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Social Structure and Sociobiology: A Radical-Political Economic Reinterpretation [1]

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Abstract

This work evaluates the contemporary debate between biosocial and critical criminologists over explanations of crime. We suggest that both approaches have something to offer to explanations of criminal behavior by drawing upon three observations in that debate. First, we suggest that in previous debates, issues related to crime causation has been misrepresented in a way that intensifies the divide between biosocial and critical criminology. Doing so exposes how ideology plays a role in this debate. Second, we suggest that some varieties of critical criminology can welcome a biosocial approach to the study of crime, and limit that discussion to radical criminology which is informed by political economic analysis. Third, we address the concern critical criminologists express about biosocial criminology due to its claim that it can explain all crime, while at the same time neglecting the explanation of the crimes of the powerful. Indeed, to be a complete explanation of crime, biosocial theory must be able to demonstrate it can also explain the crimes of the powerful. On this point, biosocial criminologists can learn a great deal from critical criminologists who propose that the economic organization of capitalism contribute significantly to the crimes of the powerful. We conclude by challenging the discipline to embrace an alternative way forward that is not constricted by the biosocial-critical criminological debate within criminology that is now over three decades old, and to instead examine complex explanations that value a variety of viewpoints.

Introduction

Previously, this journal published a recent debate between critical and biosocial criminologists that extends the 1970s controversy over the role of sociobiology in explaining crime (Jeffery, 1978; Platt and Takagi, 1979; Sahlins, 1977). The recent debate illustrates the continued disharmony between biological and various forms of critical criminology. Unfortunately, there has been little consensus over the last forty years and each side has accused the other of harboring ideological biases.

The contemporary debate between critical (e.g., Carrier and Walby, 2014) and biological criminologists (e.g., Walsh and Wright, 2015) that was published in this journal focused on three decades of studies of crime. That debate has sharpened the tensions between critical and biosocial criminology and created unfortunate generalizations concerning the views of each side in that debate. The form that discussion has taken stifles any attempt to contemplate and understand how these two views – painted as diametrically opposed to one another – shares common ground and can cooperate. For instance, as examples of the current nature of these exchanges, Carrier and Walby (2014) argue that “biosocial revolutionary claims are premised on a narrow conception of criminology, aiming to entrench an iteration of the multidisciplinary but unreflexive Lombrosian project” (p. 1-2). For their part, Walsh and Wright’s (2015) response to the critical critique of biosocial criminology draws upon the same old anti-Marxist rhetoric of the 1970s and fails to recognize that substantial variations exist across types of critical criminology and its explanations of crime, and that all forms of critical criminology cannot simply be lumped together.

The purpose of this work is to evaluate the contemporary biosocial criminological debate between critical and biological criminologists. We restricted our comments to three major issues. First, the debate often considers the “causes” of crime, how to explain those causes, whether they can be explained, and the kinds of theories that might be suited to this task. It is important to be clear about whether criminology can identify the causes of crime, and how use of that term “cause” invites criticism and conflict between critical and biosocial criminology. Second, many varieties of critical criminology exist, and the origins of some critical perspectives appreciate biosocial explanation, as we shall illustrate below. Indeed, the notion of biosocial criminology is replicated in two contemporary critical criminology perspectives that can easily be integrated with biosocial explanations of crime: radical and green criminology [2]. In illustrating that point, we limit our discussion to specific types of critical criminology, of which there are a number of varieties and various assumptions [3]. In addition, in making that argument, we restrict ourselves to discussions related to epistemological positions in the philosophy of science rather than alternative metaphysical and ontological philosophical concerns addressed within some critical criminological research [4]. Third, as “critical criminologists” ourselves, we suggest that all critical criminologists are suspicious of biosocial criminology because it tends to define crime as street crime and ignores the wide variety of other forms of crime that occur in society – white collar, corporate, green/environmental, state, and state-corporate crimes. If, for example, genes “cause” crime, why do they only appear to be important in descriptions of street crime but not for corporate, state or green crimes? We take up each of these issues, and then move to a discussion of the parameters of integrated radical-biosocial theory.

The “Cause” of Crime

The use of the phrase “causes of crime” in criminology has intensified the tension between some forms of critical and biosocial criminology. We placed “causes of crime” in quotation marks to emphasize that, at this point in history, it is an ideological and not a scientific term. That is to say, criminologists – and criminological theories – posit a wide variety of crime causes. None has been sufficiently supported empirically to rule out other explanations.

Despite this reality, criminology, and hence criminologists, tend to tote the word “cause” around as if it were really possible to identify the thing(s) that cause crime to occur – as if they are easily seen and measured and made readily apparent via criminological analysis. Ideology

surrounding the term “causes of crime” emphasizes different interpretations of science and the role of science within criminology (Walsh, 2011). Indeed, one of the issues the critical/biological theory debate raises is how criminologists who wish to be identified as doing (or not doing) science ought to use the term “cause.” So, we begin with a philosophy of science perspective by asking whether it is possible to identify the causes of crime.

Scientifically speaking – and here we forego dragging up numerous references since this point should be well-known (e.g., discussions of causation by Hume, Kant and the issue of causality as identified in Newtonian physics and the concepts of Einstein causality) – a cause is something that *must always be present and precede an effect*. If something is *sometimes present* before an effect, it is *technically not a cause*. It may be something else, such as a probabilistic cause or an influence, but it is not the only factor related to the effect – its singular cause. It is sometimes possible that one thing can be attributed causation when it co-occurs with another factor that is also always present, *and* the analytic model can effectively rule out *all other possible explanations* for the emergence of the effect. But here too, both factors must always be present or else the combination of effects cannot be correctly and scientifically described as a cause of an outcome. With respect to the gene-crime association, genes are sometimes shown to have an effect. That effect, as recent studies indicate is plainly inconsistent and not always present (Iofrida, Palumbo and Pellegrini, 2014; and discussion below). Thus, we cannot say at this point in time that genes **cause** crime, and at best genes may *influence* behavior that is socially defined as criminal.

Criminologists are also unable to find the causes of crime because those causes cannot, strictly speaking, be observed. This inability to directly observe how some factor (X) causes crime (Y) can lead to any number of problems in interpreting the statistical relationship between things. This is because statistical analysis is premised on the Newtonian assumption which *assumes* the presence of a cause for each effect. Statistical relationships are, in this sense, *interpreted as if a causal association exists*, meaning that those statistical relationships are assumed to confirm whether or not a causal relationship between things exists based on their statistical relationship. The outcome, however well a study is designed, is not proof of a causal relationship, but rather is merely an expression of the way we depict causality and our assumptions about causality in modelling crime. We are not asserting that causal inference is unfounded or even unpractical in many situations. Instead, we emphasize that causality is assumed as part of the statistical analysis, and the analysis only reflects causality because we assume the existence of a causal relationship that we do not directly observe. With respect to the relationship between genes and crime, for example, we cannot directly see genes cause crime any more than we can directly see other abstract concepts used by critical criminologists (e.g., anomie, social disorganization, poverty, etc.,) cause crime.

When a cause is not directly observable, a number of other conditions of an experiment or study must be met before causation can be implied (Maclver, 1942). This is true even for many problems in the natural sciences such as physics (e.g., the transfer of force) and in other sciences as well. We can't see force. What we can do is infer its transfer by the interactions between objects and by ruling out all the alternative explanations in well-designed experiments. Likewise, we can't see social structure cause crime; we can't see individual associations at the group level such as peer relationships cause crime; we can't see psychological processes work themselves out in the brain and lead to crime; and we can't see genes exert their influence in ways that cause crime. We can only see if those factors are more or less likely to be present when “crime occurs” in whatever form crime is being measured. Thus, instead of “causes” of crime, what criminologists discover when testing “theories” of crime are factors that *potentially influence* the occurrence of crime given the conditions under which those influences have been tested ¹ – and the probability that a factor

¹ We emphasize “potentially influence” since an estimate of an outcome is never fully identified. There is no perfect model predicting criminal behavior and an under-identified statistical model of crime can always be scrutinized because some other variable *might* exert an influence on crime in a way that changes the model. That is, what we know at the moment might change.

identified as a cause is associated with an effect. As a result, we can only know that something is potentially a cause of crime when – and we would assert, in a model with perfect predictability, a condition not seen within tests of criminological theories – an explanation is tested on numerous occasions, and the variable **always** has the same effect (accounting for other threats to validity and the reliability of measures).

This notion of potential influence is important to the current debate between critical and biological criminology for the following reason: at this point in history criminologists do not know the “causes” of crime as defined above, so favoring a theoretical position is itself ideological. At best, criminologists have information about factors that *appear* to influence crime. Unfortunately, the criminological literature is replete with references to a broad and continually growing list of factors that influence crime which makes it difficult to say with any scientific surety that any given factor causes crime. For the most part, it cannot be ruled out that some of those factors are psychological, some are structural, some exist at the group and interpersonal levels, and some indicate biological influences and some reflect radical influences. *All* criminologists, therefore, make an ideological commitment when they take up one of these positions over any other, because there is no scientific evidence that definitively supports any one of the possible options over the rest (Walsh, 2011). And that observation is important because absent the ability to say that something is a cause of crime scientifically, all that a debate between biological and critical criminologists can address is their ideological difference, and those differences cannot be solved scientifically or otherwise at the present time.

Varieties of Critical Criminology

Critical criminology is made up of a variety of subfields, and the term “critical criminology” is simply and umbrella terms used to group together several schools of thought that are different than mainstream criminological thought (see Lynch and Michalowski 2006). Thus, when a biosocial criminologist offers a critique of critical criminology in general (or when a critique is levelled against biosocial criminology in general), the more specific origins of that critique ought to be noted. This lack of recognition of diversity in critical criminology by biosocial criminologists obscures the way in which biosocial and critical perspectives can overlap and blurs distinct differences between the various forms of critical criminology that exist. For example, as radical and as green criminologists who take a political economic view, we debate other critical criminologists (including green criminologists) over their epistemological assumptions and even methods of research. Despite our radical perspective, we are sometimes subjected to the same criticisms critical criminologists level against biological criminology with respect to the role science ought to play within criminology. As a result of the above observations, we suggest that the critical/biosocial criminology debate is much more nuanced than has been depicted in prior discussions. When debates are not depicted correctly they may alienate those in either approach who have some sympathies for views taken by “the opposition.” This, indeed, is the problem that these types of critiques pose – they can make people who are interested in the same kinds of issues into foes rather than colleagues. And that is unfortunate because that kind of division impacts the progress criminology can make. As an example, in the section that follows, we explore potential connections between biosocial criminology and radical criminology – two forms of analysis that are often depicted as not only having little in common, but as being antagonistic.

Marxist and the Biosocial

The early influence of biology on critical theory is apparent for those who appreciate the works of Marks and Engels. Marx and Engels saw Darwin’s theory of evolution, for example, as an illustration of how materialist theory explained the trend in or trajectory of evolution as an intersection of the biological and the physical structures of the world. Both Marx and Engels were very conscious of various scientific theories, and corresponded about Darwin’s theory and how it could be used to develop their views on scientific materialism (Marx and Engels, 1954, 1955). Angus

(2009) states that Engels was among the first to purchase Darwin's book before the first edition sold out. Writing to Marx, Engels noted that "Darwin . . . is absolutely splendid" (Angus, 2009). After reading the book, Marx described it as "the book which contains the basis in natural history of our view," and that it provides "a basis in natural science for the historical class struggle . . ." (Angus, 2009). Even before they had read Darwin, in their 1845 book, *The German Ideology*, Marx and Engels (1845) noted that "One can look at history from two sides and divide it into the history of nature and the history of men. The two sides are, however, inseparable . . ." Working out that connection became part of their analysis of society and capitalism. Finally, as Angus noted, Marx admired Darwin's work so much that he sent Darwin an autographed copy of volume I of *Capital* when it was released.

Engels wrote extensively on the intersection of nature, biology, science and scientific materialism in his books, *The Dialectics of Nature*, and *Anti-Duhring*, where he noted that "Nature is proof of dialectics . . ." Many have commented on Engels and Marx's well-developed knowledge of the sciences from their era (e.g., Bernal, 1935). As ecological Marxists have detailed, Marx was well aware of soil sciences in his day, and that knowledge impacted his discussions of the interaction between capitalism and nature (Burkett, 2008; Burkett and Foster, 2006; Clark and York, 2005; Foster, 1999, 2000, 2002, 2005; for examples of empirical applications see, Jorgenson, 2003, 2008, 2009).

Marx and Engels were not the only radicals to be favorably inclined to scientific knowledge. Noted molecular biologist, John Desmond Bernal, who was a Marxist, played an important role in the development of X-ray crystallography which was later used to discover the structure of DNA, wrote extensively on the intersection of science and society, and offered a perspective on that subject influenced by materialist theory (Young, 1996). The point is that not all critically oriented scholars reject biological sciences and discoveries, and indeed, among radicals who owe an intellectual debt to materialist analysis, those discoveries cannot be overlooked as Marx and Engels well understood.

Controversy Concerning Genes and Crime.

Recent critiques of biosocial criminology (Burt and Simons, 2014) suggest that epigenetic approaches ought to be considered, and we will argue below that perhaps Marxist and epigenetic arguments can be integrated to recasts criminological interpretations of the environment-gene relationship. The problems with critical critiques of biosocial criminology and replies to those critiques is that both sides tend to take extreme views, and lay out the critiques and responses as if the facts on each side were entirely known and definitive. In doing so they also sometimes offer caricatures of the opposition. Hidden behind those disagreements between mainstream and radical criminology are potentially useful points of agreement, a point Garofalo (1978) made nearly four decades ago.

We take the view that radical and biosocial criminology are related because there is a gene-crime-environment relationship. Since we are not experts in biosocial explanations of crime but find them interesting, here we refer to what is known about the gene-crime relationship from what scientists have to say about that relationship. To make that case, we turn to a recent study by Iofrida, Palumbo and Pellegrini (2014), who summarized what is known about the genes-crime relationship from their review of the literature and their own engagement in that type of research. With that background in mind, they note that for most of the assessed genes, the gene-crime connection is tenuous, and that studies have both supported and rejected gene-crime associations. Thus, whether genes "cause" crime is currently *in doubt scientifically if one pays attention* to the existence of these **conflicting results** and does not render a judgment based solely on positive results. While methodological issues (and even technological ones) may be involved in producing those conflicting outcomes, that unsettled matter points to a potential weakness that is currently problematic in that literature – specifically, how crime is to be defined and measured in those studies. The point is that despite what individual criminologists may have decided about the gene-crime connection, the relevant literature does not currently support one side over the other – there simply isn't the kind of

evidence needed to suggest that genes do or do not play a role in promoting crime. To present this association as otherwise is to misrepresent what is actually known. Even the interesting findings of Caspi et al (2003), often cited as evidence of a gene-crime relationship (more than 7,150 citations as of 10/10/2016), has not been replicated (Iofrida, Plaumbo and Pellegrini, 2014), leaving that finding in doubt. According to Iofrida, Plaumbo and Pellegrini (2014: 5) the best one can say is that “some genetic alleles—alone or, more likely, in combination—*may* modulate the individual risk toward violence and antisocial behavior. For this increased vulnerability to manifest, **adverse environmental factors are required**” (our emphasis). Accordingly, to say something different is to take a non-scientific, ideologically situated position on the gene-crime association at this point in history. The evidence on this potential relationship is still being collected and analyzed, and cannot be said to be definitive.

The problem here is also one that emerges from the critical critique of biosocial theory. That critique is not confined to what the scientific literature has to say, and instead takes liberties constructing what may not be a useful or accurate view of the genes-crime relationship. Ignoring the empirical content of scientific literature and instead focusing on philosophy of science issues does not get to whether biosocial criminology has produced findings that can be of some use in discussions of factors that influence crime, at least in probabilistic terms.

On the latter point, perhaps the most interesting, but yet un-established view of the gene-crime link has to do with what can be called the gene plasticity hypothesis – that the regulation of some genes enhances or diminishes susceptibility to environmental influences (Iofrida, Palumbo and Pellegrini, 2014). What this means is that environmental effects matter because the process of gene regulation is sensitive to environmental cues. Thus, the effect of certain genes can be managed by controlling the environmental context in which people find themselves located. Thus, this observation implies that environmental conditions are important because they modify gene expression. By “environmental conditions,” we mean a broad range of social structural, group and even environmental-ecological circumstances (e.g., exposure to pollution), and not the limited social contexts in which the gene-crime relationship has so far been examined within criminology. In any event, in relation to the gene-environment-crime link, this means that there is a need to consider how genes and crime intersect, that this is a gene *and* environment interaction, and that this interaction should not be viewed as a nature versus nurture debate, but one in which the structure of society and the structure of the body collide. And rather than an antagonism between biosocial and critical criminology, such a view would lead to (re)interpretations of how these views might intersect to better understand how crime is **produced** in society. Here, we purposefully use the word produced, because crime is not simply a behavior, or the result of behavior, but is behavior in a given social context with rules made by the powerful about acceptable/unacceptable behaviors. In addition, part of producing crime in such a context must take into account the enforcement – or lack of enforcement – of the law, or the behavior of law and law enforcers.

This type of interaction *is not* the way in which the interaction of genes and the environment is always or even usually interpreted within the criminological literature. As Carrier and Walby (2014) argue, the tendency of biosocial criminology has been to interpret the gene-environment interaction as if genes dominate that relationship, which creates what they call a “biopathologizing gaze.” That view is “pathologizing” to the extent that the major effect on crime is given to genes. Whether or not we know enough at this point in history to claim how much genes affect crime, criminologists have still made what appear as definitive statements on this subject. For example, Moffit and Beckley (2015) suggest that about half of the observed gene-environment-crime relationship is due to environment. Again, whether or not we know this definitively from current research and how it has been conducted is, we suggest, an unknown. For instance, we can think of no empirical study in which a biological explanation is tested against a radical/political economic explanation. Absent such tests, criminologists lack knowledge about whether biosocial explanations would hold-up against the variables posited by radical-political economic explanations (see, Lynch, 2015; Lynch, Groves and Lizotte, 1994).

There are other points on which biosocial criminology exhibits its limitations. One of the problems biosocial criminology has difficulty explaining is that crime “moves.” By “moves” we mean that crime has a trend and a geography, and the trend in crime changes. That transformation in the trend of crime cannot be explained by primarily relying on a genetic interpretation (unless genes or gene expression change in ways that also form a corresponding trend, changing over time and locations). If, for example, genes were the predominate explanation of crime and determined crime, the rate of crime would be unlikely to fluctuate very much over time *if* the gene-crime relationship is taken as a static relationship because genetic expression generally doesn’t change in a population that rapidly. Part of the problem is, as Carrier and Walby point out, addressing how the movement of crime is related to the “social construction” of crime – that to say, that what counts as crime is the result of the intersection of behavior and enforcement (how crime is produced), which has lead radical criminologist to argue that crime is produced by the intersection of various social processes that, on the one hand define crime and impact the enforcement of law, and on the other, are made up of human behaviors (Lynch and Michalowski, 2006). Thus, for an intersection of gene-based and environmental-based explanations to occur, there is a need to be “fair about” the ways in which economic and social structures contribute to movements of crime – both in space and time.

One of the well-established facts about crime – and by crime at this point we mean the traditional criminological view of crime as street crime since this is the form of crime biosocial explanations tend to examine– is that those engaged in this form of crime are economically marginalized. There is no study which indicates otherwise about street crime populations, and this is perhaps, along with gender and age, one of the most persistent facts about crime (legally defined) both historically and in the contemporary period. Keeping that fact in mind, one could argue that the influence of genes on crime that occurs through social structure involves how genes and the “stresses” (e.g., Caspi et al., 2003) produced by economic organization (i.e., one aspect of environment) and in particular, economic marginalization – interact to influence criminal behavior. Radical criminology has long detailed the stresses associated with the economic arrangements of capitalism and how living in an economic system dominated by exploitive and alienating class relationships produces certain forms of stress (for review see, Lynch and Michalowski, 2006) . Indeed, the first to recognize this fact was Frederick Engels (1845) in his book, *The Conditions of the Working Class in England*. Among those arrested at that time, Engels calculated *that only 0.22%* were from the higher classes. Engels related his discussion of crime specifically to the demoralizing effects of capitalism, and how through its ordinary progress, capitalism’s exploitation of the working class produced marginalized populations detached from the social order – the alienated, exploited working class members whose capitalism-life experiences (or one could say, borrowing from contemporary criminology – the life course of economically marginalized members of society) lead them to crime. These foundational observations about the structural origins of stress produced by capitalism for the working class provide an interesting opportunity to integrate Marxist and biosocial criminology. To our knowledge, neither critical nor biosocial criminology has considered this potential gene-class/economic stress interaction effect as it relates to capitalism or the way in which genes-environment interact.

Such an integration may also become relevant to explaining trends in crime, an issue that has largely been absent from the biosocial criminological literature. Crime rises and falls over time, and varies from place to place. Genes, however, are not ordinarily interpreted in the criminological version of the gene-crime relationship as changing in this way (though they might or could be), and it is therefore improbable that the distribution of genes, if stable, within or across societies can explain variability in crime rates across time and place. This is true unless biosocial criminology adopts some version of the plasticity hypothesis.

In contrast to biosocial explanations of crime, structural models offered by radical criminologists have been shown to be useful for predicting crime rates and changes in crime (Carlson and Michalowski, 1997; Lynch, 1988; Lynch, Groves and Lizotte, 1994). Is it possible that the stress produced by the forms of exploitation and alienation generated by capitalism could

interact with genetic influence across time and place to impact the volume of crime in society? Such an argument integrating radical and biosocial approaches has yet to be proposed in the criminological literature, and given that most genetic data is available only for individuals and not for the population, it may not be currently possible to assess whether this argument has any validity. Nevertheless, such an argument illustrates how radical and biosocial explanations intersect.

This argument also makes sense from the perspective of what is known about gene-environment interactions. It is well-known from biological studies since the 1990s that exposure to environmental conditions can change the phenotype of an organism—that is, that there are epigenetic changes that can occur to regulate the expression of genetic materials (i.e., methylation), and that those changes are then heritable (Holliday, 2006). Epigenetic change does not involve change to DNA, but rather involves changes to the transcription or expression of genetic codes. This can involve the suppression or silencing of portions of the DNA structure, and can occur through environmental influences, meaning that exogenous environmental factors change the phenotype of an organism.

One of the important findings of epigenetic research involves assumptions made about the inheritance of genetic materials in studies that employ monozygotic twins. That assumption is that monozygotic twins are genetically identical, and that the use of monozygotic twins keeps genetic variation constant while allowing for an assessment of environmental differences. Since, however, epigenetic research suggests that environment and genes interact to affect the expression of genes, there may be unobserved epigenetic differences between monozygotic twins those studies overlook (Hague, Gottesman and Wong, 2009). This observation is important because it suggests that there is more to the traditional gene-environmental interaction (often depicted as G x E) than the simple fact that genes interact with environments, or that environmental effects can be easily determined by “controlling” for genetics using monozygotic twin samples.

While there are numerous issues related to the above implications of genetic inheritance and twins (Wong, Gottesman and Petronis, 2005), part of the relevance of epigenetics research for criminology involves the suggestion that environment factors of various types can change gene expression. Epigenetics examines how gene expression can be modified, with some of those modifications being induced by environmental factors, with one area of relevance being that exposure to different environmental toxins/chemicals can play a role in this process. Extant research, for example, has established that epigenetic changes occur in relation to exposure to heavy metals, air pollutants and endocrine disruptors (Baccarelli and Bollati, 2009; Bollati and Baccarelli, 2010; Hou et al., 2011; Singh and Li, 2012) – or exposure to pollutants that are now common in environments. These kinds of changes have also been noted for some time in cancer research where it is suggested that environmental factors can enhance or reduce cancer mechanisms by altering expression of genetic materials, possibly “turning on or off” genetic processes that can lead to cancer (Jones and Laird, 1999). It is also possible – and this is the point of epigenetic studies – that altered gene expression can be inherited even when there is no change in the DNA sequence (Baccarelli and Bollati, 2010). Equally important in a criminological context related to research on life-course developments and the emergence of crime related tendencies at certain points in time, in utero exposure to environmental toxins has been shown to impact genetic expression in the case of animal studies (Baccarelli and Bollati, 2010). The point here is that the environment can change the phenotype, beginning with the regulation of gene expression, which can be passed to the next generation, and that gene expression is not immutably fixed. This can occur even when the gene itself is not changed, meaning measuring the gene does not capture how the environment has altered the expression of the gene. This observation implies that the environment plays an important role in modifying genes and gene expression. Based on this type of research, green criminologists (Lynch and Stretesky, 2014) have suggested that exposure to environmental pollutants has been found to play a role in modifying behavior.

Whether or not the environment modifies genes that may be related to behaviors such as crime is currently unknown, and such research has important implications concerning the

environment-gene interaction effects that potentially occur that may be related in various ways to crime-prone behaviors. We know of no research study that has examined this particular observation related to genes that are believed to play a role in influencing criminal behavior.

One of the facts that epigenetic research also exposes is that genetic inheritance isn't straight-forward. Even many of the basic biological structures of the human body are not fully or even mostly genetically determined. For example, as Bell and Spencer (2012) indicate, twin-based epigenetic research suggests that heritability of CpG-site-specific DNA methylation, a hallmark epigenetic phenomenon, is "12 to 18% in blood, 5% in placenta, and 7% in HUVECs" (human umbilical cord). In other words, mean DNA methylation inheritance is relatively low. Given that even with respect to the basic biological structure of the human body, genetic inheritance plays a small role in determining outcomes, there is probably strong reasons to suggest that the relationship between gene inheritance and crime would be much lower, since, after all, crime is a social category and therefore fluctuates across time and place due to its social construction. These potentially and relatively small genetic effects on crime is, perhaps, a reason to look elsewhere for the "causes" of crime.

While there are still many unanswered questions about the exact epigenetic processes that may influence criminality, this research leaves open a largely unanswered criminological question as well: What might an integrated radical-biosocial explanation of crime that takes account of these observations look like? There are a number of potential answers to that question, but one option that links biosocial and radical criminological explanations follows.

Structurally, in the modern world the organization of production reflects the predominant global form of economic production, capitalism (Dunn, 2014; Oantich and Gindin, 2012; Wallerstein, 1974). That observation is important because research has both empirically and theoretically addressed the ways in which the development of capitalism influences the generation of pollution (Foster, 1993). In turn, numerous studies indicate that pollution is unequally distributed and is related to community class, racial and ethnic composition (e.g.s, Crowder and Downey, 2010; Daniels and Friedman, 1999; Downey, 2005; Hayanja, Zeliadt and Backhas, 2013; Morello-Frosch and Jesdale, 2006; Smith, 2009). Moreover, and at the same time, the geographic distribution of classes, races and ethnic groups is structured by capitalism in various ways (Browette, 1984; Peet, 1975; Smith, 2008), meaning that class also has a geographic distribution. In addition, and with respect to the study of street crime as an example, the concentration of those types of crimes also varies across class, racial and ethnic groups. Combined with epigenetic arguments, the unequal distribution of pollution geographically and socially (ie. its class, race and ethnic distribution) may generate outcomes that influence street crime consistent with what is known about the correlates of crime, which may be capable of explaining spatial and social patterns of crime consistent with arguments from both radical and biosocial criminology.

The argument that capitalism may influence how genes are expressed and is altered by pollutants, and how those genetic expressions as geographically distributed relative to pollution, is an interesting idea, one that illustrates that, for instance, capitalism has extraordinarily far reaching impacts on society and people. Numerous empirical studies indicate a relationship between capitalism and the production of ecologically disruptive impacts (Jorgenson, 2003, 2008, 2009). Moreover, following World War II, the chemical pollutants that capitalism generates have increased with the expansion of the treadmill of production which is based on the escalating use and disposal of chemicals and fossil fuels (Schnaiberg, 1980). Many of those pollutants can have epigenetic effects, some of which were noted earlier.

This potential connection between capitalism, pollution, the environment, genes and behavior should not be rejected by critical criminologists simply because it involves reference to biological concepts as part of explaining how this process unfolds with respect to the production of crime. What this view suggests is that the structure of society and *how that structure promotes the production of pollutants* that have adverse and perhaps long term biological consequences is an important consideration that connects environment-gene relationships in ways that have not been

previously explored in the biosocial criminological literature. Such a view also illustrates, as Lynch and Michalowski (2006) suggest, the various ways in which radical explanations are relevant to mainstream explanations of crime, and that radical criminology can capture and remake existing explanations in ways that emphasize their radical implications. On this point, for instance, epigenetic research modifies the traditional criminological proposition about genetic influences, since it suggests that genes and gene expressions can be changed by environmental conditions and that, therefore, the effects of genes on behavior are not stagnant but rather are subject to being changed by environmental conditions and – in reference to radical explanation – class, race and ethnic locations within social structures. In this sense, it is necessary to acknowledge that the interaction of genes and environment (measured in economic and ecological terms, ie., class, pollution), may possess some probability of affecting crime. Some varieties of critical criminology which draw on chaos theory (e.g., Milovanovic, 1997, 1996), and “constitutive criminology” as well (Henry and Milovanovic, 1991) include assumptions that allow for the broad recognition that the “space” crime occupies is diverse, folding, bendable, or dimensional, and reflects efforts to mirror complex ideas related to time and space found in physics. These approaches, largely described as non-linear and post-modern, recognize that explanations of crime involve acknowledging that outcomes such as crime are probabilistic, without incorporating positivistic concepts such as causation. Exactly how these types of critical approach can or would incorporate gene-environmental interactions is potentially interesting to contemplate, but are well beyond the scope of the current analysis and await the contributions of others to elucidate.

In terms of describing and understanding crime, the relationships described above between genetic expression, social class, environmental pollution and so on is a probabilistic rather than a deterministic relationship. Moreover, it should be recognized that because crime is in the first instance socially constructed by law and by the application of law, the relationship in this genes-environment-social factors-crime matrix are modified by the official processing of crime or its social construction, indicating that official data concerning crime may not be the best data for assessing these potential associations.

Assuming an environment-gene relationship exists for crime, the clear policy implication is to undertake economic and social programming and restructuring that would limit the impact of negative environmental conditions (e.g., pollution) on gene expression. As Carrier and Walby lament, traditionally the biosocial approach leads to social control policies that tend to target “problem populations,” and this is certainly a concern. In the present argument, however, that problem can be averted through correct interpretation of the environment-gene interaction. Since “crime related genes,” in this view, are only activated or changed by detrimental economic and social environments, the policy response should involve re-engineering economic and social relationship in positive ways, and must not be translated into arguments which suggest that increases in punishment, policing or any other criminal justice policy will be a viable remedy to the problem of crime. The remedy for crime – if this argument turns out to hold water empirically – would be policies that impede the development of detrimental environmental conditions (ie., social, economic and ecological – pollution) that influence genetic expression should be explored. Other positive effects of this type of social and economic policy would include improved health and decreased social and environmental injustice.

On the cautionary side and in light of comments offered earlier, this integration of Marx and biology should not be taken to suggest that the “causes” of crime will become definitively known as a result of such research. Such studies may indicate that in given conditions, the interaction of environment and genes influences crime in some ways. The question that remains is how much of an influence that interaction exerts, and, given the size of such an effect, whether it has important policy implications and relevance. That means that the interaction not only needs to be found to be statistically significant *in well specified models*, but that the interaction produces a large enough effect to be of concern. Many studies in criminology find factors believed to promote crime, and the question is not simply their statistical relevance but whether the effect is large enough to adversely

impact the volume of crime in society and thus justify doing something to remedy that situation. A limitation of this traditional “theory testing” approach is that criminologists have not reached an agreement about how large a statistical effect must be to justify translating criminological research into policy. Psychological research, however, suggests several relevant effect sizes for consideration (Ferguson, 2009). Likewise, in the medical literature, such an agreement about effect size has been reached with respect to how much of a difference exposure to some noxious conditions must make to the prevalence and incidents of diseases in society to justify a policy response. It would be useful to have that kind of standards within criminology, and not to leave that decision up to the authors of individual studies.

Looking Beyond Street Crime

Of concern to most varieties of critical criminologists with respect to the biosocial literature is its exclusion of certain kinds of crimes – specifically white collar/corporate/green/state/state-corporate crime – from biosocial explanation, and this becomes an important aspect of the critical criminological critique of biosocial criminology. If, indeed, the explanations of biosocial criminology have merit as an explanation of crime more generally – and here we assume by the use of the term “crime,” biosocial criminologists do not *only* mean street crime but its various other manifestations – corporate crime, white collar crime, green crime, state crime – then biosocial criminologists are obligated to make some effort to explore how the gene-crime relationship influences these crimes as well. In the mainstream criminological tradition, crime is, to be sure, normally defined as a violation of the criminal law, restricting criminological analysis to certain behaviors, which typically has caused criminologists to focus on explaining street crimes, and exhibiting the long-standing class bias that has come to define criminological theory (Lynch, 2015). In social constructionist literature and various versions of critical criminology, there has long been a critique of that focus on the crimes of the powerless and the exclusion of research in the crimes of the powerful. Thus, part of the conflict between critical criminology and biosocial criminology is hinged on the issue of defining crime and whether an “appropriate” definition of crime should include or be expanded to the crimes of the powerful, which are not normally defined by the criminal law, but are found in non-criminal regulations.

For critical criminologists of all varieties there is something suspicious about explanations of crime that only examine street crime among the lower strata of society. Now, such a focus *might be reasonable if*, as we suggested above, biosocial explanations posited that the lower strata of society suffered from particular kinds of social structural and economic stresses that induced certain genes to act or change in transcription, producing specific types of crime among certain populations. Absent that condition or specific hypothesis, however, there is no reason why the population of offenders biosocial criminology examines ought to be almost entirely composed of lower class individuals.

Here, the genetic explanation cannot fall back on the argument that crime appears in certain ways because it is a social construction, and that outcomes such as corporate, political, green, etc., crimes are not really crimes from the social constructionist perspective. In making such an argument, biosocial theory is effectively suggestion that crime is indeed a social construction, and accepting an argument consistent with critical criminology. Here, we could say that biosocial criminology wants to have its cake and eat it too. If biosocial criminology was to suggest that crime is a social construction, then they must take that concept of crime into account, which would require paying attention to how crime is constructed socially, which requires recognizing that this definition of crime is not objective, and that there are other deleterious behaviors quite similar to legally recognized crimes (crimes of the powerful) that also require explanation (for analysis and discussion of the concept of crime see, Lynch, Stretesky and Long, 2015).

In terms of the debate between critical and biosocial criminology, as Walsh and Wright suggest, this kind of argument about the definition of crime is a chief difference between critical and biosocial epistemology, and resorting to a social constructionist perspective for certain crimes would

erase distinctions between critical and biosocial criminology. We cannot say why biosocial criminology neglects crimes that relate to the exercise of power. The potential explanation is that biosocial criminology views crimes of power as being different than street crimes and requiring different kinds of explanations. But why this should be true in a biosocial perspective is unclear. Are there certain kinds of crime which are not influenced by genes? Why should genes affect some crimes and not others? Are the thefts of the street and suite criminal so different that one is clearly produced by genetic influences, while the other kind of behavior (crimes of the powerful), which is also a theft, is for some reason excluded? These are important issues that biosocial criminology has not been able to successfully explain. As a more specific example, there is to our knowledge no biosocial explanation of state or state-corporate crime, which have been important concerns in the critical criminological literature.

Whether or not epigenetic effects produce corporate, white-collar, green or state crime is an open question, and given the kinds of research that has been carried out on these crimes, that question cannot be answered at this time. Equally important are questions related to how power structures influence the production of chemical pollutants that possess epigenetic impacts. How or whether biosocial criminology addresses those kinds of questions remains to be seen. Until biosocial criminology effectively addresses why it does or does not apply to the crimes of the powerful, critical criminology and biosocial criminology will continue to be at odds with respect to the kinds of crimes criminological theories can and should address. [5]

Conclusion

There is much to be worked out with respect to how the environment and genes interact, and whether that interaction has an appreciable effect on crime. As we have suggested, there is evidence that the environment conditions the expression and modification of genetic materials, but whether or not that process relates to modifying genes that may be related to influencing crime is yet undetermined. For genetic analysis to make further contributions to the analysis of crime, such analysis will be required. Moreover, we have suggested that biosocial arguments can be enhanced by considering how factors related to crime described in radical criminological and green criminological literatures may become relevant to biosocial criminology. Whether or not that type of discussion occurs has much to do with the ideological inclinations of researchers in those criminological subfields.

ENDNOTES

1. We would like to thank epigeneticist, Dr. Ashley E. Culver-Cochran, for reviewing and providing comments on portions of this paper. We would also like to thank the reviewers and editor for their comments and suggestions.
2. While biosocial criminologists have examined the class-crime intersection (Walsh, 2011), and make reference to Marx's position on human nature, the outcome is far from an integration of Marx and biology.
3. As noted, there are a variety of sub-areas within critical criminology. As a result, it is not possible to address the potential connections between sociobiological explanation and each of these subareas in the present discussion. We believe that research in those areas should take our comments into consideration in addressing the fit between sociobiology and specific types of critical criminology, and that one paper cannot sufficiently address all of the potential points of integration and dissimilarities.
4. The framing of a critique or an integration of critical and biosocial criminologies must pay attention to the fact that varieties of critical criminology in particular make different epistemological, metaphysical and ontological claims. It is, therefore, impossible to remedy or remediate the entire range of disagreements between varieties of critical criminology and biosocial criminology. Here, we deal with this disagreement from the perspective, as we note, of particular types of radical criminology and green criminology in which there is a preference for an epistemological preference within the philosophy of science. On this point, a reviewer asked us to comment on the following: "Where's is the post-positivist and post-modern traditions as reflected the author's argument?" In response, it should be clear that we have indeed not taken up those latter views here. By post-positivism we understand the idea of a critique of what we shall call "stringent objectivity" associated with positivism. The postpositivist critique, however, does not in our view reject objectivity, but qualifies objectivity by addressing, in the tradition of Einstein (1954), the idea that knowledge is a product of the interaction between the observable and the observer. The other modification in postpositivism, well known to many, is the perspective taken by Karl Popper which rejected the idea of verification and replaced it with the idea of falsification. Thus, while there are some technical differences between positivism and postpositivism, in the true sense, postpositivism is not a rejection of the scientific method, but proposes qualifications to more traditional positivist assumptions. In postmodernism, the critique goes much further, and in particular is associated with rejecting the idea of an objective reality, especially one that is linear. To be sure, that approach has been applied within some variants of critical criminology. Here, it is impossible to review in its entirety the postmodern critic or its applications within critical criminology. For us, the postmodern suggestion that all reality is a product of unique historical, cultural and political discourse does not apply to all conditions. To be sure, that critique is relevant to the concept "crime," which we acknowledge in this manuscript, but where we do so, we frame that argument with respect to the literature on the social construction of crime which pre-dates post-modern critical criminology.
5. Here, we have no specific suggestions as to how biosocial criminology can address the crimes of the powerful. Clearly, in our view, the crimes of the powerful are the product of political economic factors. One cannot, for example, explain the widespread dispersion of green crimes committed by corporations across time and space as a function of genetics. Biological/genetic ideas related to survival, for instance, would suggest that humans must have a pre-disposition to survival, and that therefore behaviors that damage ecosystems extensively are inconsistent with that genetic survival instinct. It might be plausible, then, for biosocial criminologists to argue – and this we believe might be a great stretch of biosocial theory – that those who make decisions to harm the ecosystem have a set of genetic structures that facilitate ecological destruction. To our knowledge, no such set of genes has been identified, and again, would be implausible from the perspective of survival, particular

since for the bulk of their existence, humans lived in environments where ecosystems provided the basis for life, and the vast majority of

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