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Ingredients for Criminality Require Genes, Temperament, and Psychopathic Personality

Matt DeLisi [a,*], Michael G. Vaughn [b]

[a] Iowa State University, 203A East Hall, Ames, IA 50011-1070, United States
[b] Saint Louis University, United States

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ABSTRACT

Background and method: Recent and emerging research demonstrates the importance of genetic factors, temperament, and psychopathic personality for understanding criminality especially more severe forms of it. Drawing on diverse interdisciplinary research, we review recent studies in behavior genetics, child development, psychology, social work, criminology, and other areas that bear on serious criminality.
Results: We suggest that genes, temperament, and psychopathic personality are the root ingredients of criminality and underscore the importance of a wide range of topics including neurobehavioral disorders, personality disorder, aggression, violence, and crime.
Conclusion: Similar to debates in psychology and psychiatry, we encourage further research on the basic constitutional foundation of criminality as a means to guide theory and research in criminology and criminal justice.
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Introduction

The study of serious and violent antisocial behavior has evolved importantly from a disproportional focus on structural and environmental factors to increasing attention on individual-level constructs along with the ways that individual-level factors are environmentally moderated. As we have described previously (DeLisi, Conis, & Beaver, 2012; DeLisi, Wright, Vaughn, & Beaver, 2009), criminology was saved by its attention to constitutional factors that influence self-regulation, emotional processing, neuropsychological functioning, and cognate processes. Now, even prominent sociologically-based general theories of crime (e.g., Agnew, 2006; Gottfredson & Hirschi, 1990) advance constructs that reflect core temperamental features relating to effortful control, affect, and emotional dysregulation (see Agnew, Brezina, Wright, & Cullen, 2002; Wilcox, Sullivan, Jones, & van Gelder, 2014; Wright, Schnupp, Beaver, Delisi, & Vaughn, 2012). Indeed, criminologists who gainsay the prominence of individual-level constructs cannot be taken seriously.

In this paper we suggest that the necessary requirements for criminality involve basic constitutional characteristics and highlight recent research on genes, temperament, and psychopathic personality for support.[1] In addition, we focus on the Comprehensive Assessment of Psychopathic Personality (CAPP; Cooke, Hart, Logan, & Michie, 2004) and explore the potential integration of genetics, temperament, and psychopathy for understanding criminality.

Genes

The developmental precursors to aggression and antisocial traits are already evident in infancy. This means that at extraordinarily early ages there is variance in the ways that children regulate themselves and in ways that children interface with environmental contexts. For instance, Hay et al. (2014) recently found that male gender, social risk factors, mother's antisocial symptoms, and mother's prenatal depression were associated with infant contentiousness defined as expressions of anger and use of force based on data from the Cardiff (UK) Child Development Study. Left unabated, contentiousness can develop into a general propensity to use aggression in interpersonal disputes. Of course, other factors beyond social risk factors explain variance in early-life aggression, anger, and conduct problems. And those other factors are genetic factors.

Genetic factors are a considerable etiological source of antisocial traits and conditions, such as aggression and an international array of investigators have provided evidence with diverse sample, diverse methodological approaches, and diverse genetic factors.[2] For instance, using data from 667 twin pairs from the longitudinal Quebec Newborn Twin Study, Lacourse et al. (2014) found that genetic factors explained about 60% of the variance in physical aggression at 20 months, 60% of the variance at 30 months, and 50% of the variance at 50 months. In addition, genetic factors accounted for most of the initial level and subsequent change in physical aggression. Their analyses also shed light on the developmental changes in genetic effects as new sources of genetic variance appeared at 32 months and 50 months. In other words, genetic effects on antisocial traits are not fixed, but developmental (also see, Barnes, Boutwell, Beaver, Gibson, & Wright, 2014; Schwartz & Beaver, 2014).

* Corresponding author.
E-mail address: delisi@iastate.edu (M. DeLisi).

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In their study of the stability of self-control across childhood, Coyne and Wright (2014) examined data from the Early Childhood Longitudinal Study, Kindergarten Class 1998-1999 and found that genetic factors accounted for most of the stability of self-control. Moreover, the heritability of self-control increased from kindergarten ($h^2 = .35$) to first grade ($h^2 = .44$) to third grade ($h^2 = .49$) to fifth grade ($h^2 = .67$) to across the study period ($h^2 = .76$). The enduring nature of self-control is deeply problematic for those generally lacking it as self-control is responsible for a multitude of behavioral outcomes relating to health, mortality, wealth, success, and behavioral control (DeLisi, 2013; Gottfredson & Hirschi, 1990; Mischel, 2014; Moffitt, Poulton, & Caspi, 2013).

A main benefit of so many scholars conducing molecular genetic association studies worldwide is the rich suite of specific genes that have been implicated for their association with criminality. For example, Li et al. (2012) examined the rs13134663 polymorphism in the collagen XXV alpha 1 gene (COL25A1) which encodes a type II transmembrane protein that is implicated in brain development and brain degeneration, such as in Alzheimer's disease. The found significant associations in this polymorphism and Antisocial Personality Disorder among whites and blacks, and the effects were stronger in persons who also had substance dependence. The findings were subsequently replicated in an independent case-control design. Using a prospective cohort of males sampled from Australia, Smearman, Winiarski, Brennan, Najman, and Johnson (2014) examined the linkages between the oxytocin receptor gene rs53576 polymorphism and antisocial behaviors at age 20 years as reported by the youth, mother report, and clinician report. They found that carriers of the G allele exhibited more antisocial behaviors when coupled with high social stress situations. Utilizing data from the National Youth Survey Family Study, Boardman et al. (2014) examined dopaminergic genes, specifically DAT1 and DRD2, and their association with serious and violent delinquency. They reported significant associations between the dopamine genes and antisocial behavior—again when coupled with the most negative environmental contexts indicating low social control.

In the first gene x environment interaction study using an incarcerated sample, Armstrong et al. (2014) recently reported significant associations between the 3-repeat allele of the monoamine oxidase A gene (MAOA) and childhood adversity. They also reported that the MAOA x parent criminality was associated with variation in individual arrest rates. Other studies of MAOA variants similarly linked low-activity variants to criminal violence, and these effects have been reported among prisoners (Stetler et al., 2014). For instance, the rare 2-repeat allele of the MAOA gene has been linked to shooting and stabbing behaviors and to multiple shooting and stabbing behaviors among a sample of males from the Add Health (Beaver, Barnes, & Boutwell, 2013). The importance of MAOA to criminality is straightforward. MAOA is a catabolic enzyme or enzymatic degrader that is involved with regulating neurotransmitters including serotonin (5HT), norepinephrine (NE), dopamine (DA) and neuromodulators such as phenylethylamine (PEA) in the synapses. High aggression is characterized by high DA levels and low 5HT levels, thus MAOA plays an important role in the neurochemistry of aggression and maladaptive behavioral responses (for a systematic review, see Suri, Teixeira, Cagliostro, Mahadevia, & Ansorge, 2014).

Several significant effects have also been reported using other polymorphisms in the dopaminergic and serotoninergic systems. Significant molecular genetic association studies have also shown linkages, for instance, between the 7-repeat allele of the DRD4 gene and delinquency, anger, and thrill seeking using Russian data (Dmitrieva, Chen, Greenberger, Ogunseitan, & Ding, 2011). Watts and McNulty (2014) linked MAOA and DAT1 to self-control and criminal offending especially in poor parent-child interactions. DAT1, DRD2, and DRD4 have been linked to school problems, self-control, and violent delinquency (Yun, Lee, & Kim, 2014).

It is important to recall that although significant, genetic effects are commonly very small and are most likely expressed in disadvantaged environments as shown by Liu, Li, and Guo (2014) in their study of 403 variants from 39 genes selected from participants in the National Longitudinal Study of Adolescent Health. The substantive significance of genetic effects outshines their small albeit statistically significant effects, however. The DNA to RNA to protein process ultimately manifests in our biology, and most importantly, our brain. We examine one of these protein products next.

Temperament

Temperament is the stable, largely innate tendency with which an individual experiences the environment and regulates his or her responses to the environment. Temperament reflects baseline differences in central nervous system reactivity that manifest in variance in activity level, emotionality and mood, approach and withdrawal behaviors, and self-regulation (for various theories, see Beauchaine, Gatzke-Kopp, & Mead, 2007; Chapman, Woltering, Lamm, & Lewis, 2010; DeLisi & Vaughn, 2014; Derryberry & Rothbart, 1997; Kagan & Snidman, 2004). Temperament is also critically important because negative temperamental features often evoke negative responses from others—even and especially from parents—early in life. A recent gene x environment correlation study looked at the effects of infant and toddler temperament on maternal negativity among *adoptive mothers* (Fearon et al., 2014). Importantly, *the birth mother* of the children had high externalizing psychopathology that was genetically associated with difficult temperament features in their children. Fearon and colleagues found that infant challenging behaviors were in turn associated with maternal negativity towards their child, but only in home environments characterized by martial problems. In other words, the genetic risk factors relating to the birth mother's temperament interacted with the environmental risk factors relating to the adoptive mother's marriage to influence infant challenging behaviors.

Another gene x environment study implicated the MAOA gene and temperament factors relating to anger proneness among infants. Drawing on data from the Wirral Child Health and Development Study, which is a prospective epidemiological longitudinal study of prenatal and infant origins of conduct problems, Pickles et al. (2013) found that lower maternal sensitivity was associated with greater infant anger. But the effect was only present among infants with the low expression MAOA variant—the same low activity variant that is implicated in antisocial behavior in the presence of early life maltreatment.

Negative temperamental displays cast a long shadow. For example, Stringaris and Goodman (2009a) examined survey data from 18,415 participants in the United Kingdom to examine the associations between Oppositional Defiant Disorder profiles of irritability, headstrong, and hurtful on other forms of psychopathology. They reported significant correlations between all three temperament profiles and conduct problems (positive correlations) and prosociality (negative correlations). Similar findings were also shown longitudinally (Stringaris & Goodman, 2009b). The hurtful temperamental profile is particularly associated with callousness and more aggressive forms of conduct problems.

Drawing on data from 2,076 children from 13 birth cohorts drawn from Dutch birth registries, Althoff, Verhulst, Rettew, Hudziak, and Van der Ende (2010) examined the adult outcomes of dysregulated temperament. Their sample contained children ages 4 to 18 and who were followed-up fourteen years later. They found evidence of a pathological subgroup of children whose temperament profile was characterized as "dysregulated profile." These youth displayed the greatest deficits in affective, behavior, and cognition as children, and about 1.5 decades later were significantly likely to meet diagnostic criteria for any anxiety disorder, any mood disorder, any disruptive behavior disorder, any drug abuse, and any major depression disorder. Similar continuity in terms of childhood behavior problems reflecting temperamental deficits and crime/violence occurring in late adolescence were found among participants from birth cohorts in Brazil and Great Britain (Murray et al., 2014). Similar continuity is seen in prospective studies of youth irritability reflected by negative emotionality and

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