B68 An Evaluation of the Investigator® 26plex QS STR Kit and a Comparison With Two Commercially Available Short Tandem Repeat (STR) Kits

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Learning Overview: This presentation will provide attendees with information regarding the performance of a new STR kit from QIAGEN® that has not yet been marketed in the United States. This project seeks to compare this new kit to two existing forensic STR kits in terms of their sensitivity, resistance to inhibitory compounds, usefulness for casework-type samples, and ability to interpret two-contributor DNA mixtures.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing information about the performance of a new human STR kit compared to two commonly used commercial kits.

STRs are the gold standard in forensic human identification. Several multiplex STR kits are currently on the market, and in recent years, kits have included an increasing number of loci, resulting in profiles with more discriminatory power. Before new kits are implemented in crime laboratories, they go through extensive validation studies. It is important that the chemistries be sensitive enough to produce profiles from low-quantity and low-quality samples. In addition, DNA profiling can be complicated by various Polymerase Chain Reaction (PCR) inhibitors common to forensic sample types, and some kits are better able to handle these inhibitors than others.

In this study, we evaluated the Investigator® 26plex QS kit and compared it to two kits commonly used in forensic laboratories: the Investigator® 24plex QS kit from QIAGEN® and the GlobalFiler™ PCR Amplification kit from Thermo Fisher Scientific™. The Investigator® 26plex QS kit is a new kit that simultaneously amplifies the Combined DNA Index System (CODIS) loci and the European standard loci, plus Penta D, Penta E, D6S1043, DYS391, and amelogenin, along with Quality Sensor (QS) markers to monitor for inhibition. A sensitivity study consisted of varying concentrations of control DNA between 16pg and 2ng. To test the kits' tolerance to common inhibitors, low, medium, and high concentrations of hematin, humic acid, calcium, and collagen were added to control DNA. In addition, a study was carried out to assess the effect of male/female DNA mixtures on profile interpretation. Finally, a variety of casework-type samples were run, including bone, hair, blood, decomposed muscle, Ultraviolet (UV) -damaged, buried bloodstains, and formalin-damaged tissue.

The data show that all three kits produce complete or nearly complete profiles with at least 32pg of DNA, and the Investigator® 24plex QS kit recovers more alleles than the other two kits at a 16pg DNA input. Additionally, the Investigator® 26plex QS kit has a wider dynamic range with relatively clean profiles at a 2ng input, while Investigator® 24plex QS and GlobalFiler™ experienced pullup between dye channels, making the resulting profiles more difficult to interpret. Investigator® 26plex QS and GlobalFiler™ were inhibited by high concentrations of calcium and collagen and experienced significant allele dropout in the presence of these inhibitors. Investigator® 24plex QS was resistant to all inhibitors and only experienced dropout at high collagen concentrations. The genotypes of the shared loci for the casework samples were concordant between the three kits, and the profile quality and completeness were similar. When two-contributor DNA mixtures were assessed, GlobalFiler™ had the most complete profiles for minor contributors. Investigator® 26plex QS and Investigator® 24plex QS preferentially amplified the major contributor alleles, resulting in more drop out of the minor contributor.

Overall, this research investigates and reports on the relative performance of three commercial STR chemistries, including a chemistry not currently available in the United States.

Short Tandem Repeats, Human Identification, Forensic Casework