

Controversial Issues in Criminal Justice

EDITED BY Beverly Reece and Catherine D. Marcum

Kennesaw State University

Appalachian State University



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Printed in the United States of America.

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Controversies in Biosocial Criminology

The State of Modern Debate

Shannon Messer

Department of Criminal Justice and Criminology, University of North Carolina at Charlotte

Samuel LaVergne

Public Policy Program, University of North Carolina at Charlotte

John Stogner

Department of Criminal Justice and Criminology, University of North Carolina at Charlotte

ARGUMENTS FOR UTILIZING BIOSOCIAL CRIMINOLOGY

Modern Biosocial Criminology Has Escaped from Lombroso's Legacy

Contrary to modern criminological research, early theorists worked almost entirely within a biological perspective (Rafter, 2004; Wright & Miller, 1998). Lombroso, perhaps the most frequently discussed biological theorist of his time, suggested that criminals were unevolved, immoral, “born criminals.” His flawed atavistic theory left little room for redemption of criminals and instead supported complete incapacitation of a population he considered irredeemable. Lombroso’s *Criminal Man* set precedence for criminologists such as Earnest Hooton, Henry Goddard, and William Sheldon to expound on the myriad of ways criminals were biologically, intellectually, and organically inferior to their noncriminal peers (Gibson & Rafter, 2006; Rafter, 2004; Rukus & Gibson, 2011). For these early researchers, some men (and women) were born with the markings of a criminal destined to be a plague on society, which led to demands for punishment that is now understood to be eugenic, sexist, and racist (Rafter, 2004). Therein lies one of the largest barriers to incorporating biological influences in criminology today; the outdated belief that

biological influences on criminality can only be mitigated through intrusive and prejudicial policies as opposed to noninvasive sociological reforms.

Policy implications targeting social institutions, as often guided by learning, control, and strain perspectives, are assumed to present more humane and ethical alternatives to policies derived from biological criminology. That assumption is well founded when examining arguments from a century ago (such as incarcerating individuals with lower IQs, certain physical traits, and mental illness), but modern biosocial criminology makes no such suggestions. Hooton's charge against allowing the "weak" to survive, continue offending, and breed has long been abandoned. Just as our society espouses "innocent until proven guilty" and champions the import of rehabilitation, modern biological, and more specifically, biosocial theory offers policy implications that avoid judgment solely on biology, increases access to prosocial services, and facilitates rehabilitation.

Though much debate still centers on the ghosts of the past, we considered those conflicts resolved; historical biological policies were flawed, prejudiced, unethical, and have no place in modern criminal justice. Recent discoveries have facilitated a more appropriate and scientifically grounded approach to biological criminology study (Cullen, 2011; Fox, 2017; Rafter, 2004). With renewed vigor, biosocial criminologists have uncovered numerous genetic and neurologically associated risk factors, all with their own practical and noninvasive policy implications (Beaver, Schwartz, et al., 2013). Far from the notion of absolute criminality adopted in the past, recent study focuses on the nexus between the biological and the sociological and seeks to create policy that strengthens individuals' genetic, biochemical, and neurological health. Thus, the discipline has undergone a change of heart, with many researchers now studying the various biological components that, along with environmental effects, impact an individual's predisposition toward criminality. Consider a statement made by Fox (2017) in an article discussing the integration of biological influences with the sociological theory of social learning:

Neither biology, nor environment, alone accurately explains criminal behavior. In fact, a comprehensive review of biosocial research analyzed results of 39 studies ranging from areas including genetics, obstetrics, neurology, hormones, brain imaging, environmental toxins, neuropsychology, neurotransmitters, and psychophysiology, and found that these factors are equally as important to the development of criminal activity as sociological and environmental factors. (p. 24)

Biosocial criminological research clarifies that biology and environment *interact* with one another to affect criminality. Biological predispositions do not happen in an environmental vacuum, and sociological effects can be intensified by the genetic makeup and brain function of the individual, increasing the explanatory power and variance of well-known criminological theories (Fox, 2017). Sociological theories surrounding them have been suggested to be both strong and consistent predictors of crime (Beaver, Schwartz, et al., 2013; Cullen, 2011). Yet individuals raised in nearly identical environments oft choose distinct futures. Perhaps biology may partially explain these divergent pathways.

Biosocial criminology is far broader than genetic studies and the problematic policies of the past. For example, lead poisoning has been linked to neurological issues that predate criminality—these findings indicate that municipalities ensuring proper upkeep of pipes may see reductions in crime. Traumatic brain injuries have been linked to aggression and antisocial behavior, suggesting that additional safety measures in school sports and more rigorous safety regulations in vehicles also serve as protective measures against delinquency. Criminology has identified a number of antecedents of criminal behavior, but many seem to be related to genetics rather than being purely sociologically derived. Genetic influences have been found for some of the most commonly discussed antecedents of crime: antisocial behavior, conduct disorder, ADHD, substance use, aggression, and lower levels of self-control (Beaver & Connolly, 2013). Practical applications for biological criminology abound, and the utility of modern research cannot be overstated. An understanding of biological influences can improve innumerable social intervention programs and increase the opportunities society has for effectively lowering crime and rehabilitating criminals. The following pages introduce a number of biosocial influences on criminality and present five arguments supporting the use of biosocial criminology research.

Traumatic Brain Injury Is Linked to Antisocial Behavior

Students of psychology are likely to recognize the name Phineas Gage, the man whose entire personality was radically altered by a freak workplace accident. Gage, a 25-year-old Great Western Railway worker escaped death but became one of the best-known victims of left frontal lobe damage (widely recognized as the area of the brain responsible for regulating self-control; Robinson & Beaver, 2009) when a tamping iron went into his head. With an uneven temperament, a penchant for lazing about, and a disheveled appearance, the “new” Gage was reported to be far from the gregarious, kempt, and hard-working man he was reported to have been before his accident (Griggs, 2015; Kotowicz, 2007; Macmillan & Lena,

2010). Understood to be the first recorded case of radical behavioral change to be attributed to brain injury, the story of Phineas Gage has been present in psychology texts for years, with more recent reports suggesting the incredible story may have been exaggerated over time by overzealous storytellers (Griggs, 2015; Kotowicz, 2007; Macmillan, 2000). The reality, at least as far as historians have discovered, is likely a bit tamer and involves a partial recovery, yet Gage's persona seems to have clearly been affected by the accident (Griggs, 2015; Kotowicz, 2007).

While the story of Gage's injury and subsequent behavior is likely embellished, the very real consequences of head injuries, even those on their surface appearing much less severe than his, have been studied in connection with antisocial and delinquent behavior for decades. Traumatic brain injuries (TBIs) and their effects have been linked to aggressive behavior (Bannon, Salis, & O'Leary, 2015; Buckley, Kaye, Stork, Heinze, & Eckner, 2017; Schwartz, Connolly, & Brauer, 2017) and neurological disorders such as ADHD, depression, and antisocial behaviors (Bloom et al., 2001; Luukkainen, Riala, Laukkanen, Hakko, & Räsänen, 2012). The Centers for Disease Control and Prevention (CDC) (2017) defines a TBI as "a disruption in the normal function of the brain that be caused by a bump, blow, or jolt to the head, or penetrating head injury." Often caused by a sports injury, motor vehicle accident, or violent altercation, TBIs are prevalent enough in the general population and impactful enough on those who sustain them that the National Institutes of Health (NIH) (1999) found TBIs to be "of major public health significance" (p. 974). Recent meta-analyses suggest the neurological deficits suffered by many individuals with a history of TBI may result in an increased propensity toward crime. In fact, studies done in criminal justice populations indicate that as many as 60% of adult inmates surveyed have a history of TBI (Fishbein, Dariotis, Ferguson, & Pickelsimer, 2016). A meta-analysis of research found juvenile offenders had a significantly greater chance of having a TBI than juveniles in the general population. Clearly, trauma to the brain results in undesirable behavior and abnormal development, affecting enough of the population to render the issue valuable to criminology.

Beaver (2013) lists the possible brain functions that can be affected by TBI: the regulation of emotions; the ability to anticipate consequences, to set goals, and to process complex information; and the capacity to delay gratification. Damage to the prefrontal cortex (considered the "executive control center") can result in adverse behavioral issues and may escalate into aggressive or violent outcomes (Bufkin & Luttrell, 2005). Bloom et al. (2001) recount research dating back to the 1980s, with results indicating that over one half of children studied post-TBI presented with psychiatric disorders such as ADHD and major depression, disorders they had never suffered from before. Further, most of the disorders were still present for

nearly 50% of the study participants 1 year following the incident, suggesting that consequences can be long-term and may require extensive management by medical professionals (Bloom et al., 2001). Antisocial behavior (impulsivity, agitation, irritability, risk-taking behavior) stemming from TBI was found in several birth cohort studies in Northern Finland (Timonen et al., 2002), Sweden (Sariaslan, Sharp, D’Onofrio, Larsson, & Fazel, 2016), New Zealand (McKinlay, Grace, Horwood, Fergusson, & MacFarlane, 2009) and England (Kennedy, Heron, & Munafò, 2017). Kennedy et al.’s 2017 study synthesized these findings and suggested that there is a possibility that TBIs sustained earlier in childhood may amplify the risk for detrimental outcomes. Each of these studies found increased psychiatric disorders, increased use of drugs and alcohol, and increased aggression in individuals with history of TBI; birth to age 11 for higher instances of psychiatric disorders and ages 12 to 16 for increases in drug/alcohol abuse and offending (Kennedy et al., 2017).

Beyond psychiatric disorders, TBIs have been linked to aggression and violent behavior. Bannon et al. (2015) gathered results from several studies regarding partner-violence perpetrators. Replicated several times since the seminal study (Rosenbaum & Hoge, 1989), multiple results suggest that 50–60% of partner-violence perpetrators had a history of TBI. Research done within incarcerated populations offers similar results. Fishbein et al. (2016) found higher aggression scores in inmates with a history of TBI than those without. Ray and Richardson (2017), in their study of inmate recidivism, found inmates with TBIs were more likely to recidivate sooner, to have more previous arrests, and to have committed a “person” or violent crime. TBI research suggests a consistent link with maladaptive, and potentially persistent, violent behavior. As a result, improved designs for football helmets, soccer headgear, automobile airbags, and bicycle protective gear become clearly tied to criminological goals. As the biological damage caused by sudden impacts to the head affects behavior, criminologists need to endorse protective measures that may minimize risk.

Environmental Toxin Exposure Is

Associated with Deviant Behavior

Another biological source of negative behaviors may be the chemical environment that surrounds us. From the moment of an individual’s conception, the physical environment begins to shape them. There is substantial support for the correlation between toxins within the fetal environment and later delinquent and criminal behavior. The fetal environment is instrumental in brain development and research associates adverse fetal environments with higher instances of ADHD, aggression,

irritability, and conduct problems (Beaver, 2013; Hermanssen & Melinder, 2015; O'Connor, Heron, Golding, & Glover, 2003; Van den Bergh, 1990). Smoking, alcohol use, and drug use during pregnancy have also been linked to deleterious effects on the developing brain, and children exposed to such toxins in utero may be more likely to offend in adolescence and adulthood (Rudo-Hutt et al., 2011). Nicotine is a particularly worrisome fetal neuroteratogen as it affects the areas of the brain responsible for regulation of violence and aggression (Beaver, 2013). Pratt, McGloin, and Fearn's (2006) meta-analysis found a statistically significant link between maternal cigarette smoking (MCS) during pregnancy and antisocial behavior in children. Rudo-Hutt et al. (2011) even suggest MCS can be used to predict violent offending. In a longitudinal study, Räsänen et al. (1999) found that maternal smoking while pregnant increased the risk of recurrent, violent offending. Those exposed to nicotine and cigarette smoke in the womb were 14.2 times more likely to engage in persistent, violent offending (Räsänen et al., 1999). With an estimated 10–15% of pregnant women smoking during their pregnancy (and 20–50% of teen mothers), nicotine exposure in utero constitutes a significant criminal justice issue. Bailey, McCook, Hodge, and McGrady (2012) recently suggested that pregnant women quitting smoking is *at least* as important as pregnant women ceasing to use illicit drugs.

Exposure to alcohol while in utero (especially in high doses) has been documented as causing cognitive deficits as well as antisocial and maladaptive behaviors (Beaver, 2013). High doses of alcohol can lead to fetal alcohol syndrome (FAS), a condition marked by growth deficiency, facial anomalies, and central nervous system dysfunction (Fast & Conry, 2009). FAS has also been linked to antisocial behavior, but even those without an FAS diagnosis who were exposed to alcohol in utero show heightened risk of criminal offending (Rudo-Hutt et al., 2011). Research concerning illicit drug use during pregnancy has provided evidence of increased irritability and attention deficits, two common antecedents to delinquency (Thompson, Levitt, & Stanwood, 2009); however, those engaging in illicit drug use often smoke cigarettes and drink alcohol, making it difficult to separate the impacts of each toxin (Robinson & Beaver, 2009).

Environmental toxins introduced in utero, infancy, or early childhood can have devastating, long-lasting consequences. Neurological deficits, behavioral problems, and cognitive issues have been statistically associated with exposure to industrial toxins, including lead and insecticides (Beaver, 2013; Billings & Schnepel, 2018; Heavey, 2016; Muller, Sampson, & Winter, 2018; Robinson & Beaver, 2009; Schlieber & Neuharth-Pritchett, 2016). Taken together, the literature

indicates not only a growing field of study, but a crucial point of convergence in the understanding of biosocial criminology and its policy implications.

Lead poisoning made headlines in the 1970s and 1980s for its deleterious effects on the growing human brain. Lead is considered a neuroteratogen, described by Beaver (2013) as an agent that attacks the central nervous system and damages critical areas of the developing brain, most notably the areas responsible for regulation of violence and aggression. The association of lead exposure and aggression was found most notably in a longitudinal research project conducted with 250 pregnant women; lead exposure and levels of lead in the blood were found to be a predictor of crime, and specifically a predictor of violent crimes later committed by the offspring (Wright et al., 2008). The resulting movement in the United States ushered in nationwide changes in the use of lead products and insecticides. Since then, an impressive amount of academic study has been dedicated to finding the true scope of consequences wrought by exposure to such toxins. While the widespread use of harmful pesticides has largely declined, Robinson and Beaver (2009) state that nearly 100,000 children a year are poisoned by pesticides. Studies finding links between pesticides and learning disabilities, behavioral problems, irritability, and higher instances of ADHD in children suggest that use of harmful chemicals may contribute to eventual delinquency and criminality (Beaver, 2013; Landrigan et al., 1999).

While many make the claim that elevated lead levels are associated with antisocial, delinquent, and criminal behavior, Sampson and Winter (2018) go further, suggesting a direct causal link. They feel confident their research revealed a “plausibly causal effect of childhood lead exposure on adolescent delinquent behavior” (p. 269). Reyes (2015), using the National Longitudinal Survey of Youth (NLSY), similarly found a “large negative consequences of early childhood lead exposure, in the form of an unfolding series of adverse behavioral outcomes: behavior problems as a child, pregnancy and aggression as a teen, and criminal behavior as a young adult” (p. 1580). These substantial and long-lasting consequences are all the more alarming when we consider that estimates suggest roughly 37 million homes in the United States have lead-based paint (LBP; Dewalt et al., 2015, p. 24). Many of these homes containing LBP are concentrated in neighborhoods more likely to be inhabited by minorities. Beaver (2013) finds racial disparities for blood lead levels to be nearly 4.5 to 1; nearly 9% of African American children present with elevated lead levels, compared to just 2% of White children. Lead exposure, through older water pipes and chipping LBP, increases an individual’s risk for criminality by damaging brain functions that control behavior and by limiting cognitive functioning that may moderate harmful social environments. As such, removal

of lead from the nation's infrastructure should become part of any comprehensive crime control effort.

Proper Nutrition Has a Role in Curtailing Criminal Behavior

Proper brain development and subsequent behavior is affected by one's diet (or the mother's diet during gestation); various vitamin deficiencies and unhealthy eating patterns have been linked to mental illness, ADHD, aggression, antisocial behavior, and impaired cognitive development (Fishbein & Pease, 1994; Jackson & Vaughn, 2017; Liu et al., 2004; Oddy et al., 2009; Robinson & Beaver, 2009). Although considered outside the "mainstream" of criminological research, Robinson and Beaver (2009) suggest the effect of nutrition on appropriate brain development and behavior is clear—and thus of central importance to criminology. Beginning in utero, the nutrients passed from mother to child allow the fetal brain to grow and mature; the absence of necessary nutrients often leads to insufficient brain maturation. In more serious cases, pregnant women who do not have the resources to eat properly while pregnant, or to feed their children in the formative years after they are born, risk long-lasting negative effects for their children. A study involving over 1,700 children observed the effects of malnutrition directly (Liu et al., 2004). Those children found to be malnourished at age 3 were more aggressive and/or hyperactive when evaluated at age 8, displayed more aggression, hyperactivity, and/or delinquency at age 11, and presented with more conduct problems (aggression, hyperactivity, excessive motor activity, and/or attention problems) by age 17 compared to children that were at healthy weight at the start of the study (Liu et al., 2004, p. 2005). Further, Liu et al. (2004) indicated the neurological deficits found acted as a "mediating" factor, meaning the malnutrition led to the neurological deficits, which then led to the antisocial behavior (p. 190).

Jackson and Vaughn (2017) studied the effects of not having nutritious foods consistently available. Adolescent males raised in homes without enough food were 168% more likely to engage in various forms of delinquency. Equally harmful, diets that are high in fats, sugars, and carbohydrates while being low on fruits and vegetables have been studied in conjunction with adverse outcomes. One of the largest studies to date, Oddy et al. (2009) used a pregnancy cohort of Australian women to survey and observe their children (1,860 children total) at the age of 14. Two general eating patterns were identified: Western and Healthy. The Western diet was characterized by red meat, fast food, and foods high in sugar, whereas the healthy diet included high portions of fruits, vegetables, and proteins. The authors found children following the Western diet were more likely to be aggressive, even after controlling for the child's physical activity level, socioeconomic status, family

characteristics, and lifestyle factors (Oddy et al., 2009). Similarly, Jackson (2016) used a classic twin design to study to isolate nutritional influence on behavior, finding that twins with poorer eating habits (lower fruit/vegetable intake, higher fast food intake) exhibited more problematic behaviors as compared to their co-twins.

Heritability Studies Indicate Genes Influence Deviance

To this point we've highlighted how the biological environment and biological injury may affect criminality. Biosocial criminology also explores the scope, mechanism, and form of genetic influences on behavior. Family-based studies have been used for decades to quantify the distinct contributions of heredity and the environment on variation within a population. Twins, especially, offer a unique insight into nature versus nurture, as identical twins have an identical genotype but may experience distinct environments. Behavioral genetics studies, oft using twins, compartmentalize influences on behavior into three components: heritability, shared environments, and nonshared environments. Evidence supporting a heritable component to variation in deviant behavior would clearly support the use of biosocial theory and policy. Put another way, family studies can demonstrate whether genetics influences deviant behavior and how strong of an influence it is relative to the environment.

Heritability is typically quantified as an estimate ranging from .00 to 1.00 representing the proportion of variation in the behavior or characteristic that can be attributed to genetics. These scores are often switched to percentages (Beaver, 2013). The portion not attributed to genetics can be viewed as the result of the environment, subdivided into environments shared and not shared by siblings. Parsing just which environment (shared or nonshared) necessitates taking a full history of study participants. For example, family structure may be a shared environment (in the event of twins, as they experience the same structure at the same time) or nonshared (nontwins would experience a new child arriving or divorce of the parents at different ages/stages). The same applies for different-sex children, both fraternal twin and nontwin siblings, as their parental socialization patterns may be vastly dissimilar. Barnes and Boutwell (2012) caution that children also may simply perceive their "shared" environments in different ways, depending on their genetic makeup. For example, a child genetically predisposed to hyperactivity and inattentiveness may perceive a rigidly structured home environment much differently than a sibling who does not have such dispositions. As long as there is more than one child in the homes studied, no matter their relationship (twins, siblings, half-siblings, cousins), heritability can be calculated by altering a statistical equation of shared genetics.

Antisocial behavior has consistently found to be 40–60% heritable, meaning that 40–60% of the variation in antisocial behavior across the population can be attributed to genetics (Barnes & Boutwell, 2013; Beaver & Connolly, 2013; DiLalla & Gheyara, 2011; Tuvblad & Beaver, 2013). Boutwell and Connolly explain, “if the similarity between MZ [monozygotic; identical] twins, who share 100% of their genetic material, is greater than that of DZ [dizygotic; fraternal] twins, who share 50% of their genetic material, then it is logical to assume there are genetic influences at play” (p. 2). This is clearly the case for other behaviors of interest to criminal justice researchers including aggression, violence, and substance abuse. Researchers have also gathered an impressive body of study that indicates many of the antecedents of delinquent and criminal behavior have genetic influences. For example, Beaver, Connolly, Schwartz, Al-Ghamdi, and Kobeisy’s 2013 study found 74–92% of the stability of self-control levels can be attributed to biological influences. The higher concordance (similarity) between identical twins as compared to fraternal twins and other sibling pairs indicates that there is a genetic component to criminogenic traits and problematic behaviors. While studies consistently estimate 40–60% heritability for antisocial behavior, thus clearly indicating genetics plays a role in criminal offending, it must be understood that heritability estimates are *statistics* only applicable to the specific samples used in its calculation (Mullineaux & DiLalla, 2015).

The presence of a genetic influence on antisocial behavior can also be seen when stepping away from complex assumptions of behavioral genetics. Consider adoption studies: Mednick, Gabrielli, and Hutchings (1984), using a dataset of over 14,000 adoptees, found adoptees who had biological parents with criminal convictions were more likely to be deviant than those children with noncriminal parents even when placed in law-abiding homes. Similarly, Beaver (2011) found adoptees with criminal biological parents were 373% more likely to be arrested than adoptees whose biological parents were law-abiding. These findings are generally supported by reviews of the literature and meta-analyses, indicating that children are likely to share some personality and cognitive traits with biological parents regardless of the where they are raised. Using different types of studies (twin, adoption, family based), researchers have clearly demonstrated that genetics is a source of a significant amount of variation in deviant behavior. The question of whether genes influence deviant behavior has been answered by this research; however, the specific sources of this influence are still somewhat unclear. Current study centers isolating genetic influences, parsing out environmental ones, and creating a clearer understanding of the etiology of deviant behaviors (Johnson, Turkheimer, Gottesman, & Bouchard, Jr., 2009; Vitaro, Brendgen, & Arseneault, 2009).

Gene–Environment Interplay Is a Significant Predictor of Antisocial Behavior

Biosocial criminology offers a unique understanding of how individuals raised in similar social environments may have differing outcomes in terms of criminality. For example, of the countless children who experience victimization and abuse, why do some perpetuate violence when they become adults and others lead prosocial lives? An understanding of these divergent responses to stress may be derived from the study of gene–environment interplay—defined as how genes and environment work together. Gene–environmental interplay includes two mechanisms: gene–environment interactions (GxE) and gene–environment correlations (rGE).

GxE, simply speaking, can be considered a genetic sensitivity to the wider environment. In other words, the scope of genetic influences may be contingent on specific environments (e.g., individuals genetically predisposed to impulsivity react to raucous environments differently than those with more peaceful temperaments). Phrased differently, a GxE implies the effect of an environmental factor on behavior may be tied to genetics. GxE describes how some individuals are genetically predisposed to be “especially sensitive or especially resilient” in regard to environmental influences (Briley, Livengood, & Derringer, 2018, p. 209) and how some genetic influences are “activated or deactivated” (Bleidorn, Kandler, & Caspi, 2014, p. 245). The importance in understanding this type of interplay is to realize that some environments may not appear to be criminogenic for all, but they may still be a risk factor for susceptible individuals. Further, other environments may actually stifle genetic influences (DiLalla & Gheyara, 2011). Legrand, Keyes, McGue, Iacono, and Krueger (2008) found the heritability of delinquency was significantly higher for a sample of urban adolescent males compared to their rural counterparts. This GxE finding suggests genetic risk for offending may be mitigated in rural areas where there is less anonymity and fewer opportunities for crime relative. A more classical GxE finding addresses the question detailed in the preceding paragraph; Caspi and colleagues (2002) found that high MAOA–activity alleles were linked to a weaker effect of maltreatment on antisocial behavior as compared to low MAOA–activity alleles. Countless other works have confirmed Caspi et al.’s (2002) findings and suggest that males with the high-activity allele are more resilient to environmental pressures while those with the low-activity allele are generally more susceptible to environmental insults.

The statistical relationship (i.e., correlation) between genotypes and the environment are called rGE, and this mechanism is meant to account for when genotypes are more (or less) likely to be exposed to certain environments (Beaver, 2013). Put

another way, rGE suggests that genes may be responsible for affecting/choosing the environment or predisposing an individual to a certain environment which itself may be criminogenic. There are three such correlations: active, evocative (i.e., reactive), and passive.

1. Active rGE suggests that environments are correlated with one's genotype by "niche-picking," or choosing a particular environment because it suits heritable traits (e.g., a child who inherited genes predisposing them to antisocial behavior then choosing to spend time with antisocial peers) (Beaver, 2013).
2. Evocative rGE depends upon the response of others and of the environment. People respond to those with caustic genotypes negatively and pleasant genotypes positively, thus affecting the behavior of the individual. For example, children with impulsivity problems may struggle to channel their energy, eliciting negative reactions from others around them and diminishing social capital (Briley et al., 2018).
3. Passive rGE describes how the source of childhood environments is the same as the source of the genotype (i.e., the parents). Beaver succinctly summarizes the phenomenon: "parents may provide genotypes that put children at risk for delinquent behaviors while also creating environments that augment that risk" (2013, p. 82).

Both Beaver (2013) and Mullineaux and DiLalla (2015) conclude that rGE and GxE likely work simultaneously to affect criminal outcomes, rather than independently of one another. All things considered, GxE and rGE suggest a logical sequence of events: children inherit a genetic predispositions, are often raised in environments that augment genetic risk, respond to those environments in a manner that may be conditioned by genetics (such as selecting a delinquent peer group due to shared personality traits), and negative societal and institutional environment reactions evoke further maladaptive behavior. Mullineaux and DiLalla (2015) synthesized recent studies and found that "positive" environments allow for full expression of desirable traits, while "negative" environments stifle those same desirable traits, thereby leaving the variance in a population to be shaped almost entirely by the environment (p. 1351). Ferguson (2011) further illuminates, suggesting that an individual's genotype sets up a "range of possible outcomes" and that the severity of the environment determines phenotype (p. 123).

Implications emerging from gene–environment interplay research indicate the necessity of continued focus on sociological determinants of crime as well as genetic factors. This genetic research has narrowed our focus in terms environmental risk factors by clarifying when, for whom, and how sociological pressures influence

criminality. It has additionally identified causal mechanisms for how those same environmental risks amplify undesirable genetic influences. For example, genetic influence appears to have a particularly strong effect when coupled with poor parenting practices and antisocial peers (Mullineaux & DiLalla, 2015; Vaske, 2015). It stands to reason that policy focus should remain on improving communities, improving support for pregnant women and struggling families, and strengthening the education system, in an effort to maintain consistent, prosocial values throughout childhood. Though these goals seem overwhelming, gene–environment interplay research can hone our focus and advise policy resolutions that utilize our awareness of how certain positive and productive environments may lessen genetic effects of criminality.

Modern Biosocial Policy Is Ethical and Effective

Continued research dedicated to understanding how genes interact with the environment helps to produce more directed interventions; this form of biosocial research is tied to policy cost-effectiveness as it may help direct specific assistance and positive resources to outlets where they can do the most good. Overall, policy implications derived from modern biosocial criminology are not dissimilar to policies proposed by sociological theorists, and are no less ethical. Much biosocial policy involves environmental enrichment or modification. More straightforwardly, biosocial criminology research justifies additional regulation of potential environmental toxins such as lead, nutritional assistance to pregnant women and children, and activity guidelines to reduce the occurrence of TBI during childhood.

Vigilance in lead testing is imperative for early detection and intervention. Many states already have programs in place to address dangerously elevated lead levels. Universally available blood lead–level testing at ages 1 and 2 years is essential to identifying, treating, and ameliorating the negative outcomes of toxic lead blood levels. Programs targeting these age groups have shown success; no differences between those identified and treated at an early age and a nonexposed comparison group were seen following the implementation of recent program in North Carolina (Billings & Schnepel, 2018). While blood tests may be invasive, offering tests for a common toxin and resources for affected families is ethical and a far cry from Lombrosian policy.

Similarly, we have described how proper nutrition may reduce problematic behaviors. Nutrition is often overlooked as a component of biological criminology, but providing healthy, consistent meals to developing children may be the most powerful tool society has to lessen the scope of crime in society. Universal breakfast programs for children have been implemented nationwide, and the federally funded

program feeds 11.6 million children every day (Hermes, 2012). Unfortunately, the quality and nutritional value of the breakfasts provided is not consistent, nor do all school-provided lunches adequately meet the needs of developing brains (Buscemi et al., 2018). Biosocial research can guide the development of nutritional regimens that will most benefit developing minds and justify the funding of meal programs and inclusion of nutritional education in school curriculums (Robinson & Beaver, 2009). Once again, this biosocially informed type of policy is consistent with modern ethics and in no way resembles Hooten's abhorrent call for eugenics.

Another ethical biosocial policy example would be Washington State's "TBI law," a policy intended to streamline TBI education in youth sports (Cox et al., 2018). Youth sports injuries account for approximately 300,000 TBIs a year, and states such as Washington now expect youth to be involved in making an informed decision for themselves about their involvement in potentially hazardous activities. TBI laws have been signed in numerous other states (Traumatic Brain Injury Legislation, 2018). It stands to reason that such laws, if effective at lessening the frequency of TBIs, are likely to have an effect on future rates of crime. Much like the previous two examples, it is clear that programs substantiated by biosocial criminology are consistent with prevailing ethical frameworks and our society's interest in the health and well-being of children.

ARGUMENTS AGAINST UTILIZING BIOSOCIAL CRIMINOLOGY

Biological Criminology May Not Have Dealt with Its Demons

Since the 1870s biological criminology has been rooted in denying rationality and embracing biological determinism through suggestions that physical, mental, or genetic abnormalities irreversibly drive deviant behavior. This perspective diminishes or even nullifies society's role in influencing criminal behavior. Early biological theorists rejected claims that crimes were the result of rational thought; instead, they claimed that the real criminal, born with immutable criminal traits, was destined to commit crime. This predestined criminal was deemed an irredeemable threat to society and law-abiding people, leaving incarceration, incapacitation, and reproductive restrictions as the only "reasonable" policy. These arguments, developed by Lombroso (2006/1876) and promulgated by Goring (1913), Hooton (1939), and others, inspired devastating policies in an attempt to neutralize biological criminals, including eugenics and genocide (Rafter, 2008).

While today's biosocial criminology distances itself from these archaic notions, traces of those founding flaws may remain. Further, the field may not be far from taking steps towards the slippery biological positivism slope and the inhumane policies those early works endorsed.

Biological positivism suffered from an inability to withstand empirical or methodological scrutiny in addition to racist, sexist, and inhumane claims. The perspective had lost all favor by the 1950s among those who studied crime and delinquency. The field was solely concerned with sociological explanations of crime and antisocial behavior until the late 1970s, when biology reappeared as a potential causal factor in delinquency (Hirschi & Hindelang, 1977). Scientific and methodological advances have enabled a new wave of biological criminology research that claims that a person's biology and their environment work in tandem to influence a person's criminal activity. They reject measurements of stigmata and other parts of the anatomy and instead focus on genetic variation (Silver & Nedelec, 2018), biochemistry (e.g., nutrition, hormones; Newsome & Cullen, 2017), and neurophysiological functions (Koegl, Farrington, & Raine, 2018). However, methodological and empirical issues still exist even within the most recent biosocial criminology research. Though the issues may be more subtle and intricate than the clear failures of biological criminologists to follow the scientific method a century ago, there are certainly methodological concerns that may bias findings.

Biosocial criminology's methods continue to become more sophisticated, and the science more advanced, yet there remain methodological, sampling, and measurement issues with modern biosocial research that concern even those conducting research in the field (Burt & Simons, 2014, 2015; Fishbein, 2001). In a top criminological journal, Burt and Simons (2014) raise questions around whether it is appropriate to separate genetic factors from environmental factors when trying to parcel out which factor has more impact on the criminal behavior—particularly when biological–environmental interaction, rather than independent functioning, is the heart of many biosocial criminology claims. Additionally, they challenge whether the Add Health database that many researchers use for biosocial research is appropriate (Burt & Simons, 2014). Furthermore, gene-based research has ascribed genetics as the cause of more phenomena, from political ideology (Alford, Funk, & Hibbing, 2005) to breakfast-eating patterns (Keski-Rahkonen, Viken, Kaprio, Rissanen, & Rose, 2004) to gang membership (Barnes, Boutwell, & Fox, 2012), and encourages the type of deterministic policies other researchers fear. In the subsequent sections we highlight two types of modern biological research and demonstrate how they still suffer from methodological flaws and offer inappropriate policy applications.

The IQ–Crime Debate Demonstrates Inconsistencies in Biosocial Criminology

Is intelligence associated with crime, and if so, to what extent? We've highlighted how early criminologists (1870–1920) thought criminals were born mentally defective and that these individual defects were the primary factor in their criminal behavior (Goring, 1913; Goddard, 1914; Lombroso, 2006/1876). By the 1950s, however, the combination of (1) criminology transitioning from a medical subfield to a subfield of sociology, and (2) the catastrophic role biology played in justifying Nazi Germany's political policy of mass extermination during World War II, led to the discarding of the concept of IQ being associated with crime (Hirschi & Hindelang, 1977; Rafter, 2008). Yet, the IQ–crime debate was rekindled after Hirschi and Hindelang's review in 1977 that reasserted that IQ was as important a factor in predicting delinquency as was environmental circumstances. Herrnstein and Murray's controversial 1994 book *The Bell Curve* served as jet fuel to the debate by arguing for drastic change in social policy based on fallacious findings that IQ is immutable and a powerful predictor of delinquency. In this section we will examine the twists and turns of the link between IQ and crime, while discussing the immense policy implications associated with the IQ–crime debate.

Early biological criminology was largely the domain of medical doctors. Physicians Cesare Lombroso (2006/1876), Charles Goring (1913), and Henry Goddard (1914) provided initial studies into the link between biology and crime. Lombroso's (1876) analysis of Italian soldiers and prisoners led him to claim that certain biological differences distinguished lawful citizens from mentally inferior born criminals. A few years later, Charles Goring analyzed English prisoners, university undergraduates, professors, soldiers, and hospital patients by measuring them on 37 different physical traits. Goring found that prisoners were shorter and thinner than law-abiding civilians, and were less intelligent; however, the measurement of intellect was based solely on the researcher's impression (Goring et al., 1913). The following year Henry Goddard published a study whereby he concluded that half of all criminals were mentally defective (Goddard, 1914). These early biological theories oft tied the existence of criminals in a society of primarily law-abiding people to mental and biological inferiority. Racism likely played a role in these claims, as the crime committed by marginalized subgroups was attributed to characteristics of the group rather than poverty, discrimination, and other challenges those groups faced. Further, grotesque policy proposals resulted (i.e., colonizing low-IQ individuals and sterilizing low-IQ people) prior to sociology's increasing influence on criminology spurring a new era in the IQ–crime debate.

In the 1920s and 1930s prominent sociologists, including Edwin Sutherland, produced research maintaining there was no association, or only a negligible association, between IQ and delinquency (Murchison, 1926; Sutherland, 1931; Zeleny, 1933). Sociologists, instead, looked to social class and race as predominant factors responsible for delinquency, not IQ (Hirschi & Hindelang, 1977). This was the prevailing criminological view of the IQ–crime association until the late 1970s, despite some studies indicating that IQ was at least as important in predicting delinquency as was social class and race (McCord, McCord, & Zola, 1959; Reiss Jr. & Rhodes, 1961; Short & Strodbeck, 1965; West & Farrington, 1973; Wolfgang, Figlio, & Sellin, 1987/1972; Wolfgang et al., 1987). These findings were generally ignored until the late 1970s and early 1980s. It was then that Hirschi and Hindelang (1977) and Wilson and Herrnstein (1985) provided influential reviews that helped to resurrect IQ’s importance from the sociologically biased literature that had restricted the IQ–crime debate. Increasing confidence in behavioral genetic research, and the associated statistical advances, represented a sea-change of sorts for the IQ–crime debate. Heading into 1990s, research now indicated that “about half of the variation in intelligence, personality, and life outcomes is heritable” (Pinker, 2002, p. 374).

Herrnstein and Murray’s (1994) book, *The Bell Curve*, changed the tenor of the IQ–crime debate while promoting racist social policies similar to those of the biological positivists. The authors claimed that “taking the literature as a whole, incarcerated offenders average an IQ of about 92, eight points below the mean” (Herrnstein & Murray 1994, p. 242), a finding echoed by more recent research (Ellis & Walsh, 2003; Farrington & Welsh, 2008; Walsh, 2011). However, the authors also made some unsupported claims, namely that intelligence had a commanding and immutable effect across a vast array of behaviors, including deviancy. Furthermore, the authors state, “Many people tend to think of criminals coming from the wrong sides of the tracks. They are correct insofar as that is where people of low cognitive ability disproportionately live” (Herrnstein & Murray, 1994, p. 251). Finally, the authors suggest that instead of focusing on problems of poverty and unemployment, the focus should be on “coping with cognitive disadvantage” (Herrnstein & Murray, 1994, p. 251).

Cullen, Gendreau, Jarjoura, and Wright (1997) used the same data yet came to a different conclusion—that IQ is only weakly associated with criminality. Cullen et al. (1997) offered a blistering critique of Herrnstein and Murray’s research claiming (1) that the amount of explained variance (i.e., R^2), which was relegated to the appendix and not reported in the text, was weak to moderate; (2) that Herrnstein and Murray’s model was misspecified, (i.e., failed to include other

independent variables, including urban/rural residence, family structure, religiosity, and the last grade the youth expects to complete, among others); and (3) that the authors incorrectly concluded that less intelligent criminals commit crime, rather than that less intelligent criminals are detected. These can be considered glaring methodological flaws that preferably would be avoided in modern research. Despite the flawed methods in the original study, subsequent research has upheld Herrnstein and Murray's general claim that IQ is consistently associated with self-reported crime (Ellis & Walsh, 2003; Farrington & Welsh, 2008; Silver & Nedelec, 2018).

Working from the general consensus that IQ is at least weakly associated with crime, Mears and Cochran (2013) examined whether that association is linear. Using the same data as Herrnstein and Murray (1994) and Cullen et al. (1997), Mears and Cochran (2013) found that IQ had a curvilinear association with anti-social behavior. Specifically, individuals between the 16th and 54th IQ percentiles committed criminal acts above the IQ standardized mean, whereas those below the 15th percentile, and above the 55th percentile committed fewer criminal acts. Two years later, Schwartz et al. (2015) found that the IQ–delinquency link was primarily linear with some curved associations at the extremes, concluding that “low intelligence is a strong and consistent correlate of criminal offending” (p. 115). Silver and Nedelec (2018) examined whether IQ moderated key environmental constructs and antisocial behavior, finding that IQ moderates the environment–antisocial behavior relationship, and that the influence of IQ on antisocial behavior grows stronger as a person ages.

In summary, the debate regarding the association between IQ and crime is still ongoing, but an examination of the research demonstrates a number of inconsistencies and potential methodological flaws as highlighted by Cullen et al. (1997). There appears to be a weak to moderate link between lower IQs and delinquency; however, the linear nature of that link (see Mears and Cochran, 2013) and whether IQ moderates the environment's effect on antisocial behavior (see Silver and Nedelec, 2018) are two of the open questions in this area of criminology. Perhaps most important, it is clear that one's IQ is changeable, contrary to Herrnstein and Murray's (1994) claims, which might inspire unethical and ineffective policy.

If one's biology determines one's life's prospects, and traits such as intelligence are immutable, as Herrnstein and Murray claimed, then crime and delinquency are inherent in the individual. In such a world, a criminal could not be rehabilitated, nor would he fear retribution for his crimes. The only policy solution would be to initiate a eugenics program that would use surgical or chemical procedures to prevent breeding or to institute long-term incarceration (Rafter, 2008). This was precisely what precipitated the eugenics movement of selective breeding in

the late 19th and early 20th centuries. Hooten (1939) and others (Rafter, 2007) subscribed to a doctrine that these genetically deficient criminals were ruining society, and that they must be dealt with by selective breeding or colonization (Rafter, 2004). Chemical castrations, brain surgery, and other medical procedures were performed as late as the 1970s to control the reproduction of people deemed criminal degenerates (Moyer, 1979). As late as 1984, Taylor (1984) recommended isolation, lobotomies, gene splicing, chemical sterilization, and abortions to stop those predisposed to criminality from reproducing, even if they had not committed a crime. So, when Herrnstein and Murray (1994) claimed that IQ was immutable, implying that one's biology was destiny, they were revisiting older theories that produced cruel, racist, and abhorrent policies. They published their work in the last quarter century, but it yields the same inferences discarded a century earlier.

Highlighting the Methodological Concerns of Genetic Criminology Research

Researchers have examined the concordance (i.e., a quantitative measure of the presence of the same attribute in both twins) of behavior in adoption and twin studies to examine the impact of heritability (i.e., the variation of a given trait attributable to genetic variation in the population), shared environment (i.e., similarities of being raised in the same home), and nonshared environment (i.e., unique experiences outside of the home) on crime (Maynard, Boutwell, Vaughn, Naeger, & Dell, 2018). A flurry of biosocial criminal research activity has been undertaken in this domain in the last quarter century, generally indicating that genetics has a notable influence on criminal behavior. Burt and Simons (2014) have called for an end to heritability studies in criminology, claiming that they are (1) seriously methodologically flawed, resulting in an outsized genetic influence relative to one's shared environment, and (2) that "[g]enes and the environment *do not* have identifiably separate influences on variation in complex phenotypes (e.g., crime) and their effects *cannot* be separated" (Burt & Simons, 2014, 2015, p. 105, original emphasis). Their first claim is that heritability studies violate the equal-environment assumption (EEA; one of nine long-standing assumptions of twin studies), which claims that the environments of monozygotic (MZ; identical twins) and dizygotic twins (fraternal twins) are substantially similar (Burt & Simons, 2014). Burt and Simons demonstrated that recent studies using kinship pairs (e.g., MZ twins, DZ twins, full- and half-siblings, cousins) violated the EEA, a fundamental assumption upon which heritability studies rest. To Burt and Simons (2014), assuming that same-sex MZ twins and opposite-sex cousins grow up in

equally similar environments, which is what those heritability studies assumed, is absurd. They criticize that the home environment is likely to be more similar for identical twins than for siblings of different ages, genders, and perhaps parents. Thus, the EEA would not be met and the findings meaningless. Barnes et al. (2014) responded to the critique and claimed that Burt and Simons cherry-picked their data; they offered a comprehensive review of the EEA literature, concluding that if EEA was breached in the research the bias toward heritability would be between “1 and 5 percentage points” (Barnes et al., 2014, p. 16). The acceptance of existing studies as flawed, even if those flaws only slightly affect estimates, fails to breed confidence in behavioral genetics studies as a whole.

Burt and Simons’s (2014) second critique, that genetics and the environment cannot be separated to determine their impact on a behavior, was conceptual in nature. They claim that heritability studies rest “on an unsound conceptual (biological) model that assumes identifiably separate ‘genetic’ and ‘environmental’ effects on phenotypic variance” (Burt & Simons, 2015, p. 109). However, their claim has faced criticism that it is based on the incorrect idea that statistical models are designed to explain individual outcomes, when, in fact, they are designed to explain sample variance and not individual behavior (Wright et al., 2015). While this debate seems unresolved, Burt and Simons’s concerns seem reasonable. If, as Walsh and Beaver (2009) indicate, genes facilitate our behavior rather than causing it, how can environmental effects be parsed from genetic ones? Regardless, researchers don’t appear to be heeding Burt and Simons’s advice to cease heritability studies in criminology (see Barnes et al., 2014; Wright et al., 2015). However, their arguments could have a chilling effect on motivation towards and acceptance of future biosocial criminological research, given the attention that the critique has received.

Other modern biosocial criminological research has attempted to identify significant gene–environment interactions. In other words, in what circumstances do genetic factors moderate the relationship between environmental conditions and some behavioral outcome such as crime? Some findings, like the role MAOA genotype plays in the maltreatment–violence cycle, have been replicated numerous times. Others are more suspect. The key issue is determining whether any *p*-hacking or data dredging took place; does a true relationship exist, or has a statistical anomaly been reported after numerous nonsignificant findings were ignored? Put another way, *p*-hacking is when researchers are unable to find statistical significance pursuant to their intended theoretical justification, and instead they look for a statistically significant pattern in the data when no underlying effect is present. This can lead to surprising, and headline-grabbing, results, that are typically spurious and irreproducible. The inability to reproduce the results can raise red flags as to

whether *p*-hacking occurred, especially when the findings may be unexpected. The question, after reviewing the literature, is whether you can trust biosocial criminological research.

DISCUSSION QUESTIONS

1. Do you trust biosocial research? Are the potential methodological shortcomings serious enough to lead you to reject the findings of the field?
2. Should states and municipalities be penalized for failing to fix toxic environments that have been found to be associated with later criminality?
3. Has biosocial criminology truly evolved from the time of Lombroso, or do some of the old ethical concerns still haunt modern works?
4. Do think the results from biological research will have any effect on the court system? For example, will awareness of biological risk factors have an effect on the way we evaluate culpability?
5. Should mothers be punished for knowingly creating an unhealthy fetal environment?

ACTIVE LEARNING EXERCISES

1. You have been assigned to argue that biosocial research is trustworthy, and you must persuade your classmates. Choose a specific area of biosocial research (e.g., TBIs, environmental toxins, nutrition, or genetics), and create a PowerPoint presentation outlining the empirical research presented in this chapter. In addition, use outside sources (see suggested readings below) to help strengthen your argument. Present your findings to the class.
2. Research recent criminal court cases involving traumatic brain injuries. Did the judge allow testimony from neurologists or other experts? Do you agree with the judge's decision? Overall, do you think the biosocial factors discussed in this chapter should be considered as legitimate defenses that can be used in criminal cases? Why or why not?

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- Wright, J. P., & Boisvert, D. (2009). What biosocial criminology offers criminology. *Criminal Justice and Behavior*, *36*(11), 1228–1240.

SUGGESTED WEBSITES

- Minnesota Center for Twin and Family Research (MCTFR): <https://mctfr.psych.umn.edu/index.html>
- Nurse-Family Partnership: <https://www.nursefamilypartnership.org>
- Prenatal Care: <https://www.womenshealth.gov/a-z-topics/prenatal-care>
- Traumatic Brain Injury: <https://www.cdc.gov/traumaticbraininjury/index.html>

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