

Introduction

In recent years, rapid growth in the biological sciences has greatly increased knowledge about the complexity and diversity of human development. Such advancements have propelled the study of a variety of social disorders, ranging from alcoholism to depression and psychiatric disturbance. Relatively few studies, however, have examined biological links to criminal behavior – a topic that sparks both controversy and criticism in an area of study that has depended, for the most part, on sociological and environmental explanations of even extreme violence.

Research on biological features of criminal behavior, and its accompanying controversy, is not new. Over a century ago Cesare Lombroso, an Italian physician, suggested that some individuals were “born” criminals with distinct physical features that he thought characterized primitive men, such as sloping foreheads, long arms, and flat feet (Lombroso, 1968; see Wolfgang, 1955, for a review of Lombroso’s work). Lombroso’s research was severely and justifiably criticized in both substance and methodology (Wolfgang, 1955). His major formulations, however, portrayed an originality apart from nineteenth-century thought and influence and, appropriately or not, they have had a large impact on modern criminological theory and studies of crime.

As in history, current interest in biological correlates of behavior has often been perceived synonymously with radical reductionism, the philosophy that all behavior can be explained in biological terms. Edward O. Wilson’s introduction of “sociobiology,” for example (Wilson, 1975, 1977; Lumsden and Wilson, 1981), has generated concerns by some that all individual differences will be biologically interpreted, thereby fueling prejudices among the different sexes, races, and social classes (Kitcher, 1985; Montagu, 1980). In turn, a minority of scholars view biological explanations of behavior as enlightening, not endangering (Caplan, 1978; Mednick Pollock, Volavka, and Gabrielli, 1982). Even Wilson acknowledges the limits of absolute reductionism (Wilson, 1977: 37–38).

The current examination of biological differences in crime confronts a similar type of dilemma, namely, the longstanding controversy between environmental (nurture) and biological (nature) orientations in science. Are we “blank slates” ultimately defined by social and cultural forces or are we genetically predetermined organisms with prescribed roles to play? Is our behavior malleable and perfectable or is it constrained and resistant to change? Are we inherently gentle and altruistic or are we aggressive, even violent beings, barely civilized by our culture? More specifically, are the “criminals” in our society “born” or “made,” a product of their biology or their environment?

Questions that probe the origins of criminal behavior are no less difficult to answer than those that concern the evolution of our humanness and our identity, the many mirrors of our selves in a culture that we learned to create either through instinct or through one another. Increasingly, research evidence suggests that a variety of both biological and environmental factors influence criminal behavior. (For reviews see Denno, 1982, 1985, 1988; Elliott, 1988; Mednick et al., 1982; Mednick, Moffitt, and Stack, 1987; Moffitt, in press; Moyer, 1987; Siann, 1985; Wilson and Herrnstein, 1985.) As yet, it is unknown, however, how these factors interact or which factors are the predominant predictors of crime.

The examination of many facets of behavior is one of the most necessary goals in the study of crime and, at the same time, one of the most ignored in actual research. The seeming indifference in the field of criminology to contributions in the biological sciences is not accidental. In part it reflects a concern that the acceptance of biological theories of crime reduces the importance of environmental factors. It also demonstrates the tendency for the different biological and environmental sciences to work in isolation, each using its own language and technique, each ultimately discouraging interdisciplinary mergence and exchange (Denno and Schwarz, 1985).

Such differences pit one research bias against the other, with neither approach singly able to discern the more complex components of behavior. Previous attempts to develop criminological theories have often failed to acknowledge variations in the physiological and psychological capabilities of individuals for learning socially approved behavior. In turn, many efforts to study biological factors in crime have ignored even the most obvious environmental and sociological influences (Denno, 1982, 1985).

One method of unraveling biological and environmental predictors of criminal behavior is to examine a sample of individuals *longitudinally* – that is, from birth through childhood, adolescence, and early adulthood.

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An assessment of multiple kinds of variables collected at key developmental points over time would provide information on the possible importance of maturational changes, a factor frequently bypassed in crime research. It would also be important to study the interrelation among these factors in a group of individuals who are demographically and environmentally at a high risk for criminal behavior – for example, black and lower socioeconomic children – as most studies of crime have focused on relatively low-risk subjects (Raspberry, 1980).

In their recent review of research on crime, Wilson and Herrnstein (1985: 512, 513) emphasize the lack of longitudinal information available in the social sciences on the complex interactions among biology, environment, and crime, particularly among high-risk samples. They suggest the need for longitudinal research on black children in particular to determine the contributions of select social and environmental influences, including family structure and socioeconomic status (1985: 478).

This book describes the results of the “Biosocial Project,” one of the largest research studies in this country on the relationship between crime and the biological and environmental influences on “high-risk” individuals. The Biosocial Project examined in detail numerous biological, psychological, and environmental variables collected on nearly 1,000 individuals followed from birth through early adulthood in Philadelphia. These individuals were selected from a total sample of nearly 10,000 families who participated in the Philadelphia Collaborative Perinatal Project at Pennsylvania Hospital between 1959 and 1966. Pennsylvania Hospital was one of twelve medical centers included by the National Institute of Neurological Diseases and Stroke in a nationwide study of genetic, biological, and environmental influences upon child development (Niswander and Gordon, 1972).

The Biosocial Project is unique in this country. Although numerous longitudinal studies of crime and behavioral disorders exist (Mednick, Harway, Mednick, and Moffitt, 1981), none has been able to examine so intensively, with multiple measures of key variables, a large sample of children both before and after the start of their criminal careers. Clinical records describing home visits with the most violent of these children provide additional insight into early biological, social, and behavioral characteristics during infancy and early childhood, and they supplement statistical analyses performed for the entire sample.

Two primary questions spurred the Biosocial Project’s approach: Given a sample of individuals who have high-risk characteristics, which factors distinguish those individuals who become criminal from those who do

not? More importantly, which factors distinguish persistently violent or serious offenders from nonviolent offenders or those individuals who never have official contact with the law?

Overall, the results of the Biosocial Project described in this book, discount one-dimensional theories of behavior. Crime and violence appear to stem from such a tightknit weave of both biological and environmental influences on behavior that the dominance of any single discipline in explaining crime cannot be justified. For example, results in this book show that what may appear to be a strictly biological trait, such as hyperactivity or severe learning difficulty, may be the product of exclusively environmental origins. The effects of lead poisoning on behavior illustrate how such biological and environmental interassociations occur. Key sources of lead poisoning are lead-based paint in old homes and lead-laden dust (Amitai, Graef, Brown, Gerstle, Kahn, and Cochrane, 1987: 758). Although these sources can be removed from a child's environment, what cannot be removed are the debilitating consequences of lead ingestion, which include, in addition to behavioral and learning problems, irreversible retardation, convulsions, or even death (Boffey, 1988). Moreover, the problems relating to lead poisoning are not restricted to the urban ghetto of the 1960s; they have persisted to the present time (Fitzgerald, 1986; Landrigan and Graef, 1987) with continuing, crippling effects.

This book does not pretend to offer a "new" bioenvironmental theory of behavior; rather, it emphasizes a social policy perspective based upon a probability framework for describing certain predictors of crime. The framework focuses on the degree of risk involved in committing a crime by analyzing the numbers and types of different biological and environmental influences during youth and young adulthood. Past proposals (e.g., Report of the Interdisciplinary Group in Criminology, 1978) have suggested that the likelihood of criminal behavior can be explained according to three different types of predictors: (1) predisposing variables (which increase the likelihood of criminal behavior); (2) facilitating variables (which, in combination with predisposing variables, further heighten the likelihood of crime); and (3) inhibiting variables (which counteract predisposing variables and thus decrease the probability of criminal behavior).

Viewed across a lifespan, combinations of these three types of predictors can explain the beginning or end of criminal behavior at different ages or show why some factors have relatively greater significance at particular points in time. For example, a predisposing variable may be premature birth, a facilitating variable may be lead poisoning, and an inhibiting variable may be stable family structure or high socioeconomic status. Depending on when these variables become most significant in an

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individual's life, crime or violent behavior may or may not occur. Developing fetuses and children below age 7 are most vulnerable to lead poisoning (Boffey, 1988). Should lead poisoning occur early in life, during either prenatal development (through ingestion by the mother) or early childhood, a child may develop problems in learning and behavior, particularly in the presence of other crime-facilitating factors, such as an unstable family environment or low socioeconomic status. The probability of criminal behavior would be relatively great for this child. Alternatively, if lead poisoning began later in life and a concerned family made efforts to avoid further poisoning, the likelihood of criminal behavior would be inhibited.

From a social policy perspective, society can break the chain of links among crime-causing factors by implementing relatively inexpensive procedures to "clean up" the crime-causing environment, such as deleading homes and encouraging early medical care for young children. From a socially moral perspective, it is evident that economic expenditures instituted early in the lives of high-risk individuals would decrease the chances of later criminal behavior as well as the considerably greater expense and social pain of punishment. An emphasis on both the biological and environmental contributions to criminal behavior can help to detect those factors that may lead to, and ultimately prevent, person-to-person violence in particular.

In this book the terms "biological" and "environmental" are loosely defined because of their close association with other related terms and with one another. Generally, "biological" factors are considered as "non-social, nonbehavioral measures of . . . constitution and functioning" (Mednick, Pollock, Volavka, and Gabrielli, 1982: 22), such as physical growth and development; "environmental" factors generally include those without a biological base, such as family income. Factors comprising "behaviorally defined characteristics," such as cognitive or intellectual ability and achievement, may have a partially biological base (Mednick et al., 1985: 22) that, presumably, can be environmentally perpetuated or altered.

The limitations of the Biosocial Project described in this book warrant emphasis. First, the Project examined only black individuals who were predominantly from the lower socioeconomic classes; thus, the results are generalizable only to those individuals with similar characteristics. Second, the Project's measures were applied in the 1960s and thus do not include the many new and sophisticated techniques for revealing biological differences that now exist. Measures of socioeconomic and environmental influences, however, are comparable to those techniques used today and

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the measures of official arrest data and crime seriousness are among the best currently available. For these reasons, biological effects may well be underemphasized. Third, the sample reflects the considerable attrition that often exists in longitudinal research although comparisons between “leavers” and “stayers” show negligible differences on key variables. Thus, although attrition exists, there is no strong evidence that those who were excluded from the Project by default differed markedly from those who were included.

Chapter 1 of this book discusses some biological, sociological, and environmental theories and research in order to provide a background for the theoretical framework of the Biosocial Project and the selection of variables for analysis. Chapter 2 describes the sample, the major variables of study, and the extent of crime and its seriousness among both males and females as children and as adults. Chapter 3 examines intelligence and achievement test score differences among offender groups in addition to placement in school programs for children who are mentally retarded or who have disciplinary problems. Chapter 4 presents statistical models incorporating numerous biological and environmental predictors of crime and violence that past research has found to be important. These models also include factors shown to be associated with intellectual or behavioral disorders that have never before been examined with criminal or violent individuals. Chapter 5 details clinical assessments based on home visits throughout the lives of 30 of the most violent and seriously criminal individuals in this sample. Home visits recorded information on mother–child interactions and the child’s social responsiveness, illnesses or injuries, and unusual habits or behaviors. Chapter 6 discusses the future policy implications of the Biosocial Project in terms of perspectives on biology and responsibility, in particular, what role, if any, biological differences should have in criminal law defenses or in our notions of intent and free will.

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Biological and environmental influences on crime

The domination of sociological explanations of crime and violence is attributable, in part, to a strong environmentalist approach in criminological research and theory. To this date, criminology textbooks provide either no discussion of biological research whatsoever or only a scattered page or two of the more explosive theories (Elliott, 1988).

The review that follows discusses some selected findings in both biological and environmental research on crime, giving a perspective and a description of those variables examined in this study and providing some background for a discussion of the study's results. More extensive reviews of the relationship of crime to genetic, biological, and psychological variables as well as of the various biosocial theories of crime proposed over the years have been provided in a number of recent books and articles (see, e.g., Denno, 1984, 1985, 1988; Elliott, 1988; Mednick et al., 1982, 1987; Moffitt, in press; Moyer, 1987; Shah and Roth, 1974; Siann, 1985; Wilson and Herrnstein, 1985). The following discussion does provide greater detail regarding certain biological and psychological variables, however, because of the dominance of existing reviews of sociological and environmental correlates of delinquency and crime in criminological journals and textbooks (see, e.g., Hirschi, 1969; Kornhauser, 1978). The discussion concludes with a model that integrates links among the variables and disciplines to present a probability theory of behavior for explaining serious, repeat delinquency.

Selected biological and psychological influences

Early biological theories

The evolution of biological theories of crime reads like a Ping-Pong match between the early biological researchers and the avid critics who denounced them each time a new theory or research study was introduced.

Historically, biological explanations of crime are perhaps tied most readily to Lombroso's doctrine of evolutionary atavism published originally in 1876 in *L'uomo delinquente (Criminal man)*. Lombroso's belief that criminals possess an innate, primitive predisposition to crime, however, was refuted 40 years later by Goring. In the United States, Dugdale's genealogical study of the Jukes family suggested a hereditary component to crime, although a stronger biological argument was raised in Goddard's 1913 genealogical investigation of feeble-mindedness in the Kalikak family. One of the most extreme biological positions was Hooten's 1939 comparative study of several thousand prisoners, which concluded that the primary cause of crime was biological inferiority. This position was quickly rebutted. During the 1940s and 1950s, research by Sheldon and the Gluecks focused on the relationship between different body types (endomorph, ectomorph, mesomorph) and delinquency. (Reviews of early biological theories may be found in Jefferey, 1955; Schafer, 1969; Wilson and Herrnstein, 1985; Wolfgang, 1955.)

All of these studies have been criticized severely on both conceptual and methodological grounds (Shah & Roth, 1974). Unfortunately, such justifiable critiques have inhibited recent attempts to examine biological correlates and their interaction with the environment. There exists, however, accumulating evidence that violence and some types of criminality are associated with disorders and trauma of the central nervous system (CNS) (see, e.g., Cowie, Cowie, and Slater, 1968; Elliott, 1978, 1988; Lewis Shanok, and Balla, 1979; Moffitt, in press; Shanok and Lewis, 1981). Such forms of cerebral insult appear to vary in importance depending upon their severity, their time of occurrence, and, perhaps most importantly, the environment. The chain of events initiating and perpetuating CNS disorder thus can potentially start very early in life – at birth or even before.

Prenatal and perinatal events

The term “prenatal” refers to the period between conception and birth. The term “perinatal” refers to the period near the time of birth (*Steadman's Medical Dictionary*, 1976). Considerable research points to associations among prenatal and perinatal complications and CNS dysfunction. Generally, early brain damage, primarily due to hypoxia (a severe lack of oxygen), may be related to later neuropsychiatric disturbances such as schizophrenia (Campion and Tucker, 1973; Handford, 1975), impaired intelligence or achievement (Broman, Nichols, and Kennedy, 1975; Friedman, Sactleben, and Bresky, 1977; Graham, Ernhart, Thurston, and

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Craft, 1962), attention-deficit disorder (minimal brain dysfunction) (Benton, 1973; Bernstein, Page, and Janicki, 1974; Nichols and Chen, 1981; Rie and Rie, 1980; Wender, 1971), pathological cerebral dominance (Bernstein et al., 1974; Nachshon and Denno, 1987b; Vandenberg, 1973), and reading failure (Denhoff, Hainsworth, and Hainsworth, et al., 1972; Kawi and Pasamanick, 1958). Directly or indirectly through these disturbances, pregnancy complications may also lead to general physical or behavioral disorders (Cott, 1978; McNeil, Wiegerink, and Dozier, 1970; Rogers, Lilienfeld, and Pasamanick, 1955) and delinquency (Kleinpeter, 1976; Lewis and Balla, 1976; Rosenberg, 1978; Shanok and Lewis, 1981; Stott and Latchford, 1976; Stott and Wilson, 1977).

The extreme vulnerability of the fetus-neonate to brain damage explains why brain lesions early in infancy may be more severe than comparable lesions in adulthood (Towbin, 1978). Thus, children or adolescents with learning disorders or other indicators of attention-deficit disorder may demonstrate “soft” (minor and often undetectable) neurological signs of latent cerebral injury originating from some kind of perinatal stress (Benton, 1973).

In contrast, other studies show no correlation or weak links between pregnancy complications and intellectual deficits (Broman et al., 1975; Denno, 1982, 1984, 1985; Henderson et al., 1971; Nachshon and Denno, 1987a), behavioral disorders (Colligan, 1974; Minde et al., 1968; Werner et al., 1968), or delinquency (Denno, 1982, 1984, 1985; Lewis and Shanok, 1977; Litt, 1972, 1974; Pasamanick and Knobloch, 1966; Robins, 1966; Schulsinger, 1977; Shah and Roth, 1974). These discrepancies among results may be attributable, in part, to numerous conceptual and methodological differences in research approaches (for a discussion, see Chipman, Lilienfeld, Greenberg, and Donnelly, 1966).

For example few attempts have been made to categorize or more precisely define birth stress measures. In their articles on the relationship between birth stress and delinquency, Lewis et al. (1979: 419) define “perinatal difficulties” only in terms of any problem ranging from “maternal syphilis to postnatal apnea requiring incubation.” In *Deviant Children Grown Up*, Robins (1966) uses “forceps delivery” as the sole indicator of perinatal injury relative to delinquency, a poor choice for several reasons. Not only is a single variable insufficient for measuring birth-related effects, but “forceps delivery” in particular has been shown in recent research to produce misleading results if not accompanied by other controls (e.g., maternal age) or related factors (e.g., birth weight) (Broman et al., 1975; Friedman et al., 1977). In his book *Studies of Troublesome Children*, Stott (1966) fails to provide any identification whatsoever

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of the factors that constitute the variable “pregnancy complications,” although later articles are somewhat more precise (Stott and Latchford, 1976). Additional factors may confound or influence associations with birth-related events, such as the definition and categories of delinquency and violence.

The relationship between birth events and delinquency or its correlates also appears to be environmentally dependent, not genetic or heritable (Lewis and Balla, 1976: 66–67). Accordingly, sociological and environmental effects, such as family makeup and income, should be included in analyses. However, nearly all the research cited as relating birth events to delinquency and its correlates ignores environmental factors.

Such an important omission may also explain, in part, inconsistencies in research findings on intellectual functioning. Just as early CNS damage may recur at adolescence, it may also disappear, particularly in good environments. Thus, studies measuring intelligence with young or disadvantaged subjects may find a link to birth complications relative to studies with older or more advantaged samples where this link is not made.

Such compensatory environmental influences are most detectable in longitudinal research (Werner, Bierman, French, Simonian, Connor, Smith, and Campbell, 1968, present an exemplary study). According to Sameroff (1975: 274), “the data from . . . various longitudinal studies of prenatal and perinatal complications have yet to produce a single predictive variable more potent than the familial and socio-economic characteristics of the caretaking environment.” Thus, in advantaged families, prenatal and perinatal complications had negligent or nonexistent longterm effects, whereas in disadvantaged families they predicted “significant retardations in later functioning” and intellectual deficits (Sameroff, 1975: 275).

Overall, then, the link between prenatal and perinatal complications and intellectual and behavioral deficits is potentially strong in poor environments. The strength of the link between intellectual deficit and delinquency or crime in particular is the topic of the next section.

Intellectual functioning and achievement

A conflicting literature exists concerning the extent to which delinquents or criminals differ from nondelinquents in intellectual functioning (Bachy-Rita, Lion, Climent, and Ervin, 1971; Hirschi and Hindelang, 1977; Lewis and Balla, 1976; Offer, Marohn, and Ostrov, 1979; Spellacy, 1978; Wilson and Herrnstein, 1985; Wolfgang, Figlio, and Sellin, 1972) or