


# Taking the 'identical' out of 'identical twins'

We've all heard the claim in crime fiction before: genetically speaking, there is no way to tell identical twins apart – that is, twins who developed from a single fertilised ovum. →

**T**his dilemma has been at the root of many legal issues, from paternity suit dismissals to high-profile acquittals of serious crimes. But it raises the question: is the DNA of identical twins really identical?

Determined to crack the case, experts from Eurofins Medigenomix Forensik and Eurofins Genomics in Germany, together the largest commercial DNA and genomic service provider in Europe, joined forces to come up with a game-changing scientific breakthrough. They found

that through a genome sequencing approach, it was possible to spot specific mutations that happen in the early stages of all embryonic development. These occurrences are specific to each individual, meaning DNA samples from one identical twin can be distinguished from the other.

Burkhard Rolf, Managing Director of Eurofins Medigenomix Forensik GmbH, sheds some light on the story behind this innovation and its impact on the forensic field. 

**Q : WHY WAS IT SO IMPORTANT TO BE ABLE TO TELL IDENTICAL TWINS APART AT A GENETIC LEVEL?**

**BURKHARD :** Monozygotic, or 'identical', twins are a lot more common than you'd think – they represent one in 250 people worldwide. And to really understand the importance of this innovation, you have to consider the implications outside of the scientific field. If two individuals share the exact same DNA, there is no way to tell them apart from a legal perspective – which means if your suspect in a criminal case has an identical twin, you simply can't prosecute them. Finding a way to differentiate identical twins was a huge step towards bringing closure to families impacted by such cases.

**Q : HOW DID YOU COLLABORATE WITH EUROFINS GENOMICS TO DEVELOP THE TWIN DIFFERENTIATION METHOD?**

**BURKHARD :** It wasn't our first time collaborating; Eurofins Genomics' experience, resources and services have been of tremendous help to us throughout the years. When working to answer this twin differentiation conundrum, we made good use of their next-generation sequencing (NGS) method to screen whole genomes for even the tiniest of differences. Eventually, we found what we were looking for: rare mutations that occur very early in the embryonic stage and are therefore unique to each twin. Even better, we were able to provide evidence that, because these changes happen so early in the embryo's development, they can be found throughout the individual's DNA, notably in their reproductive cells (gametes). This means the genetic characteristic is inherited by their children, so it can also solve paternity cases involving monozygotic twins as potential fathers.

**Q : TO WHAT EXTENT HAS THE METHOD BEEN WELL RECEIVED AND UTILISED?**

**BURKHARD :** Since our initial publication in 2014, our method has been used to successfully establish paternity in a number of cases brought to us by family or criminal courts, and as the feedback from the larger forensics community and the associated media coverage has been overwhelmingly positive, we've certainly been kept busy with even more cases!

The first application of the test in a criminal case context was to support the Boston Police Department and Suffolk County District Attorney's Office in a serial rape case, in which one of the offenders had an identical twin. We used saliva samples to unambiguously match the DNA to one twin, which was powerful evidence. However, the US justice system tends to be wary of new techniques, so as it awaits recognition from the criminal courts in the United States, this evidence cannot yet be admitted in court, as of July 2022.

**Q : WHAT CHALLENGES DO YOU FACE?**

**BURKHARD :** The biggest challenge for us is to stay 100% focused when dealing with the most sensitive cases. It is impossible not to feel for the families involved, but at the end of the day, we always maintain the highest professionalism and we can clock out knowing we helped bring families and victims closer to the truth.

**Q : SO, WHAT'S NEXT FOR THE METHOD?**

**BURKHARD :** Actually, the scope for potential future applications of this method is quite extensive. We have already cut costs by 50% to make it more accessible to families in need of answers, but we don't plan on stopping there. We are exploring alternative screening methods, such as microbiome profiling, which would entail looking at new genetic areas to even further improve accuracy and reliability.

Is the DNA of identical twins really identical?