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Disasters and DNA science

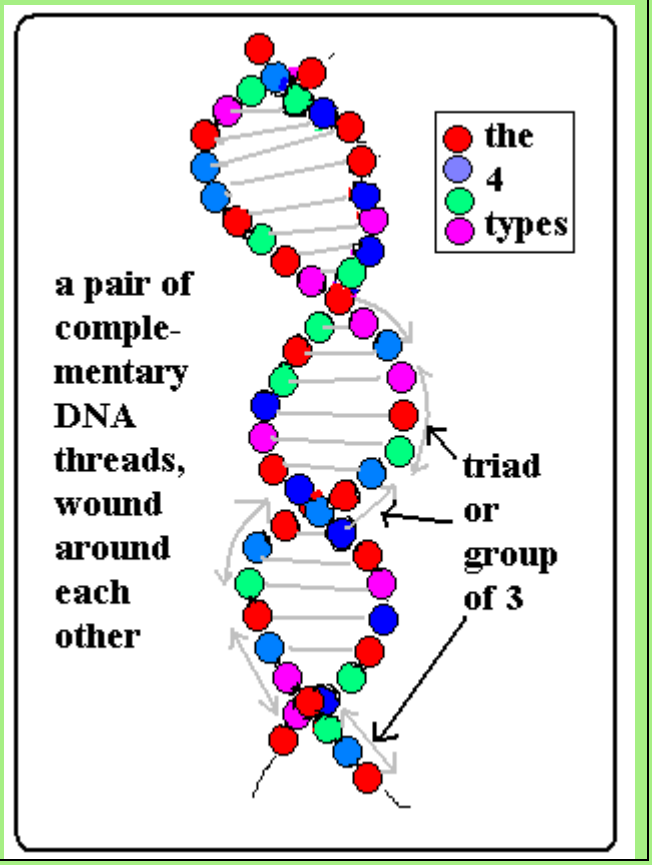
Recent disasters have refined methods of DNA fingerprinting, says S.Ananthanarayanan.

Working out the genetic signature of people has been useful in identifying siblings, deciding paternity or even identifying dead people. Each one of us has a unique genetic identity, certainly many times more unique than fingerprints. And we carry this identity in each one of the cells of our bodies.

And so, if we leave traces of ourselves at the scene of a crime, we leave behind a 'visiting card' which we will find difficult to deny when the police comes calling. In happier circumstances, similar genetic traces can help reunite us with brothers and sisters. This is because we inherit our DNA from our parents. As siblings have the same parents, they end up with similarities in DNA too.

How it works

In the nucleus of every single cell of living things is a bunch of complex, thread-like molecules called DNA. The structure of the DNA is a code that dictates what proteins the organism will produce. And the features of an organism, whether it is a man, chimpanzee or a bacterium, are decided by what proteins its cells produce – some proteins to build tissue, other proteins, the enzymes, to direct the function of various organs. Given one set of proteins, the organism may have brown hair, and given another set, it may grow a trunk and become an elephant!



What is the code?

The DNA is like a string threaded with millions of beads, of four colours. Every consecutive triad, or group of three beads, specifies one amino acid, a building block of proteins. The millions of proteins are all built from just twenty of these basic components. And just three beads, each one being one of four colours, can specify these twenty with space left over for duplicates, for safety. And humans have twenty three sets of DNA, to deal with the myriads of features that make up each one of us. With millions of 'beads' in each DNA, the variety of identities possible are unimaginable.

During reproduction, half this 'dictionary of individuality' is taken from each parent to create the genetic inheritance of the child. Specifically, half the DNA comes from one parent and half from the other. The combination then makes a 'profile' that is unique to an individual, with common features among siblings or blood relatives.

How is the code read?

'Comparing' DNA profiles is easier said than done. The features that we are looking for are specific sequences of the 'beads of one of four colours', found in the DNA. This amounts to following the sequence at the scale of atoms along a string millions of atoms long! But techniques exist to work this marvel in the laboratory.

A sample of DNA is first isolated, in a small smear from the body or even a bit of hair or skin, if we are dealing with the dead or traces left at the site of a crime. Now, there are enzymes and chemicals that can cut the DNA chain at specific points, like where a particular combination of the four 'beads' occurs. Once cut like this, particular bits of the DNA can be filtered out, and compared with matching sequences in the control DNA.

Disaster sites

This simple method runs into trouble when dealing with mutilated DNA where the samples have been exposed to fire, chemicals and so on. This is like what happened with the victims of the 9/11 disaster or tsunami victims. Complete DNA samples are not available and matching needs to be done with partial and incomplete sequences

After 9/11, private Bio-Technology and IT firms took on the task of developing systems to work with mutilated DNA remains. The firms used special computer software to read and integrate different forms of data from DNA scraps, along with other forensic information to build identity profiles of sources of DNA. In the 9/11 disaster at World Trade Centre, New York, 2,700 people died but standard DNA analyses could not make reliable matches.

But the new methods helped make 80 new matches as soon as they were used and 55 people were identified. So far 1,598 victims have been identified.

The same methods are now being used to use the barest traces of DNA in mass graves of Jews killed in Nazi pogroms, to build links with survivors of the ***holocaust***, maybe to bring together survivors from the same town or even distant relatives!