I3 Criminal Behavior and Single Nucleotide Polymorphisms in Genes Related to Dopamine and Serotonin Modulation

Gabriella Cansino, BS, 2209 Bobby K Marks Drive, Apt 55, Huntsville, TX 77340; Peyton Gandy, MSFS, 2052 Myrtle, Unit 3, Dover, DE 19901; Jessica A. Motl, MS, 4312 Homestead Circle, San Angelo, TX 76905; Todd Armstrong, PhD, Sam Houston State University, College of Criminal Justice, 816 17th Street, Huntsville, TX 77320; Matt R. Nobles, PhD, Sam Houston State University, College of Criminal Justice, PO Box 2296, Huntsville, TX 77341-2296; Brian Boutwell, PhD, Sam Houston State University, College of Criminal Justice, 816 17th Street, Huntsville, TX 77320; and David A. Gangitano, PhD, 13906 Paradise Valley Drive, Houston, TX 77069*

After attending this presentation, attendees will understand how principles of behavioral genetics can be applied to investigate antisocial or criminal behavior.

This presentation will impact the forensic science community by providing a better understanding of the manner in which certain genes related to modulation of neurotransmitters influence criminal behavior.

Little is known about the biological mechanism that regulates antisocial behavior; however, a number of dopamine-related genes have been implicated in the etiology of violent behavior and conduct problems. These genes include Monoamine Oxidase A (MAOA), Monoamine Oxidase B (MAOB), Catechol-*O*-Methyl-Transferase (COMT), Dopamine Beta-Hydroxylase (DβH), and Tryptophan Hydroxylase 1 (TPH1). A landmark study in molecular genetics reported that individuals with low-functioning alleles within the MAOA gene were more likely to develop antisocial behavior following maltreatment. Although the literature concerning behavioral genetics is accumulating, there is limited information concerning the neurobiological mechanisms influencing criminal behavior in humans

The focus of this research is to investigate polymorphisms in genes associated with dopamine and serotonin modulation in an incarcerated population and a control group. This study investigated 13 single nucleotide polymorphisms (SNPs) in five genes involved with dopamine and serotonin regulation. The following SNPs were selected: rs909525, rs3788862, rs979605 (MAOA), rs1799836, rs2283729 (MAOB), rs740603, rs737865, rs165599, rs4680 (COMT), rs739398, rs1611115, rs129882 (DβH), and rs1800532 (TPH1).

DNA was extracted from buccal swabs collected from male inmates incarcerated in a southern Texas jail (N=100) and from control male students (N=93). All the protocols used in this study were approved by the Institutional Review Board at Sam Houston State University. DNA was quantified by real-time Polymerase Chain Reaction (PCR) and samples were amplified and subjected to single base extension. Extended products were detected by capillary electrophoresis with fluorescent detection.

After correction for multiple comparisons, departures from Hardy-Weinberg equilibrium were not observed in any group. Linkage disequilibrium was strong in MAOA and COMT genes (D'>0.8), moderate in MAOB (D'= 0.65) and weak in DβH (D'=0.30). Although no single genetic variant in any of the five genes differentiated individuals in the investigated groups, significant haplotype differentiation ($p<0.05$) was observed for MAOA, MAOB, and COMT markers.

Moreover, gene-gene interaction was identified between MAOA rs3788862-rs979605, COMT rs165599-rs740603, and COMT rs4680-DβH rs739398.

This evidence suggests that defined haplotypes and Single Nucleotide Polymorphism-Single Nucleotide Polymorphism (SNP-SNP) interactions in MAOA, MAOB, and COMT SNPs are associated with criminal behavior. Overall, the study attempts to understand the biological basis of complex behaviors, such as antisocial and criminal behaviors, by identifying relevant genes and promoting future research on the genetic influence on criminal behavior.

Behavioral Genetics, Criminal Behavior, Single Nucleotide Polymorphism