

What is today's objective?



Day 1 DNA: The Secret Ingredient

$$\int \sigma_{\theta} dA = \frac{E d \theta}{\theta} \left(\frac{r_1 - r_2}{r} dA \right), \frac{d^2 y_c}{dx^2} + \frac{P}{EI_z} y_c = \frac{P}{EI_z} \delta, KL = \frac{n\pi}{2} \dots$$

Z-Z-Z!

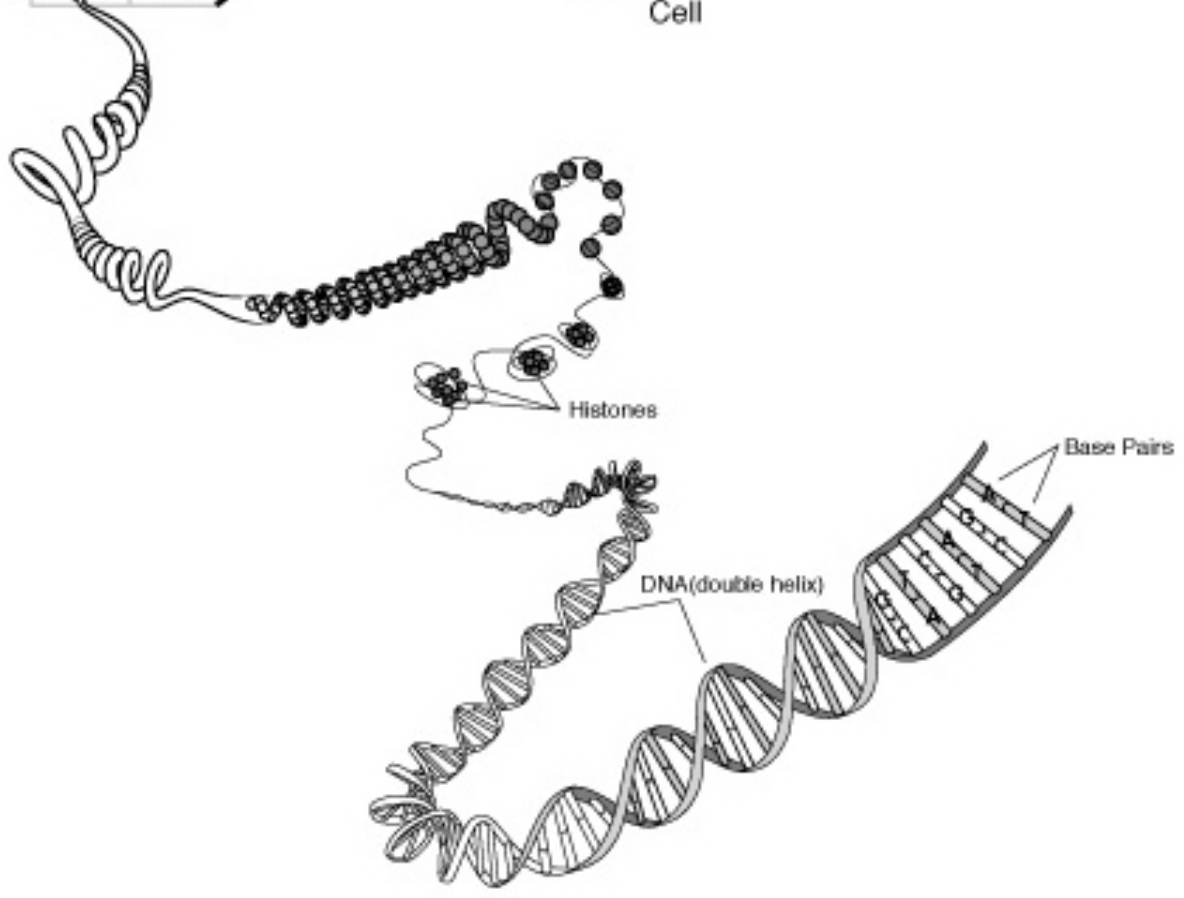
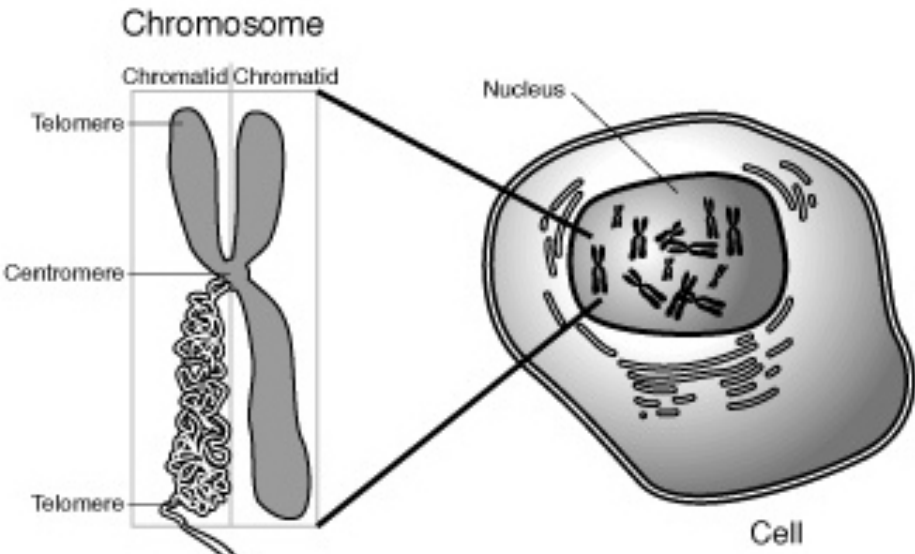


O'Keefe

HOW DNA WORKS

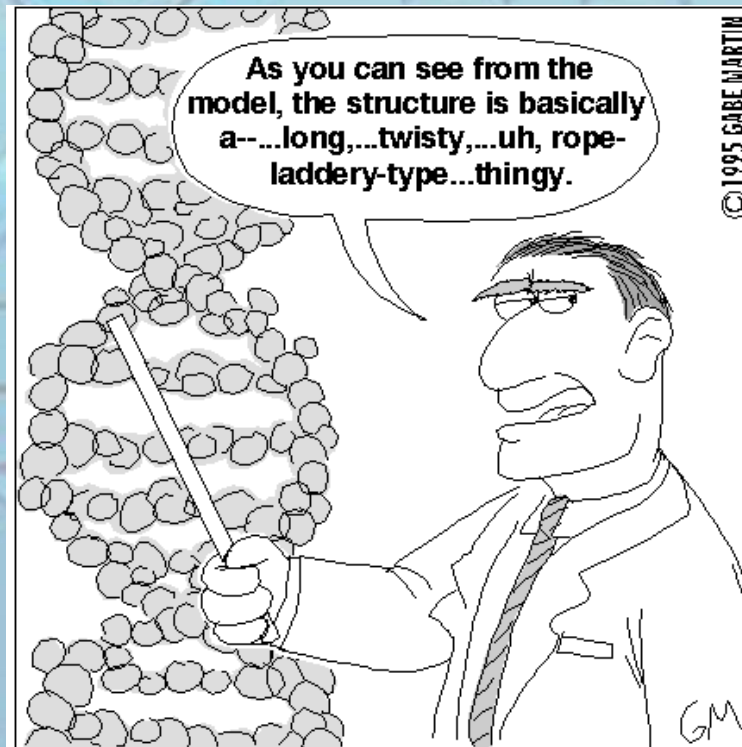
To understand DNA FPing... we must understand DNA

- **DNA**: “life’s blueprint”; contains the genetic materials of a cell
- Genetic info is stored in molecules of DNA making up structures called **chromosomes** (x-somes)



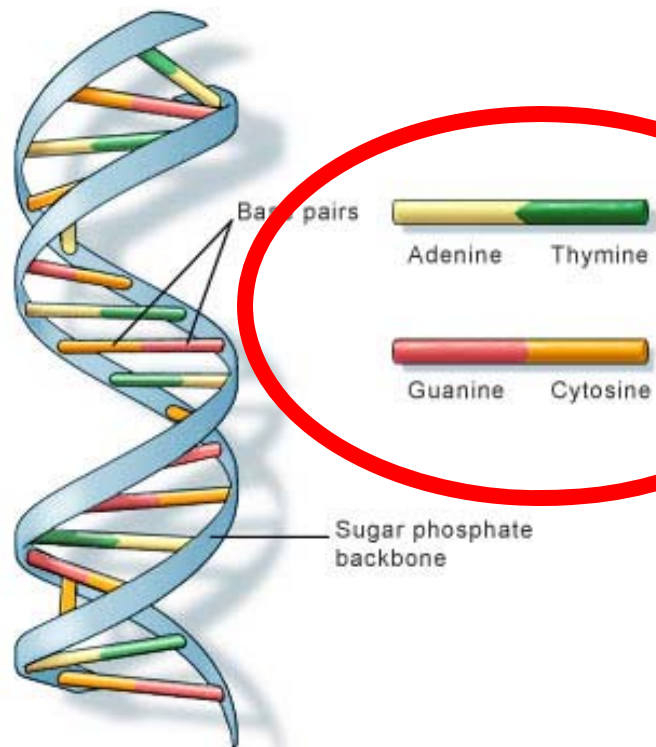
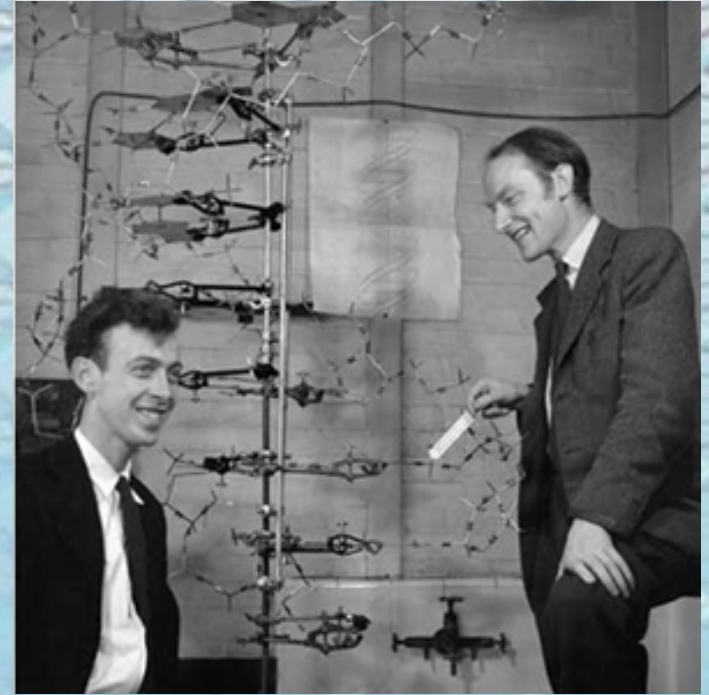
STRUCTURE OF DNA

- 2 strands tightly coiled
 - b/c each DNA is composed of 2 strands, it is known as a **double helix**

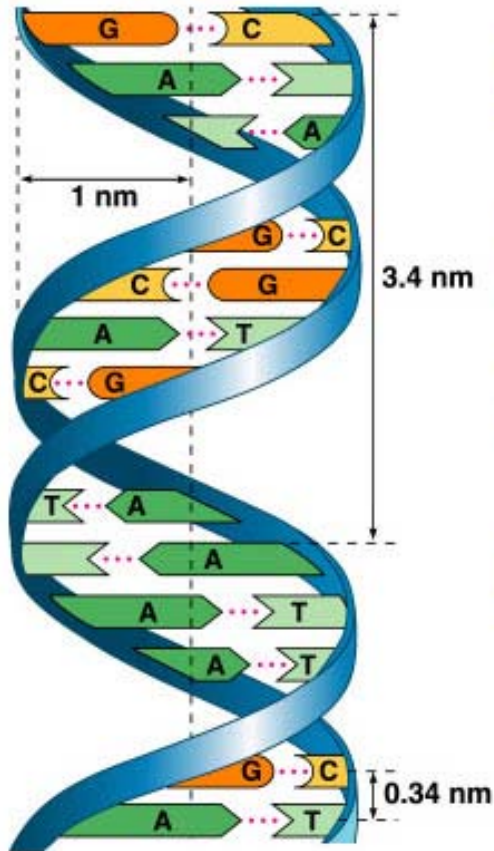


1953: The structure of the DNA molecule is first described.

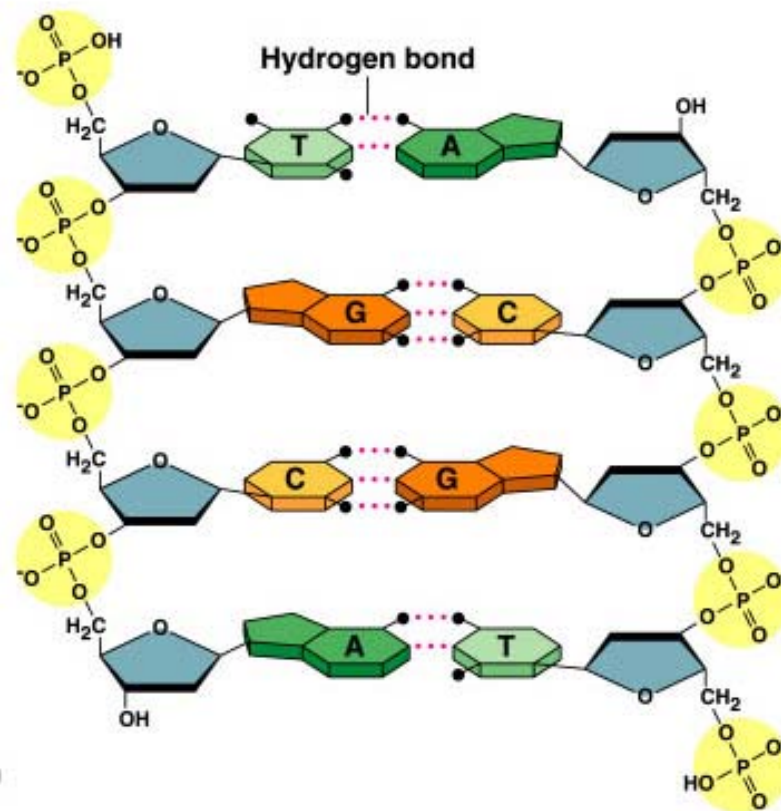
- The rungs of the ladder = *pairs of molecules* called nitrogenous bases (aka **BASES**)



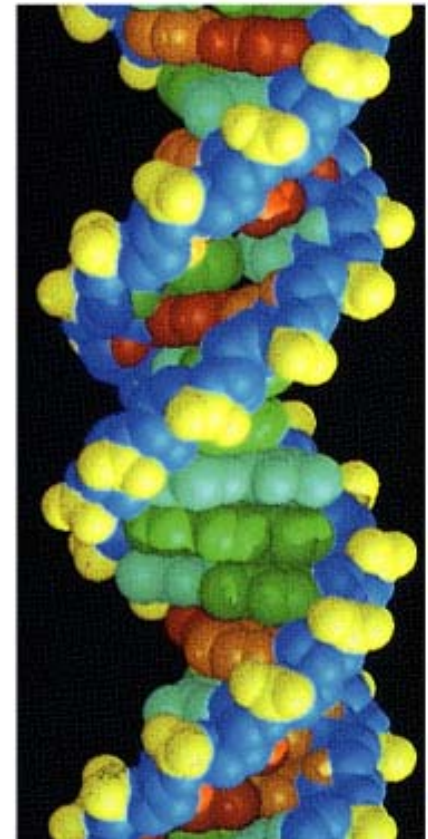
Double helix structure of DNA



(a) Key features of DNA structure

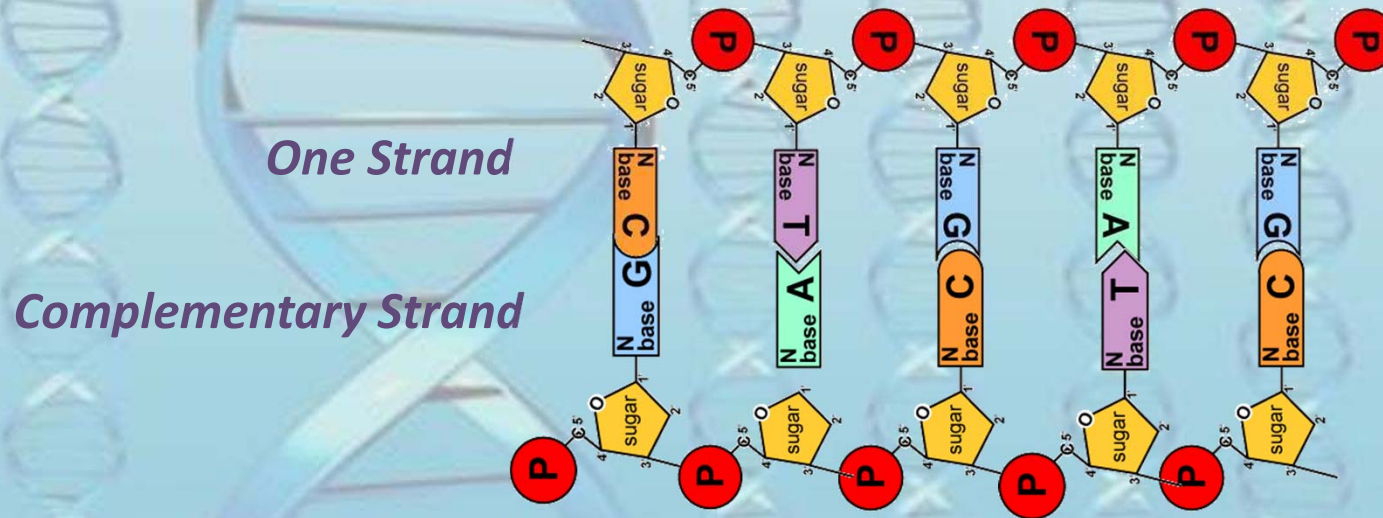


(b) Partial chemical structure



(c) Space-filling model

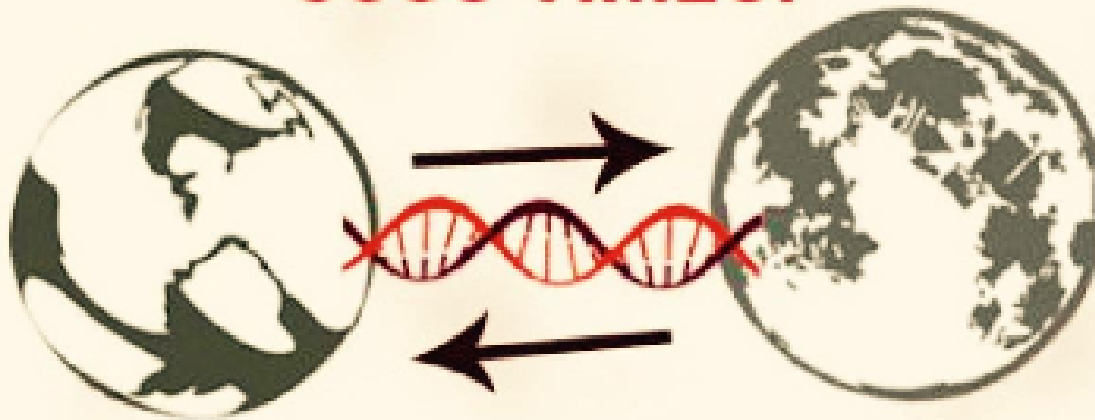
- When the base pairs of 2 Hu DNA strands form a double helix, the DNA strands are **complementary**



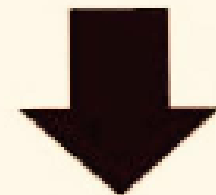
- Hu's have **23 pairs** (total 46) – *1 pair from mom, 1 pair from dad* - in nucleus of cells
- This DNA is called **nuclear DNA (nDNA)** and is ~identical in every cell in the Hu body (*xcept egg & sperm*)

FUN FACT!

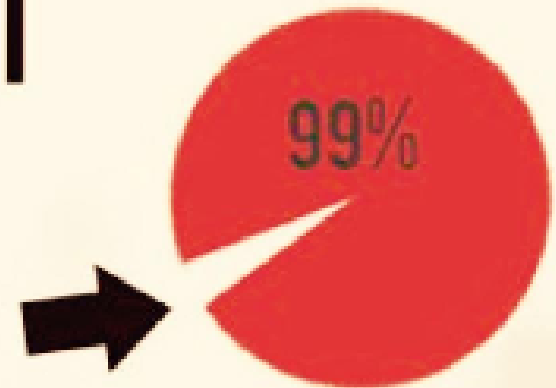
IF YOU UNWRAP ALL OF THE DNA YOU HAVE IN ALL YOUR CELLS, YOU COULD REACH THE MOON **6000 TIMES.**



99.9% OF OUR DNA SEQUENCE IS THE SAME AS OTHER HUMANS'.



This **0.1% DNA DIFFERENCE** between us may have to do with the number of nucleotides in a person's DNA.



DNA FPing



- 1984: SIR Dr. Jeffreys observed that different ppl have different polymorphisms
 - He developed technique for isolating & these variable areas = **DNA FPing**
 - When DNA FPing done, these variable regions appear as **bands**.
 - These bands can be analyzed & used to ID ppl (*b/c each person's DNA has a different # and location of polymorphisms*)



How many skin cells does it take to get a DNA profile?

There is ~ 6pg of DNA/cell

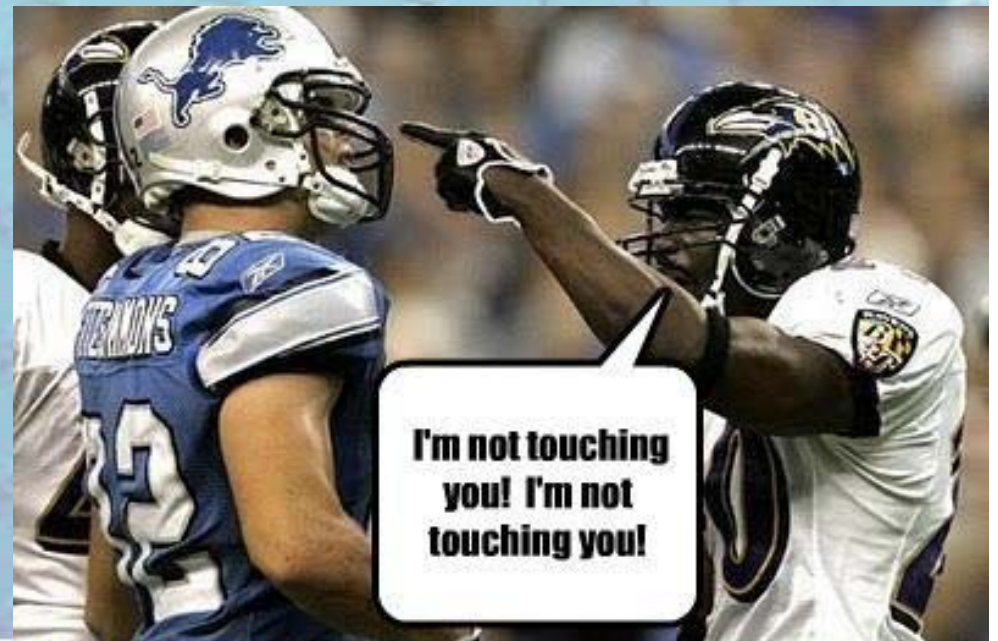
We can obtain full DNA profiles w/ 750pg

= 125 cells

Every minute, 40,000 dead skin cells fall from your body

If we slough off dead cells so much, why can't we always get a DNA profile from "touch evidence"?

1. Depends if a person is a good "slougher"
2. Depends how long they have handled the item



SOURCES OF DNA

- DNA = **individual evidence**

DNA IS FOUND IN ALMOST EVERY CELL IN HU BODY

****Found in anything with a nucleus****

- Hair **doesn't** contain cells, but *hair follicles* do
 - Saliva **doesn't** contain cells, but as it passes through salivary ducts, it picks up cells from ducts and mouth (aka **buccal cells**)
 - DNA in blood testing is from **WBCs** (b/c RBCs **don't have a nucleus**)

DID YOU KNOW

after a rape or sexual assault...



- You can go to the hospital and not report to the police
- *Evidence* can be collected up to 5 days and will be held up to 6 months whether or not you decide to report to the police
- Testing for *Date Rape Drugs* can be done from 24 hrs up to 72 hrs
- Medications to prevent *STD's and Pregnancy* need to be started within 72 hours
- A rape crisis counselor can go with you to the hospital

*Everything you do/don't do is
YOUR CHOICE*

Twins' DNA hinders France sexual assault investigation

Police who are investigating a series of sexual assaults in the southern French city of Marseille have arrested identical twin brothers.

The 24-year-old unemployed delivery drivers, named locally as Elwin and Yohan, were placed under investigation on Friday.

Officers say they are sure that one of the two men carried out the attacks, but that they do not know which.

Standard DNA tests are unable to differentiate between their DNA.

CCTV footage

There have been six similar sexual attacks in Marseille on women aged between 22 and 76 between September 2012 and January 2013.

Police got a lead from CCTV footage on a bus, and as a result they arrested the twin brothers. A victim also identified one of them as her attacker, but could not tell them apart.

The problem is that the investigators do not know which of the two men is responsible for the assaults, or indeed whether it could be both of them, reports the BBC's Hugh Schofield in Paris.

Traces of the DNA of the perpetrator - or perpetrators - have been found on the victims.



Police have been told it would cost upwards of 1m euros to conduct an ultra-sophisticated genetic test

Related Stories

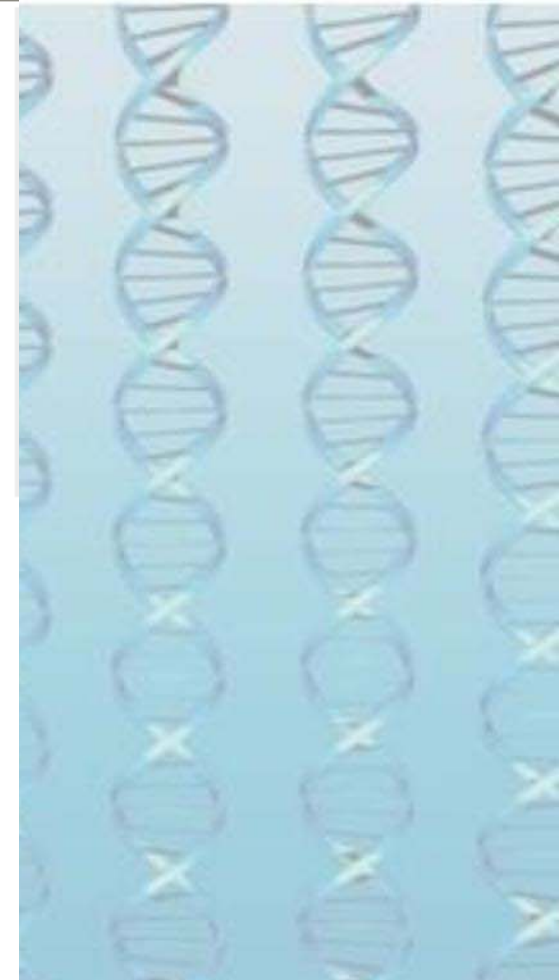
How does DNA testing work?

But this does not really help, our correspondent adds, because the DNA of identical twins is itself more or less identical.

Police have been told it would cost upwards of 1m euros (£850,000) to conduct an ultra-sophisticated genetic test that would be able to tell one set of the twins' DNA from the other.

One expert told the French newspaper La Provence: "For a normal analysis, we would compare 400 base pairs [of nucleotides] which make up DNA."

In the case of identical twins, he added, "We would be looking at billions."



How just a drop of DNA can create a mugshot profile

GETTING away with murder in the 21st century is set to get tougher and may soon prove impossible.

Rapid advances in science and technology are arming police with a new and formidable crime-fighting arsenal.

Investigators will soon be able to routinely create a genetic mugshot of a suspect from a sample of DNA left at a crime scene, or determine their prescription drug use, diet and the time they were at the scene from a single fingerprint. They will even be able to accurately predict their age and height from a single eyebrow hair.

The Sunday Telegraph interviewed leading forensic experts to delve into the cutting-edge ways police will catch crooks in the near future.

European scientists have developed technology that can create a genetic mugshot of an offender based purely on a DNA sample.

Someone who commits a murder and leaves traces of blood, saliva, skin, semen or even hair at the scene could potentially have their DNA-generated mugshot out on social media just hours after their victim's body is discovered by police.



It's almost a mugshot: This is Ben in the flesh -



This is Ben's NSW Police EFIT-V image - not a bad likeness. |

Forensic DNA profiling might be about to take a big leap forward. Are we ready?

Cath Ennis

Monday 6 February 2017 06.59 EST

Advances in e
might soon be



i Just how much i

Picture the scene. A detective is addressing her team:

“The DNA test results are in. We’re looking for a white male suspect, 34-37 years old, born in the summer in a temperate climate. He’s used cocaine in the past. His mother smoked, but he doesn’t. He drinks heavily, like his Dad. We’re seeing high stress levels, and looking at the air pollution markers, let’s start looking downtown, probably near a major intersection”.

Science fiction? Yes, for now. But advances in [epigenetics](#) - the study of reversible chemical modifications to chromosomes that play a role in determining which genes are activated in which cells - might soon start making their way out of research labs and into criminal forensics facilities.

Take the idea of the epigenetic clock, one of the ways in which our cells and DNA can betray our age. Epigenetic patterns change throughout our lives, along broadly predictable paths, making it possible to infer age from DNA samples.

[Steve Horvath](#) at [UCLA](#) has developed a statistical model based on 350 potential epigenetic modification positions in the human genome that can estimate your age to within three and a half years. The rate of epigenetic aging seems to depend somewhat on race, and can be affected by some health conditions, but this kind

COLLECTION & PRESERVATION

GOAL : Prevent contamination!!!!

- wear gloves & change them often
- use disposable instruments for each sample
- avoid touching area where you think DNA is
- avoid touching yourself when collecting DNA
- air-dry evidence thoroughly b4 packaging
- put evidence in new bags/envelopes
- if wet evid can't be dried, it may be frozen

