The Emergence of **Rapid DNA Technology**

International
Biometrics+Identity
Association

Overview

IBIA strongly supports biometrics and forensic applications of DNA, and offers this white paper as a primer for those desiring to know more about rapid DNA analysis technology.

Deoxyribonucleic acid (DNA) carries the genetic instructions that make each person unique. Since its discovery in 1953, DNA has found many applications in the fields of biometrics and forensics, among others. Since the 1970s, DNA analysis technology has evolved considerably. It is now considered the "gold standard" for biometric and forensic identification purposes.

DNA is the only biometric that can infer familial relationships— an extremely valuable tool in scenarios such as missing person and disaster victim identification, lost-child and counter-human-trafficking applications, paternity and maternity testing, and determinations of eligibility for immigration benefits. Like fingerprints, DNA is one of the few biometrics that can be "left behind" at a crime scene.

While highly accurate for identification purposes, DNA can be cumbersome and time-consuming to process. Traditional methods of forensic and biometric DNA analysis require a certified laboratory with at least six expensive instruments, two trained and certified technicians, and about a day per sample of processing time. When the months of waiting in lab backlogs are considered, the timeframe for obtaining DNA test results can be quite long.

Rapid DNA analysis technology is a compelling new development that can significantly shorten analysis times and backlogs, putting less expensive and easy-to-use portable alternatives in the field. Field locations are closer to the points of need, thus relieving and speeding the work of the central laboratories that are still needed for complex forensic analysis.

Advancing Rapid DNA Technology

Current rapid DNA offerings typically consist of a desktop instrument to process single-use cartridges that contain chemical processing agents and analysis materials. The analysis operation is self-calibrating, and proceeds automatically after samples are inserted into the instrument. The self-calibrating system allows people who are not lab technicians to operate the equipment with about an hour of training.

Rapid DNA processing times are typically 75 to 90 minutes, which facilitates faster identification of criminals who might otherwise only be held for two hours or more. Expanded availability of rapid DNA technology could play a critical role in exonerating or excluding suspects, allowing far more efficient investigations when time is critical.

A number of companies around the world are developing rapid DNA analysis technologies to address growing needs for DNA in forensics and biometrics. (See the appendix for brief descriptions of noteworthy companies with technologies to offer.) Instrument costs are on the order of $250k to $350k, with single-use processing kits ranging from $250 to $350 each. As the market for such capabilities grows, the cost will likely go down rapidly.

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Most DNA sequences are common in all humans, making just a small fraction relevant for identification purposes. There are known locations within the genome where these relevant sequences occur. The rapid DNA analysis process isolates twenty of these key points so they can be measured.[1]

The innovations that helped to advance rapid DNA technology to the current state are numerous, but often revolve around micro-fluidic processing techniques. This technology uses much smaller amounts of chemicals to reduce cost, speed reactions, and compress instrument and cartridge sizes. Previous laboratory-based processes of sample DNA extraction (cell lysing), purification, amplification (also called polymerase chain reaction or PCR), separation (also called electrophoresis), and detection are now all accomplished within one rapid DNA instrument, often on one microfluidic chip.

1 Traditionally, and since 1997 within the FBI's Combined DNA Index System (CODIS), 13 of such STR loci were analyzed, along with a marker for gender called amelogenin. However, in late 2015 the FBI announced an expansion of the original 13 loci to 20 core loci effective as of 2017. More loci means that the set selected can be a superset of the U.S. and international core loci, facilitating international data sharing. In addition, more loci means not only better identification of individuals, but also more assured family relationship testing.

Federal Regulatory Advancement Supporting Rapid DNA

From 2015 to early 2017, Congress considered a number of amendments to the DNA Identification Act of 1994 designed to hasten the field deployment of rapid DNA technology. The Rapid DNA Act of 2017 (S.139 and HR.510) amends the DNA Identification Act of 1994 to permit the use of automated rapid DNA instruments in addition to traditional laboratory-based processing mechanisms. This bill cleared the Senate and the full House, and was signed into law on August 18, 2017 by President Donald Trump.

The 1994 law uses a DNA Advisory Board to develop standards for agencies and operators to analyze DNA samples. The National Institute of Justice then certifies DNA processing centers based on the board's standards. The new law will dissolve the DNA Advisory Board, empowering the Director of the FBI to directly issue standards and procedures for the use of Rapid DNA instruments and resulting analyses.

The Rapid DNA Act of 2017 also facilitates law enforcement exchange of DNA identification information, to include information on DNA identification records and DNA analyses. This index applies to agencies that engage in rapid DNA analysis with respect to the intake, processing, booking, detention, or incarceration of individuals charged with or convicted of qualifying offenses.

The ultimate goal of this legislation is to allow rapid DNA devices in the field to be connected to the FBI's CODIS database.

Rapid DNA and Privacy

Some privacy advocates oppose the use of rapid DNA technology. Immigrants' rights and civil rights groups raise concerns about unauthorized and invasive biometric collection. Others believe that rapid DNA technology will pave the way for development of a nationwide DNA index.

These concerns are consistent with arguments that have been made about biometrics in general for decades. IBIA's perspective is that DNA used for identification purposes is no different from a fingerprint—a view consistently upheld in the courts. Yet DNA is different in one key and very useful respect—it can be used to infer familial relationships, which can be useful for government applications where benefits are based on connection to an eligible relative.

Commercial DNA databases should follow the same best practices that the IBIA advocates for all biometrics.[3] For government applications within the U.S., 29 Federal laws and acts currently govern various aspects of privacy protection for American citizens. Unfortunately, criminals use these laws to their advantage, hiding behind the veil of anonymity or false identity. By lifting this veil, rapid DNA technology denies criminals the ability to exploit systemic loopholes.

For more information, visit **www.ibia.org**.

3 See www.ibia.org for a listing of the IBIA recommended best commercial practices.

Identity Matters

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