Automated Quality Assurance for the Forensic DNA Laboratory

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STR profiling is a scientifically reliable approach to human identification widely used in criminal justice and other critical applications. A high quality DNA laboratory that consistently generates reproducible data supports society's confidence in the science. Conversely, lower quality data can undermine the integrity of DNA identification and its acceptance as legal evidence. Therefore, a key goal of the forensic community is to assure the quality of the DNA laboratory process.

Yet quality assurance (QA) is currently a time consuming, labor intensive process that only partially characterizes the DNA process. Labs conduct special studies to determine the reproducibility of certain STR data variables. It would be useful to have a computer-based QA process that continuously monitored a wide range of STR variables on the actual forensic data. This computer process should operate automatically on lab data without human intervention, and provide ongoing reporting of its QA measurements.

Cybergenetics TrueAllele® System 3 provides this automated background QA process, supporting both reference samples and casework data (including mixtures). Quality variables of interest include size precision, peak variability, background noise, PCR stutter and relative amplification. Greater variation (i.e., less precision) suggests less reliable data. A forensic scientist can examine how these variables change over time in order to assess STR data reproducibility. The early detection of data variability can prevent problems and facilitate troubleshooting.

In this study, we present TrueAllele QA assessments performed on reference and casework STR processes from many public and private DNA laboratories across a variety of DNA sequencers and STR panels. We show comparisons between DNA vendor labs that are helpful in quantifying quality, and in using high quality as an objective purchasing criterion (that complements low price). Quality comparisons within a laboratory illustrate how continuous QA can lead to consistent results and quality improvements over time. Moreover, we show how such QA comparisons can help identify which instruments, panels, people and processes are more (or less) reliable. By shifting the burden of QA from scientists to their computers, continuous QA helps assure the integrity of the forensic DNA process.