

## **Biochemistry Section**

Biochemistry is the section of the Forensic Laboratory dedicated to identifying the source(s) of biological material that is collected at crime scenes and from sexual assault kits. DNA can be extracted from a number of different biological materials such as blood, semen, saliva, sweat, tissue, bone and teeth. A sample of biological material is processed using the steps described below to develop a DNA profile that can then be compared to the known DNA profiles of all involved individuals. This comparison can result in a match between the evidence and an individual (inclusion), no match between the evidence and an individual (exclusion) or no conclusion if the condition of the evidence prevents the collection of sufficient information to render an opinion. Qualifying profiles generated from the evidence can then be entered into a DNA database to determine if there is a match with evidence from another case or with an individual who was required to submit a DNA sample to the DNA database.

The general process of DNA analysis for the Biochemistry Section is as follows:

- Magnetic bead technology used to extract and purify DNA manually or with automated liquid handling instruments.
- Quantifiler Duo® Kit (Life Technologies) using 7500 Real Time PCR System used to quantitate how much total human DNA and male DNA is present in samples.
- Many copies of specific locations on the DNA molecule are then created using a process called PCR (Polymerase Chain Reaction).
- PowerPlex® 16/PowerPlex® 16HS (Promega Corporation) identifies 16 locations on the DNA molecule including a location that identified the gender of the donor.
- PowerPlex® Y (Promega Corporation) is used to analyze male DNA by identifying 11 locations on the Y chromosome.
- Applied Biosystems 3130 Genetic Analyzer capillary electrophoresis instrument is used to analyze DNA samples and develop a DNA profile.
- The data generated by the Genetic Analyzer is evaluated and a report is written detailing the conclusions reached by the analyst.

The State DNA database is a part of a national network called CODIS (COmbined DNA Index System). Accredited DNA labs from cities, counties, states and the federal government use the same software to handle the samples in their databases. These databases are all connected to NDIS (National DNA Index System). The purpose of these databases is to provide investigative leads to law enforcement concerning unsolved crimes and to aid in the identification of unidentified human remains.

- The West Virginia DNA Database consists of several categories of profiles including forensic unknowns (evidentiary samples), convicted offender samples, unidentified human remains/deduced victim known and relatives of missing persons.
- Convicted offenders are individuals who have been convicted of a felony or sex crime based misdemeanor in West Virginia and is required by law to give a DNA sample for inclusion in the database.
- Unidentified human remains are remains that have not been identified through standard methods such as dental records.
- Deduced victim knowns are profiles collected from items commonly used only by a person who has been identified by law enforcement as a missing person.
- Relatives of missing persons are reference samples submitted to the database from close relatives of a missing person. These profiles are only used to identify unidentified human remains or a person who is unable to communicate their identity to law enforcement.
- Databases of forensic unknowns are searched against each other to provide possible links between crimes.
- Databases of forensic unknowns are searched against offender databases to identify the possible donor of the biological material collected from a crime scene.

- Databases of unidentified human remains are searched against forensic unknown databases, offender databases and relatives of missing person's databases to try and provide investigative leads concerning the identity of the remains.
- Databases of missing persons are compared to forensic unknown databases, offender databases and unidentified human remains databases to try and provide investigative information to law enforcement concerning the missing person.
- The same categories and searches that occur with the West Virginia DNA Database also occur at NDIS.
- A match occurs between samples when the DNA profiles are identical or when there is a great deal of similarity between the two samples.
- When a match is confirmed a letter is sent to the investigating officer detailing the new information provided by the database match.

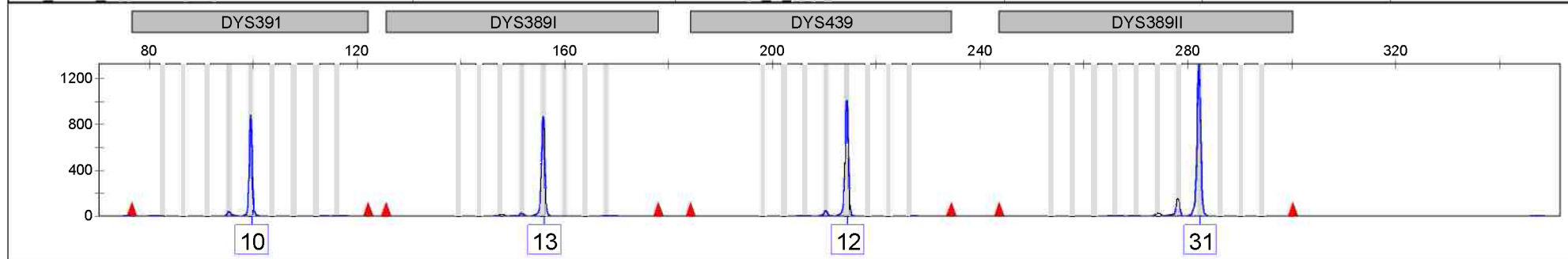
In order to provide the best possible service to the State of West Virginia the Biochemistry Section is audited under several different standards. Trained auditors, who are also experienced DNA analysts, from other accredited laboratories evaluate the Biochemistry Section for compliance with the standards on a regular basis. The Section must pass these audits to continue to operate. The Laboratory has been accredited by ASCLD/LAB since 1994. Compliance with these standards ensures that the work performed by the Section is of the highest quality and conforms to national standards. The Standards and responsible organizations are as follows:

- Quality Assurance Standards (QAS) for Casework Laboratories developed by the DNA Advisory Board (DAB) and SWGDAM (Scientific Working Group on DNA Analysis Methods) and supported by the FBI.
- Quality Assurance Standards (QAS) for Databasing Laboratories developed by the DNA Advisory Board (DAB) and SWGDAM (Scientific Working Group on DNA Analysis Methods) and supported by the FBI.
- Standards and criteria developed by ASCLD/LAB (American Society of Crime Lab Directors/Laboratory Accreditation Board)

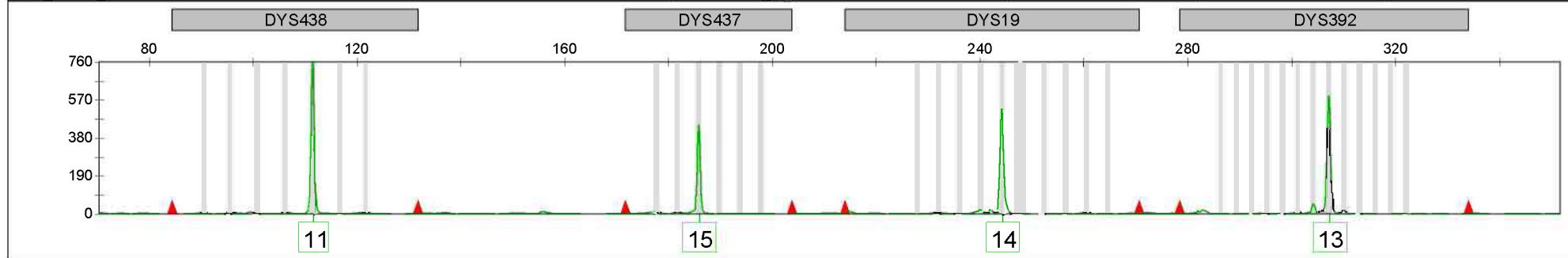
National standards require a DNA analyst to possess not only the educational requirements described under **Forensic Analyst** at the WV Division of Personnel Classification/Compensation website but specific coursework as well. An applicant **must** possess a minimum of nine hours of college credit (semester or the equivalent) covering Biochemistry, Molecular Biology and Genetics. If the applicant does not have college credit with each of these subjects as the title of a course then the applicant must provide supporting documentation that these subjects were an integral part of the coursework being submitted to meet the nine hour requirement. Coursework or training in population statistics or population genetics is preferred but not required.

The following two pages are called electropherograms representing the two identification kits used by the Biochemistry Section. An electropherogram is a plot of the results generated by the genetic analyzer using electrophoresis to separate the amplified products generated by the PCR process. The gray bar above each peak contains the name of the locus (specific location on the DNA molecule). The first electropherogram is from the PowerPlex Y kit. This kit is specific to male DNA. Since most males possess a single Y chromosome there is generally only one peak (allele) for each locus. The DYS385 locus will often show two peaks due to a genetic mutation long ago. The second electropherogram is from the PowerPlex 16 kit. Again the locus name is in the gray box above the peaks. Since everyone possesses two of each chromosome, except for the X and Y chromosomes, there will be two copies (alleles) for each locus. If there is one peak for a locus then the two alleles were identical and the individual is homozygous at this locus. If there are two peaks, then the alleles were different and the individual is heterozygous at this locus.

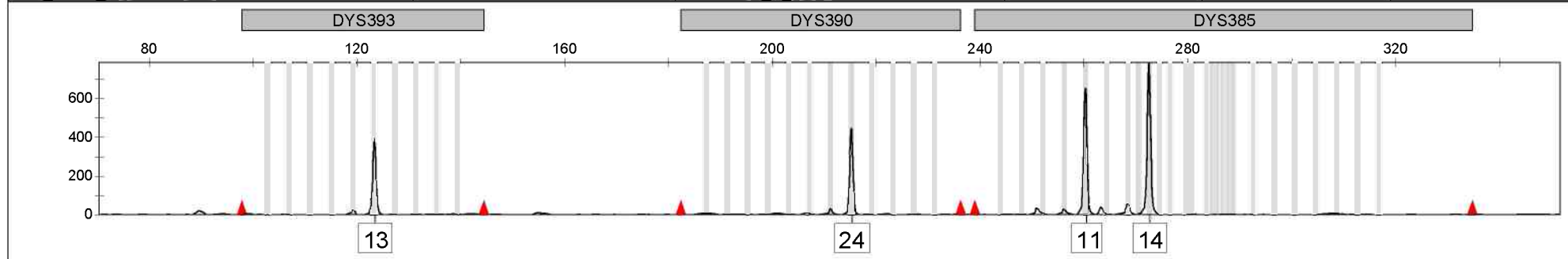
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F04_PPY+ 1297795000635.fsa	PPY+	PowerPlex Y ID3.2.0			
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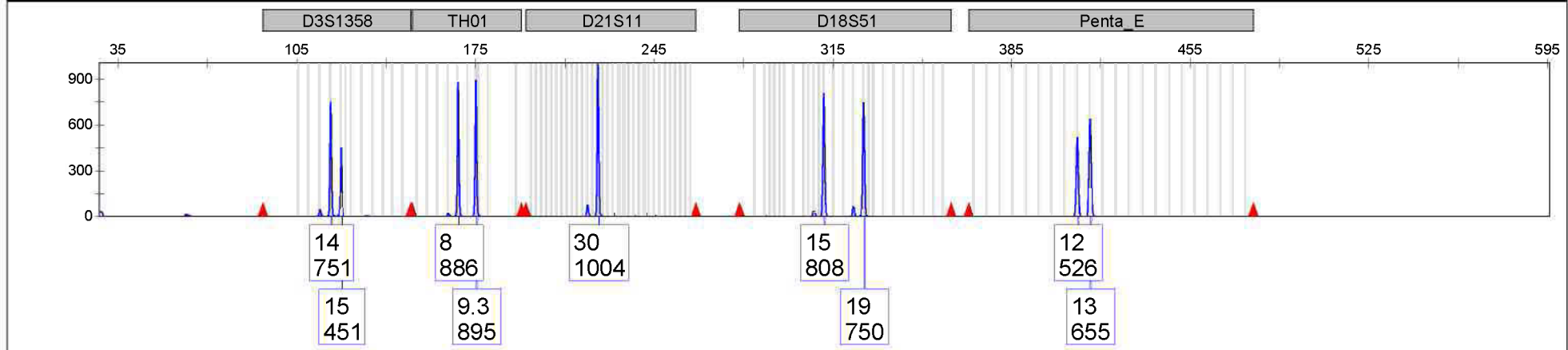


F04_PPY+ 1297795000635.fsa	PPY+	PowerPlex Y ID3.2.0			
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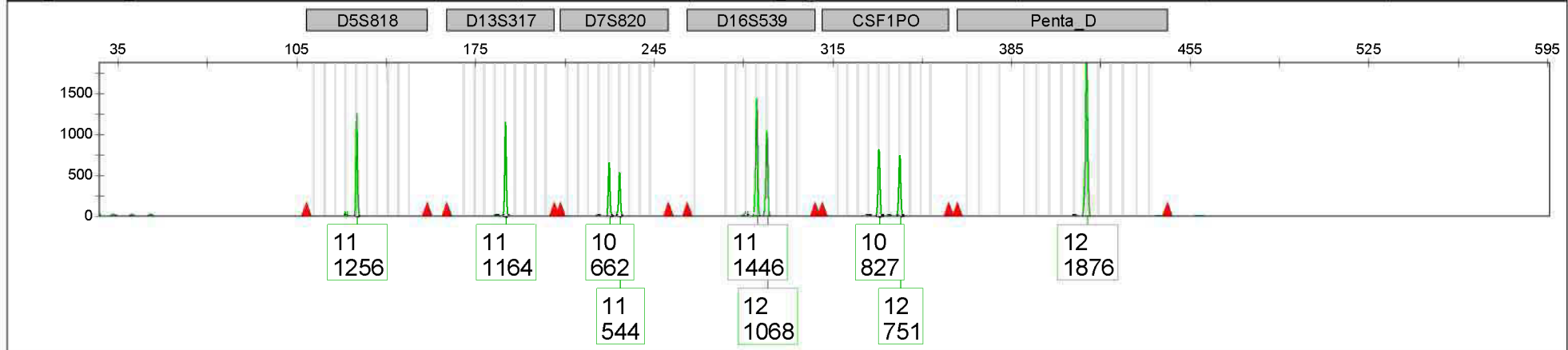


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Sample File	Sample Name	Panel	SQO	OS	SQ
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B01 1302538557293.fsa		PowerPlex_16_ID3.2.0	■	■
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