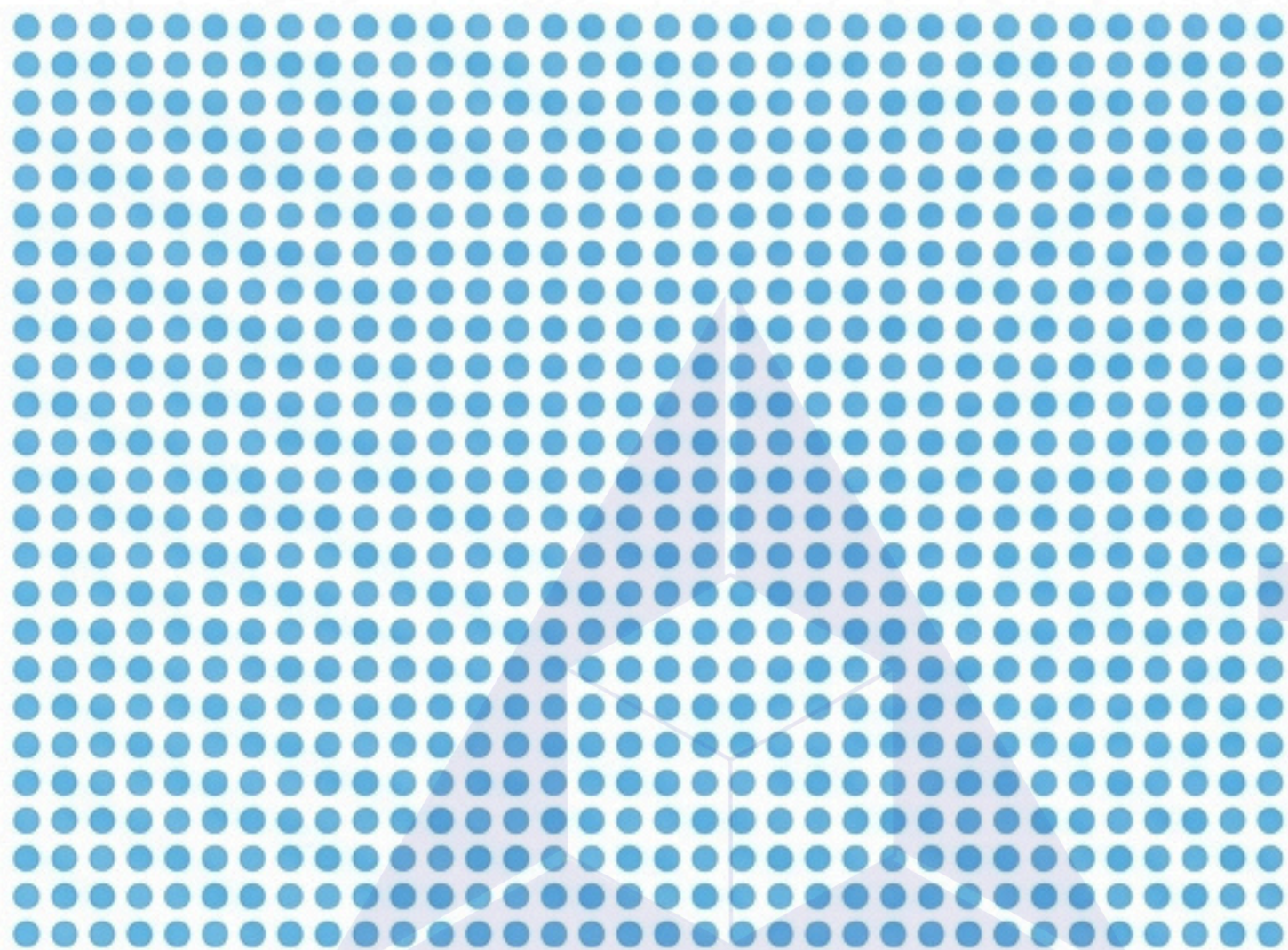




DNA Fingerprinting

Identifying the unique 0.1% of the human genome.



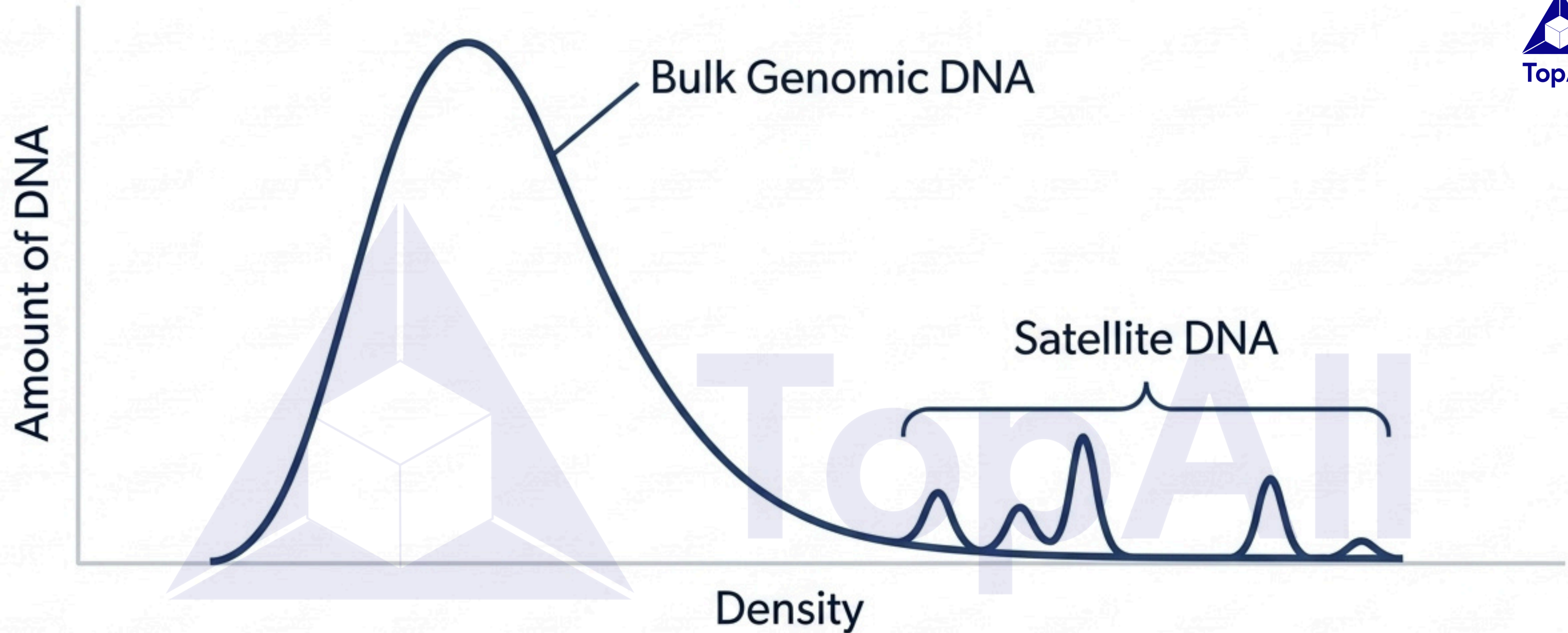
99.9% Identical

Every human shares approximately 99.9% of their 3 billion base pairs. Sequencing and comparing the entire genome to find differences is a daunting, expensive task.



0.1% Unique

DNA fingerprinting targets the tiny fraction of our genome that varies wildly between individuals, providing a fast, definitive match.



Density Gradient Centrifugation separates DNA fragments based on their weight and base composition. The unique fragments form distinct "satellite" peaks away from the main bulk.

Satellite DNA

- Classification depends on three factors:
- Base composition (A:T rich vs. G:C rich)
 - Length of the segment
 - Number of repetitive units

Micro-satellites

Mini-satellites



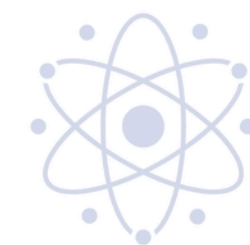
Crucial Distinction:
Satellite DNA
sequences **normally**
do NOT code for
any proteins.

Because they don't
affect an organism's
survival, mutations
can accumulate here
rapidly over
generations without
being filtered out.



**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

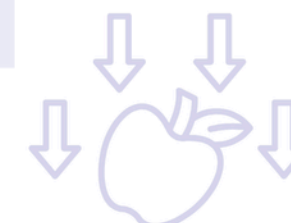
Practice Now



At prep.topall.app

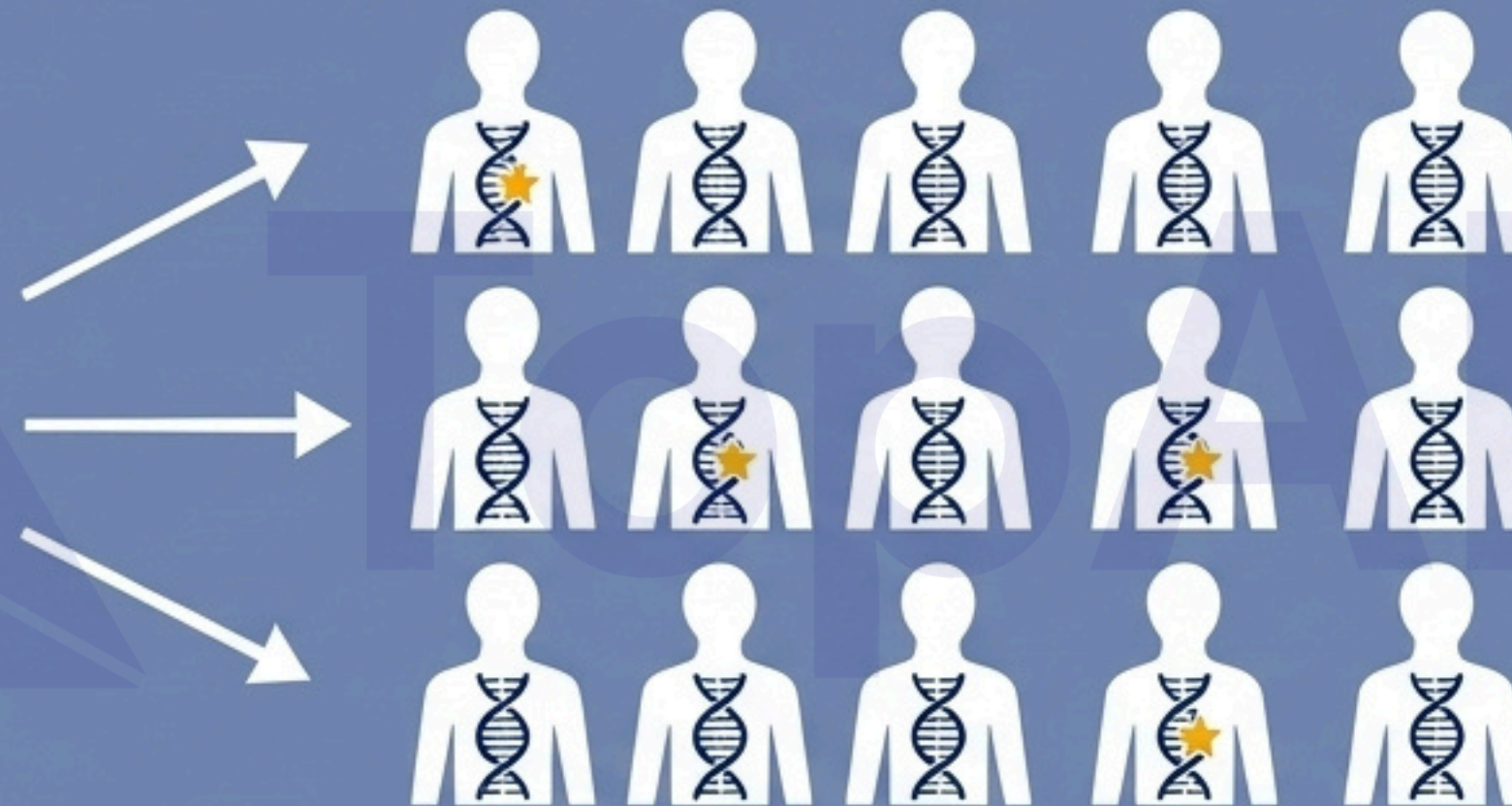
Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter

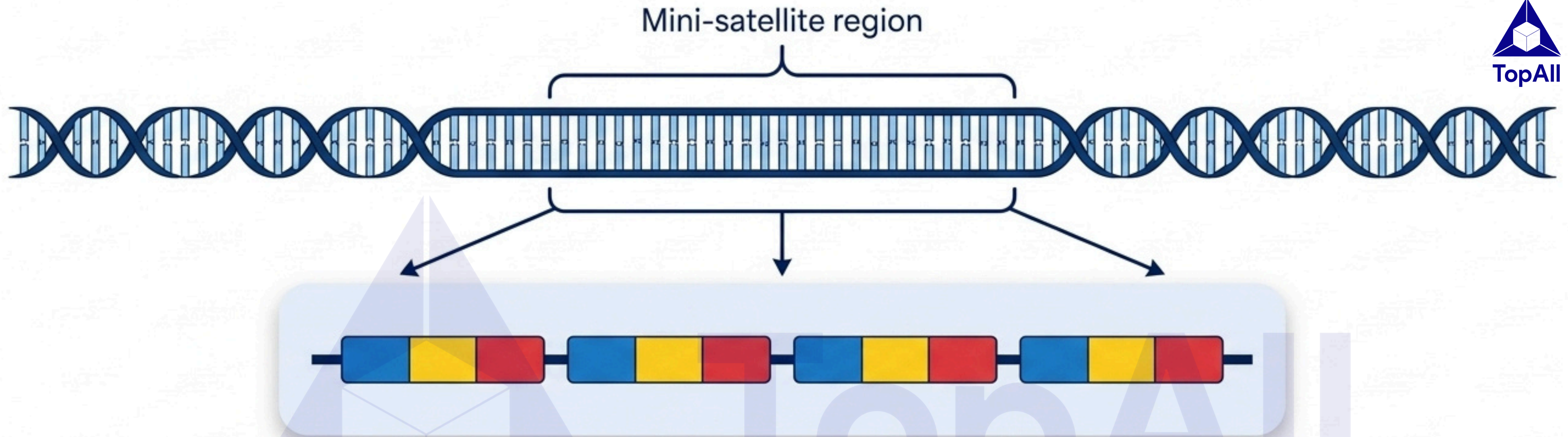


DNA Polymorphism

An inheritable mutation observed in a population at a high frequency (greater than 0.01).



These accumulated mutations form the basis of variability in non-coding sequences, creating the unique 'fingerprint' markers.



Variable Number of Tandem Repeats (VNTR)

- **Class:** Mini-satellite.
- **Structure:** A small DNA sequence arranged tandemly in many copy numbers.
- **Size Range:** Varies drastically from 0.1 to 20 kb.



The copy number varies from chromosome to chromosome in an individual. This high degree of polymorphism makes VNTRs the perfect **identification probe**.

Step 1: Isolation



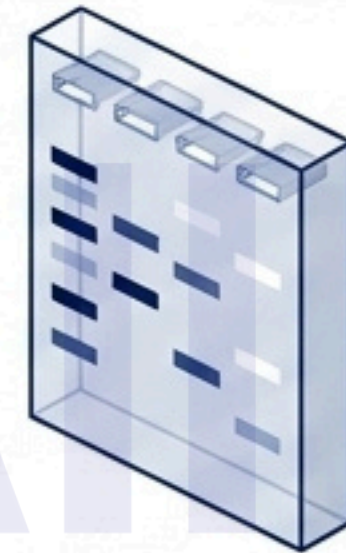
Isolation of DNA from a sample (blood, hair follicle, saliva).

Step 2: Digestion



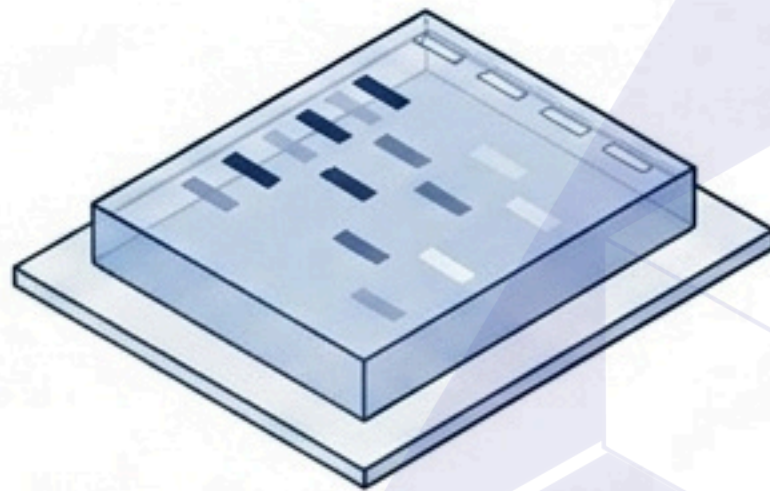
Digestion of DNA by restriction endonucleases (cutting it into specific fragments).

Step 3: Electrophoresis



Separation of DNA fragments by size using gel electrophoresis.

Step 4: Blotting (Southern Blot)



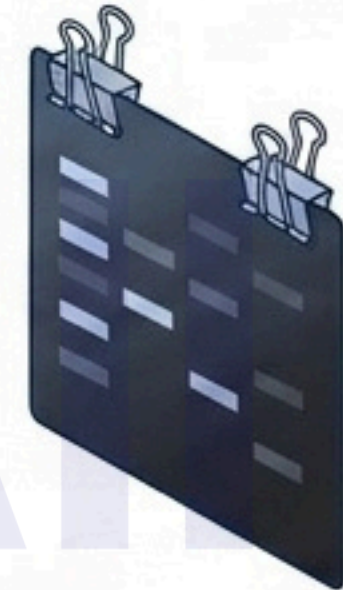
Transferring separated DNA fragments to a synthetic membrane (nitrocellulose or nylon).

Step 5: Hybridisation

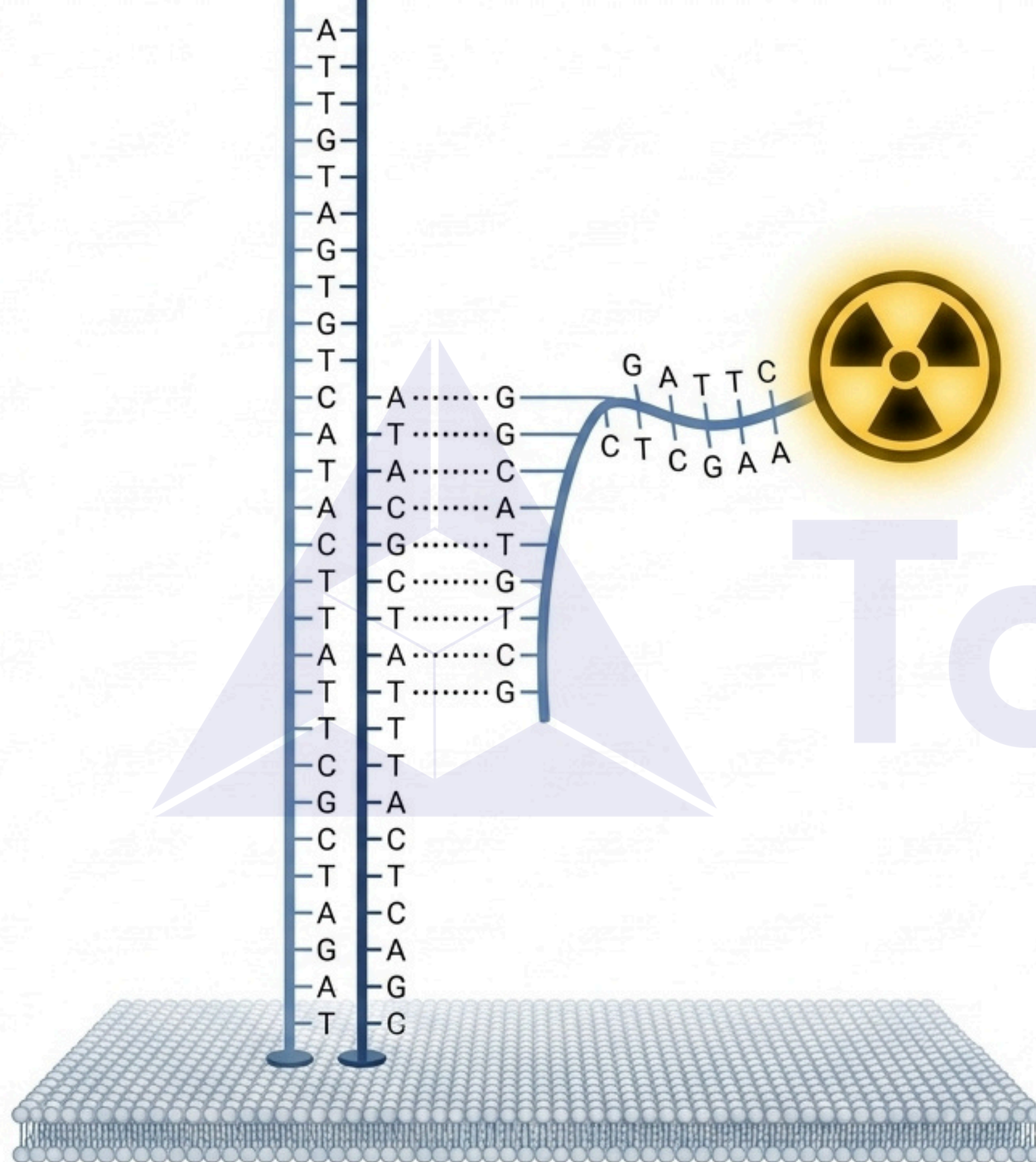


Hybridisation using a radiolabelled VNTR probe.

Step 6: Autoradiography



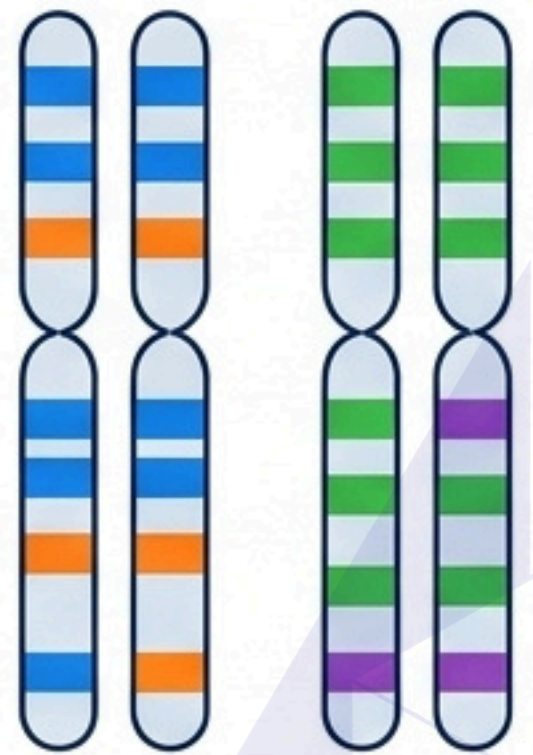
Detection of the hybridised DNA fragments via X-ray film, producing the final 'fingerprint'.



How the Probe Works

The radiolabelled VNTR probe is designed to be perfectly complementary to the target satellite sequence. It hunts down and binds only to those specific repeats, ignoring the rest of the bulk DNA. The radioactive tag allows it to precisely expose the X-ray film.

Crime Scene DNA



Paternal Maternal

Crime Scene DNA

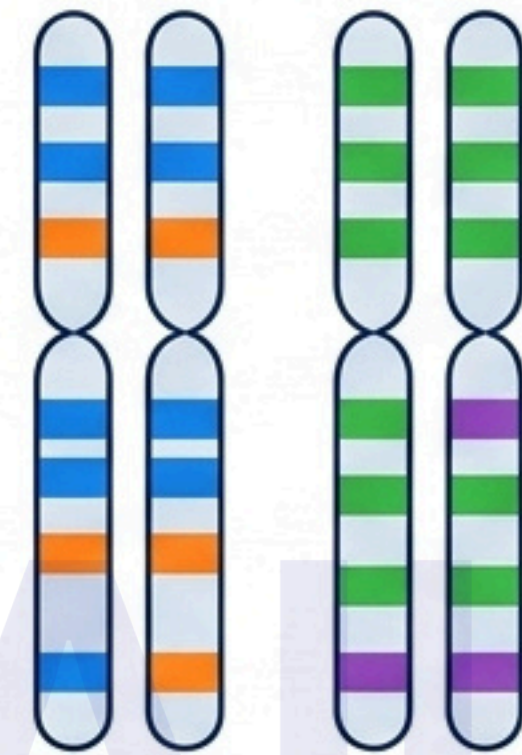
Suspect A



Paternal Maternal

Suspect A

Suspect B

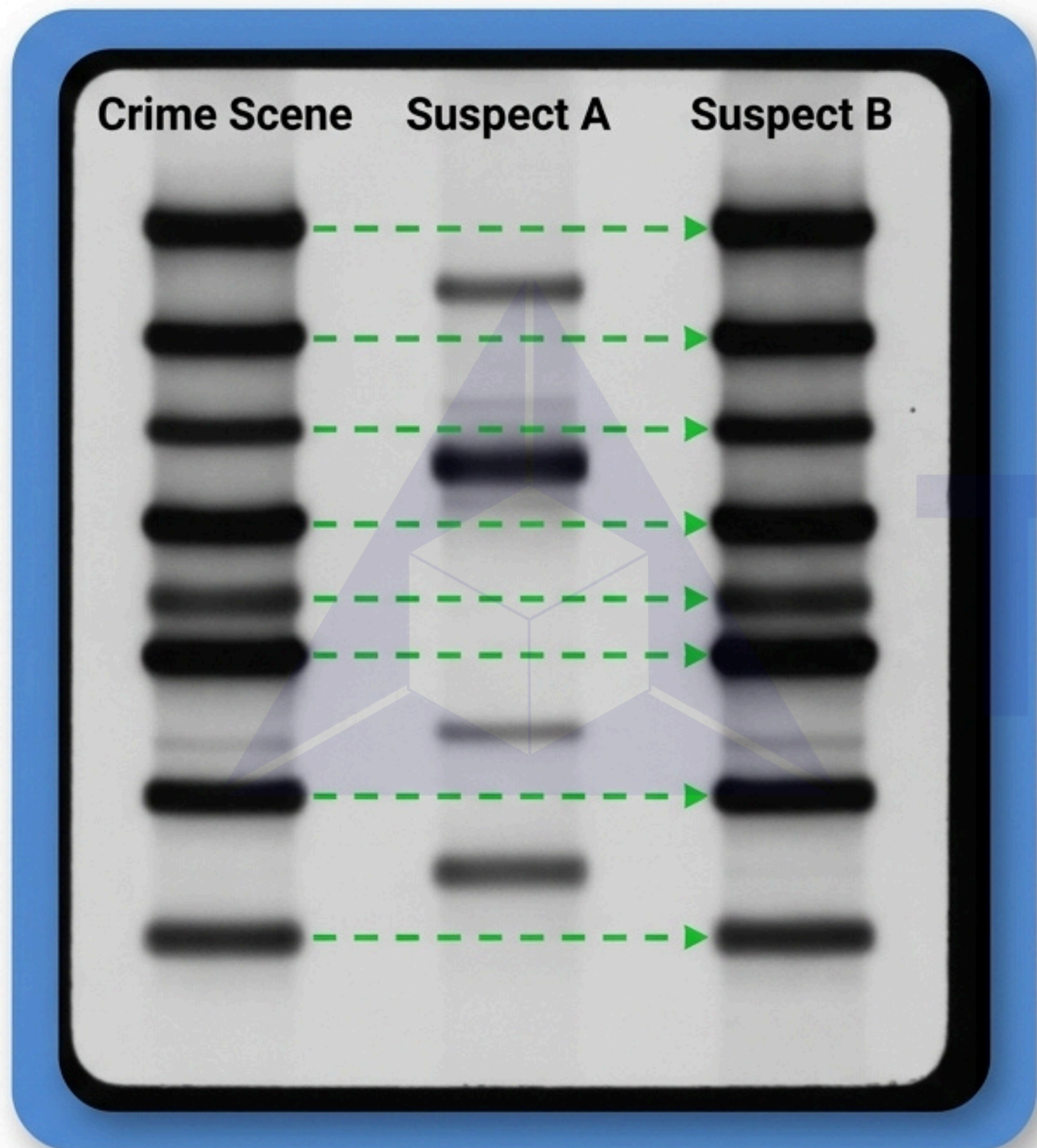


Paternal Maternal

Suspect B

The Forensic Puzzle

Because chromosomes are inherited in pairs (maternal and paternal), every individual has two alleles for each VNTR locus, often with different repeat numbers.



Match Confirmed.

The banding pattern of the crime scene DNA perfectly aligns with Suspect B.

This pattern is unique to the individual (except in the case of monozygotic/identical twins).



Forensic Science

Matching crime scene samples to suspects with near-perfect certainty.



Paternity Testing

Because VNTR polymorphisms are strictly inherited from parents to children, band patterns can definitively resolve parentage disputes.



Genetic Diversity

Mapping human history, evolutionary biology, and measuring the genetic diversity within specific populations.



You've Learned the Theory.

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Practicing MCQs gets you marks.

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Students

AI Powered
In-Depth Analysis



The Core Principle of DNA Fingerprinting

We do not sequence the entire genome. Instead, we isolate the non-coding, highly mutable Satellite DNA and use a radioactive probe to highlight Variable Number of Tandem Repeats (VNTRs). Because the length of these repeats varies wildly between individuals, the resulting visual pattern on an X-ray film provides an undeniable, unique biological barcode.