B14 Building a Face for a Case: Advanced Investigative Leads From Forensic DNA Phenotyping and Prediction Markers

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Learning Overview: After attending this presentation, attendees will be better informed regarding which forensic DNA phenotyping prediction marker tools are more reliable for developing externally visible characteristics such as skin, hair, and eye color. Attendees will also appreciate and understand the value of using these biometric predictions for investigative leads for potential suspect identification in criminal casework.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by improving knowledge and increasing the fundamental understanding regarding the prediction reliabilities determined by this research. The forensic science community will be able to use this information in conjunction with published prediction tool accuracies to ascertain which tool is better suited for the marker(s) of interest.

Suspect identification plays an important role in criminal investigations. Without a suspect, a crime cannot be solved. Law enforcement agencies depend on their selected prediction tools not only for accuracy but also for reliability. Reliability is the key to identifying potential suspects. Genetic variations in single nucleotide polymorphisms (SNPs) provide very useful phenotypic markers about the physical characteristics of an individual. The externally visible characteristics (EVCs) can identify a face of a suspect.

This presentation will discuss the reliability of Forensic DNA Phenotyping prediction tools for SNPs used to predict externally visible characteristics. The 8-Plex and 7-Plex phenotype prediction tools for skin color were analyzed for reliability. A Hirisplex prediction tool was analyzed for hair and eye color prediction reliability, and Irisplex, 8-Plex, and 7-Plex prediction tools were analyzed for eye color prediction reliability in various populations.

The results of this study indicate that: (1) suspect identification from eyewitness statements is an unreliable source of identification, with an error rate greater than 75%; (2) with an 8-Plex phenotype prediction tool, successful identification outcomes approach 81% and with the 7-Plex phenotype prediction tool, successful prediction outcome is 62%. Skin color phenotype predictions are significantly more reliable with the 8-Plex compared to the 7-Plex model (p-values <0.05); (3) IrisPlex tool results in significantly higher eye color prediction rates than using the 7-Plex or 8-Plex tools (*p*-values <0.05). All three prediction tools had greater iris color prediction failures in the European population in the green and/or blue eye color bins. IrisPlex was the only eye color prediction tool that also had a significant number of failures in the green eye color prediction bins for mixed populations; (4) there was no statistically significant difference between HIrisPlex reliabilities for hair and eye color predictions (p-values >0.05). HIrisPlex eye color predictions resulted in an intrinsically similar pattern using the IrisPlex, 7-Plex, and 8-Plex tools, where the highest number of failures were in the intermediate eye color category; and (5) DNA-based "witnesses" created from forensic DNA phenotyping facial composites resulted in solved cases proven by this study to be successful at a significance level greater than >75%.

This empirical research provides data that supports the reliability of forensic DNA phenotyping prediction tools. The data demonstrated that the prediction tools evaluated in this study can be utilized for generating reliable facial reconstruction composites to provide law enforcement with advanced investigative leads. Thus, when facial composites are published for suspect identification law enforcement agencies can be confident that they will lead to the right suspect.

Forensic DNA Phenotyping, Single Nucleotide Polymorphisms, Externally Visible Characteristics