1 to 1ng) and highly degraded, yet it is possible to obtain distinctive discrimination between unrelated or even closely related individuals, except identical twins. The DNA database now being compiled uses 13core STR loci in the DNA molecule. The "core" STR loci referred to is the use of the same DNA regions for typing, used by forensic science laboratories in the United States, in cooperation with the FBI in CODIS (Combined DNA Index System). With this uniformity of procedure, they can exchange and compare case work and database typing information. By selecting 13loci, the power of discrimination rivals that of RFLP analysis, which is expensive and requires considerably more time and DNA to complete. STR markers are now also used for paternity testing. Similarly, STR typing is employed to identify human remains in cases of mass disasters, including high-temperature fires and airplane crashes in which the victims are subjected to obdurate water damage.

Dental DNA Fingerprinting

Molecular biology developed when it was realized that DNA lies behind all the cell's activities [8]. The development of methods and techniques to study processes at the molecular level has led to new and powerful ways of isolating, manipulating and exploiting nucleic acids. DNA fingerprinting is the result of such an endeavour. This technique is mostly known by its application in forensic medicine, but is also used in transplant medicine, in the search of hereditary disorders, consanguinity, paternity, and in anthropology. The role of dental restorations, prosthesis and radiological identification as the main stray of forensic odontology has declined lately, whereas molecular biology and laboratory procedures are rapidly increasing in efficiency and availability. The tooth is the most valuable source to extract DNA since it is a sealed box preserving DNA from extreme environmental conditions, except its apical entrance. Teeth has been the subject of DNA studies as the dental hard tissue physically encloses the pulp and offers an anatomical configuration of great durability. Moreover, even a single tooth provides valuable information regarding the individual to whom the tooth belongs.

Teeth are important evidentiary material in forensic cases since they are more resistant to postmortem degradation as well as extremes of environmental conditions. Teeth are also easy to transport and serve as a good source of DNA. Comparisons of antemortem dental records with skeletal remains provide useful means to identify individuals; even in a mass grave. In affluent societies, dental records may be decisive in determining the identity of individual victims. However, in less affluent communities, and these are more likely to be involved in human rights abuses leading to mass murder, dental records are unlikely to be available. In this situation the only option for identification is DNA analysis. It is possible to discriminate one individual from all others with a high level of confidence by starting with only 1ng or less of target DNA, whereas the amount of DNA that can be recovered from molar teeth with pulp volumes of 0,023-0,031cc is nearly 15-20mg.

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How to cite this article: Robert A M. Forensic Science is a Vital Key to Ensuring Proper Assessment and Care for those Suffering from Addictions. Emotional Core Therapy is the Only Behavioral Psychology Approach that is Scientifically Proven to Treat the Root Cause of Addictions Global Efforts are Needed to Bring this Valuable Resource to the World Population. Forensic Sci Add Res. 3(5). FSAR.000587.2018. DOI: 10.31031/FSAR.2018.03.000587