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Biosocial Criminology Versus the Constitution

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BIOSOCIAL CRIMINOLOGY VERSUS THE CONSTITUTION

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Abstract

The continually emerging field of biosocial criminology provides a basis for productively merging biology with sociological reasonings for criminal behavior. Mainstream research in criminology focuses on environmental factors as the sole reason individuals exhibit antisocial behavior patterns and may ultimately commit crimes. Criminological research has travelled in this direction for decades. The current climate within this community subscribes heavily to the notion that biology has very little to do with why people behave the way they do, and if it did, government control would be the norm. The nature of biocriminology opens a door through which constitutional issues may enter. Conventional criminology envisions a dark side to this aspect where search and seizure and due process questions exist, similar to intrusive issues recognized in early 20th century legislation. Questions of how and when biological samples are collected and from whom suggest the potential for a slippery slope into unreasonable access by the government. Biosocial researchers do not intend this. The purpose of biosocial research can and should enhance traditional criminological theory, thus, potentially offering more realistic solutions to social challenges. Addressing current issues such as crime rates in disadvantaged areas, incarceration and recidivism rates, and challenges that affect the mentally ill, reveals possibilities that may provide intervention by offering viable treatment protocols rather than endless explanations. It is important to create solutions that bypass political or ideological motivations. The goal is to capitalize on this integration in such a way so as not to violate the constitutional rights of the individuals who would receive the most benefit.

Keywords: biosocial criminology, civil rights, biology, genetics

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Biosocial Criminology Versus the Constitution

This research will analyze constitutional implications of integrating the results of biosocial research into the criminal justice system. Biosocial criminology integrates conventional sociological and environmental theories of crime and criminal behavior with biological reasoning that, to varying degrees, underlie behavior. By combining the two, biosocial research offers more viable explanations that support, rather than repudiate, conventional criminological theory. Potential exists for identifying programs that might divert an individual from a life course of criminality. For example, a vast amount of criminological and biological research, regardless of theoretical perspective, identifies anti-social personality disorders as potential precursors to criminal behavior (Barnes & Boutwell, 2015; Beaver, Barnes, & Boutwell, 2015; Ferguson; 2010; Fishbein, 1990; Jeffery, 1959a; Meldrum, Trucco, Cope, Zucker, & Heitzeg, 2017; Morley & Hall, 2003; Pratt & Cullen, 2000; Wright, Tibbets, & Daigle, 2015). The research, of course, is not definitive, but certainly represents a risk factor. Findings throughout scientific literature indicate that certain behaviors, such as aggression, remain stable throughout the life course (Tuvblad & Baker, 2011; Wright et al., 2015). Upon consideration of an indicator like aggression as a backdrop for crime control and prevention strategies, one can expect conflict between the biosocial research community and the criminal justice system. This paper explores reasoning that fuels this conflict, what biosocial research offers criminal justice, legal analysis pertaining to the use of biosocial data to inform decisions and sentencing, and possibilities for prevention and diversion strategies that conform to the constitutional rights afforded to all citizens.

The following explanation provides an example of the limitless possibilities for identifying the potential for criminal behavior at a young age. People, using children as an

example, who have been diagnosed with attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), conduct disorder (CD), or callous unemotional (CU) traits—collectively anti-social personality disorders (ASPD)—early in life are much more likely to commit crimes than individuals who do not exhibit these characteristics. Once these traits are identified, it is possible to make comparisons between those who have been diagnosed and those who have not. This is accomplished by performing MRI imaging of the brain along with visual aids shown to each child. The child is shown pictures of various situations, such as a picture of a puppy or someone crying, that should produce feelings of happiness, joy, anger, empathy and so forth. Images are made of which parts of the brain activate while the child views the pictures. Children who are not diagnosed with ASPD show certain brain activity that can be compared to children who are diagnosed with ASPD. The comparison shows what an unaffected brain looks like and what the brain looks like when ASPD has been diagnosed.

To take this a step further, some aspects of ASPD have been shown to have a genetic basis. Studies also show that, to some degree, children who experience abuse or exposure to cigarette smoke (as examples), show changes in their genes that affect brain function. These changes can show up as ASPD. Specifically, testing DNA can potentially show which combinations of genes produce which disorders. This occurs by comparing genetic analysis to the brain images to see which connections can be determined. To make this work, DNA records would be created from the blood already taken from every baby born in the U. S. Then suppose that observations made by medical professionals of family characteristics and interactions are recorded and entered into database records. Once these records exist, connections can be made between suspicious family behavior and a DNA analysis of a child. Some of this information already exists in medical records. Adding a DNA profile of every child born simply adds

another piece of data to the record. This conceivably creates a road through which the government can intrude into the lives of citizens. Today's technology, policy climate, access to large databanks of information, and changes that are taking place in health care provide a short jaunt toward unconstitutional intrusion into the personal lives of everyone. Indiscriminate use of this highly personal information can bring unwanted, unnecessary, and unconstitutional scrutiny to persons of interest, just because.

The concept of using discrete biological markers, genetic and otherwise, to anticipate developmental disorders insinuates challenges into methods of crime control and the maintenance of due process. The possibility that such evaluations may predict the potential for life course criminality fires into the heart of the Packer model—crime control versus due process—a stalwart base in the study of criminal justice (Packer, 1964). The data reported must provide a balanced discussion of the issues. Identifying potential criminals by genetic signatures presents questions of ethics (Morley & Hall, 2003). Care must be taken to avoid government interventions into such practices as reproductive rights, pre-emptive interventions like incarceration or forced medical treatment, or racism based on scientific determination. The presentation of ethical, unbiased research will allow readers to draw their own conclusions of the viability of the proposed process. Most importantly, any policy that might be considered practical must not regress to historical philosophies, such as eugenics, that decried biosocial solutions recognized in the early 20th century. It is important to create moral and ethical solutions that bypass political or ideological motivations. The goal is to capitalize on this integration so that it does not infringe upon the constitutional rights of the individuals who would receive the most benefit.

Statement of the Problem

Francis Crick and his colleagues, the Nobel Prize winners who discovered the familiar double helix construct of the DNA molecule said this:

> "You," your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules (Crick, 1995, p. 3).

This profound statement by one of the leading scientists in genetics states simply that the brain controls everything. It controls how the body moves, thinks, and feels through the network of neurons, axons, synapses, and neurotransmitters that comprise its structure and function. The brain, as well as the entire human body, functions as it does because of the genomics of the organism created at the point of conception. When one considers the process that creates the human organism, one should see how research in biocriminological areas can address how biology (Beaver, Barnes et al., 2015; DeLisi & Vaughn, 2015; Fishbein; 1990; Walsh & Wright, 2015a), behavioral and molecular genetics (The 1000 Genomes Project Consortium (GPC), 2015; Beaver, Nedelec, da Silva Costa, & Vidal, 2015; Coyne & Wright, 2015), neuropsychology (Fishbein, 1990; Månsson et al., 2016; Vaske, Galyean, & Cullen, 2011; Whitten, 2013; Wilson, Hayes, Biglan, & Embry, 2014), and evolutionary psychology (Durrant & Ward, 2015; Tooby & Cosmides, 1992; Wilson et al., 2014) affect individuals. Using the integration of these, and other disciplines, it becomes possible to develop programs and interventions that may conflict with the constitutional rights of individuals. One can also begin to recognize the challenge of identifying specific genetic effects due to the complexity of the numerous physiological interactions within the human organism. The importance of integrating the outcomes of these studies with preserving affected individuals' privacy and due process

protections cannot be overstated. The intention of this research endeavors to address the potential of such an integration.

Purpose of this Research

Using biological data in criminal justice creates a path for medical professionals, educators, law enforcement, and the judiciary to intrude upon the lives of citizens. The public will, undoubtedly**,** take offense to such processes. Conflict within society today exists between law enforcement, the government, and the citizenry who decry perceived overbearing controls placed upon them by that same government. Law enforcement at all levels, federal to local, maintain responsibility to provide crime control and protection strategies to the public. Conversely, the citizens that law enforcement protects demand their constitutional rights to privacy and due process. These comments describe a baseline representing the perpetual nexus between crime control and due process as explained by Packer (1964). Packer's oppositional models, developed among the sweeping due process and civil rights decisions made by the Warren Court in the 1960s (Aviram, 2011), provide continuous fodder for discussion throughout the criminal justice system, as it will in this context. Griffiths (1970) suggested that Packer's theory would be better described as "the police perspective and the ACLU perspective" (p. 362). Despite the age of these two documents, the relevance of both remains apparent. One can see a conflict brewing. Issues that biosocial criminology must confront, as with all criminological disciplines, are the Fourth Amendment to the Constitution which states, "The right of the people to be secure . . . against unreasonable searches and seizures . . ." and the Fifth Amendment to the Constitution which states, "No person . . . [shall be] deprived of life, liberty or property, without due process of law . . ." The rights of individuals must be protected while ensuring the safety of the public. Neither side of the due process versus crime control debate is more important than

the other. What must take precedence is the balance that must be struck between the two without sacrificing due process and rights to privacy for the citizenry.

Research Questions and Rationale

The continually emerging field of biosocial criminology provides a basis for productively merging biology with sociological reasoning for criminal behavior. Mainstream research in criminology focuses on environmental factors as the sole reason individuals exhibit antisocial behavior patterns and may ultimately commit crimes. Criminological research has travelled in this direction for decades. The current climate within this community subscribes heavily to the notion that biology has very little to do with why people behave the way they do. Thus, the continuing nature versus nurture debate continues. Some softening is beginning to occur between traditional theorists and biosocial theorists (Beaver, Barnes, et al., 2015; Rocque & Posick, 2017). Published research drives scholarly recognition. The most visible research remains within the study of environmental influences while review still tends to be more limited for biosocial submissions (Beaver, Nedelec, et al., 2015; Wright & Cullen, 2012). Tielbeek et al. (2012) also suggest bias exists within the academic publishing community that may limit the availability of research that supports identified replication of results, an important metric for data viability.

Biological research incorporates several disciplines, each with its own potential contribution to predicting behaviors (Barnes & Boutwell, 2015; Beaver, Barnes et al., 2015). Despite the burgeoning wealth of research, the glaring question among the debaters remains, "How effective can biology be when predicting behavioral outcomes?" What seems obvious is that biosocial theory can enhance traditional criminological theory, thus, potentially offering more realistic solutions to social challenges (Vaughn, 2016). Addressing current issues such as

crime rates in disadvantaged areas, incarceration and recidivism rates, and challenges that affect the mentally ill, reveal possibilities that may provide actual solutions by offering a treatment protocol rather than endless explanations. Widespread acceptance of biosocial criminology's broad input may perhaps unravel some of the mysteries that plague the criminal justice system and allow for effective policies.

Definitions

Epigenetics—Changes in gene expression that are affected by environment. The change occurs through a biochemical process that does not alter the DNA sequence. Changes may or may not be passed on to progeny (Beyond the Genome, 2015; Bird, 2007).

Gene Expression—Outcome of transcription of information to the organism that affects ultimate function of the organism (Barnes, Boutwell et al., 2014; Coyne & Wright, 2015; Griffiths, 2015).

Genome—The complete categorization of an individual's DNA sequence (National Human Genome Research Institute, 2015). Comparisons can be made among specific populations, as well as evidenced by research completed by the 1000 Genomes Project Consortium (GPC, 2015; Sudmant et al., 2015).

Nucleotide—One of four chemicals found on DNA. The molecules always align into two pairs that are not interchangeable. Each pair, can change places with another pair (Griffiths, 2015).

Phenotype—The outward appearance of gene expression in a particular genotype (Griffiths, 2015). Traits, external such as physical appearance or internal such as behavioral, are phenotypical.

Single Nucleotide Polymorphism (SNP)—A location on a strand of DNA where the position of base pairs is not duplicated. Such changes cause modifications in output that affect the phenotype of the organism (GPC, 2015; Griffiths, 2015; Sudmant et al., 2015; Tiihonen et al., 2015). Millions of SNPs occur in the human genome (U. S. National Library of Medicine, 2018). For example, SNPs allow for identifying disease markers or possible susceptibility to toxins.

Stem Cells—A cell that can differentiate into other cell types. The biological processes, stem cells can remain undifferentiated or become specific cell types such as muscle, blood, or brain.

Stem cell research indicates that repair of various tissues can be intensified using stem cell therapy (National Institutes of Health, 2016).

Literature Review

This literature review presents a collection of recent and past research and commentary pertaining to biosocial criminology and its meaning to and integration with various aspects of the criminal justice system. The reality of biology that informs criminology, and thus, the justice system, sets the stage for, what some might consider, fiery controversy. The biosocial community and its disciplinary affiliations provide an additional layer of understanding to criminal behavior. Neuroscience, behavior and molecular genetics, biology, and evolutionary psychology inform biosocial research (Albert, Chein, & Steinberg, 2013; Barnes & Boutwell, 2015; Barnes, Boutwell et al., 2014; Beaver, Barnes, et al., 2015; Coyne & Wright, 2015; DeLisi & Vaughn, 2015; Durant & Ward, 2015; Heylen, Pauwels, Beaver, & Ruffinengo, 2015; Osorio & Duster, 2005; Vazsonyi & Ksinan, 2017). Mainstream criminology has, for decades, maintained the belief that biology has very little to contribute to the study of criminal behavior (Barnes, Boutwell et al., 2014; Burt & Simons, 2014; Coyne & Wright, 2015; Rose, 2000; Walsh & Wright, 2015a, 2015b). Cynics may suggest that attempts at interventions will direct unwanted scrutiny toward the individual. This view dovetails with long-held beliefs within traditional criminology that suggest all biologically related solutions are succinctly reductionist or determinist (Agnew, 2012; Barnes & Boutwell, 2015; Carrier & Walby, 2014; Dauphin, 2003; Ferguson, 2010; Fishbein,1990; Heylen et al., 2015; Rafter et al., 2016; Ridley, 2003a, 2003b; Rocque et al., 2012; Vaske et al., 2011; Walsh & Wright, 2015a, 2015b); therefore providing little to no insight into the current discussion.

Understanding the historical progression of biology and crime provides insight into the challenges still seen within the criminological community. In the mid-20th century, biological associations were relegated to its historical annals as sociological explanations replaced

everything biological (Platt & Takagi, 1979; Rafter, et al., 2016; Walsh & Wright, 2015b). Tooby and Cosmides (1992) call this shift in criminological thinking the standard social science method (SSSM); it ignores any concepts related to anything but sociological constructs. Wright and Morgan (2015) vehemently identify the ideological divide among sociologists, anthropologists, and the biosocial community. The ultimate fear encompasses the possibility of a return to a "new eugenics" (Rose, 2000, p. 7) such as that promulgated by Nazi Germany (Rafter, 2008). Moving beyond these ideological limitations becomes necessary so that the primary goal of criminology can be delivered to the criminal justice system.

The balance of the literature addresses the legal and ethical ramifications of an integrated criminology. Criminology must provide data that can balance the boundary between due process, according to the Constitution, and crime control, the reason for the existence of the criminal justice system in the first place (Griffiths, 1970; Packer, 1964). Protecting individuals from the over reach of the government should be the foundation of consideration when applying biosocial principals (Adams, 2015; Carrier & Walby, 2015; Church, 2017; Cwik, 2017; Lanphier, Urnov, Hacker, Werner, & Smolenski, 2015; Norrgard, 2008; Jones, 1999; Vaughn, 2016; Welsh, & Farrington, 2012; Wright, et al., 2015). One can see the challenges that surfaced as DNA profiling became widely used along with the use of criminal databases to record those profiles (Guillen, Lareu, Pestoni, Salas, & Carracedo, 2000; Jost, 1999; Murphy, 2013b; Osorio & Duster, 2005). *Maryland v. King* (2013) addressed such an issue when the U.S. Supreme Court overturned the appellate court's ruling that the collection of King's DNA subsequent to his arrest was an invasion of his privacy. Issues pertaining to privacy, understanding outcomes via the consent process, and ethics are clearly abundant.

What is quite clear based on the growing body of biosocial research, is that biological factors are inseparable from environmental influences when considering any behavioral direction, including criminality (Barnes, Boutwell et al., 2014; DeLisi, 2012a; Fox, 2017; Meldrum et al., 2017; Ridley, 2003a, 2003b; Tiihonen et al., 2015; Wright & Cullen, 2012). An example of this is the gene X environment (GXE) philosophy which has been recognized in biosocial literature (Barnes & Jacobs, 2013; Beaver, Schutt, Vaughn, DeLisi, & Wright, 2012; Beaver, Wright, & DeLisi, 2008; Fox, 2017; Simons, et al., 2011; Rocque & Posick, 2017) for many years. This correlation indicates an intrinsic relationship between genetics and environment. To explain further, some individuals might engage in behavior considered daring or dangerous, whereas others do not. Personalities that engage in these behaviors influence the environment around them. Genetic influence creates the personalities that exhibit the risky behavior. This same genetic influence perpetuates the hazardous environment, in turn exacerbating the behavior. Environments include familial relationships, peer group relationships, chemical exposure in utero, maternal stress, and so on. Detractors of biosocial research seem to overlook the literature that indicates the symbiotic relationship between genes and the environment.

Research has begun to identify biological and neurological markers that may predict a life course of anti-social personality disorder, bi-polar disorder, attention deficit hyperactivity disorder, and other “brain-based disorders” (DeLisi, 2015, p. 172) that commonly correlate to criminal behavior. Armed with such information, it becomes possible to alter the potential for life course criminality in the early stages of life. Neuropsychological techniques like cognitive behavioral therapy can produce changes in brain structure through its natural plasticity (Månsson et al., 2016; Vaske et al., 2011; Whitten, 2013; Wilson et al., 2014). This results in a

"physiologic response (biological) to an external stimulus (environmental)" (Vaughn & Groom, 2011, p. 402). Prevention science research shows some success when studying how underlying neural pathways affect "malleable mechanisms that underlie behavior change" (Fishbein & Dariotis, 2017, p. 2). These interventions support the idea of cognitive therapy, particularly when used to target specific behaviors early in life. Currently, the benefits appear limited. The authors suggest further studies may solidify the evidence already revealed. A possible symbiosis between prevention science and biosocial criminology could provide significant contributions to crime prevention policies and interventions. Coordination between the two may be bridged by utilizing intervention policies and programs initiated within that field (Fishbein & Dariotis, 2017; Leve et al., 2017; Musci & Schlomer, 2017).

Historical Criminology and Biological Explanations of Criminal Behavior

Understanding the history and progression of biological explanations for criminal behavior provides a colorful background. The ongoing conflict between sociological and biological viewpoints in the study of criminal behavior becomes apparent, once one peruses the chronology. Many published authors of criminological research engage in the debate as to whether biosocial criminology has a place within the discipline. The debate can be vicious. Some reveal thinking that negates any contribution the biological disciplines might make to provide a better understanding of behavior (Nachshon, 1982; Carrier & Walby, 2015). Proponents argue that conventional criminology presents a more political motivation that follows liberal progressivism as an ideology (Fishbein, 1990; Wright & Morgan, 2015). As a case in point, Larry Summers, a former President of Harvard University, created a politically incorrect furor in a keynote speech made at a diversity conference. Summers reasoned that fewer women would engage in various mathematical disciplines because of innate differences in abilities

between men and women (Mackenzie, 2009). Ultimately, Summers resigned. There were various reasons for his action. One reason for his departure revolved around what he said in that speech and the media's interpretation that Summers was sexist. His comments were based on recognized academic research that supported what he said. However, Beaver and Nedelec (2015) explain that his delivery could have been less callous, and that he could have offered statements that qualified his position. The debate continues, and history provides an explanation.

Enlightenment and the Scientific Method

Nicole Rafter, author of the *Criminal Brain,* is considered one of the foremost criminology historians (Rocque & Posick, 2017). Rafter wrote prolifically about the progression of biocriminology. Rafter moved from being a staunch opponent of biological reasoning based on her historical knowledge, to providing a more current position of acceptance and necessity (Rafter, 1992, 2004, 2008, 2010; Rafter et al., 2016). The trajectory of biological explanations for criminal behavior began in the 18th century during the period in history known as the Age of Reason. Historically speaking, this social period brought about a shift in thought from theocratic ideology to an era of reasoning and empirical thought (Bristow, 2017). This period in world history is often referred to as the "long 18th century" (Enlightenment, n.d., para. 1) as it spanned the period from 1685 to 1815. The Enlightenment period promoted revolutionary thought in many areas, including ethics, philosophy, science, medicine, politics, and criminal justice. Recognizable names from the period include Isaac Newton, John Locke, Jean-Jacques Rousseau, Immanuel Kant, Benjamin Franklin, and Thomas Jefferson. The Enlightenment produced theories of the laws of physics, the concept of the social contract, rational choice, the French and American revolutions, the Declaration of Independence, and the Bill of Rights. Throughout this expanded century, criminal justice experienced changes as the classical school of criminology

emerged with Cesare Beccaria and Jeremy Bentham (Jeffery, 1959b). Bentham believed that punishment produced a deterrent effect and proposed reforms to alter methods of punishment. By focusing on crime and its legal ramifications, the classical philosophy of criminology viewed crime as a cost/benefit determination by the perpetrator (Pratt & Cullen, 2005; Schwartz, 2014, Wilson et al., 2014). This perspective fomented the basis for many modern criminological theories like rational choice, self-control, routine activities, strain theory, social learning, and differential association (Durrant & Ward, 2015). The medical profession, primarily physicians practicing early psychiatry (Jones, 2017; Nachshon; 1982; Rafter et al., 2016), began to use scientific methods to study the individual who exhibited criminal behavior. Experimentation became the basis for theories of behavior based on thoughtful reasons. Andersen and Hepburn (2015) describe this process as scientific method. This began a departure from the long-standing belief that sin, coupled with the wrath of God, caused abnormal behavior. Much of the non-theological speculation regarding criminality surfaced in the 18th century.

Understanding this historical trajectory of early scientific recognition of biological factors that might affect behavior provides an explanation for modern criminology's departure from accepting biological reasoning for criminal behavior. The progression from late 18th century psychiatry and asylum medicine to the eugenic beliefs that carried into the early 20th century developed through this historical process and allows for understanding the continuity of the modern conflict. The precursor to a biological study of crime began with these early physicians (Jeffery, 1959b; Rafter et al., 2016). The field of psychiatry provided the basis for later thought about how an individual developed into a criminal actor. Some of the case studies of the time included individuals who, for all intents and purposes, acted normally; well educated in some instances. Experts found that such persons could and did commit violently heinous acts without

any identifiable provocation. It was within these various contexts that terms like moral insanity developed (Nachshon, 1982; Rafter et al., 2016). Throughout the 19th century, this focus recognized that certain individuals did not fall into the same category as patients who experienced "delusions, hallucinations, depressions, and rages" (Rafter et al., 2016, p. 39). Thus, the early 19th century defined the discipline of psychiatry. The moral insanity diagnosis became commonplace at the time and provided the legal system with a vehicle for describing insanity defenses by experts (Jones, 2017; Rafter et al., 2016). From there, the scientific study of criminal behavior from a biological perspective emerged as phrenology. Positivism began its replacement of classical outlooks by introducing attempts at empirical reasoning.

Phrenology, Roots in Multiple Biological Disciplines

Phrenology took root in the early 19th century. This study of cranial contours correlated to areas of the brain that control behavior represented as faculties by phrenologists. As such, phrenology became the most comprehensive study of criminal behavior to date. Physician Franz Joseph Gall and his associate, Johann Gaspar Spurzheim, declared the following points:

- The brain is an organ of the mind
- The brain is an aggregation of about thirty separate organs or faculties, such as Combativeness, Covetiveness, and Destructiveness, that function independently.
- The more active an organ, the larger its size
- The relative size of the organs can be estimated by inspecting the contours of the skull.
- The relative size of the organs can be increased or decreased through exercise and self-discipline (Rafter et al., 2016).

Gall, Spurzheim, and others methodologically correlated the contours of the skull to segments of the brain; each represented particular faculties and correlated to specific behaviors. Propensities

for thievery, violent assault, and homicide existed as a faculty that could be read by the shape of the skull. The study of phrenology introduced a rudimentary understanding of biological underpinnings to explain criminal behavior. The brain became the central focus. Phrenologists incorporated many other scientific disciplines as evidenced by observations made from vivisection and autopsies.

Phrenology eventually fell short of scientific acceptance as social mores changed. The scientific community realized that the discipline explained everything about human behavior without refute. From a critical perspective, phrenology came to be seen as deterministic to the point of overshadowing free will (Rafter et al., 2016). Critics of modern biosocial criminology make similar claims (Platt & Takagi, 1979; Carrier & Walby, 2014). The phrenologists believed that everyone entered the world "with their faculties in harmonious balance" (Rafter et al, 2016, p. 56) and thus, did not engage in criminal behavior. An abnormal brain structure determined criminal behavior, and that structure could be attributed to familial inheritance, negative environment, or disease. They also believed in rehabilitation with proper guidance. Thinking behind this perspective might be correlated to what is known today as brain plasticity, a 20th century discovery (Collerton, 2013; Gajos, Fagan, & Beaver, 2016; Kellerman, 2013; Månsson et al., 2016; Sweatt, 2013; Wilson et al., 2014); the ability of the brain to process new information and adapting to that new information (Queensland Brain Institute, n.d). Balance could be restored to those whose faculties had degenerated. As a background for penal reform, they understood that deterrence as a punishment seemed ineffective and used their practice to recommend sentencing that included rehabilitation. Phrenology eventually gave way to ideas of cultism and snake charmers. Its unintended contribution to criminology resulted in an all-inclusive explanation for criminal behavior. Biocriminology owes its earliest roots to

phrenology through its use of biology to explain social behaviors (sociobiology), selective behavior (evolutionary criminology), and the effect of environment on behavior (Rafter et al., 2016).

Positivism and Cesare Lombroso

Positivism's scientific focus gained traction as Cesare Lombroso gained prominence with his overarching and controversial theories of how biology determined criminal behavior (DeLisi, 2012b; Jeffery, 1979; Rafter et al., 2016). Despite the notoriety created by various questionable theories, Lombroso became known as the father of criminology (Wolfgang, 1961). Lombroso's point of view carries over into the long-standing conflict regarding the benefits of biology when determining causes of criminal behavior (Ellwood, 1912; Fishbein, 1990; DeLisi, 2012b; Rafter et al., 2016). DeLisi (2012b) described Lombroso's work as the "good, the bad, and the ugly" (p. 1). What made Lombroso's work relevant were his many attempts to explain causes of crime and the correlations he made. Jeffery (1959b) explained that positivism incorporated numerous disciplines that looked like a curriculum for biology, sociology, psychology, and other sciences. This was Lombroso's good according to DeLisi (2012b). Lombroso established a bedrock of multi-disciplinary studies that fuels modern biocriminology. Where Lombroso fell short was in his belief that the criminal man was an evolutionary throwback, or atavistic. The criminal was underdeveloped from an evolutionary standpoint, and therefore, retained primitive animal instincts; he compared them to various aggressive plants and animals (Rafter et al. 2016). He also felt that these traits could lie dormant, in many cases, through social control, until a significant event triggered criminal behavior by the most degenerate individuals. Lombroso's concept of this used anthropological studies of human races as categorized by Carolus Linnaeus, a zoologist of the time, and Darwin's *Origin of the Species* that was published early in

Lombroso's career. This represents scientific racism; a common social perspective within the scientific community at the time. Lombroso's writings clearly indicate that he embraced that point of view. DeLisi (2012b) identifies this as the bad and ugly within Lombroso's purview. On the other hand, an important nuance within Lombroso's thinking provides early recognition of the effect of environment on genetic predispositions or GXE. He suggested that unaffected children grew out of radical behavior. This seems vaguely familiar in the context of adolescence-limited versus life-course criminality as evidenced by a sizeable body of research (Albert et al., 2013; Boutwell et al., 2013; Moffitt, 1993; Schwartz & Beaver, 2015; Wright et al., 2015). Additionally, it was clear that his scientific methodology was woefully inadequate. Contemporaries of Lombroso felt his work very nearly unworthy of recognition (Ellwood, 1912). Rafter et al. (2016) explain that Lombroso exhibited very little coherence among his various theories, none of which seemed to correlate to his underlying theory of atavism. Lombroso's view was that undesirables "should be removed from society for life" (Rafter, 2008, p. 290); this was clear in his writings. The 21st century finds Carrier and Walby (2014) claiming that "Lombroso's legacy is typically that of embarrassed and patronizing heirs" (p. 14). Biosocial criminologists, according to Carrier and Walby, leave behind atavistic determinism and replace it with what appears to be a more acceptable picture of the same. In other words, today's biosocial criminologists simply changed the vernacular contained in their research to what they call biopathologization [sic]; everything is a biological disease process.

Biocriminology and Eugenics

The greatest fear that confounds opponents of biological reasoning stems from the eugenics movement. The term, coined by Galton, a cousin of Darwin (Farber, 2008; Rafter et al., 2016), separately substantiated Lombroso's theories that supported ideas that certain

individuals were "unfit for society" (DeLisi, 2012b, p. 13). Galton's research proposed that superior individuals could be bred, and that social control could be restored through selective breeding. Animal breeders understood the process of selective breeding (Wilson et al., 2014). Eugenicists incorporated the breeders process in their beliefs that social control could be accomplished by government intervention into human reproductive strategies. Harry Laughlin, appointed as the assistant director of the Eugenics Record Office (Lombardo, 1985; Rafter et al., 2016), and one founder of the American Eugenics Society (Farber, 2008), published his Model Eugenical Sterilization Law in 1914 (Lombardo, n.d.). Individuals who were diseased, deformed, feeble-minded,[1] criminals, homeless, orphaned, and others, became targets for sterilization practices to control the socially unacceptable (Lombardo, n.d.). Eugenicists believed that by controlling reproduction, they could control various burdens on society that would dilute "old-stock America" (Sofair & Kaldjian, 2000), a view that supported scientific racism. Several notable entities of the time subscribed to or were involved in funding studies of eugenics. The Carnegie Institution funded eugenic research. John Harvey Kellogg (of the cereal company) and the American Breeders' Association also made financial donations. The American Association for the Advancement of Science (AAAS) offered its support. Preeminent figures such as Woodrow Wilson, Winston Churchill, and Alexander Graham Bell believed that the notion of selective breeding by government intervention contributed to the well-being of modern society and were strong proponents of eugenics.

As the eugenics movement flourished in the early 20th century in the United States, scientific reductionism became firmly entrenched. The scientific community fully embraced the

[1]To facilitate understanding, feeble-minded referred to the mentally retarded. Eugenicists believed that the feeble-minded should not reproduce and that the worst criminals were feeble-minded (Rafter, 2001). This ultimately led to methods of intelligence screening, known today as IQ tests.

idea that science could solve many of society's ills. Following this track, several states imposed legislation based on Laughlin's model for sterilization. Indiana became the first state to legislate for sterilization in 1907 (Sofair & Kaldjian, 2000). Nearly two dozen states enacted such laws by 1926, several of which imposed mandatory sterilization; procedures occurred when mental defect or certain criminal behavior presented. Three states allowed voluntary and involuntary procedures; another five maintained voluntary statutes for sterilization. One allowed consent from a family member if the individual was (not necessarily) considered incapable of providing consent.

Moving through the 1920s, eugenics began a slight decline but was recharged by Justice Oliver Wendell Holmes opinion in *Buck v. Bell* (1927). The plaintiff was an inmate in an institution. She was considered the feeble-minded offspring of a feeble-minded mother, and as a result of rape, bore a feeble-minded child. This case was a planned test case for the constitutionality of Virginia's Eugenical Sterilization Act passed in 1924 (Lombardo, 1985). Holmes' opinion affirmed the decision of the appellate court that state-sponsored sterilization did not violate the due process rights of the plaintiff or equal protection clause of the Fourteenth Amendment. The holding revived the eugenics movement in the United States. Paul Popenoe, a leading biologist in the 1920s and secretary of the Human Betterment Foundation (HBF) wrote extensively about the protection of hereditary lines and promoted eugenics as a solution (Stern, 2005). The HBF maintained that California's sterilization program, enacted in 1909, successfully exhibited how sterilization could improve the community (Popenoe, 1929). The practice of sterilization was considered as commonplace and acceptable as an "appendectomy or tonsillectomy" according to Popenoe (1929, p. 882). Holmes explained that "the principle that sustains compulsory vaccination is broad enough to cover cutting the Fallopian tubes. Three

generations of imbeciles are enough" (Buck v. Bell, 1927, p. 207). Popenoe also suggested that sterilization represented inmates who were "of a high enough type to be considered for future parole" (p. 882).

The consensus of eugenicists suggested that misfits, degenerates, people of color, and immigrants were all candidates for eugenic sterilization. The medical community exhibited support for the movement as evidenced by numerous articles published in the *New England Journal of Medicine*. An archival search for eugenics in issues spanning the years 1900 to 1945 revealed hundreds of articles that included commentary, editorials, and research. Further refinement of the search returned 35 original articles, 76 items of correspondence and book reviews (example: *The Chances of Morbid Inheritance*, 1934), and 48 editorials and other commentary. The scope herein does not allow the ability to ascertain the context within which eugenics is mentioned. However, accessible titles include *Sterilization of the Unfit* (editorial from 1936), *Sexual Sterilization in New Hampshire* (original article also from 1936), and Popenoe's *Eugenic Sterilization in California* (cited herein). Prolific publication within the medical community, also reflected by Sofair and Kaldjian (2000), the landmark case of *Buck v. Bell*, Laughlin's Model Eugenical Sterilization Law, and organizations like HBF fueled Hitler's enactment of the Law for the Prevention of Hereditarily Diseased Offspring (translation as cited by Farber, 2008, p. 244) in 1933. Germany, prior to Hitler's rise to power, prosecuted physicians for performing non-therapeutic sterilization. Involuntary sterilization began after the enactment of the law and targeted the mentally diseased, the epileptic, the deaf and blind, and the deformed. Throughout the 1930s, Germany sterilized hundreds of thousands of individuals. By the advent of World War II, sterilization devolved into involuntary euthanasia as evidenced by the death camps. Nicole Rafter defined this as, "criminology's darkest hour" (2008, p. 287).

By the end of World War II, 30 U.S. states had enacted sterilization laws that affected over 40,000 individuals; half of these were considered insane and the rest, feeble-minded (Sofair & Kaldjian, 2000). Experts began to criticize eugenics, and criminology turned nearly completely, to sociological explanations for criminal behavior. The Carnegie Institution withdrew its support for the Eugenics Research office in 1939 (Farber, 2008). Subsequently, the institution supported the growing field of genetics, including the work of the 1933 Nobel Prize in Physiology or Medicine winner, Thomas H. Morgan. Morgan, who identified the relationship between chromosomes and genes (Nobelprize.org, n.d.), chastised the movement. His argument emphasized eugenicists' claims of feeble-mindedness by suggesting that such a categorization could not be extrapolated singularly from any heritable trait without further research. Upon reading Justice Holmes in *Buck v. Bell* and Popenoe on sterilization in California,[2] among numerous others, one can understand the determination with which critical criminology finds biology suspect in understanding any etiology of criminal behavior. This point of view cemented the idea that incorporating biology into the study of criminal behavior was dangerous. Moving forward, sociology nearly completely eclipsed biology as a basis for criminological research. Such a discussion, however, is beyond the purview of this paper.

Lessons of Genetics

Winston Churchill, through a path fraught with chance, became Prime Minister of England (Arnn, 2017). He often imparted jewels of wisdom that represented life lessons. He was quoted as saying "both chance and choice play a large part in human affairs" (p. 3). He went on to say that if all had been fate, Hitler would have won the war since Hitler believed everything was fate. This lesson from recent history provides an important view of research

[2]California's law was repealed in 1979; however, not before some 20,000 sterilization procedures had been performed (Stern, 2005).

within the contemporary biosocial community. Chance encompasses the complexity of genetics while the choice, made by individuals, deliberate or not, of environmental influences drives the outcome. Jeffery's (1976) seminal work, *Criminal Behavior and the Physical Environment*, emphasizes environment as an effect on criminal behavior. A few of these environmental influences include substance abuse (Meldrum et al., 2017), ecological conditions (Boutwell, Nelson et al., 2017), abusive relationships (Vaske, 2017), and peer group associations (Nedelec, Park, & Silver, 2016). Children, of course, have no choice in many instances; yet are affected nevertheless.

The human genome does not exist in a vacuum. Nothing is predetermined. The importance of the human genome and its interaction with the environment in the study of criminology cannot be understated. Ridley makes the comment that understanding the genetic code defines living things "by the eternal replication of linear digital messages" in the form of "arbitrary genetic code" (2016, para. 2). This is the chance of genetic replication. Gene expression is only somewhat predictable; thousands of human phenotypes are impossible to predict with certainty. The environment selectively creates changes in gene expression in another area of study, epigenetics (Beyond the Genome, 2015; Bird, 2007; Singh, 2012; Sweatt, 2013; Walsh, 2009). Consider a comment made in the Beyond the Genome editorial. "Tackling disease using information on the genome alone has been like trying to work with one hand tied behind the back" (p. 273). Analogize this to GXE studies. The correlation between genetics and environment is exceptional; without including studies of the effects of environment, answers become elusive at best. This paper is by no means a technical treatise on genetics, epigenetics, biochemistry, neurology, psychology, or any other discipline mentioned. A few basics will

clarify the need for biosocial research. The tenets of biosocial criminology demand integration; its very nomenclature is self-explanatory (Coyne & Wright, 2015; Fox, 2017).

Molecular Genetics

Molecular genetics provides a look into the foundation that supports all behavior. Following are a few basics of molecular genetics and its contribution to biosocial research. To offer some context, the Human Genome Project (HGP) began in 1990 and took 13 years to complete (HGP, 2017). The project catalogued the 20,000 plus genes that are contained in human DNA. Data from the HGP extends knowledge to specific programs that address other areas of research. The International Genome Sample Resource (IGSR) project, part of the 1000 Genomes Project Consortium, contains the most comprehensive database of human genomes (IGSR, n.d.). Ridley makes the comment that "genes are not the puppet masters, nor blueprints" (2003b, p. 6). Realistically, regardless of the thousands of genes mapped through the HGP, complexity dictates the variability of outcomes when considering GXE. The initial GPC project examined the genome of approximately 2,500 individuals from across the globe to identify variances within populations (GPC, 2015). The base frequency of variance measured around 1%. The mathematical possibilities of 1% of the population represent millions of phenotypic variations. Genetics researchers expect to identify biological disease processes through continually sequencing genomes. From a biosocial perspective, variants can identify predispositions to numerous disorders, including cognitive disorders that underlie criminal behavior (Barnes, Boutwell et al., 2014; Barnes & Jacobs, 2013; Barnes, Wright et al, 2014; GCP, 2015; Sudmant et al., 2015). Understandably, the vast complexity of genetic data and its millions of variations requires research to be extremely thorough, conscientious, and ongoing.

Ridley (2003) suggests that one of the shortcomings of non-biological researchers is that a consensus seems to believe that specific genes define causality. Ridley calls this "OGOD" or "one gene, one disease" (p. 234). The reality of genetics is that OGOD, in the grand scheme of things, is exceptionally rare. The complexity of connecting such research to various behavioral representations is enormous. Throughout the last century, researchers in genetics made significant advances within the field. The revival of Mendelian genetics[3] through to the mapping of the entire human genome occurred during this time (Griffiths et al., 2015). Anyone who has taken a biology class knows that humans have 23 chromosomal pairs, half inherited from each parent; there are occasional exceptions such as in Down Syndrome (an extra chromosome 21, U. S. National Library of Medicine, 2018). Thousands of genes reside on the chromosomal pairs. Genes are comprised of DNA. DNA contains combinations of four nucleotides arranged in specific pairs (Genomic Science Program (GSP), 2017; Griffiths et al., 2015). The double helix of DNA connects the pairs. Adenine (A) pairs with thymine (T) and guanine (G) pairs with cytosine (C). The pairs are always the same; it is the order in which they appear in sequence that drives information output. The base pairs by themselves are insignificant, much like the zeros and ones in the binary code used in programming computers (Glaser, 1971). They become the assembly language for producing 20 amino acids which program how proteins are synthesized in the organism. Simply speaking, the proteins conjugate into the building blocks of how an organism functions. In humans, as in all organisms, all functioning stems from these building blocks. How cells function relies on the sequence. Biochemicals such as hormones and neurotransmitters rely on the sequence. The 20,000 genes in the human genome translate into billions of possible combinations. Considering the vastness of possibility, it becomes clear how

[3]Mendelian genetics refers to the basic dominant/recessive presentation of genetics (Griffiths et al., 2015).

a slight modification in replication can cause notable changes in the phenotype of the organism. These changes occur through single nucleotide polymorphisms (SNP), pronounced snip; a modification or mutation caused by changes, insertions to, or deletions from the DNA sequence. Chemical alterations that do not affect DNA structure itself can be caused by environmental influence—epigenetics (Barnes, Wright et al., 2014; Beyond the Genome, 2015; Bird, 2007; Burt & Simons, 2014; Fox, 2017; Rangasamy, D'Mello, & Narayanan, 2013; Sweatt, 2013; Walsh, 2011). If the chemical change occurs at specific places in the sequence, the possibility of the epigenetic change may be inherited by offspring. The result is that genes might be affected in a nearly infinite manner considering the fact that genes cause a direct effect to a phenotype in very rare instances (Bearden & Glahn, 2017). The possibilities appear virtually endless, and every combination can produce changes that are difficult to predict (Plomin, DeFries, Knopik, & Neiderhiser, 2016).

Behavioral Genetics

Prominent psychologist, Eric Turkheimer, through his ongoing research made the following statements about the law of behavioral genetics:

- All human traits are heritable
- The effect of being raised in the same family is smaller than the effect of genes
- A substantial portion of the variation in complex human behavioral traits is not accounted for by the effects of genes or families (2000, p. 160).

Turkheimer goes on to explain that while animal studies can control observable outcomes, twin studies are the most influential process to determining complex human behavior. Outcomes are multi-directional indicating no specificity in a particular result. Testing becomes impossible to scientifically control in human development due to ethical considerations. Animal breeding

provides data as the nearest relative of such studies. Conversely, Burt and Simons (2014) argue that long-used twin and adoption studies present flaws that do not adequately represent the influence of environment on the organism, nor do the studies provide insight into causes of crime. Their claim is that heritability models represent genetic effects as acting autonomously outside the framework of environmental influence. They describe natural assumptions used in heritability studies as "biologically nonsensical" (p. 225) and "preposterous" (p. 236). Therefore, heritability studies in criminology should be ended by suggesting that all such studies are inherently, and irrevocably biased. To be clear, heritability does not represent what an individual inherits from its parents. Heritability refers to that portion of a given phenotype due to genetic effects exhibited in a population (Byers, 2008; Griffiths et al., 2015; Walsh & Beaver, 2009; Wright et al., 2015), a measurable characteristic. Barnes, Boutwell et al. (2014) rebut Burt and Simons by pointing out that statistical models are always based on "testable assumptions" (p. 591). A statistical failure becomes as useful as a success because biases can be recognized. Wright et al. (2015) also counter Burt and Simons' view that "it is impossible to disentangle genetic from environmental influences" (p. 114). Barnes, Boutwell et al. (2014) go on to show that each of Burt and Simons' claims regarding twin and adoption studies, where they provide statistical models, are mathematically invalid. In fact, Burt and Simons' review did not provide much depth in their limited analyses of heritability studies (Wright et al., 2015). As mentioned previously, genetic combinations and the effects of the environment encompass possibilities in the billions. Wright et al. (2015) admonish that the "dirty work of examining 'minutiae'" (p. 115) is being accomplished by dedicated researchers willing to address the seemingly limitless possibilities.

Epigenetics and Heritability

To follow on with this reasoning, a vast body of literature supports the fact that genetics and epigenetics play a significant role in behavior in general, and behavior that precedes criminality. To begin with, extensive heritability studies estimate that 50% to 70% of all human traits are heritable (Barnes, Boutwell et al., 2014; DeLisi & Vaughn, 2015; Fox, 2017; Nedelec et al., 2016; Plomin & von Stumm, 2018; Polderman et al., 2015). A trait is the sum of heritability from additive genes (how specific genes interact with one another) and the identification and quantification of environmental variances (Byers, 2008; Griffiths et al., 2015). The Polderman et al. study represents a thorough review of nearly 3,000 publications. This meta-analysis provided data on roughly 18,000 traits that examined over 14 million twin pairs. Trait classifications were based on the ICF (The International Classification of Functioning, Disability and Health, a World Health Organization (WHO) function) that established international standards to measure health and disability. A second method of classification of traits utilized the ICD-10[4] (The International Classification of Diseases, also a function of WHO) which describes diseases. Additional chapters were added to the ICF and ICD-10 to accommodate studies that identified traits not specifically classified within either. The study thoroughly utilized various modeling strategies to reduce bias. Only twin studies were used, and then, only those where the siblings were reared together. The extensive research by Polderman et al. (2015) vindicates the necessity of using twin and adoption studies when researching variances that affect heritability.

Discounting Genetics in Criminology

To support this viewpoint Barnes, Boutwell, et al. (2014) discuss the challenge of incorrect results when conventional research does not account for genetics within the

[4]An update to ICD-11 is scheduled for publishing in 2018 (WHO, 2016).

methodology. The authors intend to explain why proponents of the SSSM (Heylen et al., 2015; Schwartz, 2014; Tooby & Cosmides, 1992) do not fully describe crime causation. Through a simulation of data obtained from several meta-analyses, the authors successfully show how the challenges of identifying causation suffers when genetics do not factor into the final account.

Research throughout the biosocial community utilizes various methods for making their point. Barnes, Boutwell et al. (2014) combine both qualitative and quantitative approaches in the subject article. In the early section of the paper, the authors address how results from biosocial research should apply to modern criminology and its attendant theories. The second part of the paper utilizes a quantitative, analytical approach that identifies the extent to which biosocial criminology studies offer another layer of understanding. The SSSM (Tooby & Cosmides, 1992) interprets data without considering the effects of genetics (Barnes, Boutwell et al., 2014; Schwartz, 2014). Weisburd and Piquero (2008) explain that criminological research compiled in the late 20th and early 21st centuries exhibits low variances. Reports containing low variances generally indicate weak explanatory power for the data outside the variance. The authors call this "'omitted variable bias'" (p. 455). Genetic effect provides the missing variable. Such studies cannot properly identify causation as statistical variations will not be as accurate as possible. Defining causation is a key component for studying criminology in the first place. This perspective fits with the first section of the Barnes, Boutwell et al. (2014) analysis. The key issue in the second section focuses on whether genetics influence the organism as an independent variable; a component that has long been overlooked in the literature.

Barnes, Boutwell et al. (2014) go on to explain various properties of behavioral genetics research. The importance of this is crucial to the Barnes, Boutwell et al. analysis. A basic introduction to some of the terminology of genetics helps the reader to understand the analytical

processes by which genetics and the environment effect behavioral outcomes. Beyond an individual's basic DNA structure, or genome, a phenotype develops. Phenotypes represent the manifestations of measurable changes in individuals' traits or behaviors (Barnes, Boutwell et al., 2014; Burt & Simons, 2014; Schwartz, 2014; Wilson et al., 2014). Behavior such as anti-social patterns and self-control abilities are examples of phenotypes influenced by both environmental and genetic factors (Schwartz, Connolly, Nedelec, & Beaver, 2017). Variables within the study of behavioral genetics appear as heritability (an individual's genome), shared environment (parental influence), and non-shared environment (peer influence). It is within these three variables that quantitative measures can identify which component creates the most influence over the phenotype (Barnes, Boutwell et al., 2014; Burt & Simons, 2014; Hicks, Krueger, Iacono, McGue, & Patrick, 2004; Schwartz et al., 2017). Other meta-analyses reveal that heritability of traits falls in the range of 30% - 50% (Plomin et al., 2016). Additionally, these studies show significant replication—an important finding that indicates the importance of these measures.

Data for quasi-experimental research often comes from twin studies, adoption studies, and various longitudinal studies. Sibling studies offer a generous contribution to the three-pronged view of phenotypic variances (Barnes, Boutwell et al., 2014; Barnes, Boutwell, Morris, & Armstrong, 2012; Plomin et al., 2016; Schwartz, 2014). These studies are effective because no trait is 100% heritable. The remaining variation, therefore, provides the balance of the data. The final part of the Barnes, Boutwell et al. (2014) paper presents a simulation analysis that ultimately describes the shortcomings of SSSM research that does not control for genetic influence. The design includes three variables. The dependent variable, designated Y, identifies the outcome of the results. A second, and independent variable is designated the

"'Criminological Variable'" (p. 474). The third variable represents "'Genetic Factors'" (p. 474). Using data from existing literature, correlations were established for self-control factors, aggression, violent behavior, delinquent peer associations, and the etiology of family effects on these crime correlates (Beaver, Barnes, May, & Schwartz, 2011; Pratt & Cullen, 2000; Pratt & Cullen, 2005; Schwartz et al., 2017; Weisburd & Piquero, 2008). Since this analysis involved simulating specific factors, it does have some limitations. Adjustments for these limitations can be made by considering data from a specific set of parameters such as that found in the original research. Despite the limitations, Barnes, Boutwell et al. (2014) determine varying levels of effect when criminological variables are correlated to genetic effect. By controlling for genetic correlates, the research will provide a more holistic approach to understanding causation. Rather than following Burt and Simons' (2014) path of refraining from the use of heritability studies, the field should forge ahead, as such complexity will require diligent attention to provide further understanding.

Neuroscience—Connecting the Dots

Crick comments that all thought and action result from a combination of cells and molecules (1995). In Crick's context, cells and molecules converge in the brain. Essentially, the brain controls all, and how the brain operates results from an individual's DNA sequence or genome. All behavior results from the interaction between an individual's environment and their genetic structure (Turkheimer, 2000). Studies that incorporate the GXE combination range from biochemistry (Gato, Posick, Williams, & Mays, 2017), neuroscience (Whitten, 2013), neurobehavior studies (Albert et al., 2013; Bearden & Glahn, 2017), neuropsychology (DeLisi & Vaughn, 2015), and other disciplines that incorporate studies of brain function. Neuroimaging studies provide a window into brain function. What has become clear through neuroimaging is

that changes in the brain can be correlated with behavior (Bearden & Glahn, 2017). Findings from various research projects represent the relationship between genetics, brain function, and the potential for criminal behavior. Meldrum et al. (2017) utilize functional magnetic resonance imaging (fMRI) to test regions in the brain associated with low self-control and delinquency. Their position recognizes that most criminological explanations of the causal effects of low self-control and ultimately a "myriad of antisocial behaviors" (p. 1) arise from studies of social context. Imaging studies were performed on a cohort of high-risk individuals from the Michigan Longitudinal Study. Imaging revealed correlations between neural functioning and responses to stimuli recognized as faulty inhibitions which lead to a lack of self-control. This understudied direct measurement of brain function, particularly executive function, requires more thorough investigation that will encompass greater numbers of participants (Bearden & Glahn, 2017; Coyne & Wright, 2015; DeLisi, 2016; Fishbein & Dariotis, 2017; Meldrum et al., 2017; Nedelec et al., 2016; Rocque et al., 2012; Vaske, 2017). Gato et al. (2017) explore the effect of the human microbiome on behavior. Microbes in the human body exist in the trillions; trillions more than human cells. In addition to other neurological complexities, a gut-brain axis exists that balances activity between the central nervous system and the gastrointestinal system. Research has shown that the enteric nervous system contains as many neurons as the spinal cord. As a result, a bi-directional communication connection exists between the gastrointestinal tract and the brain. If the microbiome does not develop properly, findings indicate that certain gene expressions become lacking and affect neuronal growth within the nervous system. When this occurs, expression of neurotransmitters and hormones, all which attribute to behavior (Albert et al., 2013; Coyne & Wright, 2015; DeLisi & Vaughn, 2015; Gato et al., 2017; Tiihonen et al., 2015; Tuvblad & Baker, 2011; Vaske, 2017; Walsh, 2011), may become damaged. Ultimately,

stressors linked to an inadequate microbiome can contribute to developmental and cognitive disorders causally related to later criminal behavior (Gato et al., 2017). Generally speaking, the effects appear at birth and are expressly affected by diet and possible early treatment with antibiotics. The beauty of the brain is that from an epigenetic perspective, many behavioral outcomes can be mitigated by its plasticity; this allows a response to environmental influences that reroute neural pathways. Whitten emphatically states, "when the brain changes, behavior changes" (2013, p. 239); more positive input forges more positive changes. These various viewpoints offer a springboard to applying biological sciences to the causal study of criminal behavior.

Biocriminology Connects to Criminal Justice

DNA Fingerprinting

Genetics, behavior, and neuroscience entered the courtroom a number of years ago. The most obvious arena from biocriminology comes from the introduction of DNA analysis into criminal justice. DNA fingerprinting became a forensic addition to the criminal justice system in the mid-1980s (Gill, Jeffreys, & Werrett, 1985). To facilitate the use of DNA in the identification of individuals, the Combined DNA Index System (CODIS)—generic terminology—was created by the FBI as a pilot program in 1990 (FBI.gov, n.d.). The Federal DNA Identification Act of 1994 (hereinafter DNA Act) became the legislative bedrock creating a national DNA database called the National DNA Index System (NDIS). NDIS is the collection of all the profile records in the database acquired from various laboratories. Follow-on legislation created the Privacy Act Notice for the National DNA Index System in 1996 (Privacy Act Notice) (FBI Laboratory, 2017) which describes how NDIS is to be used. The Privacy Act Notice delineates whose samples will be categorized and includes convicted offenders, missing

persons and relatives, victims, and personnel responsible for DNA records at all governmental levels. No physical samples are stored with NDIS as they are kept at member laboratories. No personally identifiable information (PII), other than that of DNA personnel, is stored within NDIS. From a risk management perspective, data storage is never completely invulnerable despite attempts to make it so (McCallister, Grance, & Scarfone, 2012). As always, a motivated individual could ascertain an identity with certain other identifiers such as a specimen ID. A protocol for the release of information is contained in the DNA Act and reiterated in the Privacy Act Notice. PII can only be provided from appropriate criminal justice agencies. The Justice Department's list of blanket routine uses for disseminating information from various FBI systems specifically exclude the NDIS (Privacy Act of 1974). Criminal justice agencies may not provide DNA profiles for investigative purposes. Procedures also exist for expungement of DNA records. Reasons for expungement include overturned convictions, arrestees' dismissed charges, acquittals, or charges not filed within a required time period. State and local agencies participate in utilizing CODIS, each state having its own set of regulations pertaining to the collection and use of DNA in criminal investigations.

The pervasiveness of DNA collection and testing has precipitated questions of constitutionality. This makes sense considering the following data which indicate how widespread DNA fingerprinting has become. The use of DNA fingerprinting has been legislated for use in 29 states and the federal government (National Conference of State Legislatures (NCSL) (2013). All 29 states require DNA collection for some felonies, 14 of which require collection for all felonies. In states where DNA collection occurs for all felonies, five include certain misdemeanors and four include juveniles. In the remaining 15 states where some felonies require collection, three include certain misdemeanors and four include juveniles. Six of the

states require a probable cause hearing prior to sample collection, eight prior to laboratory analysis; four of these waive the hearing if the arrest was made under warrant with probable cause. One state, Oklahoma, allows DNA collection only if the arrestee is an unauthorized immigrant. The government requires DNA collection in all 50 states for certain felony convictions involving violence (Durose, Burch, Walsh, & Tiry, 2014). Durose et al. (2016) report that in 2014, forensic labs throughout the country received nearly four million requests for service of which 24% were DNA profiles, nearly one million samples. On one hand, the efficacy in convicting or exonerating an individual is stellar. Opponents express concern that privacy and due process might be easily violated, suggesting that the technology provides much more information than the singular process of matching samples from crime scenes. Murphy (2013a) suggests that the next step is "license, registration, cheek swab" (Title).

Maryland v. King

Fourth Amendment privacy concerns are telling as are those pertaining to due process as stated in the Fifth Amendment. The most precedential case to be heard by the U. S. Supreme Court is *Maryland v. King* (2013). King was arrested in 2009 for a felony that, under Maryland law, required collection of a DNA sample. His plea deal reduced the conviction to a misdemeanor. Subsequently, the sample was sent to a lab and the results uploaded to the state's database. A routine search through the database matched King's sample to an unsolved sexual assault case from 2003. King was arrested and charged for that crime. King moved that the search did not rise to the standards and requirements of probable cause, since his 2009 case had pled down to an offense that would not have required DNA collection. The trial court denied the motion and King was convicted and sentenced. The Court of Appeals of Maryland reversed the conviction. Maryland petitioned the U.S. Supreme Court for *certiorari* which was granted.

Ultimately, the Court held that the use of a DNA sample collected according to state statute to connect the defendant to a case unrelated to the current arrest was reasonable and balanced with the government's interest (Kaye, 2013). Murphy (2013a) reports that the case received much attention from the legal community. Nearly 30 amicus briefs from numerous entities reveal the interest in the case (ScotusBlog, n.d.). Proponents argued that arrestees' expectations of privacy were limited. Ultimately, this became a central tenet of the Supreme Court's decision. Other arguments included the fact that samples provided very limited information regarding identification; that the presumption of innocence had no bearing on privacy; and that the DNA collection maintained a similarity to conventional fingerprinting which advanced the government's interest. Proponents also argued for the use of DNA collection in cases where prevention might have occurred if samples were analyzed and compared to existing results. Opponents argued against the expansion of databases, particularly CODIS. The briefs declared that profiles contained more than basic identification which could extend to familial searches; that samples were widely used for investigative purposes—particularly against minority populations; and that various police departments retained samples indefinitely. One neutral brief offered technical information and did not support either party stating that DNA results maintained in CODIS did not support causal variations that signified any trait and that what could be correlated would not be useful in circumstances that supported arguments of health or insurance risk information.

Additionally, familial relationships do appear; however, racial or ethnic variations are particularly weak.[5] In a 5-4 split, Justice Kennedy delivered the Court's opinion in support of

[5]Review of amicus briefs were taken from the following: Brief of Amicus Curiae National District Attorneys Association in support of petitioner, retrieved from https://www.americanbar.org/content/dam/aba/publications/supreme_court_preview/briefs-v2/12-207_pet_amcu_ndaa.authcheckdam.pdf; Brief of the Global Alliance for rapid DNA testing as Amicus Curiae in

Maryland and remanded the case to the lower courts. Kennedy's opinion stated that the balance between privacy of the individual and government need tipped toward the government, and that the search was reasonable and part of arrestee booking procedures (Kaye, 2013). A vehement dissent by Justice Scalia focused on searches lacking suspicion which "are *never* (emphasis in original) allowed if their principal [sic] end is ordinary crime solving" (*Maryland v. King*, 2013, p. 37). This synopsis provides a foundation for discussing the constitutionality of utilizing information gleaned from studies within the various biosocial disciplines.

The Brain Enters the Courtroom

Farahany (2016) presents a quantitative analysis of the use of neuroscience and behavioral genetics (hereinafter neurobiology) in the courtroom. Farahany recognizes the various research disciplines that connect the effects of genes on the brain and ultimately behavior. There is an increase of positive outcome on appeal when such data is presented; this includes reversals, remands, or modifications of some trial component. Success rates can be upwards of 20% in capital and non-capital cases. In the seven-year period between 2005 and 2012 nearly 1600 judicial opinions considered neurobiological evidence at some point in trial or sentencing phases. The research revealed a significant annual increase when a comparison was made between the number of cases in 2007 and 2012 that presented a defense that included neurobiology. Arguments range from diminished responsibility to less severe punishment. In some cases, judges ruled defense counsel ineffective for not including neurobiological evidence. A shortcoming of this study exists in comparing the efficacy of such defense strategies in

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support of petitioner, retrieved from http://supremeobserver.com/case-document/?doc=14595; Brief of Amici Curiae Electronic Privacy Information Center and twenty-six technical experts and legal scholars in support of respondent, retrieved from https://www.epic.org/amicus/dna-act/maryland/EPIC-Amicus-Brief.pdf; Brief for the Howard University School of Law Civil Rights Clinic as Amicus Curiae in support of respondent, retrieved from http://sblog.s3.amazonaws.com/wp-content/uploads/2013/02/Howard-University-School-of-Law-amicus-brief.pdf; Brief of genetics, genomics and forensic science researchers as Amici Curiae in support of neither party, retrieved from http://www.personal.psu.edu/dhk3/pubs/12-MdvKing-SciAB.pdf

juvenile cases since they are not included in data from the Bureau of Justice Statistics. However, three cases heard by the U.S. Supreme Court recognized the immature neurobiological development of the juvenile brain in its decisions, each ruled as a violation of the Eighth Amendment's cruel and unusual punishment clause. In *Roper v. Simmons* (2005), a capital case, the Court abolished the death penalty for juveniles. *Graham v. Florida* (2010) abolished life imprisonment without the possibility of parole for juveniles for cases not involving homicide. A third case, *Miller v. Alabama* (2012) took *Graham* a step further and removed mandatory life imprisonment without the possibility of parole in all cases, including capital cases. Justice Kagan's decision in *Miller* did not directly recognize the contribution of biosocial research studies. However, the reasoning behind the decision adequately represents many of the GXE findings in biocriminology studies (Albert et al., 2013; Barnes & Jacobs, 2013; Musci et al., 2014; Russell et al., 2017; Welsh & Farrington, 2012). The significance of this supports the incorporation of biocriminological perspectives into the justice system.

Method

Article collection occurred over the author's recent academic career. Searches of Academic Search Premier, Proquest, J-Stor, Google Scholar, Medline, Science Direct, PubMed, Hein Online, the New England Journal of Medicine, and general Google searches were performed. Initial search terms included biocriminology or biosocial criminology. These searches provided a basis for retrieving research articles addressing the general content mentioned throughout this paper. Other related search terms included studies of behavioral and molecular genetics, among others. Searches of the Supreme Court website provided information pertaining to case law that focuses on the use of biocriminological disciplines that pertain to constitutional issues. Review of the Human Genome Project website provided background on

the science of genetics and identified offshoot projects that also provided information within the context. Other areas of review included prevention science, bioethics, public health, and several books pertaining to the various topics found within this text. Comparative analysis ensued with a focus toward the presentation of historical background and development of biocriminology into the 21st century. The analysis concludes with review of ethical and legal considerations where biosocial research, particularly genetics, may conflict with criminal justice applications of due process and rights to privacy. Throughout, qualitative and quantitative analyses were presented and correlated the past with the present and what might be expected for the future use of biosocial research throughout the criminal justice system.

Discussion

Biosocial research encompasses numerous disciplines that connect biology, particularly genetics, to the environment. This is the crux of biosocial criminological research. Despite disfavor within the criminology community, integrating biology with sociology provides promising directions that can inform prevention and intervention strategies (DeLisi, 2012a; Vaske, 2017). Rocque, et al. (2012) explain that implementing crime prevention through an integrated criminology can provide a proactive rather than a reactive approach to crime prevention. An analogy can be made to the medical community. Disease prevention is proactive. Ongoing research to discover the etiology of a disease provides a much more effective approach to treatment. Conversely, treating symptoms is a reactive response after a disease has begun to run its course. Identifying risk factors that contribute to behaviors that promote criminality allow the potential for intervention and possible prevention. Outcomes currently being studied in the biosocial community can offer the potential for invaluable solutions based on this knowledge (Barnes, Wright et al., 2014; DeLisi, 2016; Gajos et al., 2016;

Fishbein & Dariotis, 2017; Fox, 2017; Isasi & Knoppers, 2015; Leve et al., 2017). It is this expanse of possibilities that suborn the continual rhetoric that occurs within the criminological community and limits acceptance of this path. Focusing on underlying behavior that precedes the potential for criminal activity allows an approach that follows on a public health strategy that correlates with the justice system (Fishbein, 1990; Rocque et al., 2012; Rose, 2000; Russell et al., 2017; Welsh & Farrington, 2012) without sacrificing the dignity and rights of the individual.

Cases such as Jacobson v. Massachusetts (1905), Buck v. Bell (1927), and most recently Maryland v. King (2013) represent rulings that address aspects of unconstitutional intrusions into the privacy and general well-being of citizens. The following discussion addresses some of these issues. Numerous elements from biosocial studies contribute to the understanding of criminal behavior. The prime question becomes how this information can inform the justice system without sacrificing an individual's rights to privacy and due process. *Maryland v. King* (2013) provides convincing arguments within the justice community for using DNA fingerprinting in the identification of criminals already in the system. A comparative analysis can be made from within the medical community. A 1905 U.S. Supreme Court decision, *Jacobson v. Massachusetts*, held that mandatory vaccinations did not infringe on the constitutional rights of the affected population. The underlying principal of Justice Harlan's decision lies within the power of the state to impose a regulation in the best interests of public health—at the time, smallpox. Harlan stated, "The good and welfare of the Commonwealth, of which the legislature is primarily the judge, is the basis on which the police power rests in Massachusetts" (p. 27). In the event of a threat to the community, the state may impose police power congruent with the level of necessity to ameliorate the threat. Gosten's (2005) analysis of *Jacobson* recognizes that the state must act in a reasonable manner that balances the physical protection of the governed

with the proportionality of the benefit that does not infringe upon the rights of citizens. The concept reiterates Packer's conflict model. Gosten reported that 69 Supreme Court cases cited *Jacobson* as part of the opinion, an overwhelming majority of which recognized that balance as positive. According to a Harvard Law Review note (2008b), "medical necessity" not "practical necessity" (p. 1834) should be the basis for imposing mandatory vaccinations. This considers the fact that other vaccines exist for non-airborne diseases like HIV or HPV;[6] smallpox, of course, is no longer an issue in the U. S. This reasoning could be used to acquire widespread biological information for use in protecting society for the greater good.

Current technology such as gene splicing might be considered an equivalent of vaccination. Gene splicing can inhibit the presentation of a disease process (Church, 2017; Cwik, 2017). Studies involving lower life forms such as bacteria reveal this process. Prenatal or embryonic genome sequencing can identify potential defects that might appear in spermatocytes or oocytes (gametes) that combine to create a zygote that becomes a human fetus (Church, 2017). Technology allows for the introduction of modified stem cell clones into a DNA sequence. This allows for modification of DNA at the molecular level creating a mutation in resulting cells that have the potential of removing a recognized disease process from the phenotypic outcome. Without going into any technical detail, a vaccine works in a somewhat similar manner. This oversimplification of complex technology suggests that perhaps somewhere down the road, at risk behaviors might be siphoned out of the phenotype—conjecture. Paradoxically this seems like eugenics revisited. "Liberal eugenics" (Harvard Law Review, 2008a, p. 1578) suggests that screening for and allowing genetic modifications that can inhibit disabilities or produce more intelligent children are acceptable. This is a decision

[6]Vaccines exist for human papilloma virus which is a precursor to cervical virus.

determined by parents rather than the state—not eugenics from the early 20th century. Ridley (2016) suggests that without state coercion, eugenics does not exist. Ridley's argument correlates to the idea of liberal eugenics in that people want their own healthy children and therefore the process would contradict the eugenic ideas of the early 20th century. The argument in the Harvard note (2008a) promotes reproductive freedom, an area addressed in many Court decisions. Abortions to prevent bringing to term a child with a genetic disease that would be debilitating or fatal are constitutionally allowed. Regardless, the only allowable intervention should be one desired to improve quality of life.

Incorporating genetic science into the courtroom has become more prevalent in criminal and civil cases (Sabatello & Applebaum, 2017). Testimony used in proceedings that involve behavioral genetics must meet certain standards, as defined by the U.S. Supreme Court holding in *Daubert v. Merrell Dow Pharmaceuticals* (1993). The Court held that the use of scientific evidence must meet standards of viability as it considers expert testimony. The Daubert standard underlies the Federal Rules of Evidence Rule 702 (2018). Experts must be knowledgeable to the extent that complex issues can be explained to triers of fact. The data used must be based on sufficient, reliable facts and methods that the expert has applied to a case at hand. The purpose of the Daubert standard allows for the exclusion of evidence that might be misleading, difficult to understand, or prejudicial to the case (Sabatello & Applebaum, 2017). Moving forward, utilizing genetic evidence remains extremely difficult as the complexity of tying genetics to behavior does not resolve to a specific mathematical equation—if this then that. In criminal cases, presenting mitigating factors based on behavioral genetics have seeped into the courtroom with some success, particularly in death penalty cases. Civil cases also provide an avenue to introduce behavioral genetics. Notably, cases involving medical malpractice and product

liability where genetic evidence provides information on the "health status and susceptibility to adverse physical outcomes" (p. 293) enjoy some success.

Obtaining genetic information creates questions of collection. Aside from obtaining the information as part of gathering evidence in an existing case—a subpoena of medical records—genetic thievery exists (Sabatello & Applebaum, 2017) wherein a sample might be collected and analyzed without consent of the donor. Violations of chain of custody would undoubtedly preclude the use of those results in a legal proceeding. Police often collect samples surreptitiously from bodily fluids or tissue left behind by suspects (Kaye, 2001; Murphy, 2013b; Sabatello & Applebaum, 2017). Paternity testing is quite common (Juengst, 2004; Sabatello & Applebaum, 2017). Newborn screening has been in effect for many years (Kelly, Makarem, & Wasserstein, 2016) and provides an avenue by which genetic information could be obtained. Certain tests are already performed on all newborns in the U. S. The residual sample, considered waste, until recently did not fall under the auspices of federal regulations pertaining to research on humans. According to Kelly et al., (2016), The Newborn Screening Saves Lives Reauthorization Act of 2014 was passed specifying that such waste specimens used in federally funded research do fall under the umbrella of human research and its use requires informed consent. Implementing a widespread program to gather an inclusive database of genetic information remains highly unlikely. In health and research related environments, the Health Insurance Portability and Accountability Act (HIPAA) regulates the disclosure of health and medical information. HIPAA provides a layer of security not found in the consumer market. This is important because, with the advent of commercially available DNA testing, access to genetic information does not meet a similar standard (Drabiak, 2017). Companies such as 23andMe fall outside the realm of regulations, such as HIPAA, meant to protect the privacy of

the consumer. Considering the expanse of Internet technology and the vulnerability of any entity, the risk to private genetic data increases regularly. To further compound the potential risk, Drabiak suggests that over 80% of individuals would submit samples to such companies if they could afford it. Readily available information pertaining to personal genomes has become commonplace. Without the safeguards implemented in other areas of health information, consumer genomics becomes a breeding ground for the acquisition of highly sensitive personal information that could be used in an unconstitutional manner.

Conclusion

Biosocial research encompasses numerous disciplines that connect genetics to the environment. It seems that criminology generally finds disfavor with genetic explanations for behavior while other salient disciplines embrace it (Fishbein, 1990; Jeffery, 1979; Russell et al., 2017; Sabatello & Applebaum, 2017; Simons, et al., 2011). It is, however, an important part of an integrative approach to studying the etiology of criminal behavior. An integrative approach provides promising directions in prevention and intervention (DeLisi, 2012a; Vaske, 2017). Rocque, et al. (2012) explain that implementing crime prevention through an integrated criminology can provide a proactive rather than a reactive approach to crime prevention. An analogy can be made to the medical community. Disease prevention is proactive. Ongoing research to discover the etiology of a disease provides a much more effective approach to treatment. Conversely, treating symptoms is a reactive response after a disease has begun to run its course. Identifying risk factors that contribute to behaviors that promote criminality allow the potential for intervention and possible prevention. Imaging techniques provide valuable information to clinicians who develop significant therapies, such as cognitive behavioral therapy, that have demonstrated success in diverting individuals from life paths that develop into criminal

behavior (Schwartz et al., 2017; Vaske, 2017; Vaske et al., 2011; Wright & Cullen, 2012). Outcomes currently being studied in the biosocial community can offer the potential for invaluable solutions based on this knowledge (Barnes, Wright et al., 2014; DeLisi, 2016; Gajos et al., 2016; Fishbein & Dariotis, 2017; Fox, 2017; Isasi & Knoppers, 2015; Leve et al., 2017). It is this expanse of possibilities that suborn the continual rhetoric that occurs within the criminological community and limits acceptance of this path. Focusing on underlying behavior that precedes the potential for criminal activity allows an approach that follows on a public health strategy that correlates with the justice system (Fishbein, 1990; Rocque et al., 2012; Rose, 2000; Russell et al., 2017; Welsh & Farrington, 2012) without sacrificing the dignity and rights of the individual.

Currently, this research can only be called suggestive of behavioral outcomes. As technology advances, connecting specific DNA sequences to specific environmental influences may yet arrive at some predictive level in the future. Utilizing the information for criminal justice purposes will become more refined along the way. Although, it seems inevitable that the vast amount of data available that resides outside substantive constitutional protections will subvert those protections. Attempts to enhance privacy protection will continue as evidenced by the biotech community coming together through an international organization dedicated to defining ethical principles that pertain to the use of human cellular biotech (Wolpe, Rommelfanger, & the Drafting and Reviewing Delegates of the BEINGS Working Groups, 2017). Criminological research must extend beyond the divide with social science. As the nexus addressed herein becomes more mainstream, hastening of predictive ability should occur. By doing so, revealing etiologies for anti-social behavior, and thus, criminal behavior, will provide substantial meaning for intervention and policy strategies. The argument will, no doubt,

continue long into the future. However, as time passes and technology advances, the crossroads should meld into one another, creating one path.

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