THE USE OF A FORENSIC RANKING INDEX FOR ASSESSMENT OF DNA STR PROFILE QUALITY

Jon Davoren, Bode Technology Group

The assessment of DNA STR profile quality is typically performed by manual examination of data which is generally not quantified and relies on empirical knowledge of the practitioner. Manually assigning quality metrics on large data sets is not practical and can be difficult to reproduce. To streamline and standardize the process of quality ranking DNA STR profiles, the Forensic Index (FI) was developed by Hedman et al 2009. The FI calculation involves first determining the total peak height (TPH), the mean local balance (MLB) and the Shannon Entropy (SH), then reducing the three factors down to one number with Principle Component Factor Analysis, and finally validating the result against a manually ranked calibration set. The FI combines signal strength and balance into one number providing an unbiased and quantitative quality assessment of STR profiles.

The FI is very helpful for ranking STR profiles based on data quality but, there are some limitations. The FI was initially implemented, by Hedman et al, on the AmpFlSTR® SGM Plus® PCR Amplification Kit which contains 10 STR loci and the results are not directly comparable to other systems as the TPH and SH values vary with the number of loci. The choice of calibration set affects the final ranking of profiles therefore results from different laboratories are not directly comparable without sharing calibration data sets.

The FI was evaluated for assessing the DNA STR profiles generated as part of a DNA preservation study. The study included evaluating more than 2000 samples, from four different biological fluids, that were collected at time points up to 10 years and were exposed to 12 possible preservatives to increase the stability of the DNA. Even with the large number of samples the FI calculation was easy to implement as it is automated in a Microsoft® Excel workbook. The FI provides one index that makes data comparison simple and was consistent with the results achieved with much more involved calculations of profile quality including percent of complete profile, signal strength, and intra and inter locus balance. When applicable the FI may provide a best practice approach for evaluating data in basic research as well as developmental and internal validations.