

DNA Matching

Forensic Science

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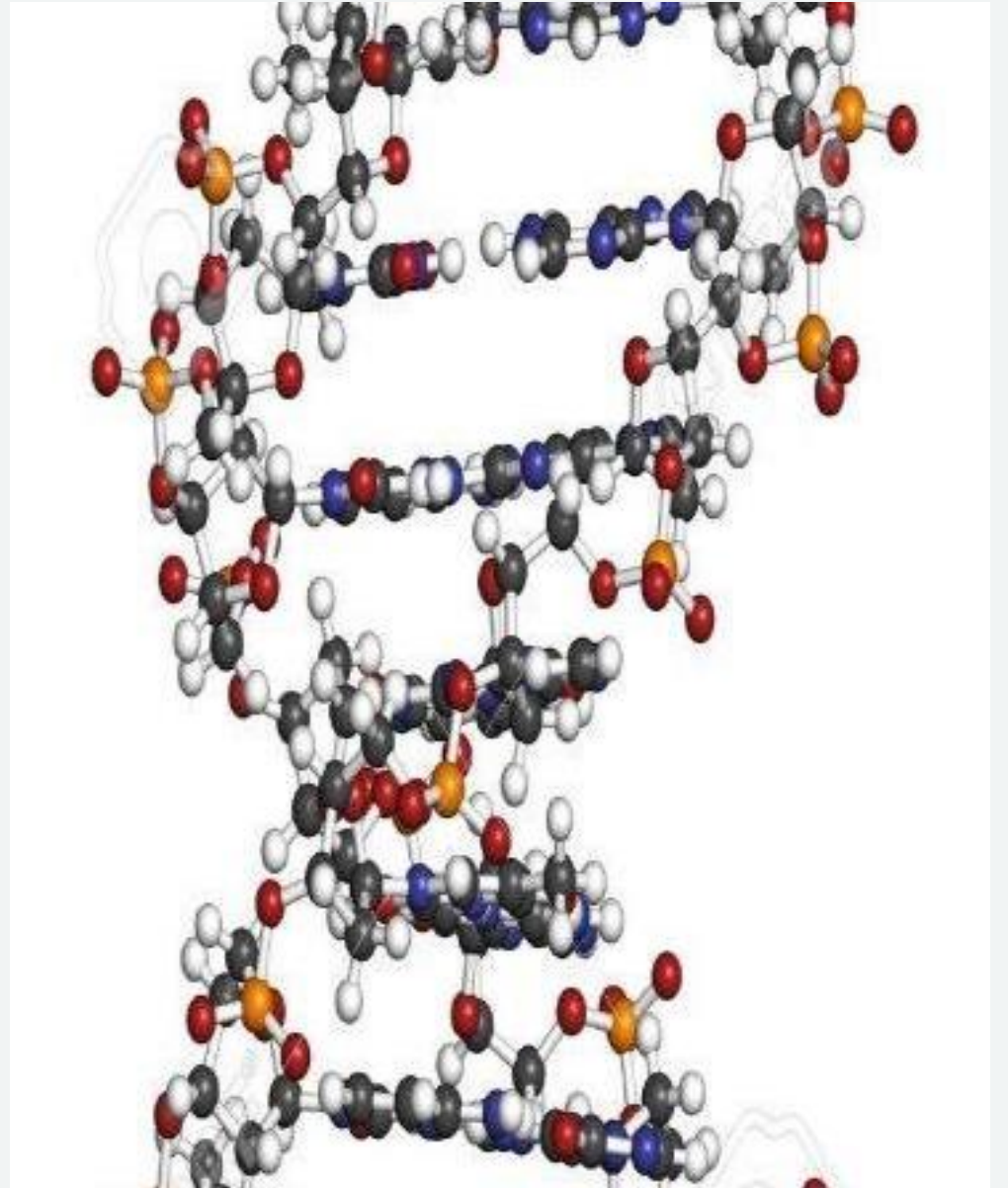
DNA

- Heard about on television dramas than on the news
- Key to solving crimes the scientific way
- Started being used in court and its future in crime stopping is unquestionable and ever more common



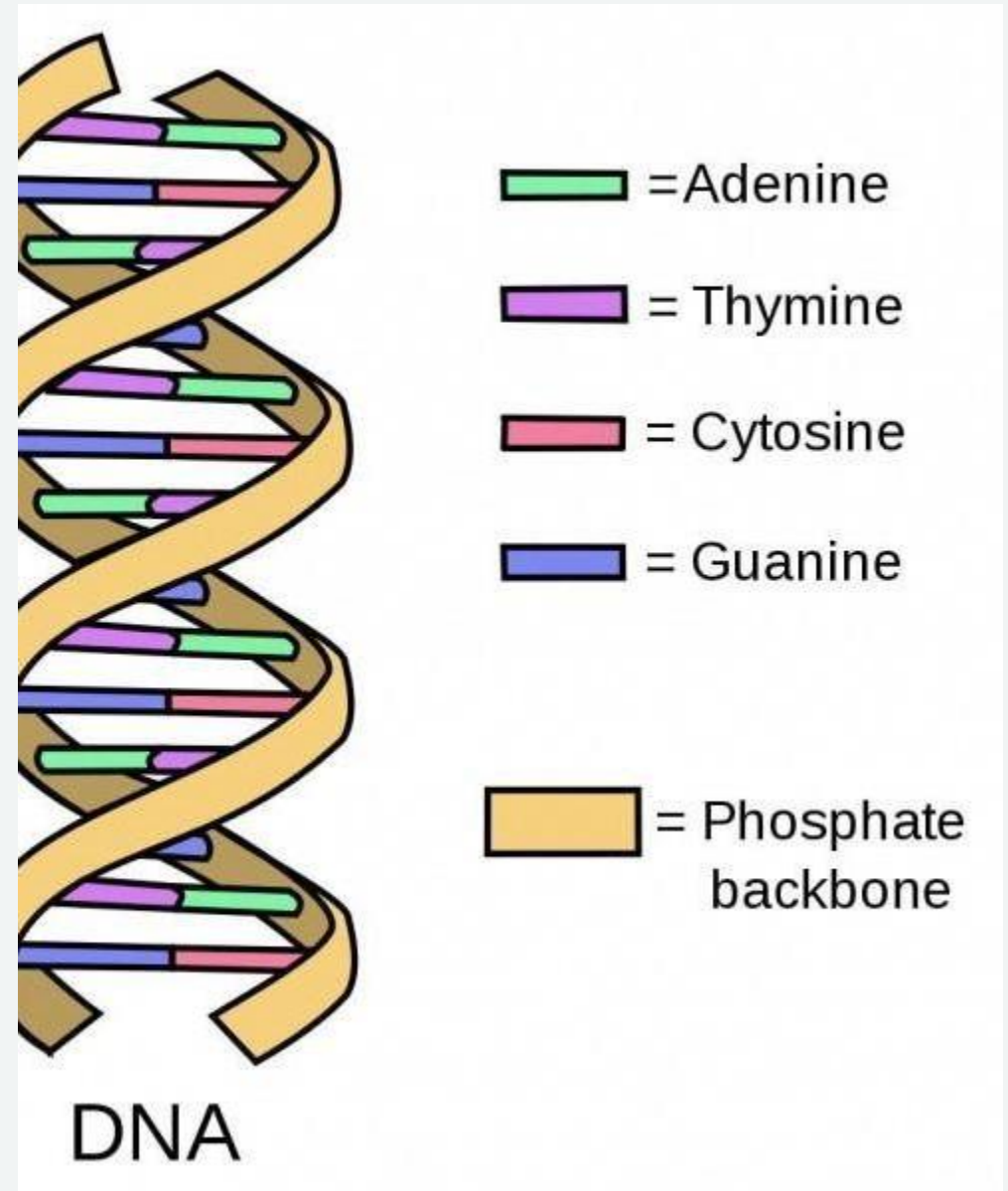
What Is DNA?

- Short for the scientific words, “Deoxyribonucleic Acid”
- Looks like a ladder that is curled around continuously and features about 3 billion rungs that are attached to the ladder
- Rungs are made up of simple natural base chemicals known as guanine, cytosine, thymine and adenine
- The order in which these chemicals are arranged on a strand of DNA is unique to every individual person, making DNA a very efficient tool for the identification of a person as well



The Advantage of DNA

- DNA exists in every single cell in the body and only a minute amount is needed for analysis, makes a sample easily obtainable.
- DNA is also useful in identifying a victim, as we inherit half of our DNA from each parent, and therefore, a part match from the parent of a missing person can reveal the relationship of an unidentified body.



The Advantage of DNA Continued

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Junk



Only a small section of a DNA strand is responsible for our appearance, while the remainder of the DNA is called 'junk' and appears to have no specific purpose or function. 'Junk' can provide forensic scientists with the most information in terms of identification.



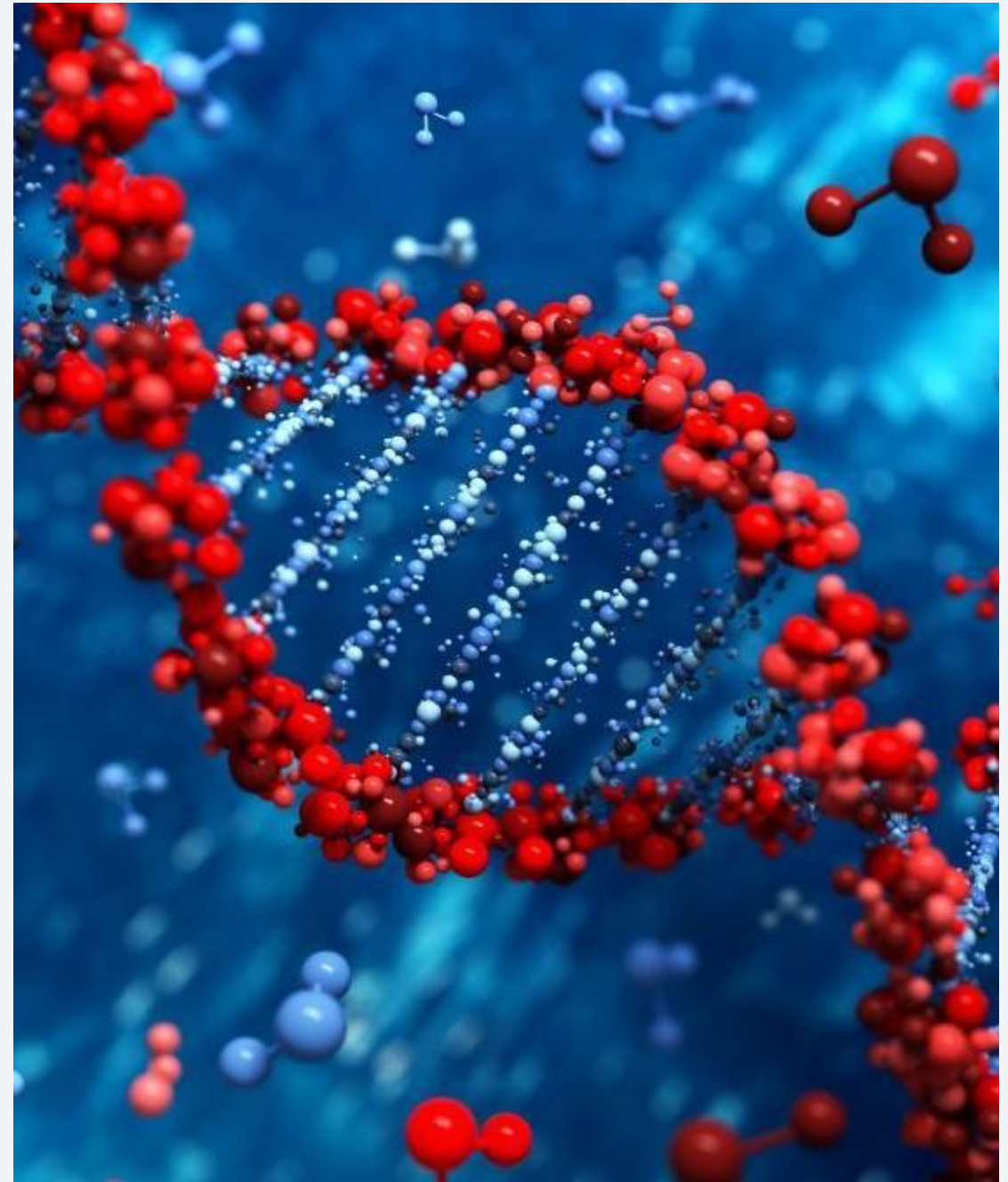
Consists of small sequences of the base chemicals, known as '*short tandem repeats*' (STR's), which continuously repeat end to end.



The number of times the STRs repeat varies noticeably in each individual person and, therefore, allows for identification. ϕ The repetition of STR usually only needs to be counted up to thirteen and it is at this point that we are able to make a match in identity.

Polymerase Chain Reaction

- DNA is extracted from a sample using a mixture of chloroform and phenol, which isolates the DNA strand from the other material in the nucleus
- This method usually doesn't produce sufficient enough DNA for analysis, so the strand is then artificially increased using a method known as polymerase chain reaction (PCR)
- This process involves an enzyme from the human body called a 'polymerase', which is added to the already extracted DNA
- As a catalyst, the polymerase enzyme efficiently replicates the strand, producing sufficient DNA for analysis



Analyzing DNA

- The long strand of DNA must then be separated into shorter pieces (of different size) by using a restriction enzyme, which cuts up the DNA each time a specific nucleotide pattern occurs
- These pieces of DNA must then be sorted according to size, using the process of electrophoresis
- The fragments of DNA are poured into a narrow tube of gel and a positive charge is applied to the bottom of the gel while a negative charge is applied at the top



Analyzing DNA Continued

- Because DNA has a faintly negative charge, it is attracted towards positive electrodes in the same way as north and south poles in magnets are attracted to each other, and the DNA begins to move toward the bottom (positive charge).
- However, smaller DNA travels faster and sinks further down, while larger pieces move relatively slower. This eventually creates 'bands' on the gel, which are used for comparison with other samples



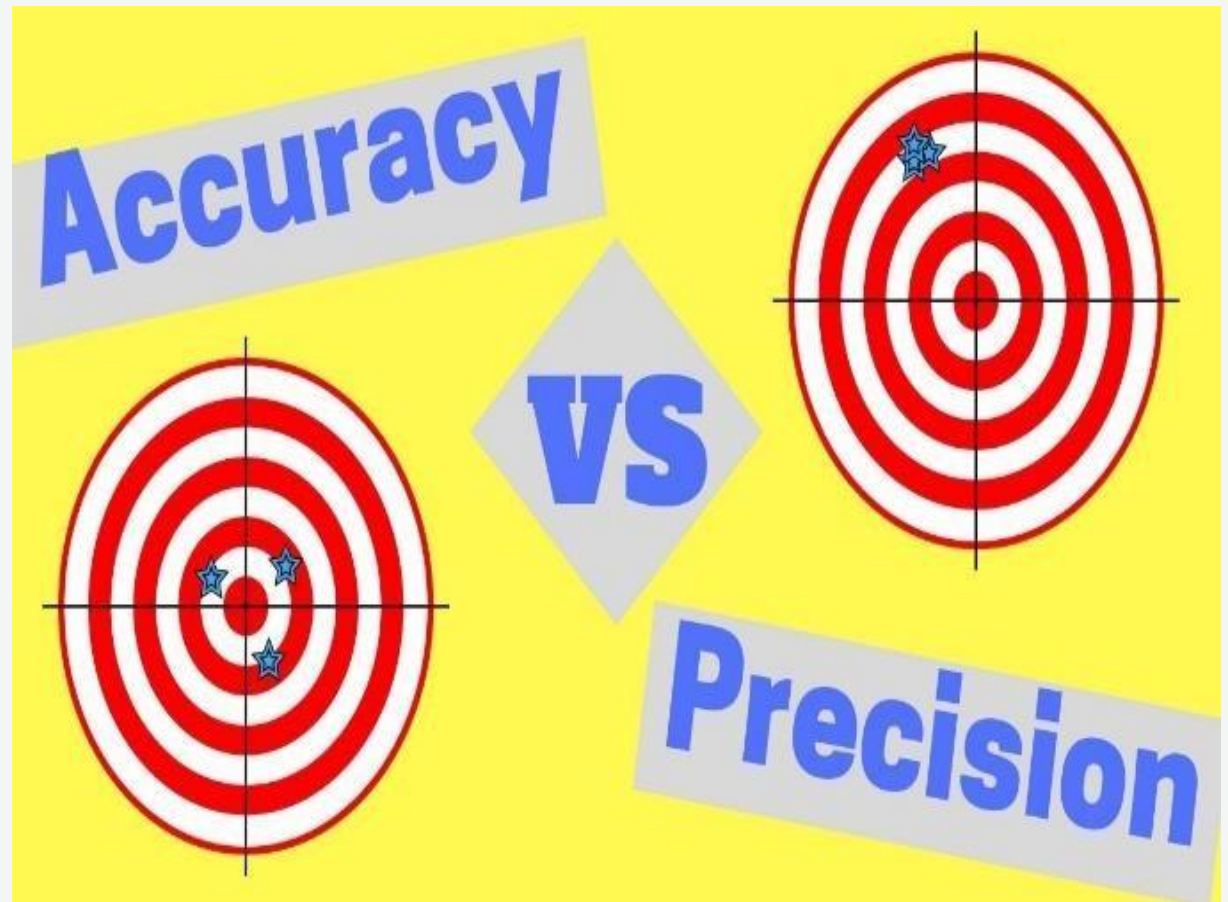
DNA Matching

- Revolutionized the solving of crimes in forensic science
- Samples that have been taken from a suspect and crime scene can now be compared using DNA databases, which can easily match samples to prove a suspect guilty
- DNA matching has been subject to a lot of criticism, especially when used as evidence in a court of law



The Accuracy

- DNA databases have built a reputation as being a fast and efficient way of solving crimes
- The identity of an individual is encoded in a database using a compilation of numbers no longer than four telephone numbers, making it extremely simple to match the numbers from the criminal with the numbers from the crime scene



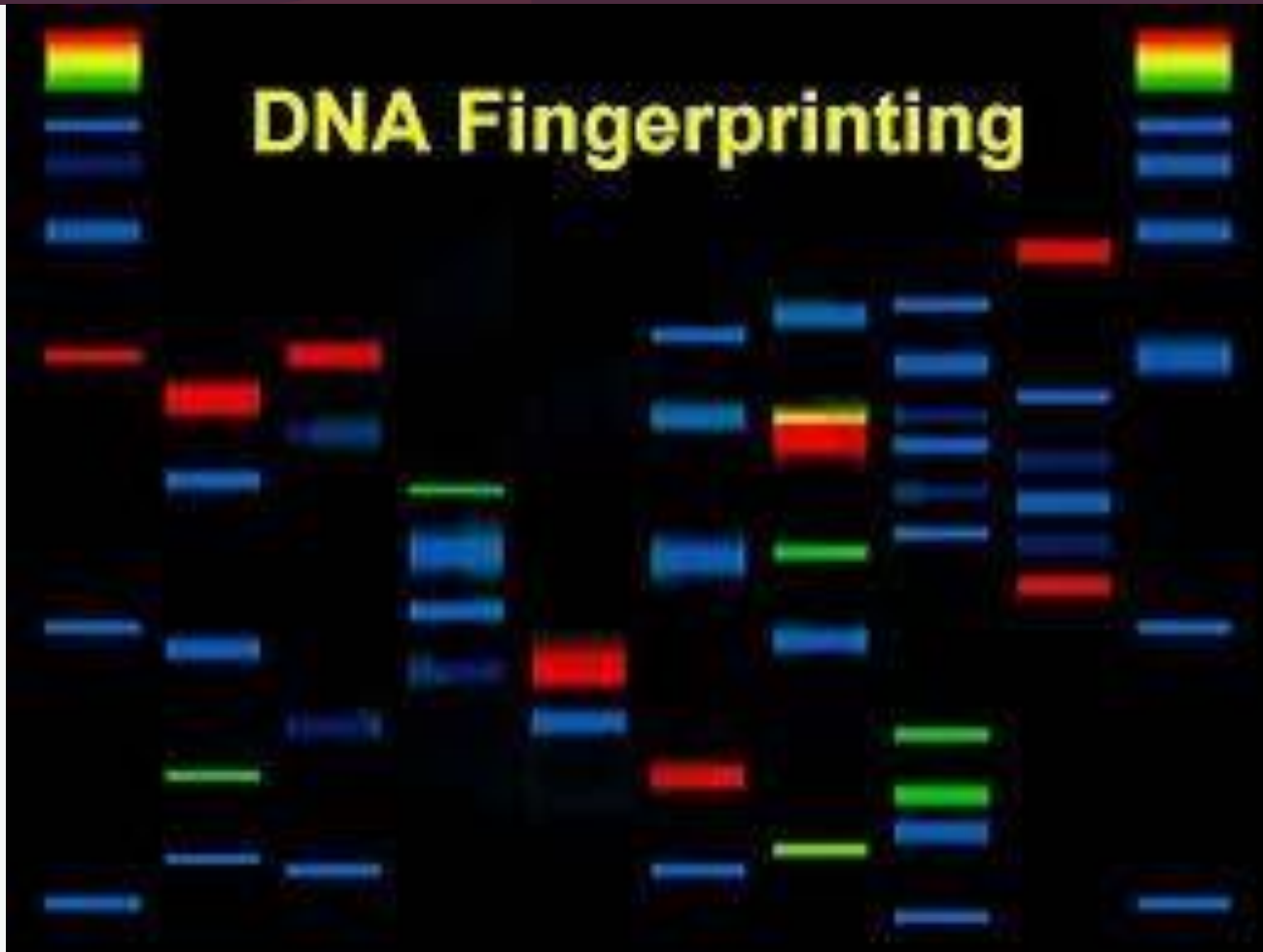
The Accuracy Continued

- NA matching is however, constantly under question when used as evidence in court, as contamination of a sample is possible, even though strict precautions are put in place to prevent contamination
- For example - a stain containing DNA was found at a crime scene in a country that has a population of 10 million people, and the crime scene DNA sample is accurate enough to match 1% of the population
- A suspect is arrested, and that person's DNA sample matches perfectly with the one found at the crime scene
- The prosecutor argues that because only 1% of the population shares the same DNA profile, there is only a 1 in 100 chance that the person is innocent
- The defense however, then argues that if 1% of the population share the same DNA, then there could be 99 999 (1% of 10 million minus 1) other individuals who could have possibly been at the scene of the crime



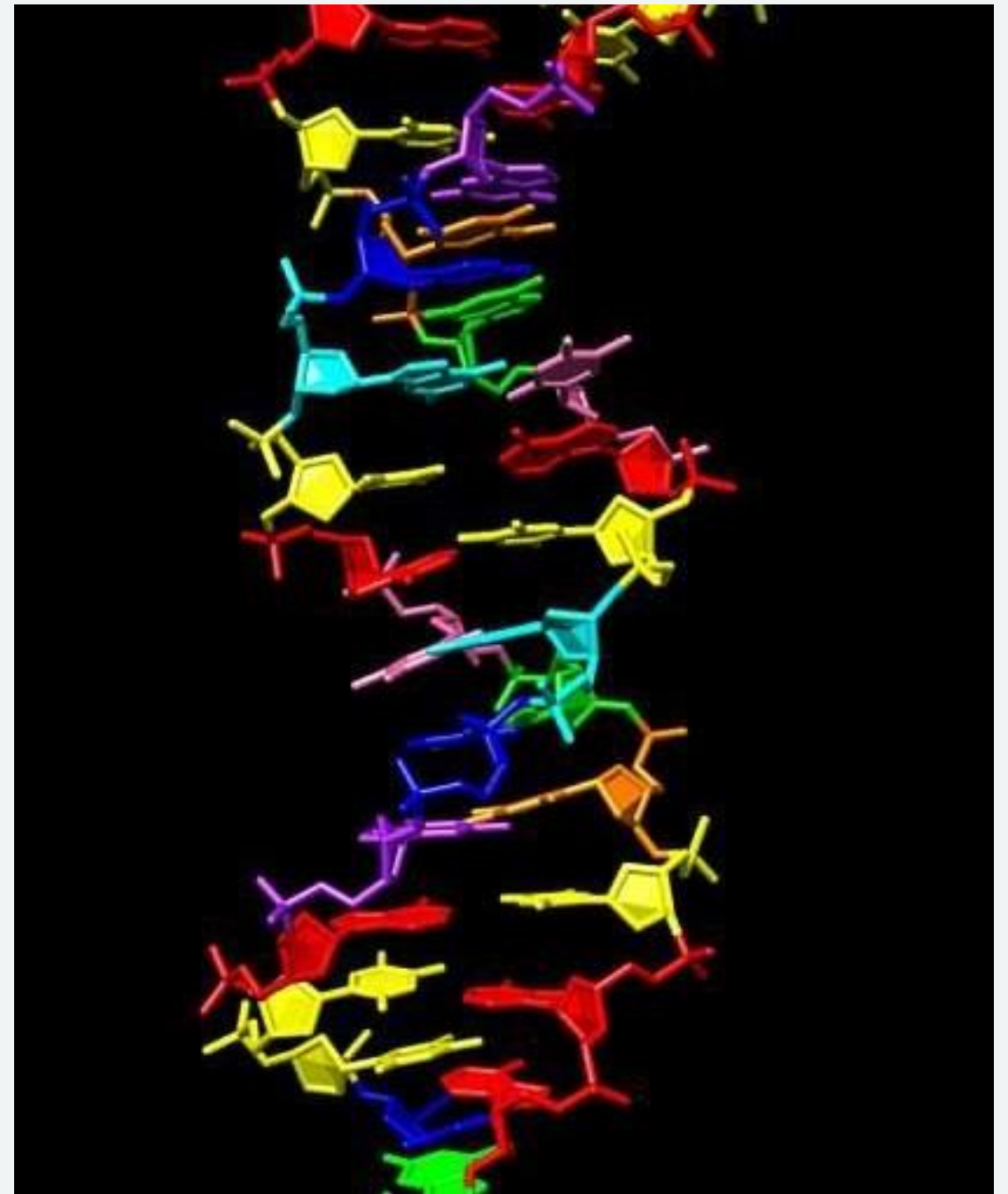
The Accuracy Wrap-up

- Presuming innocence, the odds of the suspect being guilty are actually 1 in 100 000
- This example shows the hazards of relying too much on DNA as evidence
- If there is enough evidence to support the DNA sample, then this amplifies the suspicion of guilt and makes a very persuasive case
- However, if there is little or no evidence to support the DNA sample, then the sample is practically useless



The Next Generation

- The future of DNA matching has a very promising outlook, with the completion of the mapping of the human genome in 2001
- Scientists are now able to identify the genes responsible for inherited traits and using this, can reveal the suspect's hair color
- Scientists predict that future DNA study will be able to reveal what height and race a suspect is and possibly the building of a suspect's face from just a single drop of blood
- This is still a long way off, but as research grows and technology improves, advancements in this area are constant





**Thank You For
Your Attention!**

Questions and Comments