

What is a Twin?

We are often asked about DNA testing for twins and the hope the following will explain a little more about the situation. By all means call us if you need more information.

Firstly, the frequency of twins is much more common than it ever has been; twinning is now in over 90% of multiple births. There are a number of reasons for this;

- a) The increasing use of fertility treatments - using fertility drugs often results in several eggs being released per ovulation.
- b) Fraternal twinning is in the family (mum is a fraternal twin, has a fraternal twin sibling or has had fraternal twins herself).
- c) Having had more previous pregnancies increases the chances of twins.
- d) Increasing maternal age – higher levels of oestrogen in women in their 30's and 40's causes greater ovary stimulation and hence the changes of more than one egg being produced.
- e) Race – Asian women have the lowest incidence of twins and black African women have the highest, Caucasians are somewhere in between.

There are two types of twins, fraternal (two cell or dizygotic) and identical (one cell or monozygotic).

In fraternal twinning, two different eggs (ova) are fertilised by two sperm to produce two genetically distinct children, which share the same genetic relationship as siblings born at different times, that is, they are **full** siblings. The twins could be male or female, there is no

bias. Fraternal twins represent two out of every three twin births.

In identical twinning, a fertilised egg (an ovum) splits into two (the cause or mechanism is not yet understood) and then the two embryos develop independently. This type of twinning is generally about one in every three twin births. The two babies have the same original genomes (a carefully chosen phrase) ...and the use of the word "identical" needs to be challenged, though monozygotic is still true and fine to use!

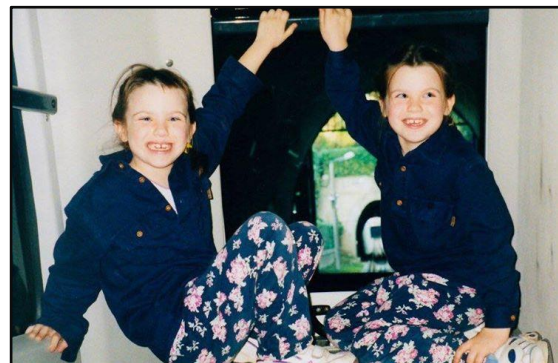


Figure 1. Identical Twins.

Whilst opinion is divided, there is a though in the scientific literature that a released egg may split into two before fertilisation and then each separate egg is fertilised by a different sperm. These are fraternal twins, i.e. **full** siblings, but may look like identical twins. Very much a theory to explain why fraternal twins may look alike - More on this in a subsequent article!

Thirdly, a myth to dispel...the incidence of twins does not skip generations!

DNA Testing for Twins

The way human identity testing is conducted is to compare chunks of DNA between individuals. These chunks of DNA (known as markers) come from across the genome... the formal name is Short Tandem Repeats (or STRs). Generally, between 16 and 21 markers are analysed and in the case of paternity either completely exclude a tested man (with 100% certainty) or determine that the tested man is the biological father with at least 99.99% certainty. The sample we collect is from the inside of the mouth - cheek cells are rubbed on to a cotton bud and when this sample is back into our lab, we extract the DNA from the cells and subject it to molecular analysis. In terms of the actual DNA test, subject to appropriate consent from a person with parental responsibility, we would sample the children and compare their DNA profiles.

In the case of fraternal twins, we would expect the children's' DNA profiles to be different and our statistical calculations should indicate a **full** sibling relationship. Ideally, the mother, father or both parents should participate in this test to improve the result.

If there is any question of paternity relating to the children who are to be DNA tested (that is, that may be half siblings), we strongly suggest that you call us to discuss the situation beforehand.

For identical twins and using STR DNA technology, we would expect the DNA profiles to be identical and match at every marker tested. For general curiosity testing, this type of test is sufficient to resolve any question of fraternal vs identical.

The same principles apply to other multiple births such as triplets.

Can You Distinguish Identical Twins Using DNA Technology?

The answer, is yes (hence my challenge to the word "identical" above), but the experimental work we would have to do is more complex and time consuming (hence expensive). Generally this type of testing is only reserved for forensic testing to resolve criminal cases but there is in fact far more to the "twin thing"...believe it or not, technology companies see twins as the best possible test bed for their facial and voice recognition technologies! Plus, advertisers want to know if the twins online habits are the same. Inadvertently, we have drifted into the "nature vs nurture" debate. Not one we subscribe to, but more of that in a later article...

So How about DNA Testing for Twins?

The "identical" tag is true at one point in time. Conception. As with all of us, twin genomes are not the same as the one they were born with - the world has been to work! In "identical twins", the effect of the environment begins to take effect straight away with differences exposure to chemical and environmental effects (such as sunlight) leading to small changes in the genome. This then modifies how your genes are expressed. It is possible to distinguish twins using complex molecule biology, but highly expensive and outwit the technology used for identity testing, which looks at relatively large chunks of DNA interspersed across the genome.

To summarise, paternity and maternity tests for fraternal and identical twins is well established, as are sibling tests for fraternal twins (**full** siblings when they have the same father, **half** sibling when not) and identical twins - **full** siblings.



For fraternal twins we expect to see a different DNA profile from each other (but still be able to statistically calculate the relationship) and for identical twins, we expect to see the **same** DNA profile.

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