CHAPTER 4

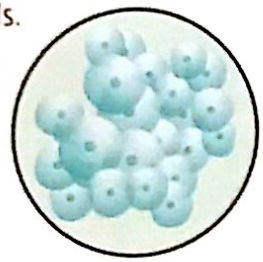
Secrets in the cells

All too many crime scenes are covered in blood, whether it belongs to one victim, many victims, or even the criminal who did it. Serologists have been able to find out some information about blood for over a hundred years, but a major breakthrough happened in 1955, when scientists discovered DNA. Now, serologsts can connect a bloodstain directly to the particular person the blood came from.

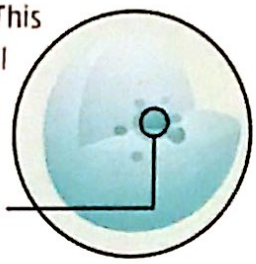
Di-oxy-ribo-Nu-cle-ic Acid, to use its full name, is the chemical that controls how our bodies are

built. It does this by controlling the cells in our body. These are the building blocks that people are made of. DNA itself is an incredibly complicated chemical, made up of billions of parts known as genes. Genes help to control different things, such as the length of your toes or the size of your memory.

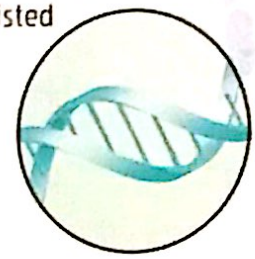
This is a cluster of skin cells.



Inside most cells is a nucleus. This tells the cell what to do.



Inside each nucleus is a long, twisted molecule of DNA.



It has to be you

You inherit all your DNA from your parents. Exactly half the genes in your DNA come from your mother, and half from your father. There are so many ways in which these two halves can combine that it's impossible even for your brother or sister to have exactly the same code even as a coincidence. Only identical twins or clones share the same DNA.

Most bloodstains contain the DNA of the person they came from. But detectives had to wait a few years before they could use this information. In 1985, British scientist Alec Jeffreys worked out a way to extract and compare DNA from two separate samples. Using this technique, serologists compare DNA from a crime scene with DNA from a suspect. This process is often described as genetic fingerprinting. It's one of the most common tests in forensic science.

FORENSIC FACT

Whenever a new scientific technique is developed, it takes time before most people understand it. Judges and juries can be slow to trust scientists when they talk about new techniques in a trial.

For about 20 years, clever lawyers were able to persuade juries that genetic fingerprinting was based on unreliable science. It is true that scientists can make mistakes that affect the results. But the science of DNA is reliable, and is now trusted in courts all over the world.

DNA profile

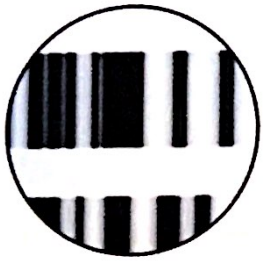
Since 1985, scientists have developed many new ways to process a DNA sample. They all require special equipment and chemicals, but the specific method used depends on how large the sample is. One of the most common methods is known as Short Tandem Repeat (STR) analysis. In this process, the serologist chemically highlights 13 sections of human DNA. These 13 sections are then printed onto a sheet called a profile. Samples of DNA that have been taken from several different places can be printed onto the same profile, so it's easy to see if they match.

DNA FACT

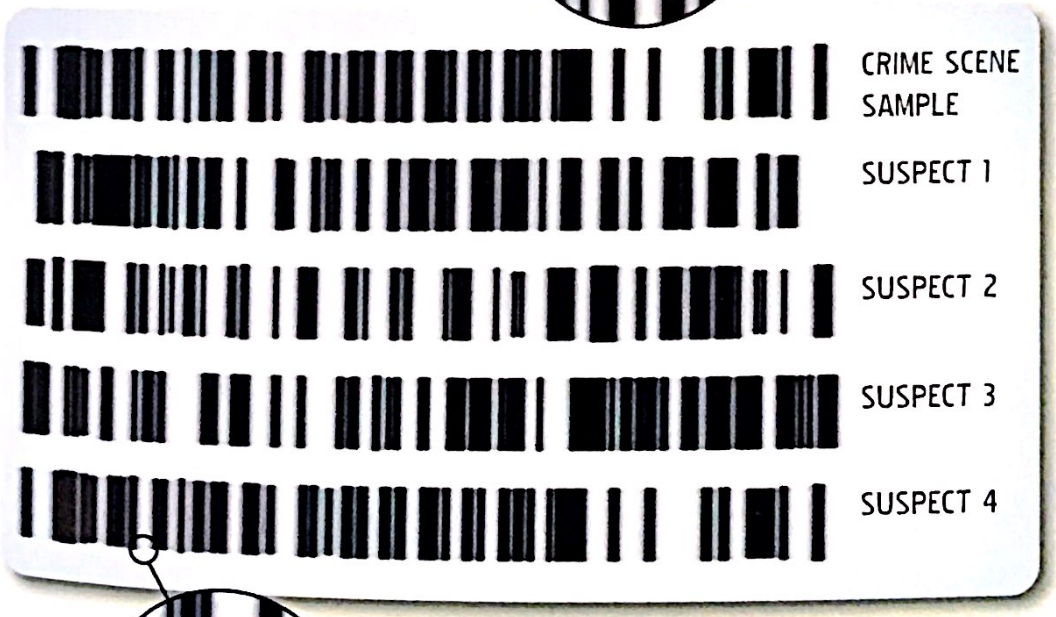
DNA tests are also used to prove that people are related to each other. If a child doesn't know who his or her genetic father is, a DNA paternity test can help them to find out the answer.

Relatives don't share exactly the same DNA profiles, but they will match in more places than two unrelated people would.

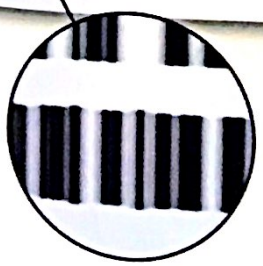
Each person's profile spreads down the page, a little like a long bar code.



The lines on the profile vary in thickness depending on a person's genes.



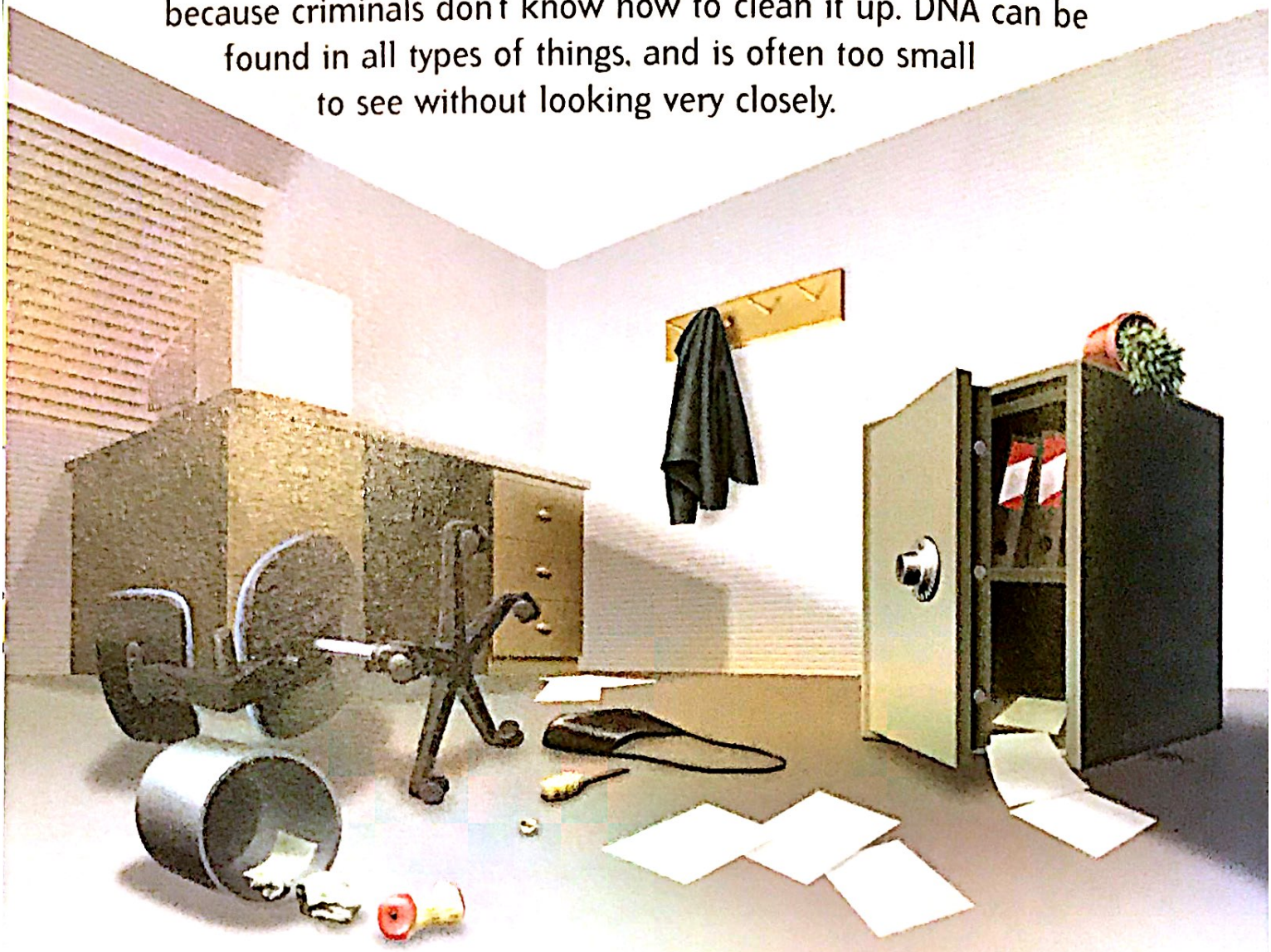
The first profile shows the crime scene sample. The rest show samples taken from a number of different suspects.



Suspect 4 has a profile that matches the evidence profile very closely. And all the other suspects can be ruled out.

Finding DNA

One reason why DNA can be found at many crime scenes is because criminals don't know how to clean it up. DNA can be found in all types of things, and is often too small to see without looking very closely.



Crime scene: office burglary

CSIs found no fingerprints in the room, but there are all sorts of places to check for DNA. Where would you look?

- Any objects that have definitely had human contact: saliva on the apple core, skin cells on the ring, hair on the hairbrush.
- Anything that is out of place: knocked-over chair, plant pot, sweat marks on the pieces of paper. All of these might have flakes of hair and skin from the burglar.

DNA can be found in so many things that it can seem as if every crime scene is littered with the stuff. This in itself can be a major problem for detectives. DNA evidence is amazingly useful, but only if it's big enough or clean enough for a scientist to use.

DNA difficulties

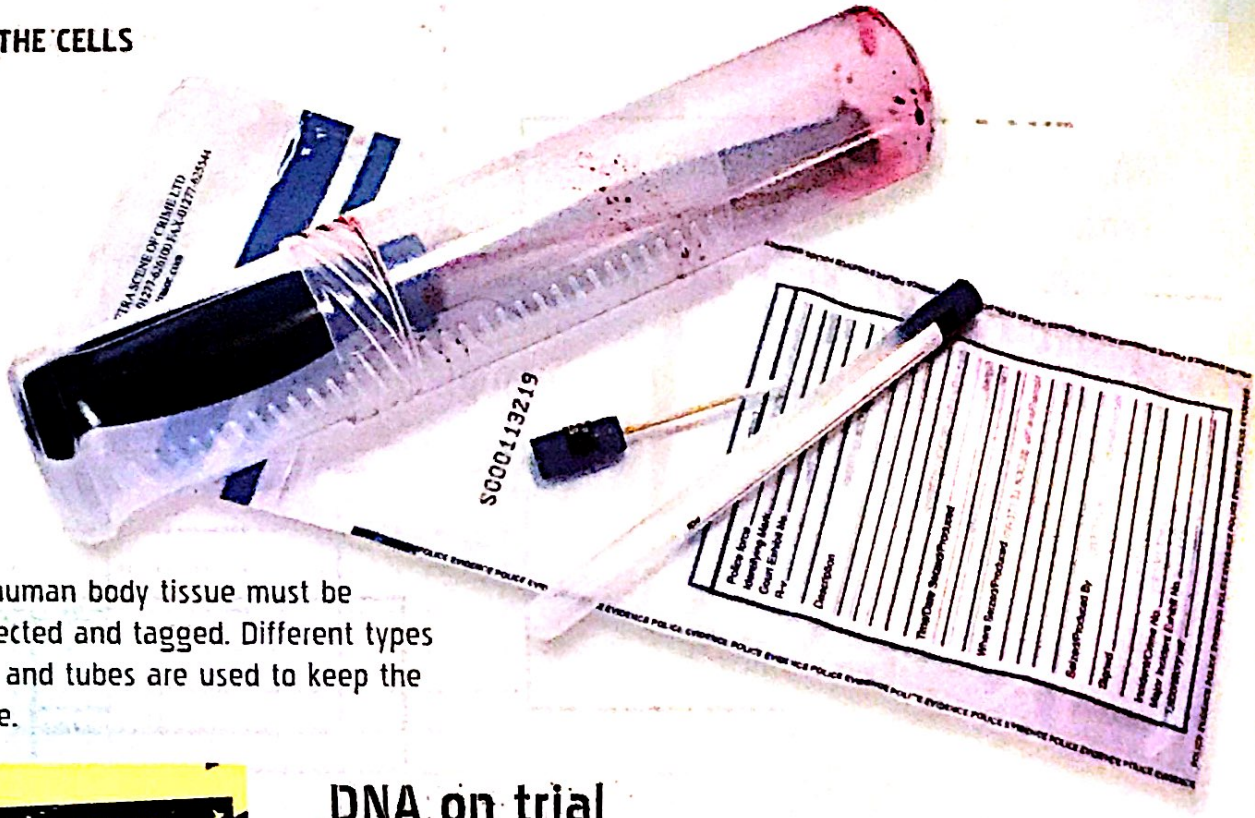
Crimes that take place on the street, or in a busy building, can be very awkward for the police when they are looking for clues. There will be a lot of DNA in the area because of all the people who walk through it every day. Even if there is something obvious, like a pool of blood, it could be contaminated with DNA from other people's skin or hair that may have fallen into it.

Another sad problem is that there is so much DNA evidence from crime scenes that serology labs often have huge piles of evidence to examine, much of which will turn out to be useless.

It's not all bad news for detectives, though. DNA can remain at a crime scene for years. Even bones that are thousands of years old still contain DNA that can be extracted and tested. Scientists are improving analysis techniques all the time, and DNA may soon overtake fingerprints as the most common evidence used in solving crimes.

CSI FACT

When gathering evidence from a murder scene, CSIs need to wear protective coveralls. This is to make sure that they don't drop any of their own DNA onto the scene.



Samples of human body tissue must be carefully collected and tagged. Different types of bags, jars and tubes are used to keep the evidence safe.

FICTION FACT

CSI: Crime Scene Investigation is one of the world's most popular TV shows. It has helped people to realize that DNA and other tiny clues can be found at all kinds of crime scenes.

The science used in the show is accurate, but real crime labs don't all have brand new equipment, and tests take much longer to do.

DNA on trial

Once a suspect has been accused of a crime, any DNA samples that link that person to the scene of the crime, or to the victim, or a murder weapon, can be very compelling to a judge and jury. Many people on juries already know a little about DNA evidence, and they understand that it is unique to a person.

In fact, DNA has become so well-known that some juries expect it to feature in any trial, especially a murder. This is sometimes called the 'CSI' effect, named after the long-running TV series about a forensic science team.

But DNA evidence is not always relevant. For example, DNA found on a murder weapon can prove that a particular person touched it, but it can't prove how the DNA got there. As with all branches of forensics, DNA evidence usually needs to be combined with witness testimony to paint a full picture of what happened. Just sometimes, though, DNA is a crucial witness...

Crimes solved by science No. 3

An innocent man

Place: Baltimore, USA

Date: 1983

Crime: murder

Victim: Dawn Hamilton

Chief suspect: Kirk Bloodsworth, ex-marine

Incriminating evidence: 1. Eyewitness report of a man seen running away from the scene matches Kirk's description. **2.** Kirk was reported by friends as acting strange that day.

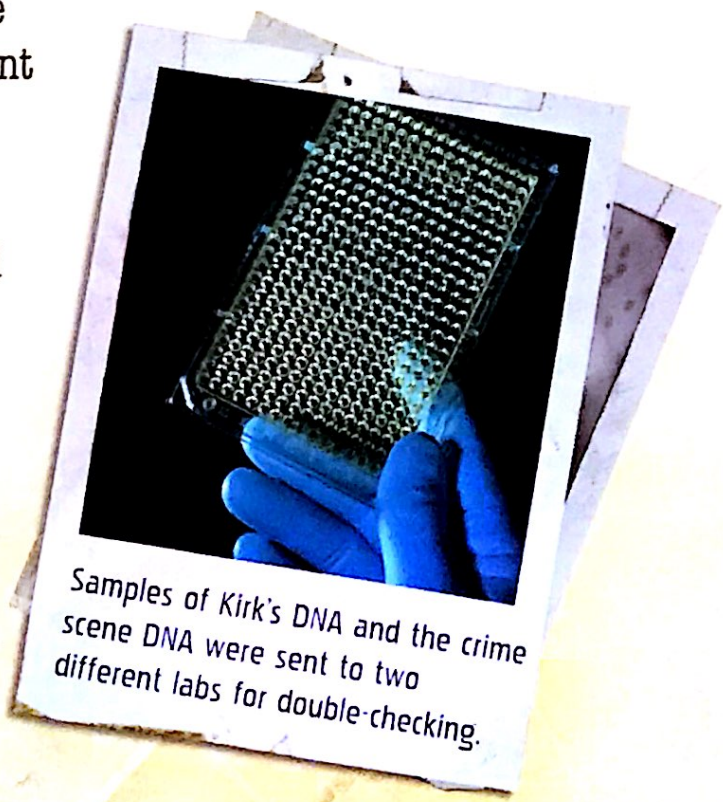
Suspect's statement: "I'd just had an argument with my wife. That's why I was acting funny. I never saw the girl."

Verdict: guilty

Forensic breakthrough: DNA testing didn't exist in 1983, but 10 years later, stains on the victim's clothing were finally sent for DNA analysis.

New verdict: this DNA did not match Kirk Bloodsworth's – and he was finally released.

Case closed: in 2003, the real killer was found using a DNA database search: K. S. Ruffner. His DNA was on file because he was in prison for another crime.



Samples of Kirk's DNA and the crime scene DNA were sent to two different labs for double-checking.