Biosocial criminology and modern crime prevention
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Abstract
Objective: In the late 19th and early 20th centuries, criminological efforts to prevent or reduce crime were
centered on addressing presumed biological causes of crime. Most of these strategies involved calls for eu-
genics—proposals that today are considered unethical and morally reprehensible. Biologically-oriented crim-
inology and crime control policies have re-emerged with new sophistication and attention to the importance
of social context. Additionally, developmental crime prevention, with a special focus on biological/physiological
risk factors in the early life course, has become influential in criminology. This paper examines the relevance
of biology to modern day crime prevention.

Materials and methods: Narrative review of the theoretical and empirical literature of biology and developmental
crime prevention.

Results: There are a growing number of developmental crime prevention programs that address biological risk
factors for delinquency and later criminal offending. These programs are found in the family, school, and com-

community domains. Evidence suggests that these programs can reduce crime.

Conclusions: While “biological crime prevention” as a separate field has not yet emerged, findings show that
crime prevention programs can and do address biology in a sociologically sensitive manner—and these pro-

grams have shown significant impacts on crime.

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Introduction

Early criminological work argued that deviant behavior occurred as a result of biological or mental predispositions, which led to proposals for crime prevention that involved eugenics (Rafter, 1997; 2008; Vaske, Galyean, & Cullen, 2011). However, these proposals are no longer accepted or even considered by criminologists, who have been sensitive to the negative implications of using biology to explain crime. As a result of increased recognition of human rights, biologically-oriented criminology and crime control policies lost favor in the early to mid-20th century.

To this day, many criminologists remain wary of any theoretical or policy work that carries the slightest hint of biology. However, criminological research examining biological factors has re-emerged with new sophistication and attention to the importance of social context (Beauchaine et al., 2008; Rafter, 2008; Walsh & Beaver, 2009a; 2009b). Additionally, in recent years, a stronger focus on crime prevention has emerged, with a growing literature on developmental crime prevention. A large part of this literature is concerned with addressing biological/psychological risk factors early in life (see Farrington & Welsh, 2007; Tremblay & Craig, 1995). Thus, biologically-based crime prevention (while not currently so labeled) has re-entered the criminological literature.

In this article, we attempt to show that this new biological crime prevention is vastly different from the biological strategies of the past. Far from advocating unethical eugenic measures, this work focuses on improving the environment to promote healthy biological development early in life. Thus, in a sense, this crime prevention work is integrative in recognizing the import of both the environment and the body. In what follows, we introduce the concept of developmental crime prevention, and then discuss the biological or psychological risk factors for offending that developmental prevention programs may influence.

Crime Prevention in Criminology and Criminal Justice

Crime prevention has a long history in the fields of criminology and criminal justice. Evaluations of crime prevention programs have been carried out for decades, especially in the United States (see Welsh, 2011). With respect to biology, crime prevention efforts in the late 19th and early 20th centuries involved calls to prevent so-
called inferior peoples from reproducing (Fink, 1962; Rafter 2009). Eugenics and most other policies seeking to prevent crime by focusing on biological factors lost favor as the 20th century progressed (Rafter, 1997). However, scholarly interest in the study of more environmentally-based crime prevention has grown in recent years (Clarke, 2009). The pioneering work of Ronald Clarke in the 1970s and early 1980s at the British Home Office helped to establish the field of situational crime prevention in criminology (Clarke, 2009). At about the same time, early childhood programs seeking to improve life-course development began to collect data on delinquency and antisocial behavior, helping to demonstrate the crime prevention potential of early intervention (Tremblay & Craig, 1995). Other governmental programs focusing on different types of prevention emerged in the following decades in the U.S. and abroad, along with increased academic interest (Tonry & Farrington, 1995; Visher & Weisburd, 1997).

The study and use of crime prevention strategies start from the premise that responding to crime after it happens is a missed opportunity. A primary prevention approach advocates determining what facilitates criminal behavior and addressing those factors before crime occurs. Crime prevention can be viewed through a public health lens. Here, physicians do not rely on identifying victims of disease as their only means of treating the illness; instead, they pool their knowledge on the risk factors known to produce certain diseases and provide guidance to those at risk in order to avoid illness before it occurs (Rivara & Farrington, 1995). The type of risk factor then determines the prevention approach that is advocated.

An influential scheme distinguishes four major strategies for classifying crime prevention programs (Tonry & Farrington, 1995). Developmental prevention refers to interventions designed to prevent the development of criminal potential in individuals, especially those targeting risk and protective factors discovered in studies of human development (Tremblay & Craig, 1995; Farrington & Welsh, 2007). Community prevention refers to interventions designed to change the social conditions and institutions (e.g., families, peers, social norms, clubs, organizations) that influence offending in residential communities (Hope, 1995). Situational prevention refers to interventions designed to prevent the occurrence of crimes by reducing opportunities and increasing the risk and difficulty of offending (Clarke, 2009). Criminal justice prevention refers to traditional deterrent, incapacitative, and rehabilitative strategies operated by law enforcement and criminal justice system agencies (Blumstein, Cohen, & Nagin, 1978).

Developmental prevention is the newest form of crime prevention. It is also the most relevant to crime prevention from a biological perspective and, potentially, the one approach that can give rise to neuroethical concerns. This is because developmental prevention focuses on risk and protective factors that have been shown to affect the probability of delinquency and later criminal offending (DeLisi, 2005; Welsh, 2011). While it is the case that not all risk and protective factors targeted by developmental prevention are internal to the individual, many of the programs or interventions that are considered developmental explicitly address biological factors.

Preventing the Development of Criminal Behavior: The Role of Biology

As Rafter (2008) argues, after a prolonged hiatus in the mid to late 20th century, sociologically-oriented criminologists are becoming more comfortable with studying biological/psychological factors related to crime. Research has become more sophisticated, able to isolate particular genetic polymorphisms and brain functioning patterns that are correlated with increased criminal behavior (Baker, Bezdjian, & Raine, 2006; Raine et al., in press; Raine & Liu, 1998; Raine et al., 2000; Yang et al., 2005). The work of Raine and colleagues has shown technology (e.g., functional MRIs) can illustrate the link between brain functioning deficits and criminal/antisocial behavior. For the most part, modern strategies or policies that attempt to prevent the development of antisocial behavior from a biological standpoint target risk factors. Risk factors are prior factors that increase the probability of criminal or deviant behavior (Farrington, 2007). Thorough reviews of early risk factors and what Brennan and Raine (1997) call “biosocial bases” of crime can be found in numerous sources (see Farrington, 2007; Farrington & Welsh, 2007; Lipsey & Derzon, 1998; Raine & Liu, 1998), and will only briefly be discussed here. This will serve to provide context for the discussion of crime prevention strategies or recommendations that target these factors.

Neuropsychological/Cognitive Deficits

One of the strongest correlates of later criminal behavior (and other life-course problems) is neuropsychological or cognitive deficits in childhood (see DeLisi & Vaughn, 2011; Moffitt, 1993; Tremblay & Craig, 1995). These deficits are characterized by a difficulty in “planning, organizational skills, selective attention and inhibitory control, and optimal cognitive-set maintenance” (Morgan & Lilienfeld, 2000: 114). Individuals with cognitive deficits may have trouble conforming to social expectations and delaying gratification or adjusting to society. Neuropsychological or cognitive deficits are measured in a variety of ways, including tests of executive functions, attention, working memory, verbal skills, and intelligence (Beaver et al., 2010; Farrington, 2007; Morgan & Lilienfeld, 2000; Tibbetts & Piquero, 1999). Low intelligence is (in part) a function of generalized cognitive impairment across a number of neurocognitive domains (see Yoshikawa, 1995).

Researchers are still discovering the causes of neuropsychological or cognitive deficits (Beaver et al., 2010). Some work has traced neuropsychological or cognitive deficits to specific parts of the brain (e.g., the frontal lobe) and are thought to be caused in part by events early on in fetal or child development (e.g., in utero drug or alcohol use) (see Beaver et al., 2010; McGloin, Pratt, & Piquero, 2006; Moffitt, 1993; Raine & Liu, 1998). Some work has found that mental disruptions may be caused by disorders such as phenylketonuria (PKU; see Diamond et al., 1997). Some forms of cognitive deficits appear to be caused later in child development, for example, by trauma events or experiencing abuse (Navalta et al., 2006). These deficits are associated with behavioral difficulties early in childhood (e.g., conduct disorder) that tend to extend throughout the life course (Beaver et al., 2010; Moffitt, 1993). Most likely there are not one but several compounding causes of impaired cognitive functioning which encompass genetic, biological, psychological, and social influences.

Impulsivity/Negative Emotionality

While criminologists often think of impulsivity and negative emotionality as personality traits, research has indicated that they have biological underpinnings. Impulsivity is defined by the “inability to control behavior” (Farrington, 2007: 611). Some theorists argue that this trait is more important than any other in the development of criminality (Farrington, 2007; Gottfredson & Hirschi, 1990; Wilson & Herrnstein, 1985). It is unclear whether impulsivity is caused solely by biological factors or whether certain social conditions impact its manifestation. However, some work has found that genetics (Benko et al., 2011; DeLisi & Vaughn, 2011) and brain impairment are associated with this trait (Arce & Santisteban, 2006; Farrington, 2007; Farrington & Loebber, 2000). For example, impulsive homicides are associated with reduced glucose metabolism in the prefrontal cortex, a part of the brain involved in the control and regulation of behavior (Raine et al., 1998). According to Farrington and Loebber (2000), impulsivity or impulse control has been found to be significantly associated with delinquency across a number of prospective longitudinal studies (see also DeLisi & Vaughn, 2011). Negative temperament...
been associated with later criminal behavior and crime in later adulthood (Tremblay et al., 2004). Therefore, pro-antisocial behavior), research has shown that it is related to violence and externalizing behavior at later stages of the life-course. In addition, Baker and colleagues argue that conduct disorder is often a precursor to antisocial personality disorder, which is accompanied by antisocial behavior. Studies have also shown that conduct disorder predicts the development of a host of negative life outcomes, including substance abuse, intimate partner violence, and welfare dependency (Bardone et al., 1996).

Some research has indicated that substance use on the part of parents, low familial socioeconomic status, and early behavioral problems predict the development of conduct disorder (Loeber et al., 1995).

While aggressive behavior on the part of children may be considered antisocial behavior (making it a somewhat circular predictor of antisocial behavior), research has shown that it is related to violence and crime in later adulthood (Tremblay et al., 2004). Therefore, programs that identify aggressive children may be important in reducing later criminal behavior. For example, Tremblay and Craig (1995; see also Nagin & Tremblay, 2001) found that teenage motherhood, maternal smoking, and low family socioeconomic status were related to the development of early childhood aggression.

Mental/Physical Health

Research has also suggested that physical and mental health (or illness) is related to criminal and antisocial behavior. This suggestion can be traced all the way to the beginnings of scientific criminalological thinking (Fink, 1962; Rafter, 2009). With respect to mental health, schizophrenia, antisocial personality disorder, and depression are associated with crime (DeCoster & Heimer, 2001; Fazel et al., 2009). Hodgins (1992), in an analysis of a birth cohort, found that men with a mental illness were over two times as likely to have committed a violent crime. It should be noted though, that the overall relationship between mental illness and crime is complex, and the evidence shows that not all mental illnesses are associated with increased risk for criminal behavior (Brennan et al., 2000). Poor health has been associated with later criminal behavior – through poor nutrition of the mother and infant (Brennan & Raine, 1997; Raine, 2002). Liu et al. (2004) reported that poor nutrition at age 3 predicted antisocial and externalizing behavior at later stages of the life-course.

Crime Prevention and Biology

A review of the crime prevention literature reveals that there are few, if any, programs currently in place that focus solely on biological factors. The term “biological crime prevention” does not appear to be in use, most likely because of negative historic implications such a term would have. Poston and Wineberger (1996), for example, warned that reductionistic biological thinking applied to prevention of problem behaviors has resulted in a “neo-eugenics’ movement” (p. 134). However, biological crime prevention does not have to be reductionistic, denying the influence of social factors. In fact, most modern approaches that incorporate biology in the prevention of crime recognize that factors such as genes or personality interact with the environment and the best way to address them is to alter the latter (Beauchaine et al., 2008; Knudsen et al., 2006; Rafter, 2008). Thus, biologically-oriented perspectives do not see the body as operating in a vacuum.

Biocriminologists and researchers from various disciplines have increasingly begun to offer recommendations for the prevention of crime that are compatible with traditional sociological approaches (see Beauchaine et al., 2008; Beaver, 2009; Vaske et al., 2011; Wright, Tibbetts & Daigle, 2008). Scholars who advocate the integration of biology into criminological work have argued that antisocial behavior can be prevented through the use of targeted programs, and do not have to imply “repressive state interventions” (Wright et al., 2008: 253). For example, some researchers have suggested that programs emphasizing the improvement of cognitive skills (e.g., ‘cognitive remediation’) will be effective in reducing crime (Fishbein, 2000; Raine & Liu, 1998). Fishbein (2000), in a review of the relevance of neurological research to antisocial behavior policy, argued that “prevention approaches can potentially suppress genetic expression of risk factors by, for example, favorable family environment” (p. 101). Biocriminologists also often call for improvements in prenatal and maternal care in order to ensure that infants develop normally (see Fishbein, 2000; Raine, 2002; Wright et al., 2008). Raine (2002, p. 71) suggests that targeting “the psychosocial half of the biosocial equation” appears to be the most effective strategy to prevent crime from a biological perspective. He argues for the use of parenting classes to improve social bonds within families (see also Wright & Boisvert, 2009). Thus, researchers in a variety of fields are arguing that biology should play a role in prevention as well as treatment of criminal behavior. Importantly, as we discuss below, nearly all of these scholars’ recommendations have been implemented and evaluated in some form through programs that (sometimes as a secondary focus) seek to prevent delinquency and antisocial behavior in youth. In addition, some experimental work has begun to show how addressing biological factors may lead to a reduction in antisocial behavior. Our coverage of prevention programs is by no means exhaustive, but meant instead to illustrate our points.

Family-Centered and Parenting Programs

Evidence that health and nutrition programs for pregnant women and their infants can impact later antisocial behavior began to emerge in the late 1970s and early 1980s. Such programs, which usually concentrate on improving parenting skills, have been reviewed by numerous scholars and generally demonstrate a positive impact on child development (see Delisi, 2005; Farrington & Welsh, 2007; Piquero et al., 2009). Parenting programs typically seek to prevent neuropsychological or cognitive deficits along with a host of other risk factors (e.g., impulsivity, school failure). For example, teaching mothers to avoid the hazards of smoking or ingesting narcotics during pregnancy can reduce neuropsychological impairment of the infant (Beaver et al., 2010).

The most well-known home visiting program and the only one that includes a direct measure of criminal behavior is the Nurse–Family Partnership (NFP) developed by David Olds (Olds et al., 2007). NFP was first tested in Elmira, New York, in the early 1980s. Today, NFP operates in 400 counties in 32 states, serving more than 21,000 families each year. It is also being implemented in many other countries, including Australia, Germany, Norway, and the U.K.

In the Elmira trial, 400 first-time mothers were randomly assigned to receive home visits from nurses during pregnancy, or to receive visits both during pregnancy and during the first two years of life, or to a control group who received no visits. Each visit lasted just over one hour and the mothers were visited approximately once every two weeks. The home visitors provided information concerning prenatal and postnatal care of the child, infant development, and proper nutrition as well as advice on avoiding smoking and drinking during pregnancy.

The results of this experiment showed that the postnatal home visits caused a significant decrease in recorded child physical abuse and neglect during the first two years of life, especially by poor, unmarried, teenage mothers; 4% of visited versus 19% of nonvisited mothers of this type were guilty of child abuse or neglect (Olds et al., 1986). In a 15-year follow-up (13 years after program completion),
which included 330 mothers and 315 children, significantly fewer experimental compared to control group mothers were identified as perpetrators of child abuse and neglect (29% vs. 54%), and, for the higher risk sample only, significantly fewer treatment mothers, in contrast to the controls, had alcohol or substance abuse problems or were arrested. At the age of 15, children of the treatment mothers had committed significantly fewer violent and other major criminal acts than their control counterparts (a mean of 3.02 compared to 3.57; Olds et al., 1998). In the latest follow-up at age 19, compared to their control counterparts, girls of the full sample of mothers had incurred significantly fewer arrests and convictions and girls of the higher risk mothers had significantly fewer children of their own and less Medicaid use; few program effects were observed for the boys (Eckenrode et al., 2010). Large-scale replications in Memphis and Denver have also shown a wide range of positive effects for children and mothers (Olds et al., 2007).

In the evaluation literature, most parenting programs that target risk factors for delinquency take place after the birth of the child (Doyle et al., 2009). Tremblay and Japel (2003) reviewed over 40 programs that attempted to improve parenting skills through education or support. Many of these programs explicitly focused on the prevention of cognitive deficits through the strengthening of cognitive skills. Others have targeted what Tremblay and Craig (1995; see also Tremblay & Japel, 2003) term “socially disruptive behaviors,” including impulsivity and hyperactivity. The authors suggest that, for the most part, these programs have been effective.

Unfortunately, many evaluations of developmental prevention programs do not include measures of antisocial behavior, crime, or delinquency (Tremblay & Craig, 1995; Tremblay & Japel, 2003). Certain home visitation programs (such as Hawaii Healthy Start) that do not directly measure antisocial behavior as an outcome have nonetheless shown benefits for healthy child development (e.g., Duggan et al., 1999). To the extent that these programs target biological risk factors for crime (e.g., neurocognitive skills), these findings may have implications for crime prevention.

Preschool and School-Based Programs

Some programs attempting to alter the development of biological risk factors for antisocial behavior have taken place in a school setting. Enriched preschool programs are designed to provide “economically disadvantaged children with cognitively stimulating and enriching experiences that their parents are unlikely to provide at home” (Duncan & Magnuson, 2004, p. 105). Their main goals are improved cognitive skills, school readiness, and social and emotional development (Currie, 2001).

The most famous preschool intellectual enrichment program is the Perry Preschool project carried out in Ypsilanti, Michigan (Schweinhart & Weikart, 1980). A sample of 123 children from impoverished homes was allocated (approximately at random) to experimental and control groups. The experimental children attended a daily preschool program, backed up by weekly home visits, usually lasting two years when children were aged 3 to 4 years. The aim of the “plan-do-review” program was to provide intellectual stimulation, to increase thinking and reasoning abilities, and to increase later school achievement. The program produced long-term benefits. For example, Berrueta-Clement et al. (1984) found that, at age 19, the experimental group was more likely to be employed, more likely to have graduated from high school, more likely to have received college or vocational training, and less likely to have been arrested. By age 27, the experimental group had accumulated only half as many arrests as the controls – an average of 2.3 compared to 4.6 arrests (Schweinhart et al., 1993). They were more likely to have graduated from high school, had significantly higher earnings, and were more likely to be home owners.

The most recent follow-up of Perry, at age 40 (which included 91% of the original sample), found that, compared to the control group, participants in the original preschool program had significantly fewer lifetime arrests for violent crimes (32% vs. 48%), property crimes (36% vs. 58%), and drug crimes (14% vs. 34%), and were significantly less likely to be arrested five or more times (36% vs. 55%). Significantly higher levels of schooling (77% vs. 60% graduating from high school), better records of employment (76% vs. 62%), and higher annual incomes also were found at age 40 among preschool participants compared to the controls (Schweinhart et al., 1993).

Another effective preschool intellectual enrichment program is the Carolina Abercedarian Project (Campbell et al., 2002). This program was also targeted at children born to low-income, multi-risk families. A sample of 111 children aged 3 were randomly assigned either to receive full-time preschool childcare (focusing on the development of cognitive and language skills) or not. Families of children in both the experimental and control groups received supportive social services as needed. At age 21, 104 of the participants were interviewed, and it was found that fewer of the experiments compared to the controls (but not significantly so) reported being convicted for a misdemeanor offense (14% vs. 18%) or a felony offense (8% vs. 12%) or incarcerated (14% vs. 21%). It was also found that significantly fewer of the experimental participants were regular marijuana users, significantly fewer had become a teenage parent, significantly more had attended college or university, and they had significantly higher status jobs.

There are also a number of school-based crime prevention programs that have been developed for youths with identified biological risk factors. For example, Conrod et al. (2010) assessed the effectiveness of a coping skills program for teenagers exhibiting high levels of impulsivity or sensation seeking. The program took place in 24 secondary schools in London and 732 students were randomly assigned to the intervention or control groups. Intervention group students received two 90 minute sessions of problem-solving education and cognitive behavioral therapy. The results after 2 years indicated that the intervention group compared to their control counterparts used fewer drugs and were less likely to experiment with new drugs (Conrod et al., 2010).

Mental or Physical Illness Programs

There is some evidence to suggest that programs may have the potential to aid the prevention of certain serious mental illnesses or disorders. For example, a meta-analysis of 13 studies showed the potential to prevent the onset of a variety of illnesses, ranging from psychosis to anxiety disorders (Cuijpers et al., 2005). These findings have implications for crime prevention. Raine et al. (2003a; 2003b) demonstrated the potential impact of programs designed to reduce mental illness (e.g., schizotypal personality) on behavior. In their study, 100 children (age 3) were given an “environmental enrichment” program, in which nursery school teachers attempted to improve the health, physical activity, and cognitive stimulation of the participants. The program lasted for 2 years from ages three to five years. The results demonstrated that, as compared to a “community control group,” the intervention youth at age 17 had fewer behavioral problems and fewer signs of schizotypal personality. At age 23 years, the experimental group showed a 34% reduction in criminal offending. Related to the risk factor of physical health, the authors speculate that the increased physical activity and improved nutrition which the intervention group experienced might account for the benefits attributed to the program. For example, nutritional status before the prevention program began at age 3 moderated outcomes for conduct disorder at age 17; the enrichment reduced conduct disorder more in children who had relatively poorer nutrition before the program began. They note evidence suggesting that increased activity can improve brain development (in particular, neurogenesis in the dentate gyrus of the hippocampus) in animal models and may be an important crime prevention strategy for youths. To the extent that certain
types of mental illnesses are a risk factor for crime, preventing the illness in the first place should reduce criminal behavior in later life.

One interesting program seeking to prevent crime by focusing on physical health is currently being conducted in the United Kingdom. The Healthier Lives, Safer Communities program is premised on the idea that promoting better physical health will reduce offending among children (National Health Service, 2009). The evidence for the link between physical health and crime is not altogether clear, but program advocates suggest that health may impact behavior indirectly (e.g., through self-esteem). The most recent evidence to date suggests that the link between health and crime may be that persistent crime results in deteriorated health over the life course (see Piquero et al., 2007). However, it seems that little is known about the link between health and crime early in life. This program is slightly different than those reviewed above because it targets youth in contact with the criminal justice system. Nonetheless, by its focus on preventing biological risk factors (and crime) it is consistent with crime prevention approaches.

Nutrition and Crime Prevention

The effect of nutrition on cognitive development has been studied for decades (see e.g., Brown & Pollitt, 1996). Because of the increasing amount of research that has demonstrated a link among cognitive deficits, brain functioning, and crime, it is perhaps not surprising that recent work has shown that nutrition can help prevent antisocial behavior. For example, certain of the family/parenting programs reviewed above focus on nutrition and healthy development (Farrington & Welsh, 2007; Olds et al., 1986; 2007).

It appears that nutrition may even have a relatively concurrent effect on behavior. Thirty years ago, Schonthaler (1983) observed a decrease in antisocial behavior among incarcerated youth by removing unhealthy foods from their diet. Until recently, this link has gone largely ignored in the literature. Researchers have currently begun to discover that nutritional supplements may have a large impact on behavior, through cognitive functioning (Raine et al., in press). Several studies of children and adults have examined fish oil (Omega-3), specifically Docosahexaenoic Acid (DHA) and Eicosapentaenoic Acid (EPA), with respect to its effect on aggression and other antisocial behaviors. This is based on research that has shown fish oil can improve neurite outgrowth in the brain, resulting in larger dendritic branching and neurons. Interestingly enough, certain work has shown that seafood ingestion by mothers during pregnancy is associated with higher cognitive functioning and less antisocial behavior on the part of the children (Hibbels et al., 2007).

Several experimental studies have demonstrated that fish oil is associated with improved behavior and/or decreased aggression in the general population (Kirby et al., 2010; Hamazaki et al., 2008; Itomura et al., 2005). The desirable effect of fish oil has also been found for at-risk individuals. For example, Zanarini and Frankenburg (2003) carried out a study in which 30 women with borderline personality disorder were randomly assigned to a treatment group (which received 1 g of EPA for 2 months) or to a control group (a placebo). They found that the treatment group evinced lower aggression and depression at post-program follow-up. Another randomized trial, conducted by Hallahan et al. (2007), found a 29% reduction (although not significant) in aggression in a group of patients who were given 9 g DHA, 1.2 g EPA, and 24 mg vitamin E compared to a group given olive oil.

Experimental research has also focused on fish oil’s effect on anger. Buydens-Branchey et al. (2008), examining the effect of both EPA and DHA compared to soybean (placebo), found that the treatment groups had significantly lower anger than the control group. The findings suggested that it was DHA that had the largest effect. Gesch and colleagues (2002) reported on a randomized trial examining a treatment of nutritional supplements which included fish oils. Once again, this study found that fish oil resulted in a statistically significant decrease in antisocial acts. In sum, experimental research has shown that nutritional supplements may significantly impact behavior, including crime. This suggests another important link between biology and behavior that has yet to be explored in mainstream criminology or crime prevention.

Discussion and Conclusions

Biological theorizing is slowly making a comeback into mainstream criminological thought (Walsh & Beaver, 2009b). While full-fledged theoretical statements that incorporate biological characteristics are still rare (for an exception, see Moffitt, 1993), there is a growing literature on the importance of biological risk factors. Most of this risk factor work has been undertaken with crime prevention in mind. That is, to understand the most effective ways in which to prevent or reduce crime, so the logic goes, it is essential to identify the most prominent factors associated with later criminal offending.

Today’s crime prevention literature is characterized by divergent foci, from community, to built environment, to early childhood development strategies. With respect to biological causes of crime, a very relevant crime prevention strategy is developmental. This approach recognizes the interaction between the person and the environment, which is the viewpoint of contemporary biosocial researchers in crime and delinquency (see DeLisi et al., 2008; Walsh & Beaver, 2009a; 2009b; Wright & Boisvert, 2009). The developmental approach tends to focus on identifying risk factors for children or families and seeks to improve environmental conditions in order to facilitate healthy development of the child (Tremblay & Japel, 2003).

For the most part, a “biological crime prevention” approach that focuses on identifying those “born” to commit crime is a relic of the past in criminology. However, as we have shown in this article, existing crime prevention programs—programs advocated by biocriminologists (Beaver, 2009; Wright et al., 2008)—do address biological risk factors. These programs often seek to either prevent the occurrence of biological risk factors (e.g., preventing the development of cognitive deficits) or to prevent criminal behavior among those with identified risk factors. The prediction of Richard Moran, over 30 years ago, that “[o]nce biomedics and biotechnological control of crime has been demonstrated to be effective and practical, it is probable that the rehabilitative ideal... will reassert itself” (1978:354), appears to be on the verge of realization (see e.g., Vaske et al., 2011).

Developmental prevention programs likely have myriad effects on biological risk factors. For example, research indicates that programs beginning early in life encourage healthy brain development. There is a rich body of literature that illustrates how poor early environments have a negative effect on cognitive development (Doyle et al., 2002; Knudsen et al., 2006). Knudsen and colleagues (2006) argue that early prevention programs can improve cognitive functioning in a cumulative fashion. Studies showing that proper nutrition can improve neural growth in the brain is also crucial here. Other programs have been evaluated with an eye toward understanding how biological factors are changed (e.g., the effect of Raine et al. (2003a), Raine et al. (2003b) schizophrenia program on the hippocampus). Cognitive behavioral programs may have a similar impact on brain development. In cases where risk factors are heritable or genetic, programs can prevent crime through identifying environmental triggers that may increase criminal behavior.

In the future, it is reasonable to assume that more programs or strategies concentrating on biological risk factors will emerge. For example, Raine and Liu (1998) find that for those with low resting levels of arousal, stimulation therapy may be beneficial. They argue that such treatment may reduce crime for stimulation seekers. They also suggest early screening for neuropsychological or pre-frontal cortical deficits to determine the need for remediation therapy. Fishbein (2000) recommends ‘neurorehabilitation’ approaches for those with cognitive impairment. Vaske and colleagues (2011) attempt to show how biosocial research may lead to insights on offender rehabilitation.
They argue that cognitive behavioral treatment programs may be effective in part because of their impact on brain functioning and interventions should be made sensitive to neurological factors. Importantly, these approaches do not seek to radically alter the individual’s biology, but rather to improve functioning in the social world. Beauchaine et al. (2008) argue that neurocognitive research could help inform prevention and intervention strategies in numerous ways, including identifying those most genetically in need of treatment.

In terms of developmental crime prevention, research has suggested that the earlier the intervention, the better. The most important stages of development for cognitive growth appears to occur during pregnancy to the first 2 years of life, as PET scan technology has indicated impressive growth and maturation of cognitive functions during this period (Chugani, 1998). Research has found that trauma during this period can be especially impactful, affecting brain development in adulthood (Doyle et al., 2009; Knudsen et al., 2006; Perry, Pollard et al., 1995). Knudsen and colleagues (2006) argue that disadvantaged environments can severely retard cognitive development with lasting effects, which include an increased risk of poverty, lower educational status, and poorer employment opportunities. Importantly, however, work in non-human models has shown that treatment targeting those exposed to early trauma can ameliorate the negative cognitive developmental effects of trauma (Beauchaine et al., 2008; Weaver et al., 2005; Weaver, Meaney, & Szfyb, 2006). Thus, early intervention is of paramount importance in addressing certain biological causes of crime.

With respect to the criminal justice system, a more limited approach will likely prevail, but it is not unreasonable to expect that some programs that target “criminogenic needs” (Andrews & Bonta, 2010) may in fact address biological/genetic factors in the future. (Andrews & Bonta, 2010) may in fact address biological/genetic factors in the future. Thus, early intervention is of paramount importance in addressing certain biological causes of crime.

References
