

DNA for Dummies

This talk is designed for someone who knows little to nothing about DNA, but who wishes to become involved with or at least knowledgeable about the work that Innocence Projects do.

Introduction

In many states, as in my home state of Ohio, the question to keep in mind when considering whether DNA testing will exonerate a particular inmate is *whether a favorable result from testing the biological evidence from the crime scene would raise a "strong probability" that the inmate would have been acquitted had the DNA results been available to the jury at the time of his trial (the standard for a motion for new trial)*. The new trial standard may vary slightly from state to state. When seeking a pardon or clemency, the standard is less clear. Whether test results in a given case might be sufficient to meet this standard or to sufficiently demonstrate innocence for other purposes depends on the facts of the case.

Examples of when DNA testing will generally not be appropriate:

- 1) In a rape case, and the defendant's claim is that it was consensual sex. Or in a murder case, where the defendant claims he acted in self-defense.
- 2) In a rape case where the victim did not report the rape until a substantial amount of time had passed after the attack.

-discuss John Anderson case//exception

- 3) In a rape case where the semen was tested prior to trial and it matched the inmate. Be aware, however, of the possibility of bad labs, corrupt testing or false positives in the original test if a primitive form of DNA testing was used.
- 4) In a murder case, where the victim was attacked and killed in the living room, and the inmate wants a hair tested that was found in an upstairs bathroom to show it was not his hair (evidence not sufficiently connected to crime scene to be material).

For a DNA test result to meet the standard, the circumstantial evidence must suggest that the DNA to be tested came from the attacker.

Cases typically fall within 1 of 4 categories:

#1 Biological evidence in question is obviously highly probative simply because of where it was found or the type of material that it is.

Examples:

1) Semen taken from the victim shortly after a rape.

Q: What if it was tested years before, and no conclusive result?

Q: What if a partial profile was obtained that matched the inmate?

Q: What if evidence was already introduced at trial that this semen did not come from the inmate and he was convicted anyway?

2) Blood found on a murder victim's body that did not come from the victim, and the evidence suggests that the attacker struggled with the victim and victim probably inflicted injuries on the attacker.

Q: What if at the time of trial, an expert testified that this unknown blood was not of the same blood type as the inmate?

Q: What if the expert testified that blood was of the same type as the defendant?

Q: What if trial record is silent as to relation between this blood and the inmate?

3) A pubic hair found in a rape victim's genital area that an expert testified did not come from the victim.

Q: What if an expert, who examined the hair under a microscope, testified at trial that this did not come from the inmate?

Q: What if the expert testified that it DID come from the inmate?

#2 Evidence made probative by way prosecution presented it at trial

In other cases, a piece of evidence that would not otherwise be probative can be made probative by the way the prosecution argued the case at trial.

Examples:

1) Cigarette butt found at scene. Normally this would not be a probative piece of evidence, as anyone could have left a cigarette there before the attack. However, if the prosecution argued at trial that the cigarette butt was highly persuasive evidence that the inmate committed the crime, because it was his brand and a rare brand, then testing the butt and having the defendant excluded as the donor of the saliva on the filter would be worthwhile.

2) Blood found on inmate's clothing. If the prosecution argued that the defendant was guilty because he was found with large amounts of blood on his clothing when he was arrested after the attack, then a DNA result showing that this blood belonged to a friend who had just been cut and the defendant was trying to stop the bleeding, was animal blood (defendant had been hunting or cleaning fish), or at least that it did not come from the victim would be worthwhile and might be sufficient if combined with other exculpatory evidence.

3) Defendant was matched to evidence at crime scene through junk science. For example, an "expert" testified (through microscopic comparison) that the hair found clutched in the murder victim's hand belonged to the defendant. DNA testing may prove this testimony to be inaccurate. Or, an expert testified that the bite marks left on the victim match the defendant's teeth. DNA testing the saliva taken from the bite or from the clothing on top of the bite might prove that this to be incorrect (DNA testing has clearly documented that "bite mark" analysis is highly suspect).

#3 Trial evidence shows that attacker touched or might have left skin cells or other biological material on several piece of evidence. In these cases, if unknown DNA is found on all the items, and they match each other, and they do not belong to the inmate, an argument for exoneration can be made.

Example: Female victim was strangled with panty hose and male attacker accidentally left his baseball hat at the scene (victim testifies that it fell off attacker's head and he left it there). If (1) the panty hose is tested and a male DNA profile is found from attacker having touched the pantyhose, and (2) the hat band is tested and a male DNA pattern is found, and 3) the two DNA profiles match one another, and (4) this profile does not belong to the inmate in question, then a strong case for innocence has been developed.

Q: What if there was only a hat left at the scene (no pantyhose), and the DNA inside did not match inmate?

As you are reviewing cases where DNA has never been raised, keep in mind this fact pattern. If the evidence at trial demonstrated that the attacker touched or deposited DNA on several items, and no one else likely touched or deposited DNA on ALL of those items except the attacker, then this theory should be considered.

#4 Alternative Suspect cases

If you have an alternative suspect, testing nearly anything from the crime scene and matching it to him might be highly probative. If this alternative suspect is a friend of the victim and would likely have left something with his DNA on the scene for innocent reasons, then this might not work. However, if you have a case where the alternative suspect did not know the victim and had no innocent reason to be at the crime scene, then matching him to nearly anything will be highly probative.

ex. Roger Dean Gillisipie, Clarence Elkins

TYPES of DNA Testing

There are 3 types of DNA testing that are frequently used by Innocence Projects: STR (often called “nuclear”), YSTR (also called y-chromosome testing) and mitochondrial (MtDNA). PCR is sometimes referred to as a type of DNA testing. That is not technically accurate, as PCR is simply a process used to amplify small amounts of DNA for testing. STR, YSTR and MtDNA all use PCR.

1) STR/Nuclear is the most common type used by prosecutors, and has been around for many years. It is the ONLY type done by prosecutors or defense attorneys in the state of Ohio (except in rare cases where a prosecutor or defense attorney will send a sample out of state to have other forms of testing done). Many defense attorneys and prosecutors in Ohio refer to STR as "DNA testing" because they are unaware of the other types.

- Advantages:
- 1) DNA profiles generated can be entered into CODIS, the FBI database. You may be able to get a "cold hit" to another offender. This would allow you to find the true culprit and exonerate an innocent person at the same time.
 - 2) Every person in the world has a different STR DNA profile (with the exception of identical twins), so we can get very clear exclusions and inclusions.
 - 3) Cheaper than other methods of DNA testing.

- Disadvantages:
- 1) Cannot be used for hair (unless fleshy root is left on shaft)
 - 2) Sometimes difficult to get a clear, conclusive reading, particularly when the item tested might have both female and male DNA on it. If the ratio of female to male DNA is high, STR will sometimes not even register that male DNA is present because of the "overwhelm factor."

2) YSTR has been around for just a few years. It reads the DNA profile in the Y chromosome of men. Thus, this type cannot be used for female DNA.

- Advantages:
- 1) The biggest advantage of YSTR is that it ignores female DNA, and thus is perfect for items that have mixtures of both genders. For example, YSTR was used in the Elkins case because we were testing for male DNA found under a female's fingernails. Obviously, that will be a mixture of two genders, and regular STR might cause a reading of no male DNA due to female overwhelm. Because YSTR

ignores the female's DNA from her fingernails, we were able to get a clean reading on the male even when small male traces are present and mixed with a high concentration of female DNA. Often good for vaginal swabs or female panties, as they will likely contain more female DNA than male.

2) Anecdotally seems to be more sensitive and able to test smaller amounts of biological material than STR (typically only need 1/5th of what is required for STR). Some believe that YSTR also can pick up a DNA profile from old, degraded biological material where STR testing would not be able to.

3) All men have the same YSTR profile as their father. So, for example, if you're trying to match the DNA to an alternative suspect, and he is hard to find, you can go get the DNA of the suspect's father, son or brother (if they have the same father), and it will be the same.

4) Very powerful in its ability to exclude.

Disadvantages:

1) more expensive than STR

2) Cannot put profile in FBI database to get a cold hit

3) Each male does not have a totally unique YSTR profile, so numbers and statistics are not as persuasive or compelling as STR for inclusions or matches to alternative suspects or for combining several pieces of evidence at a crime scene (each male from same paternal lineage will have same YSTR profile). For example, there may be 1,000 men in the U.S., or maybe more, who have the same YSTR profile as Mark Godsey. It becomes a matter of how rare the profile is (how prevalent or rare the defendant's male lineage markers are in the general population). In the Elkins case, the YSTR from the crime scene did not match Elkins. The State argued that the male who left his DNA in victim #1's vagina could have been a consensual sex partner that had sex with her prior to the attack (despite the fact that this contradicted the trial evidence). The state then argued that the man who left his DNA on victim #2's panties was a male juror at trial who may have touched the panties, which was used as an exhibit. But the DNA on these two items matched. They each had the same YSTR

profile. Only 1 in 570 men have this YSTR profile. Thus, we argued that this theory by the State is highly, highly unlikely, as the chance that these two different men would have the same YSTR profile is only 1 in 570. Thus, it is much more likely that the same man left his DNA in these two places, and this could only be the attacker. With STR, a match is absolute, so you would not worry about statistics like these. Stats depend on size of database.

3) Mitochondrial has also only been around for a few years (early to mid 1990s). It is used for hairs, bone and teeth.

Advantages:

- 1) Allows you to test hairs that cannot be tested with other types.
- 2) Everyone, both male and female, has the same mitochondria DNA profile as their mother (everyone in the same maternal line will have the same MtDNA profile). Thus, if you are trying to match to an alternative suspect, you can get the DNA from that suspect's mother or anyone born to her (suspect's brothers and sisters, nephews and nieces, etc.). Ex. Kevin Cobb, Twins
- 3) The profile is from the mitochondria of the cell, and this degrades at a slower pace than other parts of the cell, so can be good for old, degraded types of biological material.
- 4) Very powerful in ability to exclude.

Disadvantages:

- 1) more expensive than STR
- 2) Cannot put profile in FBI database to get a cold hit
- 3) MtDNA profiles are similar to YSTR—they run in family lines on the maternal side, while YSTR is paternal, so inclusions and matches are not as persuasive as STR. Percentages work like YSTR described under YSTR disadvantage #3. Stats depend on size of database.
- 4) Cannot interpret mixtures—biggest limitation.

How to choose which type to use in a case:

1) If you are simply testing public hair from a rape kit, the only type that will be available is Mito, unless the hair has a fleshy root still attached, which is not common.

2) If you are testing something that is likely to have a female/male mixture, and you are trying to get the profile of the male, YSTR is usually the best. We use YSTR more than any other type.

3) If you are testing a sample that you believe has a lot of male in it, so you don't have to worry about the mixture messing things up, or if your goal is to put the profile in the FBI database to get a cold hit, then STR/nuclear might be the way to go.

4) But keep in mind that each person has a different profile for each type of testing. For example, a man's STR profile will be different from his YSTR profile and his Mito profile. A woman's STR profile will be different from her Mito profile. Thus, if your goal is to test several items at a crime scene with the hope that they all match the same person and this is not your inmate, then you must stick with one testing method for all items. For example, in the Elkins case we had the panties from victim #2 to test for male DNA, the vaginal swab from victim #1 to test for male DNA, and the fingernails from victim #1 to test for male DNA. Because YSTR is clearly the best for finding male DNA under a female fingernail, we used YSTR. Because our strategy was to match the DNA from the fingernail to other DNA at the crime scene, we used YSTR for everything else so that comparisons could be made. Eventually, we found that the same man's DNA on several probative items, and this man was not Clarence Elkins. If we had used different testing types on each item, this comparison between items could not have been made.