



HOME



**PATC DIVISIONS**

-  ONLINE TRAINING
-  LAW ENFORCEMENT TRAINING INSTITUTE
-  FIRE SCIENCE TRAINING INSTITUTE
-  LEGAL & LIABILITY RISK MANAGEMENT INSTITUTE
-  SCHOOL RESOURCE TRAINING INSTITUTE
-  COUNTER TERRORISM TRAINING INSTITUTE
-  PATC PUBLISHING
-  WESTERN STATES TRAINING CONFERENCE
-  Homicide Cold Case Review Committee

# PUBLIC AGENCY TRAINING COUNCIL

ABOUT PATC    PATC PUBLISHING/BOOKSTORE    TRAINING PARTNERS    E-NEWSLETTER

CONTACT US    HOME

## DNA Testing Timeline

by: **Heather R. Fisher Sargent, MFS**  
**Forensic Scientist**  
Human Identification Technologies, Inc.



**Human Identification Technologies, Inc.**

As a Forensic DNA Analyst, I have often been asked why DNA analysis takes so long. This is a rather complex question because there are many contributing factors—the huge DNA backlog, the insufficient number of qualified DNA analysts in the laboratory, and the constant influx of new cases. I have worked at state, federal, and private crime laboratories and have witnessed first-hand the severe backlogs that exist. Although the throughput of DNA laboratories must increase to meet demand, it is critical that the quality not be sacrificed.

So, minus the backlog and related issues, how long does it take to obtain DNA profiles from submitted evidence? I can think of no better way to answer this question than to take you step-by-step through what needs to be done in a forensic DNA laboratory and approximately how much time it takes to accomplish these tasks. There are a few steps that take up time throughout the analysis of a case including cleaning, documentation, and quality control measures. It is difficult to ascertain exactly how much time is devoted to each of these tasks, which occur at each step of testing from body fluid identification to the final DNA typing. The following are routine tasks that take place during and between the technical steps in DNA analysis.

### Cleaning

As forensic DNA analysts, it is incumbent upon us to maintain a clean, contamination-free environment. Every time new evidence is laid out and examined, the surface of the examination table is cleaned with bleach. Utensils such as scissors and tweezers are also cleaned in bleach followed by ethanol and often irradiated with ultraviolet light for several minutes. The enclosed work areas known as hoods are decontaminated with ultraviolet light. While cleaning is second-nature to DNA analysts, the number of minutes that it takes each day to clean may seem surprising. Keeping hoods, utensils, and instruments clean is an essential step in forensic DNA testing to prevent contamination.

### Documentation

Extensive note-taking and documentation takes place at each step of the analysis process. It begins from the time the evidence enters the laboratory, which is documented via the chain of custody. Any movement of the evidence within the laboratory must be documented to maintain this chain of custody. Communication logs are often generated at laboratories to keep records of various contacts with detectives, attorneys, etc. When the analyst takes custody of evidence and performs visual examinations, critical information about the evidence must be documented. Evidence is also often photographed. Documentation continues throughout the DNA analysis from labeling tubes to meticulously filling out forms at each phase of the process. Quality Control Measures

There are several quality control measures that are performed during the course of DNA analysis. Various instruments are used in the laboratory, which must be maintained and calibrated to guarantee they are working properly. Every time an analyst uses an instrument, this information must be documented in a user log. Temperatures of refrigerators and freezers that store evidence and reagents are recorded daily. Reagents necessary for DNA analysis must be documented every time they are prepared with information such as lot numbers and expiration dates. Lot numbers of reagents used by the analysts are recorded throughout the entire analysis in order to ensure traceability.

### Technical Steps Involved In DNA Analysis Of Casework

My goal here is to give a reasonable time-line in hours of how long it actually takes for a DNA analyst to process evidence in a typical case, from body fluid identification to a written report. To make things easy, I am going to assume that I am given a relatively straightforward case to analyze (versus a complicated homicide case with numerous boxes of evidence). We will assume throughout that I am processing a sexual assault case with a rape kit, clothing items from the victim, and reference samples from both the victim and suspect. Each technical step is described below with time estimates in bold.

#### Body fluid screening of evidence

The initial process of visually examining items of evidence for body fluid can be quite time-consuming. This basic step can actually be one of the most time intensive aspects of analysis, depending on the type of case. This is also the most important aspect because if biological material is not located, there will not be any DNA to analyze. At this point, forensic DNA analysts are looking for any type of body fluid stains that would be useful to the case, such as blood, semen, or saliva. For example, in a rape kit there are several swabs, including vaginal, anal, and oral that may be analyzed. DNA analysts test these swabs for seminal fluid and possibly perform microscopy to see if sperm cells are present that would positively identify semen. In other types of sexual assault cases with clothing items, analysts use an alternate light source (ALS) to visualize hidden stains and then further perform body fluid identification. An ALS is commonly

As the largest private forensic DNA laboratory in Southern California, Human Identification Technologies, Inc. (HIT) provides testing and consulting services to our nation's legal community. Our single scientist case approach from testing to testimony allows for consistent communication between counsel and scientist throughout the testing process. Through our DNA testing and consulting services, HIT has assisted in the resolution of numerous cases throughout the nation.

Due to an extensive criminalistics background, HIT's forensic scientists have a unique understanding of DNA's role in the criminal justice system and its impact in the courtroom. This insight has resulted in a progressive laboratory that is focused exclusively on the efficient application of DNA technology in criminal matters.

[www.hitdna.com](http://www.hitdna.com)

used to visualize stains that cannot be seen by the naked eye, such as seminal stains. Semen and other biological stains can be made to fluoresce using the ALS with various combinations of wavelengths and filters. It is also important to keep in mind that forensic scientists look for clues when screening evidence and must pay attention to the fine details such as bloodstain patterns, bloody fingerprints, and bloody shoe impressions. Details of the case may demonstrate that certain bloodstains are more probative than others. It is difficult to give a time-line of this stage because it can vary.

*Rape kit: 2 hours 30 minutes of screening*  
*Panties from victim: 2 hours of screening*  
*Clothing from victim: 2 hours of screening*

**Total Time Spent On Case At This Point: 6 hours 30 minutes**

#### **DNA Extractions**

Once the stains have been located, forensic DNA analysts focus attention on isolating the DNA from these stains. There are several types of extraction procedures used in forensic laboratories today, some of which are organic, organic differential, and QIAamp® DNA Micro extractions. For sexual assault cases, such as those including a rape kit with swabs, forensic DNA analysts are interested in isolating both male (sperm) and female (non-sperm) fractions, which is more time consuming to do than an organic extraction of a bloodstain, for example. The QIAamp® DNA Micro extraction is often performed on reference samples from victims and suspects. Reference samples are always processed separately from questioned casework samples to prevent any type of contamination. Reference samples generally contain high amounts of DNA relative to questioned casework samples. By processing them separate from one another, the chance of crossover contamination is eliminated. The amount of DNA recovered from all samples in the extraction procedure is documented in the forensic analyst's notes, as well as the amount of extract consumed for analysis. In this way, the analyst knows how much sample remains for possible re-analysis by another laboratory.

*Organic extraction: 4 hours 30 minutes*  
*Organic differential extraction: 8 hours 30 minutes*  
*QIAamp® DNA Micro extraction: 2 hours 30 minutes*

**Total Time Spent On Case At This Point: 22 hours**

#### **DNA Quantitation**

The next step is to determine how much human DNA is present in the extracted samples. It is important to know this amount so appropriate dilutions can be made if there is a lot of DNA in the sample or the extract can be concentrated if there is very little DNA in the sample. The 310 Genetic Analyzer is one instrument used to actually perform the DNA typing analysis, and operates ideally when samples have a specific concentration, which is why DNA analysts are so concerned with knowing the amount of DNA present in the extracted samples. DNA quantitation is performed using a technique known as real-time PCR in most laboratories. The analyst prepares the samples by adding chemicals and then the samples are actually run on the instrument for approximately two hours.

*Preparation time: 1 hour 30 minutes*  
*Samples running on instrument: 2 hours*  
*Analysis of data by analyst: 45 minutes*

**Total Time Spent On Case At This Point: 26 hours 15 minutes**

#### **PCR**

Once the amount of human DNA in each sample is determined, the necessary calculations are performed to set up the PCR (Polymerase Chain Reaction) step. In the PCR process, the DNA is copied or amplified and tagged at physical locations on the DNA that are of interest to forensic DNA analysts. Samples are diluted and/or concentrated to meet the target amount of DNA for the PCR reaction. The analyst prepares the samples by adding chemicals and then they run on the instrument for approximately 3 hours and 30 minutes.

*Calculations: 30 minutes*  
*Dilute/Concentrate DNA: 1 hour 30 minutes*  
*Preparation of samples for PCR: 45 minutes*  
*Samples running on instrument: 3 hours 30 minutes*

**Total Time Spent On Case At This Point: 32 hours 30 minutes**

#### **DNA Typing**

The final technical step of the process involves taking the copied and chemically tagged DNA from the PCR reaction and running it on an instrument such as the 310 Genetic Analyzer. This instrument separates the chemically tagged DNA fragments by size, identifies them through optics inside the instrument, and then by computer software, generates data that analysts can review and use to determine DNA profiles. The 310 Genetic Analyzer processes samples one at a time and it takes approximately 35 minutes for each sample. There are a number of control samples that are also run in parallel with the casework DNA samples. For a sexual assault case

with questioned casework samples (e.g. vaginal and anal swabs) and reference samples from victim and suspect(s) there may be approximately ten samples in addition to all of the control samples, which brings the total to 25 samples being run on the instrument. When the run is complete, the analyst must interpret all of the data using complicated computer software. There are numerous pages of data that need to be reviewed by the analyst so the DNA profiles can be determined. After reviewing the data, statistical analysis with the aid of a computer program is performed by the analyst to determine how frequent the DNA profiles are in the population. Then the analyst generates a report summarizing all of the scientific findings of the case.

*Preparation of samples for 310 run: 45 minutes*  
*Samples running on instrument: 12 hours 30 minutes*  
*Analyst interprets/reviews data: 2 hours*  
*Statistical analysis: 1 hour 30 minutes*  
*Analyst generates a report/paginates case file: 1 hour 30 minutes*

**Total Time Spent On Case At This Point: 50 hours 45 minutes**

#### **Technical/Administrative Reviews**

Once the analyst is finished with the case file, it is handed to another qualified forensic DNA analyst who completes a thorough technical review of the case from start to finish. The reviewing analyst evaluates the case to make sure correct procedures were followed and that the conclusions are based on proper scientific analysis. After the technical review is complete, another individual performs an administrative review, which ensures that the report meets laboratory guidelines, is grammatically correct and is free from typographical errors and transpositions .

*Technical review: 3 hours*  
*Administrative review: 30 minutes*

**Total Time Spent on Case: 54 hours 15 minutes**

#### **Conclusion**

Obviously, this time-line is a rough estimate of how long it would take to analyze a relatively straightforward case based on my experience in the laboratory. The total time adds up to approximately 54 hours and 15 minutes. Along with the other tasks mentioned earlier—cleaning, documentation, and quality control—it is probably closer to 60 hours. As can be seen, the forensic DNA analyst has many responsibilities, from quality control to actual technical work in the laboratory to technical reviews. There are other responsibilities such as testifying in court, training other laboratory personnel, etc. The analyst usually has to juggle multiple cases as well. There is no short-cut to speed up DNA testing. With lives and liberty at stake, the forensic DNA analyst has an obligation to produce the highest quality of work and with this commitment comes the cost of time.

---

[PATC Home](#)

[Recent Articles](#)

Public Agency Training Council • 5101 Decatur Blvd., Suite L • Indianapolis, IN 46241 • (800) 365-0119  
[About PATC](#) | [PATC Publishing/Bookstore](#) | [Training Partners](#) | [E-Newsletter](#) | [Contact Us](#) | [Home](#)