



# It's nature and nurture: Integrating biology and genetics into the social learning theory of criminal behavior



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## ABSTRACT

**Purpose:** Major advances in the fields of biology, genetics, neuroscience, and psychiatry have shown that many human behaviors are impacted by factors other than social influences. Still, the field of criminology has not incorporated these biological influences into any mainstream criminological theories, leaving a large divide between theories holding entirely sociological and entirely biological explanations of criminal behavior.

**Method:** Two exceptions to this strict “nature versus nurture” dichotomy are social learning theory, which posits that criminal behavior is learned through peer association, and the biosocial perspective in criminology, which uses various biological and social factors to explain the commission of criminal behavior. Given the growing evidence that both biology and environmental factors contribute to the commission of criminal behavior, it is increasingly difficult for any theory to ignore the influence of either biology or sociology altogether.

**Conclusion:** This article illustrates how to incorporate both nature and nurture into a single theory, by integrating social learning theory and the biosocial perspective into a more accurate and modern model of criminal behavior.

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## 1. Introduction

Is criminal behavior a product of human nature, or nurture? This has been the enduring question among many criminologists, and a debate that continues to perplex many theorists and researchers today. While a variety of notable theories have emerged in criminology, there are few exceptions to this strict “nature versus nurture” theoretical dichotomy. As the evidence linking both social and biological risk factors to criminal behavior constantly grows, it is becoming more difficult for any theory to ignore the influence of either biology or sociology entirely.

Despite the considerable success biosocial models have shown in predicting criminal behavior, these findings have not yet been integrated into any “mainstream” theories in criminology (Barnes, Boutwell, & Beaver, 2016; Barnes, Boutwell, Beaver, Gibson, & Wright, 2014). Rather than positing that one's biology is a direct *determinant* of criminal behavior, biosocial criminology suggests that biology is more of a *susceptibility* that may be enhanced or negated depending on different environmental factors (Belsky & Pluess, 2009; DeLisi & Vaughn, 2015; DiLalla & Bersted, 2015; Ishikawa & Raine, 2002; Vaughn, DeLisi, Beaver, & Wright, 2009). Moreover, as biosocial research indicates that our explained variance increases when biological influences are coupled with environmental factors, and no mainstream criminological theory has yet to explain 100% of the variance in criminal behavior, it stands

to reason that by adding biological concepts into social-based mainstream criminological theories an increase in explanatory power and our understanding of criminal behavior will occur (Barnes et al., 2014; DeLisi & Vaughn, 2015; Schwartz & Beaver, 2014; Walsh, 2002a, 2002b; Wright & Beaver, 2005; Wright & Boisvert, 2009). It is therefore of great benefit to our field that a direct integration of biological factors into mainstream criminological theories takes place.

This article aims to guide such an integration by reviewing the research supporting biological risk factors for criminality, and proposing the framework for a propositional integration of biological and genetic features into a mainstream sociological-based model of criminal behavior.

## 2. The “nature” of crime: a biosocial perspective

In 1964, Hans Eysenck became one of the first social scientists to subscribe to the idea of a nonsocial influence on criminal behavior (Rafter, Posick, & Rocque, 2016). Through his bold research on genetic and neurobiological influences on criminality using twin data, Eysenck (1964) found a higher concordance in criminal behavior among identical (77%) versus fraternal (12%) twins. This, and results from follow-up research led Eysenck to conclude that “beyond any question, heredity plays an important, any possibly vital part, in predisposing a given individual to crime” (p. 68–69). While these early studies had difficulty measuring genetic influence, they were the first to identify correlations between inherited genetics and criminal behavior.

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Following this lead, significant research has since been conducted on the interactive effects of various genetic and biological factors and an individual's environment on the development of antisocial and criminal behavior. This cutting-edge research has found support for the influence of factors ranging from an individual's genetic make-up, psychophysiology, autonomic activity, hormones, neurotransmitters, and environmental toxins, to name a few, making the list of biological factors now known to affect an individual's behavior is lengthy, and significant (Raine, 2002). Now called the biosocial perspective of criminal and antisocial behavior, this perspective relies on two main principles, biological influence and social environment, as the major processes which individually and interactively prompt or protect a person from criminality (Beaver, 2008; Rafter et al., 2016; Walsh, 2002a; Walsh & Beaver, 2009).

### 2.1. *The biosocial perspective in criminology*

Biosocial research examining the relationship between biological factors, sociological factors, and criminal behavior has grown exponentially over the past decade (Burt & Simons, 2014; Moffitt, Ross, & Raine, 2011), and is the fastest growing line of research in criminology (Beaver, Nedelec, Costa, & Vidal, 2015b). While the number of significant findings stemming from biosocial research are far too numerous to discuss in a single review (see Barnes et al., 2016; Beaver, Barnes, & Boutwell, 2015a; Raine, 2013; Walsh & Beaver, 2009, for excellent summaries), the following is a brief overview of key findings stemming from the biosocial perspective in order to highlight the robust and sizable impact of this line of research.

As stated, there are numerous biological factors found to play a role in producing criminal behavior, such as genetics, hormones and neurotransmitters, neurological deficits, psychophysiology, and environmental toxins. Of these, the area receiving the greatest amount of interest among biosocial criminologists is behavioral genetics (Beaver, Boutwell, Barnes, & Cooper, 2009a). Research on behavioral genetics examines the impact of three components, heritability, shared environment, and nonshared environment, on a given phenotype (i.e., criminality) (Wright et al., 2015). Heritability refers to the proportion of variance in a phenotype for a population that can be attributed to genetic factors.<sup>1</sup> The remaining variance is due in part to the shared environment (i.e. the setting shared by siblings in the same household, such as family socioeconomic status), and in part to the nonshared environment (i.e. the setting not shared by siblings, such as peer group) (Beaver et al., 2009a).

Behavioral geneticists aim to uncover the exact proportion these three factors play in developing our behavior. In general, results of behavioral genetic research indicates that up to 60% of variation in antisocial and criminal behavior is heritable, while shared environmental factors and nonshared environmental factors explain up to 10% and 50% of variance in criminal and antisocial behavior, respectively (see meta-analyses by Ferguson, 2010; Mason & Frick, 1994; Miles & Carey, 1997; Rhee & Waldman, 2002; see also Harris, 1998; Moffitt, 2005; Plomin, Owen, & McGuffin, 1994; Rowe, 1994).

More recent research has aimed to hone in not just on heritability, but the specific "candidate" genes that contribute to causes of behavior (referred to as molecular genetics) and the genes that interact with specific social and environmental factors to produce criminal behavior (referred to as epigenetics) (Walsh & Beaver, 2009). In their landmark study on the interaction between genetic polymorphism monoamine oxidase A (MAOA) and childhood abuse on future violent behavior, Caspi et al. (2002) found that abuse increased the risk of future violent behavior, but only for the youth with low levels of MAOA. In fact, while only 12% of the sample had both genetic (low MAOA) and environmental (history of abuse) risk factors, they were responsible for 44% of all the violent crime committed by the cohort. Furthermore, 85% of the youth with genetic and environmental risk factors developed

some form of antisocial or criminal behavior (Caspi et al., 2002; see also Kim-Cohen et al., 2006).

Additional research using genetically informed twin data from the National Longitudinal Study of Adolescent Health (Add Health) (Udry, 2003) suggests that dopamine receptor genes (DRD2, DRD4), dopamine transport gene (DAT1), serotonin transporter gene (5HTT) and MAOA all interact with social conditions such as delinquent peers, maternal attachment, parental criminality, family engagement, marital status, religiosity, and even neighborhood characteristics to predict criminality, violence, gang membership, desistance, abstention, and victimization among adult and adolescent males (Barnes & Jacobs, 2013; Beaver & Holtfreter, 2009; Beaver & Wright, 2005; Beaver et al., 2007; Beaver, Wright, DeLisi, & Vaughn, 2008b; Beaver et al., 2009a; Beaver, Gibson, Jennings, & Ward, 2009c; Boutwell & Beaver, 2008; DeLisi, Beaver, Wright, & Vaughn, 2008; DeLisi, Beaver, Vaughn, & Wright, 2009; Guo, Roettger, & Shih, 2007; Guo, Roettger, & Cai, 2008; Vaughn et al., 2009).

In short, while genes certainly do not cause any behavior, they do produce the traits and tendencies which lead individuals to respond to their environment in one way and not another (Walsh & Beaver, 2009). For instance, a person in the United States with a genotype for darker skin tone will often experience a different social environment than a person with lighter skin, and may therefore display different behaviors due to this combination of biological and social influences (Burt & Simons, 2014). As research on the role that genes and biology play in the production of human behavior continues to unfold, it is increasingly clear that criminal behavior results from a combination of factors, both biological and environmental. As Burt and Simons (2014) noted, "any claim to the contrary is patently false" (p. 225).

Other biosocial research has investigated the direct and indirect effects of hormones and neurotransmitters, including testosterone (Banks & Dabbs, 1996; Dabbs & Morris, 1990; Pratt, Turanovic, & Cullen, 2016; van Honk & Schutter, 2007), cortisol (Cima, Smeets, & Jelicic, 2008; Loney, Butler, Lima, Counts, & Eckel, 2006; Holi, Auvinen-Lintunen, Lindberg, Tani, & Virkkunen, 2006) and serotonin (Berman & Coccaro, 1998; Moffitt et al., 1997; Moore, Scarpa, & Raine, 2002; Sadeh et al., 2010), on criminal and antisocial behavior. This line of research suggests that hormones such as testosterone can help explain important criminological issues such as the gap in offending rates between males and females, (males typically have higher testosterone levels than females) (Ellis, 2003), and that these hormones and neurotransmitters and the environmental factors they interact with can actually be treated to reduce the risk of antisocial behavior (Brotman et al., 2007; O'Neal et al., 2010).

Advances in brain imaging research have also been extremely helpful in understanding the role that structural and functional deficiencies in the prefrontal cortex, amygdala, and hippocampus of the brain play in influencing criminal and antisocial behavior (Raine, 2013). For instance, psychopaths with criminal convictions have more impaired amygdala-orbitofrontal connections than control group members (Craig et al., 2009), while murderers and violent offenders have higher deficits in their prefrontal, orbitofrontal, and superior frontal cortex compared to normal controls (Raine et al., 1994; Raine et al., 2001). Environmental interactions with neurological deficiencies have also been uncovered. For instance, Raine et al. (2001) found that murderers from "good" homes had a 14% reduction in prefrontal cortex functioning compared to non-offenders, while murderers from "bad" homes actually had relatively higher levels of prefrontal cortex functioning than non-offenders.

Psychophysiological factors such as resting heart rate, skin conductance, and autonomic arousal have also been found to factor into future criminal behavior (Raine, 2013). Specifically, adult offenders have lower resting heart rates, lower skin conductance, and lower autonomic arousal compared to non-offenders (Farrington, 1997; Raine, Mellinger, Liu, Venables, & Mednick, 2003; Raine, Venables, & Williams, 1995; Raine, Venables, & Williams, 1996). Of these measures, low resting heart rate is considered one of the strongest biological

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