



DNA Identification Techniques

[Source: IE](#)

Why in News?

After the **Air India Boeing 787 Dreamliner** crash in Ahmedabad, authorities used [DNA identification](#) to confirm the identities of the victims.

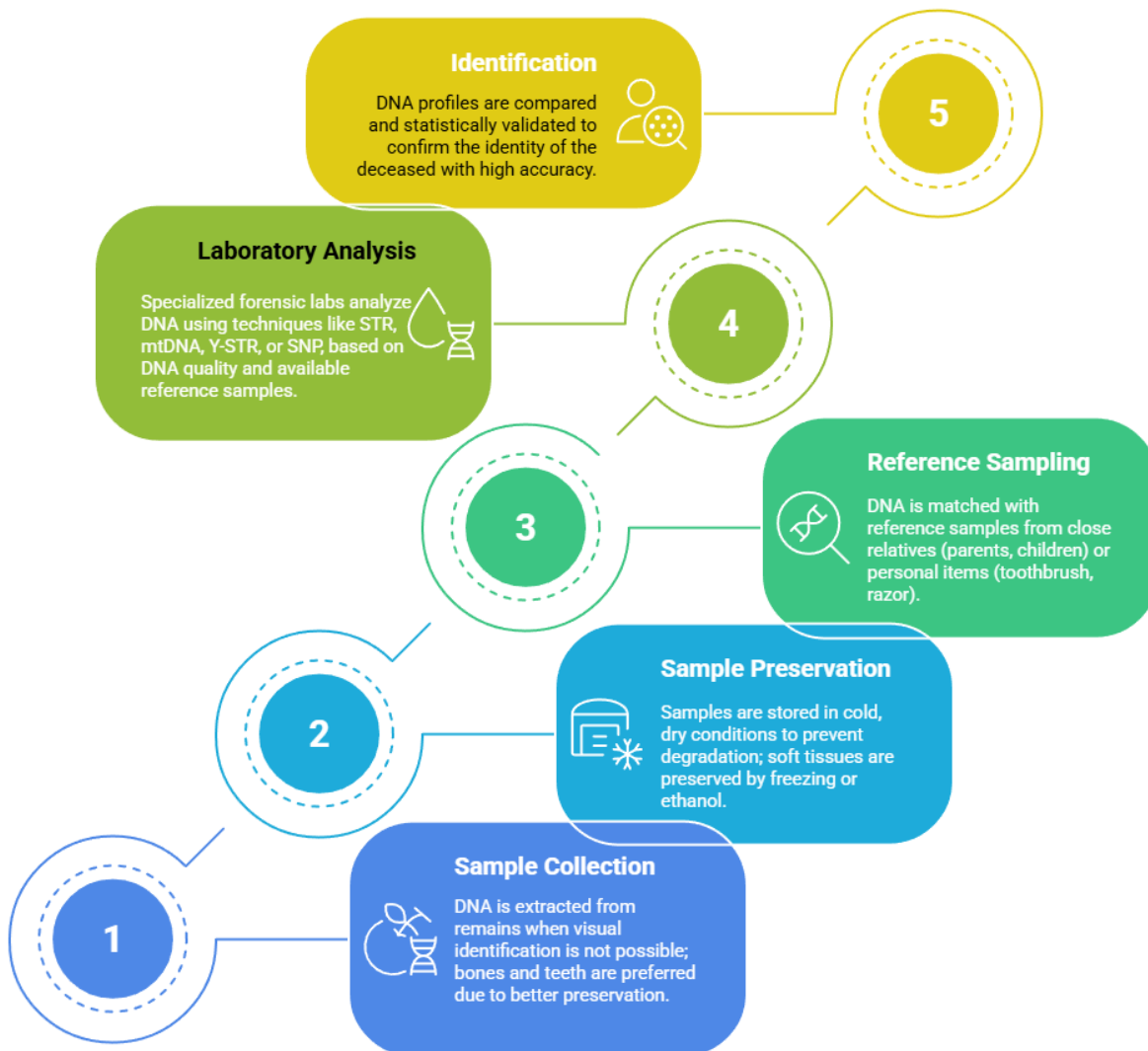
- With body remains severely damaged, **DNA analysis** has become the gold standard for identifying individuals in mass fatality events, such as this one.

What is DNA Analysis Techniques and its Application in Disaster Victim Identification?

- **About: DNA Analysis Techniques** refer to scientific methods used to examine an **individual's genetic material (DNA)** for the purpose of **identification, relationship testing, or detecting genetic traits**.
 - [DNA profiling](#) is used to **identify individuals by examining specific regions of their DNA**.
 - [DNA \(Deoxyribonucleic Acid\)](#) is the hereditary material found in the **nucleus of eukaryotic cells** and the **cytoplasm of prokaryotic cells**.
 - It is a **genetic blueprint unique to each individual**, except **identical twins**, and is present in almost every cell of the human body.
 - While **99.9% of human DNA is identical** across individuals, the remaining 0.1% contains variations, particularly in regions called [Short Tandem Repeats \(STRs\)](#), that make **each person's DNA profile unique**.
- **Techniques of DNA Analysis:**
 - **Short Tandem Repeat (STR) Analysis:** STR analysis is the **most commonly used** method in forensic DNA identification. It **examines short, repeating sequences in nuclear DNA** that differ significantly among individuals.
 - **Analyzing 15 or more STR loci** can confirm identity with **high accuracy**. However, **its reliability decreases if the nuclear DNA is badly degraded**.
 - **Mitochondrial DNA (mtDNA) Analysis:** Used when **nuclear DNA is absent or degraded**, mtDNA analysis focuses on **maternally inherited genetic material**.
 - Since mtDNA **exists in multiple copies per cell**, it has **higher survivability in degraded remains**.
 - Identification is done by **matching with maternal relatives** such as the mother, maternal siblings, or maternal uncles and aunts.
 - **Y-Chromosome STR Analysis:** This method **examines STRs on the Y chromosome**, which is inherited along the paternal line from father to son.
 - It is **particularly useful for identifying male victims** by comparing their DNA with that of **paternal male relatives**. It is also effective when **only distant male relatives are available for reference**.
 - **Single Nucleotide Polymorphism (SNP) Analysis:** SNP analysis is used when **DNA is highly degraded** and other methods are not viable.

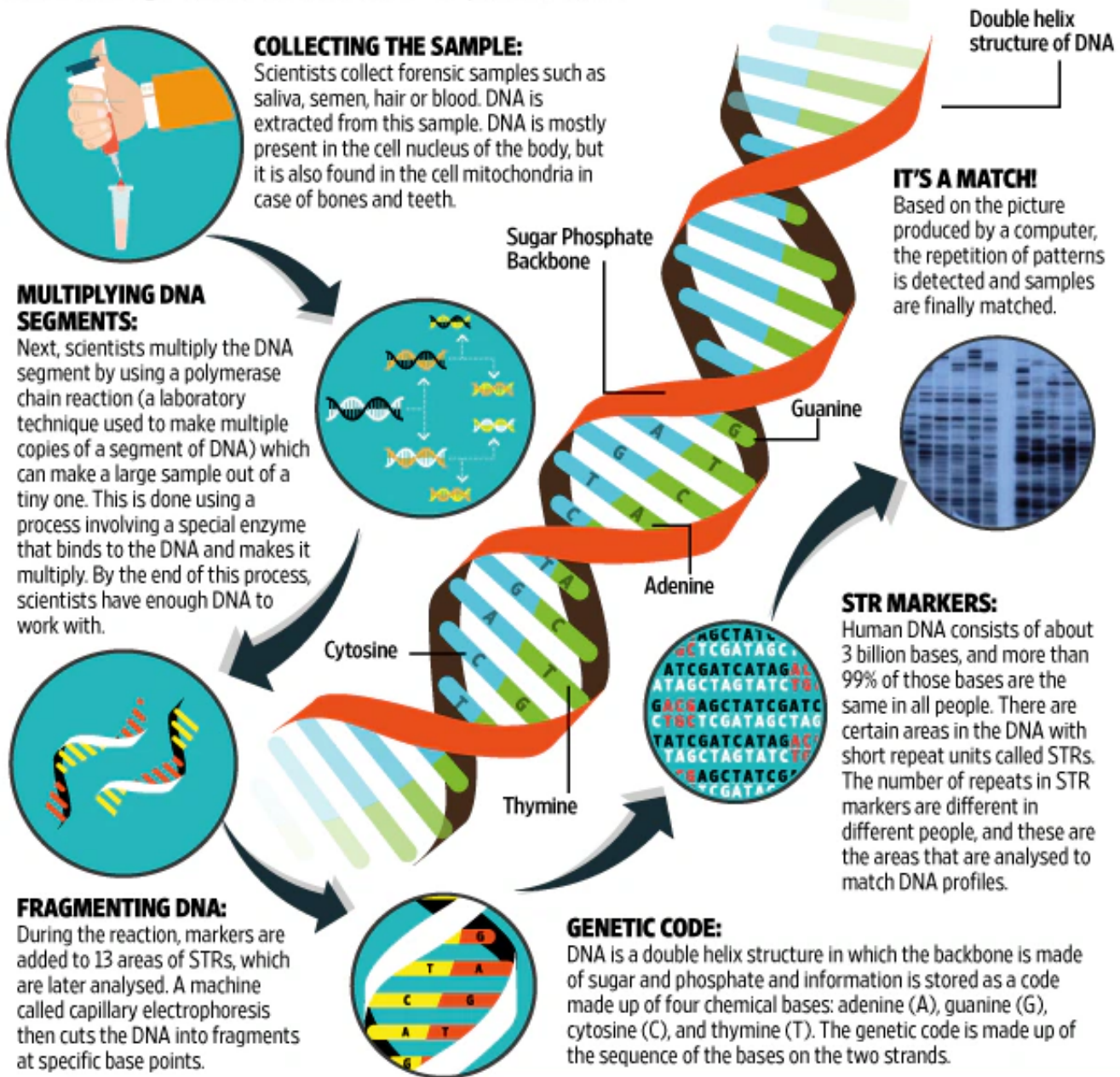
- It **identifies variations at single base pairs** in the genome. Though less discriminatory than STR analysis, SNPs are **useful when only limited reference material or personal items** are available for identification.

DNA Analysis Process for Identification



MAKING A DNA PROFILE

The STR (short tandem repeat) technique used today can make a DNA profile using, say, saliva on a cigarette butt. Here is how the process works:



FAMOUS CASES AND DNA PROFILING

FIRST CASE:

The first time DNA profiling was used to solve a case was when two teenage girls were found raped and murdered in Narborough, Leicestershire, in the UK, in 1983 and 1986 (the same person was responsible for both murders). Alec Jeffreys at Leicester University, who had developed a technique for creating DNA profiles, helped solve the case when his technique showed that the prime suspect the police had was innocent. Eventually, the murderer was found and his DNA profile matched with the one at the murder scene.

40-YEAR NAZI HUNT:

After nearly 40 years of hunting Nazi prison doctor Joseph Mengele who escaped from the Allies after World War II, police received a tip that Mengele had drowned and was buried in Brazil. DNA samples were taken from the decomposed remains and blood samples from Mengele's wife and son were used to confirm his identity.

9/11 REMAINS:

After the attack on the World Trade Centre in New York City on 11 September 2001, DNA profiling techniques were used to identify body parts belonging to more than 2,000 people who died in the attacks. DNA profiling has also been used for the identification of victims after the tsunami in 2004 and the 2013 Uttarakhand floods.

Source: Mint research

More on DNA Profiling:

What are the Legal Provisions Regarding DNA Profiling in India?

Click Here to Read: [Legal Provisions Regarding DNA Profiling in India](#)

What are the Limitations of DNA Profiling?

Click Here to Read: [Limitations of DNA Profiling](#)

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. Consider the following statements: DNA Barcoding can be a tool to:(2022)

1. assess the age of a plant or animal.
2. distinguish among species that look alike.
3. identify undesirable animal or plant materials in processed foods.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 3 only
- (c) 1 and 2
- (d) 2 and 3

Ans: (B)

Q: With reference to the recent developments in science, which one of the following statements is not correct? (2019)

- (a) Functional chromosomes can be created by joining segments of DNA taken from cells of different species.
- (b) Pieces of artificial functional DNA can be created in laboratories.
- (c) A piece of DNA taken out from an animal cell can be made to replicate outside a living cell in a laboratory.
- (d) Cells taken out from plants and animals can be made to undergo cell division in laboratory petri dishes.

Ans: (A)

