

## CHAPTER 5

# Biosocial Criminology

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Biosocial criminology is a perspective that takes seriously the fact that *any* meaningful human action is *always* the result of individual propensities interacting with environmental instigation. Moir and Jessel (1995, p. 10) have asserted that “the evidence that biology is a central factor in crime, interacting with cultural, social, and economic factors, is so strong. . .that to ignore it is perverse.” Yet it is ignored more often than not, and few criminologists consider themselves “perverse” for doing so. Biosocial criminologists know how difficult it will be to convince their mostly sociologically trained colleagues (Walsh & Ellis, 2004) that the biosocial perspective has much to offer, for it has been said that sociologists are not simply oblivious to biology, but “militantly and proudly ignorant” (van den Berghe, 1990, p. 177). We doubt that this is as true today as it probably was back then; we certainly hope not, for as sociologist Matthew Robinson has opined, “the biological sciences have made more progress in advancing our understanding about behavior in the past 10 years than sociology has made in the past 50 years” (2004, p. 4). Human beings have genes, brains, hormones, and an evolutionary history, and criminologists should be able to extract from the disciplines that study such things rich new insights into the familiar and exciting ways of discovering things previously overlooked.

Statements such as these may not sit well with those whose understanding of biology is limited to the traditional textbook fare of phrenology, atavism, and the XYY syndrome. Their sociological training leads them to argue that to invite the demon biology to the ball is to invite racism and eugenics, among other things, but as Bryan Vila (1994) has pointed out, “Findings can be used for racist or eugenic ends only if we allow perpetuation of the ignorance that underlies these arguments” (p. 329). Overcoming ignorance requires criminologists to gain a grasp of genetics, neuroscience, and evolutionary biology. One does not have to become an expert in the exotic minutia of these disciplines, it is only necessary to learn the rudiments well enough to

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appreciate and apply the relevant literature to criminology in the same way that we learn and apply statistical methods. It is certainly a challenge, but it is an exciting and rewarding one.

Biosocial perspectives owe much of their current robustness not so much to new theorizing as to huge advances in biotechnology. Neuroimaging is becoming cheaper and more efficient all the time, and DNA can be obtained from cheek swabs and analyzed for as little as \$10 per person (Butcher et al., 2004). There are a number of ambitious longitudinal studies being carried on today in concert with medical and biological scientists that have taken advantage of these technologies such as the Dunedin Multidisciplinary Health and Development Study (Caspi et al., 2002), the National Longitudinal Study of Adolescent Health Study (Udry, 2003), and the National Youth Survey (Menard & Mihalic, 2001).

Talk of genes, hormones, and brains clearly means that the biosocial perspective seeks to explain *criminality*, not crime. Crime is an event, a socially defined act that is proscribed by the law. Criminality on the other hand refers to individual predisposition to commit crimes and other acts of victimization for personal gain and is a continuously distributed trait which is itself composed of numerous sub-traits such as low levels of empathy, self-control, fear, and IQ and high levels of sensation seeking, negative emotionality, and egoism. No one argues that fluctuations in crime rates have a biological foundation; to do so would be to confuse the social, political, and economic causes of secular change with the causes of individual variance in the propensity to commit crimes. Environmental factors function by raising or lowering individual thresholds for engaging in criminal behavior.

Let us make it clear that there is no such thing as a strictly biological theory of criminality; all theories of human behavior that integrate biological insights are *biosocial*. There are three general biosocial approaches: genetic, evolutionary, and neurohormonal. All three approaches are so environmentally friendly that they may well have been called biologically informed environmental approaches. While these approaches employ different methods, work with different units of analysis, and invoke different levels of causation, their principles are conceptually consistent across all three levels of analysis and they all recognize the importance of the environment. As Baker, Bezdjian, and Raine (2006, p. 44) state, “the more we know about genetics of behavior, the more important the environment appears to be.” The same could also be said of accumulating knowledge about the brain and evolutionary biology.

## GENETICS AND CRIME

No geneticist claims that there are genes “for” criminal behavior. Genes are for making proteins, some of which facilitate (not cause) our behavior and feelings. Genes produce tendencies to respond to the environment one way rather than another, but the genome is not a blueprint containing deterministic instructions for constructing certain types of brains that then produce certain types of behavior. There are, however, genetic variations (polymorphisms) that lead to extreme values on certain phenotypic traits that increase the probability of offending when combined with other traits and with the right kind of environment.

Behavior geneticists assess the amount of variance in a phenotypic trait attributable to genes using heritability coefficients ( $h^2$ ) that range between 0 and 1.00. Heritability coefficients for most traits related to antisocial behavior are in the 0.20–0.80 range, and for antisocial behavior itself they are in the 0.40–0.58 range (Miles & Carey, 1997; Rhee & Waldman, 2002), with  $h^2$  being higher in adult than in juvenile populations because of the high base rate of juvenile

offending. Because  $1-h^2 = \text{environmentality } (c^2)$ , environmental factors account for between 40 and 60% of the variance in antisocial behavior. Heritability provides only an index of *actualized* genetic effects in a population in a particular environment at a particular time because different environments provide different opportunities for genetic potential to be realized. For instance, the heritability of IQ is considerably higher (low 0.70s) in advantaged environments than in disadvantaged environments (range 0.10–0.26) (Rowe, Jacobson, & Van den Oord, 1999; Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003).

A review of 72 behavior genetic studies conducted up to 1997 found that 93% were supportive of the hypothesis that genes affect antisocial behavior (Ellis & Walsh, 2000). Behavior genetic studies are more useful to criminologists in helping to make more sense of traditional criminological theories rather than in advancing genetic theories per se. For instance, large longitudinal behavior genetic studies conducted in the United States (Cleveland, Wiebe, van den Oord, & Rowe, 2000) and in the United Kingdom (Moffitt & the E-Risk study team, 2002) showed that genetic factors play a major part in sorting individuals into different family structures, a variable often linked to antisocial behavior. These studies focused on such heritable factors as sexual promiscuity, intelligence, self-control, and propensity for engaging in risky behavior.

A major longitudinal study of child abuse and neglect integrating genetic data showed why only about one-half abused/neglected children become violent adults (Caspi et al., 2002). Researchers found that subjects who had been maltreated as a child and who possessed the low-activity allele of the MAOA enzyme had a highly elevated probability of becoming antisocial adults, including having an official record for violent offenses. Adults maltreated as children with the high-activity MAOA allele had a much lower probability of becoming antisocial. Although only 12% of the sample had the low-activity allele *and* were maltreated as children, this small subsample of males accounted for 44% of convictions for violence. A recent meta-analysis found that the interaction between MAOA and maltreatment is a significant predictor of antisocial behaviors across studies (Kim-Cohen et al., 2006).

Another study looked at Gottfredson and Hirschi's (1990) assumption that parents are primarily responsible for their children's self-control (Wright & Beaver, 2005). A modest relationship between parental practices and children's self-control was found, but disappeared when genetic information was added. In other words, not using genetically informed methods leads researchers to misidentify important causal influences. Wright and Beaver (2005, p. 1190) concluded, "for self-control to be a valid theory of crime it must incorporate a more sophisticated understanding of the origins of self-control." Lilly, Cullen, and Ball (2007, p. 110) support Wright and Beaver when they state that "research suggests that parents may affect levels of self control less by their parenting styles and more by genetic transmission."

## MOLECULAR GENETICS

Behavior genetic studies show only that "something genetic" is operating, not the specific genes involved. Molecular genetics is the next step in the bottom-up search for the genetic contribution to the causes of behavior because it is where we may find the actual genes. After sampling DNA from individuals, researchers may correlate gene variants already identified with a trait or search for multiple candidate genes that may be associated with a quantitative trait via *quantitative trait loci* (QTL) mapping. A QTL is a locus of closely linked polymorphic genes the alleles of which are thought to affect variance in targeted quantitative traits. Each QTL may have small effect

sizes, but multiple QTLs may be identified and combined into a “QTL set” as genetic risk factors (Plomin & Asbury, 2005). For instance, a recent search found 29 genetic markers out of 374 examined for the comorbidity of conduct disorder and vulnerability to substance dependence (Stallings et al., 2005).

Researchers also examine gene  $\times$  gene (G $\times$ G) interactions in the etiology of antisocial behavior. Carrasco et al. (2006) examined two genes responsible for the functioning of the neurotransmitter dopamine—the DRD4 and DAT1 genes. To grossly simplify, dopamine is the major “motivating/reward” neurotransmitter, DRD4 is a highly polymorphic dopamine receptor gene that comes in a variety of “repeat” forms, and DAT1 is a dopamine transporter gene that also comes in a variety of repeats. Carrasco et al. found no independent effects of two genetic polymorphisms, but individuals who possessed both the 7-repeat allele of the DRD4 and the 10-repeat allele of the DAT1 were significantly more likely to be diagnosed with ADHD (odds ratio = 12.7) than subjects possessing neither or only one of these alleles. Similarly, Beaver, Wright, DeLisi, et al. (2007) found no significant main effects for either the DRD2 or DRD4 polymorphisms on conduct disorder or antisocial behavior, but the G $\times$ G interaction had significant effects on both.

## EPIGENETICS

Epigenetics is an exciting and relatively new way of looking at how the genome interacts with the environment and is defined as “any process that alters gene activity without changing the DNA sequence” (Weinhold, 2006, p. 163). Genes are switched on and off by signals from the organism’s internal chemical environment and/or by its external physical and social environments according to the challenges it faces. There are some genes that may be so strongly shaped by protracted environmental events that they are permanently turned on or off by less than the normal environmental instigation required to do so or even in the absence of such instigation. The regulation of genetic activity is accomplished by two main processes: methylation and acetylation, the most common of which is methylation (Lopez-Rangel & Lewis, 2006). Methylation involves the attachment of a group of methyl atoms to a cytosine nucleotide base (one of the four “letters” of DNA) thus preventing the translation of DNA into mRNA, and hence the protein the gene codes for is not manufactured (Corwin, 2004).

There are a few quite suggestive lines of evidence from epigenetic research that may open up whole new vistas for criminologists. For instance, a number of mental health researchers have been looking into the epigenetic regulation of serotonin and dopamine receptors in the etiology of schizophrenia and bipolar disorder (Petronis & Gottesman, 2000). However, the most important line of research for us may be in the epigenetics of nurturing. There has been a lot of experimental research with lab animals, examining the epigenetic consequences of high and low levels of nurturing. Major findings are that highly nurtured animals show reduced methylation of genes that determines the number of glucocorticoid receptors (GRs) an animal will have in the hippocampus (area of the brain responsible for memory). High levels of GRs mean the animal will have greater control of its stress responses, and because GRs modulate the expression of a variety of neuronal genes and are vital to neuronal homeostasis, they are vital for mental health as well (Weaver et al., 2004).

We do not know to what extent non-human animal epigenetic findings can be applied to humans, but they are most likely to apply to early developmental processes (Rutter, 2007). A number of epigenetic scientists believe that the field may have profound meaning for human

development and behavior. Michael Meaney, for instance, states that “We’re beginning to draw cause-and-effect arrows between social and economic macrovariables down to the level of the child’s brain” (in Watters, 2006, p. 75). Epigenetics is in its infancy, but the possibilities are as exciting as anything that has come along in the behavioral sciences in the past 50 years and once again illustrates how important the environment is to genetic expression.

## EVOLUTIONARY PSYCHOLOGY

Evolutionary psychology is interested in the common nature possessed by all humans rather than individual differences in phenotypic traits and in ultimate “why” questions rather than proximate “how” questions of genetics. For instance, while neurohormonal scientists may explain sex differences in dominance and aggression by pointing to different testosterone levels and how testosterone operates, evolutionary scientists would want to know why these sex differences exist in the first place; i.e., what the selection pressures were that led to them.

The behavior of *Homo sapiens* is subject to the same explanatory framework as the behavior of any other animal; after all, there is no *scientifically* viable alternative explanation to evolution by natural and sexual selection for the basic behavioral design of any animal. This is not to say that culture is irrelevant to understanding human behavior. Evolved behavioral adaptations require evolutionarily relevant triggers from the environment both to develop and to activate them, and these triggers differ in thresholds, permissions, and constraints in different cultural contexts. Recognizing this Jerome Barkow (1989) assures us that we will always need the social sciences to help us understand these triggers, but he also implores us not to forget that “psychology underlies culture and society, and biological evolution underlies psychology” (p. 635).

### The Evolution of Traits Related to Criminal Behavior

Because evolution has shaped human psychology and behavior, it has shaped morally undesirable human traits such as egoism, deception, and violence. Whenever an evolutionary biologist studies any behavior of any species, the first question asked is “What is the adaptive significance of this behavior?” Surviving traits and behaviors owe their existence to the fact that they were useful to the reproductive success of the species’ distant ancestors, whether they be morally repugnant or whether they be positive traits and behaviors such as altruism, empathy, and nurturance. Needless to say, humans do not display evolved patterns of behavior motivated by the desire to maximize reproductive success:

Evolutionary psychology is not a theory of motivation. Fitness consequences are invoked not as goals in themselves, but rather to explain why certain goals have come to control behavior at all, and why they are calibrated in one particular way rather than another (Daly & Wilson, 1988, p. 7).

Parents nurture their children not because of a conscious desire to push their genes into the future, but rather because ancestral parents who nurtured their children saw more of them grow to reproductive age and pass on nurturing traits down the genetic line. Parents who were poor nurturers compromised their children’s viability, and thus reduced the probability of their own

genes being represented in future generations. This is the ultimate (evolutionary) reason why nurturance of offspring is the species norm while abuse and neglect are aberrant.

In common with Emile Durkheim, evolutionary psychologists consider behavior which is defined as criminal today to be morally regrettable but biologically normal behavior. A behavior or trait is biologically “normal” if it can be shown that every member of a species has a potential for it under a variety of circumstances and the behavior occurs frequently across time and culture (Kanazawa, 2003). Of course, specific criminal behaviors are not themselves adaptations: “Genes do not code themselves for jimmying a lock or stealing a car. . .the genome does not waste precious DNA encoding the specifics” (Rowe, 1996, p. 285). Criminal behavior is a way of acquiring valued resources by force or fraud, i.e., by exploiting others, and the possession of resources, however they are acquired, is useful in the ultimate goal of all living things—survival and reproductive success.

Evolutionary biologists refer to exploitive and deceptive behavior as *cheating*, whether or not it has been culturally defined as criminal. We all have the potential to exploit and deceive others, but few of us ever do so to a criminal extent because we are a highly social and cooperative species with minds forged by evolution to form cooperative relationships built on reciprocal trust. We cooperate with others because we feel good when we do and because it identifies us as reliable and trustworthy, attributes that confer valued social status on us. In short, cooperation and reciprocal altruism are in the best interests of every member of a social species. Again, cooperation and altruism are not engaged in so that the actor can feel good, nor because he or she is consciously motivated by the desire for status. Social organisms do so, and are neurologically rewarded when they do, because their distant ancestors who behaved this way enjoyed greater reproductive success than those who did not, thus passing on the genes for the brain structures and neurotransmitters that presumably underlie the propensity (Barkow, 1997).

All evolutionary theories of criminal and antisocial behavior focus on reproductive strategies and the behavioral tactics that flow from them (see Walsh, 2006, for a discussion of these theories). The reproductive strategies of any species can be apportioned according to the time and energy devoted to parenting versus mating effort. At one extreme are species that devote all their resources to mating and none at all to parenting (e.g., oysters who lay many thousands of eggs) and at the other we have species such as *H. sapiens* who devote a huge proportion of resources on parenting effort. Reproductive strategies are underlain by a suite of evolved traits that facilitate their pursuit. Among humans, the suite of traits useful for focusing on mating effort includes deceitfulness, impulsiveness, sensation seeking, and aggression; traits useful for focusing on parenting effort include empathy, conscientiousness, and altruism.

The evolved traits useful for mating versus parenting effort can be co-opted for other forms of behavior: “crime can be identified with the behaviors that tend to promote mating effort and noncrime with those that tend to promote parenting effort” (Rowe, 1996, p. 270). A reproductive strategy emphasizing mating effort is thus similar to criminal behavior in that direct and immediate methods are used to procure resources illegitimately with little thought being given to the consequences. Parenting effort, on the other hand, is embedded in a prosocial lifestyle in which resource procurement relies on the accumulation of social and occupational skills (the ability to delay gratification) that are attractive to females.

The strength of the traits associated with the two reproductive strategies is arrayed on a continuum dispersed around an adaptive mean, they are not traits one has or has not. Nor are mating strategies fixed; most people expended resources primarily on mating effort at some points of the life course and on parenting effort at other points as reward contingencies shift. There

are some people, however, who are so deceitful, impulsive, aggressive, and sensation seeking that they are not constitutionally suited to anything requiring long-term commitment, including commitments to marriage and parenting or to prosocial activities in general. The anthropological literature has long reported striking differences between cultures that emphasize different reproductive strategies. In cultures emphasizing mating effort significantly more than parenting effort, its males exhibit behaviors such as low-level parental care, hypermasculinity, violent competitiveness, and transient bonding, all of which are considered antisocial in Western societies (Ember & Ember, 1998; Harpending & Draper, 1988).

For instance, Harpending and Draper (1988) contrasted reproductive strategies in two cultures located in very different ecological environments. The !Kung bushmen inhabit the inhospitable Kalahari desert in South Africa, and the Mundurucu inhabit the resource-rich Amazon basin in Brazil. Because conditions are harsh in the Kalahari, life is precarious, cooperative behavior is imperative, and parenting effort is favored over mating effort. The Mundurucu's rich ecology frees males for fighting, for raiding other groups, and to engage in competition for females, and mating effort is favored over parenting effort.

Empirical research supports the conclusion that an excessive concentration on mating effort is linked to criminal behavior. Ellis and Walsh (2000) reviewed 51 studies conducted prior to 1997 examining the relationship between number of sex partners and criminal behavior and found 50 of them to be statistically significant and positive. They also reviewed 31 other studies and found that age of onset of sexual behavior was negatively related to criminal behavior in all 31 (i.e., the greater the frequency and severity of criminal behavior the earlier the onset of sexual behavior). Data from a British cohort study found that 27% of the children were fathered by the most antisocial 10% in the cohort (Jaffee, Moffitt, Caspi, & Taylor, 2003). A molecular genetic study found that the genetic polymorphisms that were significantly related to number of sexual partners were also significantly related to antisocial behavior (Beaver, Wright, & Walsh, 2008). Finally, a study of family structures and antisocial behavior found that genetic differences accounted for 94% of the difference on an antisocial scale between the most at-risk group (single mothers of half siblings, a structure indicative of mating effort) and the least at-risk group (two-parent family with full siblings, indicative of parenting effort). The researchers concluded that "Although temperament, personality, or cognitive bias toward sexual variety may be proximate causes of single parenthood or multiple matings, they may also comprise components of an overall reproductive strategy that emphasizes mating over parenting effort" (Cleveland et al., 2000, pp. 744–745).

## NEUROSCIENCE

The neurosciences consist of several interrelated disciplines that examine the anatomy, physiology, and chemistry of the brain using a variety of devices ranging from the relatively simple electroencephalograph (EEG) to sophisticated neuroimaging devices such as functional magnetic resonance imaging (fMRI). The neurosciences have made spectacular gains in the last three decades or so, but the most exciting news for social scientists is essentially the same as that which comes from the genomic and evolutionary sciences—humans are designed to be exquisitely responsive to their environment (Wright, Boisvert, Dietrich, & Ris, 2009).

All stimuli arising from within the person or from the environment must be funneled through the brain before responses are emitted. The brain is a marvel of evolutionary design which

constitutes only about 2% of the body's mass but consumes 20% of the body's energy as it perceives, evaluates, and responds to its environment (Shore, 1997). The evolutionarily more primitive parts of the brain come "hard wired" at birth, but the development of the higher brain areas depends to a great extent on environmental "software" downloaded after birth in response to experience.

The genes specify the architecture of the brain and manufacture all of the necessary substances to keep it running in the same way for everyone (50–60% of all human genes are believed to be involved in the development of the brain [Shore, 1997]), but the patterns of brain wiring are greatly influenced by environmental experience. Because many neural connections reflect experience, in many ways the environment shapes the brain in its own image. Genes carry an immense amount of information, but they are far too few in number to completely specify the trillions of connections the billions of neurons will eventually make with one another. If only genes were responsible for specifying neural connections, we would be hard-wired drones unable to adapt to novel situations.

There are two basic brain developmental processes: experience expected and experience dependent (Schon & Silven, 2007). Experience-expected development relies on mechanisms that are hard-wired to "expect" exposure to certain environmental experiences that reflect the phylogenetic history of the species. Experience-dependent mechanisms, on the other hand, reflect the plasticity (the ability of the brain to calibrate itself to the environment) of the individual brain. To put it another way, every member of a species inherits species-typical brain structures and functions that are produced by a common species gene pool, but individuals vary in brain functioning as their genes interact with the environments they encounter to construct those brains (Gunnar & Quevedo, 2007; Perry, 2002).

The experience-expected process reminds us that the human mind is not a blank slate that must learn everything through experience; it is fertile with built-in assumptions about the nature of the species-relevant environments that it will encounter. Some kinds of information are attended to more readily than others because of these built-in assumptions that reflect evolved neural preparedness to capture and incorporate environmental information that is vital to normal development. Experience-expected brain organization frames our experiences so that we will respond stereotypically and adaptively to vital stimuli. Thus all animals have decision-making algorithms enabling them to relatively easily perceive and sort stimuli into positive and negative categories according to their potential for harming or assisting them in their survival and reproductive goals and to respond to them accordingly.

Whereas the neural wiring involved in experience-expected development is identical across the human species, experience-dependent brain wiring varies depending on the kinds of physical, social, and cultural environments individuals encounter. It is not an exaggeration to say that "experience-dependent processes are central to understanding personality as a dynamic developmental construct that involves the collaboration of genetic and environmental influences across the lifespan" (Depue & Collins, 1999, p. 507). Although brain plasticity is greatest in infancy and early childhood, a certain degree is maintained throughout the lifespan so that every time we experience or learn something we shape and reshape the nervous system in ways that could never have been pre-programmed.

The important message for criminologists in all this is that neural network connections are continually being built and selected for retention or elimination in *use-dependent* fashion. The experiences we encounter strongly influence the patterns of our neural connections, and thus the content of our subsequent experiences. Selective retention or pruning of neural pathways is gov-



erned by the strength (defined in terms of the emotional content of the experience) and frequency of experience in a process that has been termed neural Darwinism (Edelman, 1992). The process of neural Darwinism helps us to understand in *physical* (not just psychological) terms how events with strong emotional content experienced with some frequency come to pattern a person's way of responding to the world.

## BIOSOCIAL APPROACHES TO SOME MAJOR CRIMINOLOGICAL CORRELATES

Having briefly introduced the bare bones of the biosocial approach, our next task is to illustrate how these approaches have been applied to some major criminological correlates. Space limitations dictate that we be highly selective in our choice of correlates so we have chosen four of the major correlates and concepts of concern to traditional criminological theories: socioeconomic status (SES), gender, age, and race.

### Anomie/Strain and SES

The basis of anomie/strain theory is that there are structural impediments to achieving the "American Dream" which American culture exhorts everyone to pursue. While Merton (1938) provided his famous typology of adaptations to anomic strain, he did not provide any systematic analysis of what it is that sorts people into these different modes of adaptation other than SES. Given the emphasis on the attainment of monetary success in anomie/strain theory, it is curious that theorists in this tradition have not explored the correlates of occupational success. Perceptions and attitudes about one's chances of legitimate success are assumed to be class linked, and class is assumed to be both given and static; i.e., social class is the cause of social class. Anomie/strain theorists have to come to terms with the fact that SES is a dependent variable as well as an independent variable (Walsh, 2000).

Robert Agnew considers the following traits to be important in differentiating people who cope constructively or destructively with strain: "temperament, intelligence, creativity, problem-solving skills, self-efficacy, and self-esteem" (1992, p. 71). These traits also have obvious applicability to occupational success, and thus to the adoption of one of Merton's adaptations. Temperament and intelligence have been called "the two great pillars of differential psychology" by Chamorro-Premuzic and Furnham (2005, p. 352), who add that these two constructs are vital to predicting all kinds of life outcomes. Sociologists are suspicious of connecting individual traits, especially intelligence, to SES; for them if offspring SES is caused by anything other than an unfair social system, it is caused by parental SES. However, any attempt to predict a person's SES from his or her parental SES is hopelessly confounded by genetics.

**INTELLIGENCE AND SES.** One study tackled the SES/IQ issue head on by controlling for the entire complex of variables that constitute the environment of rearing by comparing siblings growing up in the *same home* with the *same parents*, but who had different IQs (Murray, 1997). The 5,863 subjects came from the National Longitudinal Study of Youth and were divided into "very bright" (IQ = 125+), "bright" (110–124), "normal" (90–109), "dull" (75–

89), and “very dull” ( $< 75$ ). Among the findings were that the “very brights” earned an average of \$26,000 more than their “very dull” siblings, were significantly more likely to be married, and were less likely to have children out of wedlock. Thus in this study that “perfectly” controlled for social class of rearing, very large differences in many areas of life were predicted by IQ level.

A 60-year prospective study of the non-delinquent control group used in Sheldon and Eleanor Glueck’s (1950) delinquency studies interviewed subjects ( $n = 345$ ) at ages 25, 32, 47, and 65. Although parental SES was weakly related to occupational status at age 25, by the age of 65 none of the measured environmental factors were related to occupational status, but IQ became increasingly related to it after age 25 (DiRago & Vaillant, 2007).

Daniel Nettle’s (2003) study of all children born in Britain in one week in March 1958 followed to the age of 42 found that childhood IQ is associated with class mobility in adulthood uniformly across all social classes of origin. Nettle found an average IQ difference of 24.1 points between those who attained professional class and those in the unskilled class, *regardless of the class or origin*. He concluded that “intelligence is the strongest single factor causing class mobility in contemporary societies that has been identified” (2003, p. 560).

Another British longitudinal study (Bond & Saunders, 1999) found that individual meritocratic factors (assessed when subjects were 7-years old) accounted for 48% of the variance in occupational status at age 33. All measured background variables (including parental SES) combined accounted for only 8%. Based on this sixfold difference in the proportion of variance explained, Bond and Saunders concluded that “occupational selection in Britain appears to take place largely on meritocratic principles” (1999, p. 217).

An American behavior genetic study of 1,072 sibling pairs (MZ and DZ twins, full siblings, half siblings, cousins, and adoptees) looked at verbal IQ (VIQ), grade-point average (GPA), and college plans (CPL). Partitioning the variance into genetic, shared environment, and non-shared environment components, heritability coefficients were  $VIQ = 0.536$ ,  $GPA = 0.669$ , and  $CPL = 0.600$ ; shared environment coefficients were  $VIQ = 0.137$ ,  $GPA = 0.002$ , and  $CPL = 0.030$ ; and non-shared environmental coefficients were 0.327, 0.329, and 0.370. Shared environment is everything shared by siblings, including SES, as they grow up, while the non-shared environment is everything that differs between siblings, such as peer groups and prenatal environments. The proportions of variance explained by class origin across all measures are miniscule compared with the proportions explained by genes or even non-shared environment (Nielsen, 2006).

**TEMPERAMENT AND SES.** The other half of the main determinants of occupational success is temperament. Temperament is a phenotypic trait that constitutes an individual’s habitual mode of emotionally responding to stimuli and is largely a function of heritable variation in central and autonomic nervous system arousal patterns (Kagan & Snidman, 2007; Lemery & Goldsmith, 2001). The higher heritability coefficient for GPA than for VIQ noted above is to be expected because GPA is a more “extended” phenotype than VIQ. Intelligence alone is not sufficient; one must have the requisite temperament to persistently and dutifully apply it.

Temperament is the biological structure upon which personality is constructed. The most important personality trait linked to occupational success is conscientiousness, which has a

median heritability estimate of 0.66 (Lynn, 1996). Conscientiousness is a dimension ranging from well organized, disciplined, scrupulous, orderly, responsible, and reliable at one end of the continuum to disorganized, careless, unreliable, irresponsible, and unscrupulous at the other (Lodi-Smith & Roberts, 2007). Conscientiousness has been called the “will to achieve” (Kyl-Heku & Buss, 1996, p. 49), and is more important in high-autonomy jobs than in low-autonomy jobs (Schmidt & Hunter, 2004). In an intergenerational study following subjects from early childhood to retirement, Judge and his colleagues (Judge, Higgins, Thoresen, & Barrick, 1999) found that conscientiousness measured in childhood predicted adult occupational status ( $r = 0.49$ ) and income ( $r = 0.41$ ) in adulthood. These correlations were only slightly less than the correlations between “general mental ability” and the same variables (0.51 and 0.53, respectively). Schmidt and Hunter’s (2004, p. 170) analysis of “general mental ability” (GMA) and personality variables in attaining occupational success found that “the burden of prediction is borne almost entirely by GMA and conscientiousness.”

It is becoming more and more difficult to deny that individual differences are of tremendous importance to attainment of the “American Dream,” and that they are becoming more so in the increasingly complex and competitive work environment. If the anomie/strain tradition has any merit at all, then individual differences will also become increasingly important in explaining criminal behavior in societies where merit is the major road to success.

### **Feminist Theory and the Gender Ratio Problem**

Always and everywhere males commit far more crime than females, and the more serious the crime the bigger the gap (Campbell, 2009). This “gender ratio problem” is one of the key issues in feminist criminology (Daly & Chesney-Lind, 1988). Most female offenders are found in the same social situations as their male counterparts; i.e., among single-parent families located in poor socially disorganized neighborhoods, and male and female crime rates are highly correlated (mid to low 0.90s) across different nations, states, and cities (Campbell, 1999), indicating that females respond roughly the same to the same environmental conditions as males. Females do cross the threshold into criminal behavior, but it typically takes a great deal more environmental pressure for them to do so and their crimes are usually far less serious (Campbell, 2009; DeLisi, 2005). These facts led Daly and Chesney-Lind (1996) to ask “why do similar processes produce a distinctive, gender-based structure to crime and delinquency?” (p. 349).

Criminologists have attempted to answer this question in terms of socialization. The assumption inherent in this view is that if females were socialized in the same way as males and had similar roles and experiences, their crime rates would be roughly similar. If this were the case, surely there would have been some culture somewhere in which female crime rates were equal to the male rate, but no one has ever found such a culture. Robust sex differences in dominance and aggression are seen in all human cultures from the earliest days of life and are observed in all primate and most mammalian species (Archer, 2006; Geary, 2000), and surely no one would evoke socialization to explain these differences. As Diana Fishbein (1992, p. 100) sums up the gender ratio issue, “cross cultural studies do not support the prominent role of structural and cultural influences of gender-specific crime rates as the type and extent of male versus female crime remains consistent across cultures.”

Neuroscience informs us that gender-typical behavior is the result of hormones that organize the brain in male or female directions during sensitive prenatal periods (Amateau & McCarthy,

2004). This process organizes male brains in ways that make males more vulnerable to the various traits associated with antisocial behavior (Ellis, 2003). The sexes thus come into the world with “differently wired brains,” and these brain differences “make it almost impossible to evaluate the effects of experience independent of physiological predisposition” (Kimura, 1992, p. 119). The major biological factor that organizes the male brain in ways that underlie gender differences in general antisocial behavior is testosterone (Mazur, 2009). No one claims that testosterone is a major or even minor cause of criminal behavior, only that it is the major factor that underlies gender *differences* in criminal behavior.

Lopreato and Crippen (1999, p. 114) point out that “The two sexes are endowed with differing reproductive strategies, and from this difference arise various behavioral tendencies.” There is much more variability among males than females in terms of reproductive success; some males leave no offspring and others father large numbers (Badcock, 2000; Campbell, 2009). Given the lower reproductive ceiling of females, selection pressures were exerted for traits that maximized the probability of the survival of existing children (parenting effort) rather than traits designed to maximize mating effort. Females thus have more strongly evolved neurohormonal mechanisms that underlie the traits conducive to successful parenting effort than males and, because these traits are essentially prosocial, are less likely to commit crimes.

Anne Campbell’s (1999, 2009) *staying alive/low fear* hypothesis provides an evolutionary view of the gender ratio issue. The obligatory parental investment of males is limited to a few pelvic thrusts after which they can be on their way, but the obligatory parental investment of females is enormous. In ancestral environments, only after months of gestation and years of lactation could females contemplate further children, thus their reproductive success was far more tied to children they already have than is that of males. The greater dependence of the infant on the mother renders a mother’s presence more critical to offspring survival (and hence to the mother’s reproductive success) than is the presence of a father. The care of nursing infants in ancestral environments meant that females always kept them in close proximity, and this posed an elevated risk of injury to the child as well as the mother if the mother placed herself in risky situations. Because female survival is more critical to female reproductive success (in terms of maximizing the probability that offspring will survive) than is male survival, females have evolved a propensity to avoid engaging in behaviors that pose survival risks.

Campbell (1999, 2009) proposes that the evolved mechanism underlying this propensity is a physiology that responds to many different risky situations that are subjectively experienced as fear. There are essentially no sex differences in fearfulness across a number of contexts *unless* a situation contains a significant risk of physical injury. The greater fear response accounts for the greater tendency of females to avoid potentially violent situations and to employ indirect and low-risk strategies in competition and dispute resolution relative to males. There are numerous studies using everything from skin conductance measures to fMRI scans that show females are more reactive to fear-relevant stimuli (Cahill, Ucapher, Kilpatrick, Alkire, & Turner, 2004). Even when females commit crimes their crimes rarely involve risk of physical injury. Campbell (1999, p. 210) notes that while women do aggress and do steal, “they rarely do both at the same time because the equation of resources and status reflects a particularly masculine logic.”

The invariance of sex differences in crime leads us to conclude that if in some sense we can talk about a gene “for” crime it is the SRY (sex-determining region of the Y) gene on the Y chromosome. The SRY gene precipitates a host of biological processes that masculinize (or more correctly, defeminize) the male brain, making it vulnerable to the development of the many traits associated with criminal behavior. In short, we cannot understand sex differences in any

behavior, including criminal behavior, without understanding what the evolutionary, genetic, and neurological sciences have to tell us. Given the fact that only 4 of the 27 commentaries on the Campbell (1999) article argued for a socialization explanation for gender differences in criminal behavior, we may be getting to the point of realizing this.

### Social Learning Theory and the Age/Crime Curve

The age–crime curve (the rapid increase in delinquency at puberty age across historical time and cultures followed by a slow decline after reaching its peak between 16 and 18) has long been a mystery to criminologists: “the age distribution of crime cannot be accounted for by any variable or combination of variables currently available to criminology” (Hirschi & Gottfredson, 1983, p. 554). Shavit and Rattner (1988, p. 1457) share this opinion, writing that delinquency remains “unexplained by any known set of sociological variables.” Ronald Akers (1998, p. 338) disagrees, stating that “Age-specific [crime] rates differ because individuals are differentially exposed to the learning variables at different ages.” But why does prosocial learning that has presumably enjoyed priority, frequency, duration, and intensity for the entire lives of most children suddenly count for nothing as they turn to different sources of reward and punishment? These different sources of reward and punishment are peers, but peer association does not explain why their influence suddenly becomes so powerful, or why it so often leads to antisocial behavior. To understand adolescent behavior it is imperative that we understand the *physical* as well as the social changes that adolescents experience.

The 2003 New York Academy of Sciences conference on adolescent brain development provided some key points relevant to the age–crime curve issue (White, 2004, p. 4):

1. Much of the behavior characterizing adolescence is rooted in biology intermingling with environmental influences to cause teens to conflict with their parents, take more risks, and experience wide swings in emotion.
2. The lack of synchrony between a physically mature body and a still maturing nervous system may explain these behaviors.
3. Adolescents’ sensitivities to rewards appear to be different than in adults, prompting them to seek higher levels of novelty and stimulation to achieve the same feeling of pleasure.

Puberty is a series of biological events marking the onset of the transition from childhood to adulthood and preparing us for procreation, and adolescence is a *process* that begins at puberty and ends with adulthood. Adulthood is marked by the taking of socially responsible roles such as acquiring a full-time job and settling down and starting a family, which are roles that define us as independent members of society. However, the increasing time required to prepare for today’s complex workforce results in a mismatch between the legal definition of adulthood and socially defined adulthood. This mismatch combined with the decreasing age of puberty has led to a large “maturity gap” which provides fertile soil for antisocial behavior (Moffitt, 1993).

If adolescents are to become capable of adapting to new situations, it is necessary to temporarily strain close emotional bonds with parents. For adolescents not to assert themselves would hinder their quest for independence. Adolescents must leave their childhood nests and bond and mate with their own generation and explore their place in the world. Leaving the nest is

risky, but it is an evolutionary design feature of all social primates as males seek out sexual partners from outside the rearing group. Seeking age peers and conflicting with parents “all help the adolescent away from the home territory” (Powell, 2006, p. 867). Research shows that moderate conflict typically leads to better post-adolescent adjustment than either the absence of conflict or frequent conflict (Smetana, Campione-Barr, & Metzger, 2006).

After testosterone (T) surges organize the male brain during the second trimester of pregnancy, a second surge activates it at puberty (Ellis, 2003). After brain organization takes place, there is little difference in levels of male and female T until puberty, at which time males have approximately ten times the female levels (Felson & Haynie, 2002). The pubertal T surge facilitates behaviors such as risk taking, sensation seeking, dominance contests, sexual experimentation, and self-assertiveness, none of which are antisocial per se, but can easily be pushed in that direction in antisocial environments. Although T levels are heritable, they are highly responsive to the environment, rising and falling depending on the organism’s need at the time (Booth, Granger, Mazur, & Kivligan, 2006). The “need” to conform to risky deviant behavioral patterns, to seek dangerous sensations, and to engage in dominance competitions with other males certainly qualifies as challenges that would require raising T levels to meet them (Mazur, 2005).

Large changes in the adolescent brain are prompted by the pubertal hormonal surge, including changes in the ratio of excitatory to inhibitory neurotransmitters. The excitatory transmitters dopamine and glutamate peak during adolescence, while the inhibitory transmitters, gamma-aminobutyric acid and serotonin, are reduced (Collins, 2004; Walker, 2002). The adolescent brain also goes through an intense period of restructuring as hormonal surges prompt the increase of gene expression initiating the process of refining the neural circuitry to its adult form (Walker, 2002). A series of fMRI studies have revealed that the prefrontal cortex (PFC) undergoes a wave of synaptic overproduction just prior to puberty followed by a period of pruning during adolescence and early adulthood (Giedd, 2004; Sowell, Thompson, & Toga, 2004).

Another important modification of the adolescent PFC is the additional myelination (myelin is the fatty substance that coats and insulates axons) that is occurring (Steinberg, 2005). The PFC is “the most uniquely human of all brain structures” (Goldberg, 2001, p. 2) and is the last brain area to fully mature. This vital part of the human cortex has extensive connections with other cortical regions, as well as with deeper structures in the limbic system. Because of its many connections with other brain structures, it is generally considered to play the major integrative, as well as a major supervisory role in the brain. The PFC is also vital to the forming of moral judgments, mediating affect, and for social cognition (Romaine & Reynolds, 2005).

A less myelinated brain means less efficient message transmission and a larger time lapse between the onset of an emotional event in the limbic system and the PFC’s rational judgment of it. Thus, there are *physical* reasons for the greater ratio of emotional to rational responses often observed in teenagers. Adolescents are operating with a brain on “go slow” superimposed on a physiology on “fast forward.” This explains why many teenagers find it difficult to accurately gauge the meanings and intentions of others and to experience more stimuli as aversive during adolescence than they did as children and will do so when they are adults (Walsh, 2002, p. 143). Richard Restak (2001, p. 76) put it best when he wrote, “The immaturity of the adolescent’s behavior is perfectly mirrored by the immaturity of the adolescent’s brain.” The implications for antisocial behavior in all this are obvious in that the neurohormonal modifications going on facilitate a tendency to assign faulty attributions to situations and to the intentions of others. A greater sensitivity to stressors leads to an increase in irritability and a decrease in self-control, which in turn lead to a greater probability of antisocial behavior (Agnew, 2005; Walsh, 2009).

Advances in the biology of adolescence can greatly enhance our understanding of antisocial behavior during this period, and criminality in general. Neuroscience in particular has already had a huge impact on juvenile justice. The Supreme Court decision (*Roper v. Simons*, 2005) banning the death penalty for murders committed before age 18 relied heavily on data regarding the immaturity of the adolescent brain (Walsh & Hemmens, 2008). However, the biological advances in our understanding of adolescence are barely touched upon (if at all) in the typical juvenile delinquency textbook. To keep relying on “peer pressure” to explain delinquency without digging deeper to discover why peer pressure is so important during adolescence is to do a great disservice to the discipline.

### **Social Disorganization and Subcultural Theory, Race, and Violence**

Social disorganization theory maintains that disorganized neighborhoods lack the ability to control its youthful members who are thus free to follow their natural inclinations (Shaw & McKay, 1972). Having facilitated crime by failing to inhibit it, social disorganization also encourages it by providing a set of criminogenic values that become the organizing principles of a subculture. Subcultural theories switch emphases from structural variables to cultural variables to explain the criminal behavior of the subculture’s inhabitants. Wolfgang and Ferracutti’s (1967) *subculture of violence* thesis focused on Philadelphia’s black community in the 1950s where the homicide rate for black males was 12.3 times the white male rate, and the black *female* rate was 2.7 times higher than the white *male* rate. The differences in black–white crime rates mirror almost exactly the differences between overall male–female rates; i.e., black rates are significantly higher than white rates, and the more serious the crime the greater the difference (Federal Bureau of Investigation, 2007).

**VIOLENT SUBCULTURES IN EVOLUTIONARY CONTEXT.** Violent subcultures have been dubbed honor subcultures and defined as “communities in which young men are hypersensitive to insult, rushing to defend their reputations in dominance contests” (Mazur & Booth, 1998, p. 362). Taking matters into one’s own hands is the only way to obtain street respect where status is a zero-sum game gained only by taking it from somebody else (Anderson, 1999). Assaults and homicides are usually the result of trivial challenges to a male’s reputation and are typically staged in front of an audience of friends of both the assailant and victim to maximize “juice” from the incident (Baumeister, Smart, & Boden, 1996). This “in your face” jousting of inner city males supports the evolutionary position that “. . .crime is functionally related to inter male competition that has its ultimate roots in reproductive rivalry” (Quinsey, 2002, p. 3). Similarly, Elijah Anderson (1999) characterizes the inner city code as operating in accord with the “law of the jungle” (p. 84) in which violent posturing is a “campaign for respect” (p. 68) with “people looking around for a fight in order to increase their share of respect—or ‘juice’” (p. 73).

Status has positive fitness consequences for males in all sexually reproducing species, which is why males have been designed to seek it (Alcock, 2005). How it is sought among humans depends on cultural context. The cost/benefit ratio of violent status competitions among inner city males for trivial reasons defies rational choice assumptions because competitors are risking injury

or death in defense of an intangible, but when viewed in evolutionary terms the logic becomes clear. The more young males come to devalue the future, the more risks they are willing to take to obtain their share of street respect, which provides them with enhanced mating opportunities. Access to females in the inner city is “taken quite seriously as a measure of the boy’s worth”; a young male’s “primary goal is to find as many willing females as possible. The more ‘pussy’ he gets, the more esteem accrues to him” (Anderson, 1999, p. 150).

Status-related violence is not unique to disadvantaged males. Dueling over trivial matters of honor was ubiquitous among the aristocracy of Europe and the American South until fairly recently, and killing has been “a decided social asset in many, perhaps most, prestate societies” (Daly & Wilson, 1988, p. 129). Duels about “matters of honor” were instrumental in enhancing the duelists’ reputation, thus providing them public validation of their self-worth (Baumeister et al., 1996). If young men are not controlled by law or cultural norms “dominance contests become ubiquitous, the hallmark of male–male interaction” (Mazur & Booth, 1998, p. 360). Thus although violence in pursuit of status is morally unacceptable, from an evolutionary and historical perspective it is both “normal” and “natural” in inner city contexts.

**TESTOSTERONE AND CHALLENGE.** As we have seen, dominance and aggression are facilitated by testosterone. The evidence suggests that African Americans have higher average levels than whites (Lynn, 1990; Nyborg, 2004), although it is unclear whether the difference reflects a true basal difference or reciprocal (feedback) effects. Mazur and Booth (1998) argue that the reciprocal model best explains the relationship between testosterone and behavior and that the higher levels found among black males reflect the status challenges they face in their subcultures that require physical responses rather than true racial differences in baseline levels.

As with all facilitating chemicals, testosterone needs receptors. The testosterone receptor is the androgen receptor (AR) gene, a polymorphic gene that has different repeat frequencies. Males with the shorter repeat version (< 22 repeats) have a greater binding affinity for androgens, thus making them more receptive to its effects. All studies done thus far indicate that African American males have a greater frequency (about 0.76) of the short version of the AR gene than whites (about 0.62) or Asians (about 0.55) (reviewed in Nelson & White, 2002). The AR gene data may render the basal/reciprocal argument redundant. If black physiology is more receptive to the same level of testosterone than white or Asian physiology, identical levels of the hormone will have stronger activating effects for blacks than for others.

Another highly environmentally responsive chemical to consider is the neurotransmitter serotonin. Serotonin plays a vital role in behavioral inhibition and it promotes confidence and self-esteem (Archer, 2006; Mehta & Josephs, 2006). By artificially manipulating serotonin levels in experimental situations among non-human primates, researchers have shown that serotonin underlies primate status hierarchies (Anderson & Summers, 2007), with highest ranking males having the highest levels of serotonin and the lowest ranking have the lowest. Low-ranking males in established hierarchies defer with little fuss to the demands of higher ranking males, but when the hierarchy is disrupted, it is the low-constraint (low-serotonin) males who become the most aggressive in the competition for available resources. Males who succeed in establishing a new status hierarchy find that their serotonin rises to levels commensurate with their new status.



Low serotonin is associated with two major correlates of criminal behavior—low self-control and negative emotionality (the tendency to experience many situations as aversive and to respond to them with irritation and anger) (Agnew, 2005; Wright & Beaver, 2005). Experiments with rhesus monkeys have shown that peer-raised monkeys (read, “fatherless, gang raised children” for humans) have lower concentrations of the serotonin metabolite 5-HIAA than parentally raised monkeys (Bennett et al., 2002). This suggests that elevated testosterone is most likely to result in violence when it is present in conjunction with low serotonin (Fox, 1998). As disadvantaged males “try their luck” in the status/dominance game they do so against others with the same high testosterone/low serotonin profile. Thus, both are likely to respond with irritability and anger and to act impulsively at perceived attempts to thwart their efforts to gain status. These studies again point to important environmental effects on the functioning of biological systems, particularly the deleterious effects of parental deprivation to which inner city African Americans are especially vulnerable (Brown & Bzostek, 2003).

**VIOLENCE AND THE BRAIN.** Powerful evidence suggests that human infants have evolved neurological and endocrine structures that demand the formation of affectionate bonds with loving caretakers and that psychopathology is often the result for those who fail to get it (van Goozen, Fairchild, Snoek, & Harold, 2007). It is a neuroscience truism that “Experience in adults *alters* the *organized* brain, but in infants and children it *organizes* the *developing* brain” (Perry & Pollard, 1998, p. 36; emphasis added). Because neural pathways laid down early in life are more resistant to elimination than pathways laid down later in life, brains organized by stressful and traumatic events tend to relay subsequent events along the same neural pathways. A brain organized by negative events is ripe for antisocial behavior because established neural pathways are activated with less provocation than is required to engage less established pathways.

Black inner city children are more likely than other children to have their brains organized by violence. According to the Child Trends Data Bank’s analysis of 903,000 reported maltreatment cases in 2001, black children were 2.4 times more likely to be abused and neglected than white children and black infants were 4.3 times more likely to be fatally abused (Brown & Bzostek, 2003). Children in America’s inner cities also witness violence on an almost daily basis. For instance, 33% of inner city Chicago school children said they had witnessed a homicide and 66% a serious assault (Osofsky, 1995). Witnessing and experiencing violence on a consistent basis gouges the lesson on the neural circuitry that the world is a hostile place in which one must be prepared to protect one’s interests by violent means if necessary. If children’s brains develop in violent environments, they expect hostility from others and behave accordingly. By doing so they invite the hostility they are on guard for, thus confirming their beliefs that the world is a dangerous and violent place, and setting in motion a vicious circle of negative expectations and confirmations (Niehoff, 2003; Volavka, 2002).

Again, although violence is morally reprehensible, it is not irrational and maladaptive under all circumstances. Having a reputation for violence would have been an asset in evolutionary environments when calling 911 to have someone else settle your problem was not an option. In today’s inner cities where one is expected to take care of one’s own beliefs, violence or credible threats of violence works to let any potential challenger know that it would be in his best interests to avoid you and your resources and look elsewhere. All this is why a “bad ass” reputation is so

valued in those areas, why those with such a reputation are always looking for opportunities to validate it, and why it is craved to such an extent that “Many inner city young men. . .will risk their lives to attain it” (Anderson, 1994, p. 89).

In sum, the evolutionary and neuroscience views converge on the point that the major long-term factor in violence instigation is how much violence a person has been exposed to in the past. Natural selection has provided human beings with the ability to switch to a violence mode quickly when they have reason to believe that things they value may be taken from them and when they must rely on themselves to protect those things. In disorganized neighborhoods in which a tradition of settling one’s own quarrels without involving the authorities is entrenched, such a switch is most useful. As Gaulin and McBurney (2001, p. 83) explain, when many acts of violence are observed “there is a feedback effect; each violent act observed makes observers feel more at risk and therefore more likely to resort to preemptive violence themselves.”

## CONCLUSION

We recognize the discomfort some criminologists may feel when reading anything that elevates the role of individual differences (or even cultural differences, since people are the carriers of culture) over structural factors in explaining criminal behavior. As we have previously noted, the role of the environment is of tremendous importance in explaining the prevalence of crime because different environments provide different opportunities and incentives to commit crimes and different restraints against committing them, i.e., moving individuals back and forth across the “offend/don’t offend” threshold. But ultimately it is real flesh and blood people who commit crimes, and lower level explanations of human behavior almost always absorb the explanatory efficiency of broad social categorizations such as race, gender, age, and class and add incremental validity to them. As Lubinski and Humphreys (1997, p. 177) suggest, “Whatever the causes of group differences in social phenomena are, measures of individual differences typically reflect those causes more effectively than does membership in demographic groups.” Lubinski and Humphreys (1997) and Walsh (1997) provide several examples of the superiority of lower level measures with reference to major demographic variables such as gender, race, age, and SES.

As we have shown, while the above variables are excellent *predictors* of criminal behavior, they are not *per se explanations*. It is only when we discover the particular mechanisms that underlie these broad holistic categories that we can reasonably claim to understand their link to behavior. For many criminologists with a sociological bent we are committing the cardinal sin of reductionism. There is nothing sinister about trying to understand a phenomenon at a more fundamental level; it has long been the guiding principle of the hard sciences. We wonder where these sciences may be today if they maintained that it was always essential to place their explanatory focus on whole systems rather than their constituent parts. Having said this, however, we must be careful that we do not lose *meaning* as an essential component to understanding behavior by an overemphasis on mechanistic accounts. We must not become what Daniel Dennett (1995, p. 82) has called “greedy reductionists” (those who skip over several layers of complexity in a rush to fasten everything to a supposedly solid foundation). Nonetheless, science has made its greatest strides when it has picked apart wholes to examine the parts to gain a better understanding of the wholes they constitute. As Matt Ridley (2003, p. 163), the heavyweight champion of the biosocial principle of nature *via* nurture has opined, “Reductionism takes nothing from the whole; it

adds new layers of wonder to the experience.” We conclude with Lilly et al. (2007, p. 304) that “It is clear that the time has arrived for criminologists to abandon their ideological distaste for biological theorizing.”

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