POLICING PROJECT FIVE-MINUTE PRIMERS:

RAPID DNA

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The Policing Project's five-minute primers aim to provide basic information on one of the more complex—and rapidly changing—areas of policing: the use of biometric technologies. In each entry in this series we will explore four questions about a particular type of biometric technology:

- **How are police using this technology?**
- **How does the technology work?**
- **How accurate is the technology?**
- **How concerned should the public be?**

The third blog in this series covers the use of **Rapid DNA**. Law enforcement has used DNA analysis as an investigative tool for decades, but in recent years, the technology has leapt forward. Rapid DNA analysis now allows police to process a DNA sample in less than two hours, whereas older processes might take between 24 and 72 hours.

Police across the nation are acquiring Rapid DNA machines—including in Utah, Kentucky, Pennsylvania, Arizona, Florida, and California. Further, in 2017, Congress revised a federal law that has accommodated and propelled police use of this technology.

HOW ARE POLICE USING RAPID DNA?

Police are currently using Rapid DNA technology as a tool to generate leads in investigations, helping solve a variety of crimes. In murder and kidnapping cases, police take DNA samples from crime scene evidence to help locate and charge suspects. Police also use Rapid DNA to solve property crimes, like burglaries and theft.

Additionally, increasing demand for DNA evidence has resulted in a substantial backlog of unprocessed samples, particularly in cases involving sexual assault. This backlog delays prosecution and denies justice to victims. Rapid DNA has the potential to alleviate the backlog by testing rape kits more quickly, providing both moral and economic benefits.

In addition to collecting DNA from crime scenes and victims, police collect DNA samples from people charged with crimes for both rapid and traditional DNA testing. The federal government and 31 states have laws that sanction DNA collection during arrest. In ten of these states, the law requires an arrestee to be indicted, arraigned, or given a judicial hearing before DNA collection and analysis can occur; in other states, DNA can be analyzed immediately. Further, while the Supreme Court approved DNA collection from *arrestees* in *Maryland v. King*, police departments in some cities in Florida, Pennsylvania, North Carolina, and Connecticut have also requested voluntary DNA samples during routine traffic stops—and critics have contended the voluntary nature of these requests was not made clear.

Police use of Rapid DNA technology received a boost in 2017, when the Rapid DNA Act was enacted. This federal law gives local police departments the authority and means to connect their Rapid DNA machines to the FBI's Combined DNA Index System (CODIS), a database containing over 18 million samples.

HOW DOES RAPID DNA WORK?

Understanding how Rapid DNA machines work requires some basic familiarity with the process of DNA profiling. There are four general steps performed during forensic DNA analysis: extraction, amplification, separation, and detection.

- Extraction is the process by which DNA is separated from other proteins and cellular materials in an evidence sample, which can come in the form of saliva, blood, skin cells, or other biological materials. This is the step where the DNA sample is most susceptible to contamination.

- Amplification is a process that makes multiple copies of a piece of DNA in order to give the scientists enough material to test, compare, and verify their analysis.

- Separation is the phase at which DNA molecules are cut into smaller pieces at specific points (loci) using enzymes. The separated DNA then undergoes electrophoresis, which separates the DNA fragments by size across a gel, resulting in bands of DNA that form patterns unique to an individual.

- Finally, during detection, the patterns in the DNA bands at each loci from the unknown DNA sample are compared against known samples to determine whether they are a possible match.

Traditional DNA analysis requires a trained scientist or technician to complete these steps, each of which could take hours. Rapid DNA machines miniaturize and automate all of these steps, removing the need for a human to be present at all stages of analysis. The officer, technician, or scientist running the machine simply needs to place the sample (i.e., a blood or saliva swab) into a disposable cartridge and let the machine do the work. (It is worth noting that these disposable cartridges are not cheap, costing hundreds of dollars per sample.)

One significant difference between Rapid DNA machines and traditional DNA analysis conducted by scientists is that Rapid DNA

machines destroy the initial DNA sample during processing, whereas traditional analysis does not. Though it may be possible to take a different sample from the original piece of evidence, place it in a new cartridge, and test it again to verify earlier results, chemical contamination during the machine's analysis process makes it impossible to retest the same sample cartridge twice, making Rapid DNA unsuitable for some limited crime scene samples. As we will discuss further below, this is one of many concerns raised by Rapid DNA critics.

HOW ACCURATE IS RAPID DNA?

Forensic DNA analysis is generally considered to be largely accurate, though imperfect. Critics contend Rapid DNA machines can exacerbate those imperfections for several reasons.

First and foremost, Rapid DNA machines make mistakes. In 2017, the Swedish National Forensic Center conducted an evaluation of a Rapid DNA machine to determine whether the technology could be used to analyze crime scene samples. Their results showed 36% of the tests had problems or errors affecting two or more samples, and only 77% of the samples gave returns that completely matched the DNA profiles that were expected.

Additional testing in 2018 by the National Institute of Standards and Technology found that without human intervention, Rapid DNA machines were successful approximately 85% of the time, but when experts oversaw the process of the machines, the success rate climbed to 90%. However, experts are not the only people who process samples in Rapid DNA machines.

While many traditional forensic labs, such as the FBI's, have education and training standards for their staff, local police departments that utilize Rapid DNA machines are not held to any standard. For example, when the Bensalem, Pennsylvania police department became the first in the country to install a Rapid DNA machine in 2017, it only required an officer to complete training provided by the machine's manufacturer, with no third-party oversight or accreditation, before operating the device.

Additionally, many Rapid DNA machines are stored in offices—not sterile laboratories—which furthers the risk of contaminating DNA samples, another critical concern for accurate analysis. Contaminated samples run the risk of leading police to the wrong person in an investigation, and prosecutors in multiple states have raised concerns that inadequate handling and processing of evidence can jeopardize cases.

If Rapid DNA machines are used beyond their design parameters, their accuracy is further compromised. According to the FBI Laboratory's chief biometric scientist, the machines are best suited for "large amounts of DNA from a single person, soon after it's collected." However, crime scene evidence often contains samples of DNA from multiple people. Another forensic expert compared the difference in difficulty between analyzing a DNA from a cheek swab versus DNA from a crime scene to the difference between reading the children's book *Run Spot Run* versus reading Shakespeare in Old English.

DNA transfer, an under-studied forensic phenomenon, also contributes to the complexity of analyzing crime scenes, and is a serious accuracy concern for Rapid DNA machine use. Each day, a person will shed thousands of cells containing DNA, and no one is quite sure how long the samples last or how they can transfer. Researchers have found that DNA can even transfer between an evidentiary item and its packaging, or between items with which it was packed during the trip from a crime scene to a laboratory.

These sorts of contamination risks are potentially exacerbated in the era of Rapid DNA, with samples being processed with minimal training outside of the confines of accredited laboratories.

SHOULD THE PUBLIC BE CONCERNED ABOUT RAPID DNA?

Many view DNA collection as an invasion of personal privacy. DNA represents the most private biometric information that you have—the building blocks of what makes you, you. Rapid DNA technology places that fundamental identifier within quick reach of the police with few safeguards, standards, or regulations.

But perhaps more importantly, even in the hands of experts, DNA analysis is not flawless—and the potential risk to innocent people is not insignificant. Concerns about DNA transfer are also not merely theoretical: transferred DNA had led police to impossible suspects (including, in one case, a man who had been dead for two years) and to charge at least one innocent man with capital murder.

The ease and speed of Rapid DNA machines is likely to create an increased reliance on DNA evidence in criminal investigations and prosecutions, in much the same way that traditional DNA analysis came to be relied on. As Rapid DNA machines proliferate, so too will DNA databases, which house the information to compare and identify samples. Just as Rapid DNA machines can be bought by local police, DNA databases can also be created at a local level, often with little to no oversight. One public safety director estimated that approximately 60 police departments use local DNA databases. However, the true number of local databases is unknown, as they are beholden to no state or federal oversight.

Recent case law allowing police to collect DNA samples from arrestees without a warrant has meant that the number of individuals entered into DNA databases is likely to balloon, raising serious privacy and civil liberties issues. For example, it is not apparent why allowing police departments to collect DNA evidence to solve a particular crime (say, a misdemeanor property crime), means that they should be allowed to keep a suspect's DNA profile and compare it against other future samples for years on end. Or, in many jurisdictions, it is unclear what protections or recourse a person who was unlawfully arrested might have after their DNA has already been analyzed and catalogued without their consent. The unfettered collection of DNA and proliferation of Rapid DNA analysis is likely to compound the problems described with these systems and runs the risk of serious intrusions into the liberty of innocent people swept into the databases.

Finally, Rapid DNA also presents potential political and financial impacts as a global multibillion-dollar industry that in America is controlled by only two companies, Thermo Fisher Scientific and ANDE, both of which invested significant lobbying efforts into the passage of the 2017 federal Rapid DNA Act. In 2019, a proposed Rapid DNA bill in Arizona showed the potential complications of this duopoly. The bill created controversy when it attempted to mandate the use of Rapid DNA technology by the Arizona Department of Public Safety—with the qualifier that the machines must be FBI approved. Only ANDE (which helped draft the bill) has an FBI-approved machine, meaning the bill would have effectively granted the company a monopoly on forensic DNA analysis in Arizona. Though the bill ultimately did not pass, it showed the potential complications that can arise at the intersection of for-profit businesses, surveillance, biometric technology, and the criminal justice system.