APPLICATION OF A FORENSIC SNP ARRAY TO PREDICT BIOGEOGRAPHICAL ANCESTRY, GENDER AND Y-HAPLOTYPE GROUPS FROM BLINDED DNA SAMPLES

Joseph Donfack[1], Aruna T. Bansal[2], Susanne E. Howlett[1,3], Mark F. Kavlick[1], Lora J. Gioeni[4], Garth D. Ehrlich[5], Kenneth K. Kidd[6], and Brendan J. Keating[7].

[1]Counterterrorism and Forensic Science Research Unit, FBI Laboratory Division, Quantico, Virginia, 22135, USA

[2]Identitas USA, Inc., New York, New York 10010, USA

[3]Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee, 37831, USA

[4]Chemical, Biological, Radiological, and Nuclear Sciences Unit and Forensic Science Research Unit, FBI Laboratory Division, Quantico, Virginia, 22135, USA

[5]Center for Genomic Sciences, Allegheny Singer Research Institute, Pittsburgh, Pennsylvania, 15212, USA

[6]Department of Genetics, Yale University School of Medicine, New Haven, Connecticut, 06520, USA

[7]Institute for Translational Medicine and Therapeutics, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania, 19104, USA

Criminal investigation using the Combined DNA Index System (CODIS)-based system has been very successful with over 12 million samples profiled on the US national system. However, there are always cases that remain unsolved because the evidence DNA sample profile does not match a suspect's DNA profile, or produce a hit in any database of criminal DNA profiles. In such situations, predictive DNA technologies could be utilized as supplemental investigative tools to define ancestry, phenotypic traits and kinship. There has been remarkable progress in the development of rapid, reliable, DNA-based genomic screening and characterization technologies; and these technical advances combined with the construction of reference population panels derived from the performance of genome-wide association studies pave the way for predictive models to help with profiling specific criminals. Predicting human externally visible traits from genotype could be challenging due to the complex interplay of different genes; but advances in DNA-based technologies are now making "DNA intelligence" a reality. In this study, 310 human subjects were blindly genotyped utilizing a dedicated forensic 201,173 SNP array using the Infinium technology (Illumina, San Diego, CA). The predicted externally visible traits and DNA characteristics included: gender, biogeographical ancestry and Y-haplotype groups. Gender and biogeographical predictions were 100% and 99.6% accurate, respectively. The performance and sensitivity of the SNP array using serially diluted and heavily degraded DNA samples were also assessed. This study shows that, SNP technology will likely play a role in a very near future as a supplemental investigative tool by providing leads based on individual phenotypic characteristics derived from DNA. ⌘