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Criminality: The Biological Accident

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Abstract:

Criminality refers to delinquent behavior of committing objectionable acts that are forbidden by the law. While a criminal act craves the necessity of Actus Reus and Mens Rea to be labeled as such, the matter of preeminence is the cause of abomination. While social and environmental factors have a prodigious domination over someone's behaviour, our concern is the genetic nexus of such behaviour. Genetic Diversity mainly caters a way for populations to adapt to the environment. Adapting and conforming, however, can be used in scathing someone else, or property or a community. The paper promulgates and thus explains the correlation between delinquency and its genetic basis.

Keywords: Criminality, Genetic Diversity, Delinquency

1. Introduction

NATURA NIHIL FRUSTRAM FACIT-Leucippus

Meaning- Nature does nothing in vain

“Crime is a fact of human species, a fact of that species alone, but it is above all the secret aspect, impenetrable and hidden. Crime hides, and by far the most terrifying things are those which elude us.”

-Georges Bataille

According to the Merriam Webster dictionary crime can be defined as “an act or the commission of an act that is forbidden or the omission of a duty that is commanded by a public law and that makes the offender liable to punishment by the law.” It can simply be understood as an act that is detrimental to an individual or the society in general and is liable for legal punishment. Behaviorally, crime is explained on the basis of criminality, a concept that enunciates the state of being a criminal of an individual. Criminality can be defined as “a personality profile that causes the most alarming sorts of crimes.”

types of crime	explanation/example
petty crime	less serious crimes such as shoplifting and pickpocketing
serious crime	when the sum involved is large or the consequences more serious
violent crime	includes assault, mugging and armed robbery
white-collar crime	crimes committed by "office workers", for example fraud
organised crime	large scale crime by crime organisations such as the Mafia, for example smuggling
crime against property	includes vandalism and theft

Table 1: Types of Crimes (Reference- www.dcielts.com)

It is needless to say that crime has adverse effects not only on the victim but it also hampers the societal development be it directly or indirectly. Altruistic principles are butchered followed by unintentional development of feelings of suspicion, trepidation, bigotries. Indirect intrusion in our lives is caused by stringent laws that are enforced in order to reduce crime rate, this collectively tend to impede societal growth and economy.

2. Factors Affecting Criminality

Socioeconomic, psychological, biological and behavioral correlates of criminality have been proposed with capricious degree of empirical sustenance. They are mentioned as follows: -

- Struggle for existence due to overpopulation: Increase in population tends to create a feeling of resentment in an individual due to unfulfilled needs in the long run. Frustration builds up in such people and this may lead to commission of delinquent acts.
- Economic Deprivation-It is one of the major causes of the increased crime rates in the world. Man tends to resort to easier ways to meet the basic needs.
- Low literacy rates-A very high number of individuals are not able to cope up with the work pressure due to low levels of intellect hence out of a state of helplessness they resort to many criminal means to obtain resources for livelihood.
- Politics and the want of power-There comes a stage where hunger for more supremacy and resourcefulness blinds the man. In the current scenario, mafia gangs are running to subjugate people in particular political party's favor. Politics is associated to misconduct on a considerably larger and heinous level.
- Racism and associated problems- One of the gravest concerns in the world is the issue of racism. It is usually due to some imprudent beings that this problem gets impetus to grow and the innocent suffer. Discrimination on the basis of skin color and ethnicity is even though absolutely senseless but sadly is still prevalent.
- Media, internet and television influence- Boon and bane of television, media and internet has always been a highly debated topic. Emulation of violent acts telecasted by such means is done by people who cannot successfully differentiate between fiction and reality. This tends to disrupt the societal peace.
- Family relationships- If the development of the child is fixated in the early years of development due to abusive nature of the parent or absence of the parent in general then the minor is prone to delinquency in his or her formative years. Violence in the family and other issues also affect crime in many ways. It is observed that most sexual offenders were victims of sexual abuse themselves.
- Mental disorders and biological factors- People with mental disorders and biological abnormalities are evidently seen committing crimes. One cannot entirely accuse them of a guilty intention as their medical condition tends to amplify their emotions. Such patients should be treated as rapidly as possible to minimize the risk to the society. Some of the individuals with mental disorders end up committing self-harming crimes. It should be duly noted that the emotional state has a huge impact on individual thought process which in turn influences the criminal activities.
- Drugs-There is absolutely no positive or sympathetic ground on which the consumption of drugs can be assumed as a boon. There comes a time when such an individual is unable to support their addiction and end up committing crimes to fuel their habits. Hence criminality is encouraged. Selling of drugs is as grave an offence as consuming it. These are punishable offences.
- Justice System and unfair rulings- There have been times when a person is a victim of chance and happens to fall into crimes. Sometimes individuals are accused falsely and convicted. Due to adverse conditions within prisons and jails, such individuals often end up making worse criminals. This problem can be solved by careful trial procedures and classification of people in prisons.

3. Literature Review

- Pollak (1950) studied the criminality of the XX female and concluded that it has been not been given its due importance. In his research, he studied various female crime patterns and consequently interpreted that criminality in women is not only because of the social or cultural settings but also because of their biologically diverse nature.
- Michael Bohman (1978) studied genetic facets of inebriation and misconduct in adopted and biological offspring. According to his research, adoption aided in decreasing the likelihood of inheritance of social behavior of biological parents however alcoholism acts as an exception to this. In other words, development of alcoholism can be explained genetically as opposed to any delinquent behavior.
- Witkin, Herman A; Mednick, S; Schulsinger, F; Bakkestrom, E; Christiansen, K; Goodenough, D; Hirschhorn, K; Lundsteen, C; Owen, D; Philip, J; Rubin, D; Stocking, M (1976) studied the criminality in XYY and XXY men. They concluded that the increased criminal rates of XYY might be related to low levels of intellect rather than their elevated aggressive tendencies. They also indicated that the chromosomal eccentricity might happen either due to the presence of an extra Y chromosome or a surplus X chromosome.
- Michael Bohman; c. Robert Cloninger; Anne-Liis von Knorring; Soren Sigvardsson (1984) carried out cross fostering analysis in order to establish a genetic relationship between alcoholism and delinquency by comparing two clinically separate somatoforms in 859 Swedish women who were adopted at infancy. According to their analysis, women having fathers with Type 1 of alcoholism (consumption of alcohol in response to major setbacks) have lesser risk of diversiform somatization as opposed to women having fathers suffering from Type 2 alcoholism (Drinking alcohol regardless of the happenings in their lives).
- Sarnoff A. Mednick; Elizabeth S. Kandel (1988) studied criminal specialization and natural determinants of violence. In their research they suggested that criminal specialization is an outcome of personal characteristics that incline them to commit violent acts

recurrently. They further explained this on the basis of family, twin and adoption studies. They concluded the study on the note that this genetic inclination of an individual to commit violent acts is only limited to property crimes.

- William Amos; John Harwordin their paper spoke about factors affecting genetic diversity which included population size and variability, inbreeding depression, social and spatial structure, heterozygote instability, meiotic drive and Y chromosome evolution, mutations and chromosomal defect.

- Nita Farahany; William Bernet discussed the use of behavioural genetics in criminal cases on the basis of two gene variants MAOA and SLC64A by understanding the interplay between specific gene variants, environmental stressors and violence.

- Martin Gottschalk; Lee Ellis discussed the evolutionary and genetic principles of violent crimes by studying sexual selection which makes males more violent than females and the genes that influence the aggressive behavior in an individual.

4. Biological Theories of Crime and Criminality

Numerous theories have been proposed to explain crime and criminality. The following biological theories aid in the successful comprehension of the link between genetic diversity and criminality. Genetic Diversity as a whole is defined as the total number of genetic characteristics in the genetic makeup (sum total of genes transferred from parent to offspring) of a species. Genetic diversity serves as a way for populations to adapt to changing of environments. Genetic diversity plays an important role in the survival and adaptability of a species. When a population's habitat changes, the population may have to adapt to survive. The ability of the population to adapt to the changing environment will determine their ability to cope with an environmental challenge. Genetic diversity is highly important for a species evolution. Evolution basically results from a species ability to find new ways of surviving unfavorable conditions with ease. The species that are able to do this evolve better than species which cannot survive and hence, disappear from nature by becoming extinct.

4.1. Lombroso's Theory of Atavism: (1876)

Cesare Lombroso (1835-1909), the Father of Criminology founded the Italian School of Criminology and acted as one of the key contributors of biological positivism. Italian School of Criminology was a consequence of dispute on the Classical School of thought which was based on the notion that individuals with free will choose a life of crime. Lombroso wrote 'The Criminal Mind' in 1876 explaining characteristics that identify BORN CRIMINALS by observing physical characteristics of Italian prisoners (head, body, arms and skin). Before his death, Lombroso translated 'The Criminal Mind' to English along with his daughter to be understood better. He was one of the first to apply Darwin's findings to criminals and their behavior and reached his own conclusion by studying cadavers.

According to the theory, while most individuals evolve some devolve becoming primitive or 'atavistic'. On the basis of Charles A. Ellwood's definition of atavism ("Reproducing the physical psychical characteristics of remote ancestors, he is a savage born into the modern world"), Lombroso said that it is these evolutionary throwbacks that makes them born criminals and most violent criminals in the society. To support his theory, he conducted studies where he measured the inter-digital distance between first and second toes. On comparing these results, it was found that in the relaxed state the distance in toes was approximately equal to or greater than 3mm in case of criminals. Other physical characteristics on which he distinguished the 'Born Criminals' were as follows- Asymmetric face, large monkey ears, large lips, receding chin, twisted nose, long arms, skin wrinkles. The prevalence of these characteristics in the individuals was indicative of criminality and is called Atavistic Stigmata.

Furthermore, in order to prove the accuracy of his theory Lombroso presented images of criminals to young girls (the apparent inexpert in the world of good and evil") and found that the unknowledgeable identified criminals from non-criminals solely on the basis of facial features. Later, applications of the photos served as an early French Police guide to identify particular types of criminals.

4.2. Galton's Theory of Eugenics (1883)

Francis Galton (1822-1911), born in Birmingham was best known for his contribution in the fields of intelligence theory and testing but having been an ardent possessor of multidisciplinary abilities and knack for various subjects he made significant contributions in other fields as well. In case of forensics, the individual characteristics of fingerprints are named as Galton details after him. He also proposed a classification system on the varying patterns of the ridges seen on the volar pads. This system has helped in criminal identification since then.

In his book *Inquiries into Human Faculty* in 1883, Galton used the term 'eugenics' for the first time. He defined eugenics as "the study of all agencies under human control which can improve or impair the racial quality of future generation." It basically advocated the 'able' couples to breed in order to encourage production of "more fit" and discourage the production of "less fit". According to his theory, without encouragement, it was the natural state of man and society to revert to mediocrity or regression towards the mean. He viewed that as the repressive of social or individual progress.

Galton's theory has also been used to trace criminality in the family by researchers like Richard Dugdale and Henry Goddard. Dugdale traced the descendants of matriarch Ada Jukes in his book *The Jukes: A Study in Crime, Pauperism, Disease and Heredity* and found that most of the Jukes family members were criminals and harlots.

4.3. Theory of Social Darwinism (1850)

To understand this theory, we should first be conversant with Charles Darwin's theory of Natural Selection. Darwin's theory has clearly been explained in his following two publications- *The Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life* (1859) and in *The Descent of man and Selection in Relation to Sex* (1871). According to both his works he concluded that organisms evolve over a period of time as per their needs and **survival of the fittest** occurs. In other words, organisms which have successfully endured all conditions and have achieved reproductive success are naturally selected. Later in 1871 he stated that humans were no exception to this theory. Numerous researchers and scientists made Darwin's theory one of the standard parameters for their own researches and proposition of subsequent theories. Consequently, SOCIAL DARWINISM started to gain importance.

Sociologist Herbert Spencer was the person who is held responsible for coining the term 'survival of the fittest'. He argued that through competition social evolution was bound to produce opulence and independence unparalleled in human history. Social Darwinism can be understood as interpretation of the human society in terms of struggle, competition, biology and characteristics of human nature. It can be considered as a philosophy that posits survivals of the fittest in the society among human groups and their institutions. Criminals are presented as losers in this struggle.

4.4. Hooton's theory of Biological Inferiority: (1939)

Hooton supported Lombroso's idea of born criminals and stated that most criminals were biologically inferior. He classified these inferior characteristics into *sociological areas, psychological, physical, pathological areas*. According to him, criminals were biologically inferior, "organically inadaptible" and communally besmirched. He was also greatly influenced by eugenics and consequently enumerated a few characteristics of criminals on the basis of his findings:

- Most criminals were either married or divorced.
- Eye color of most criminals was blue-grey or mixed. Dark eye colors were rarely found in criminals.
- Low sloping heads, thin lips, high nasal bridges, rolled helix in ears, thinner beards and tattoos were usually prevalent in criminals.
- Distinct auricular tubercle is found in criminals.
- Criminals often have brownish red and straight hair.

He suggested that the human body type can act as an indicator of the type of crimes the he/she will commit in near future, like- tall-slender men were at a higher risk of committing murder and robbery whereas short-heavy men were predisposed to committing sexual offences. Hooton advocated segregation of these individuals from the rest of the society.

4.5. Sheldon's Constitutional Theory: (1940)

William H. Sheldon, Jr. (1898-1977) was a Cambridge and Massachusetts scholar. By profession he was a numismatist and a psychologist who made a significant contribution in the field of constitutional psychology and somatotyping. He also devised a 'Sheldon Scale' that graded coins on numeric basis from 1 to 70 in numismatics. This scale is still used as standard amongst the American numismatists.

It was post World War II that research into the biology of crime started to gain importance. Sheldon was immensely inspired by the theories given by Hooton, Darwin and Galton. Consequently, he developed a classification system known as **somatotyping** in order to combine principles of the aforementioned theories. To establish a relationship between criminality and respective body types of individuals he created the following three classifications:

- *Ectomorphs*- Flat, thin, delicate, tall, skinny and linear individuals with restrained and introverted personalities came under ectomorphs.
- *Mesomorphs*- Rectangular, muscular, sturdy, athletically built with a competitive and aggressive personality came under mesomorphs.
- *Endomorphs*- Heavy, obese, round, soft shaped individuals with a sociable and outgoing personality come under endomorphs.

As per the empirical evidence to support Sheldon's study he sampled four hundred males in criminal rehabilitation. A majority of the sample were *mesomorphs* and very few *ectomorphs*. His study basically indicated that *mesomorphs* are more prone to delinquency and aggressive personality. This conclusion was based on the scores of mesomorphic individuals in the fields of mental, psychiatric and medical insufficiency.

He presented his early observations in terms of the male members of the society. In order to give a general classification applicable to both males and females he categorized body types into the following:

- *Viscerotonia*- These individuals were sociable and relaxed. A gluttonous temperament was observable in such people.
- *Somatotonia*- Such individuals had a strong drive towards action and power dominated by muscular activity.
- *Cerebrotonia*- Such individuals were found to have a restrained and asocial temperament with high cerebral activity.

Sheldon explained himself and said this theory is not solely an outcome of genetic makeup of an individual but also the environmental factors. He wrote four books about this theory and delivered methodologies and substantive applications associated with the same.

4.6. Modern Biological Theories

Understanding of the influence of genes is still evolving and the discovery of genetic code aids in the same. A number of researchers can be attributed for the recent development in the comprehension and interpretation of genes. Chromosomal anomalies prevalent in criminal individuals can now explain their antisocial behavior.

Chromosomal involvement- Normal human beings have 23 pairs of chromosomes. During fertilization if the sperm bears a Y chromosome, the resulting embryo develops into male (XY). If the sperm bears an X chromosome the resulting embryo matures into female (XX). During this course of conception, things might progress uncharacteristically because of which some men might be left with an extra Y chromosome. Jacobs et Al discovered this in 1965 and stated that such men were more aggressive than the normal XY men. XYY men were found to have lower intelligence which was the possible cause that led to aggressive tendencies.

Rare cases of males with 48 chromosomes and XYYY configuration of chromosomes has also been found. One of the first few cases of the aforementioned disorder was of J.C in 1920. He was one of four children and was described as “taller, thinner, friendless and argumentative brother” by one of the nursing staff. These characteristics were presumed to be an outcome of the surplus Y chromosomes.

Twin Studies- Various studies were conducted on monozygotic (MZ) and dizygotic twins (DZ) and their criminal tendencies. Twin studies attempt to control the impact of the social environment, hypothesizing that these surroundings are akin for twins.

As per Johannes Lange’s research in 1929, on studying 30 pairs of twins (out of which 17 were DZ and rest 13 was MZ) he found that at least one of both the twins had committed a crime. However, the rate of concordance in MZ was much higher. He found that both twins in 10 out of 13 MZ pairs were known to commit delinquency and only 2 out of 17 DZ pairs gave the same result.

In 1999, Bartol conducted a “MZ apart” study and calculated the average rate of concordance for criminality or degree of similarity between two twins. The rate between MZ twins was 55% and DZ twins as 17%. Greater similarity between identical twins (MZ) than between fraternal twins (DZ) provides genetic evidence for the link of criminality.

Adoption Studies- Aim of these studies was basically to indicate whether the adopted child exhibits traits of biological parent or adopted parents. Biological traits between sons and fathers particularly showed strong relationships.

If Biological Parents Had a Criminal Record	Whether Adoptive Parents Had a Criminal Record	% Of Sons with Criminal Record
NO	NO	13.5
YES	NO	20.0
NO	YES	14.7
YES	YES	24.5

Table 2: Likelihood of criminal tendencies; Reference- Study by Mednick et al, 1987

These results indicated that genetic and environmental influences were synchronous in nature but where there was an improvement in the living and social environment the crime rate went considerably down. Later, **Walters and White** conducted a meta-analysis of adoption studies and reinforced the importance of it to determine the impact of environment and genetics on human behavior.

5. Correlation of Genetic Diversity and Criminality

The influence of genetics on criminality is a multifarious mechanism to understand due to its interdependence and interaction with the environment. Reasonably narrow but growing body of evidence about the risk and shielding factors is concomitant with particular genes. Example of such a case, low levels of enzyme monoamine oxidase could predispose an individual to violent and antisocial behavior. This regulation of enzyme might occur due to unexpected and sudden changes in the genome of the individual.

Single gene cannot be identified responsible for most behavior hence criminality cannot be understood as an outcome of one gene. Most biological traits are not directly genetic but occur due to various factors such as mutations in genetic makeup, biochemical exposures, recombination, candidate genes or a deleterious social environment. On the basis of the interpretation we can successfully link the genetic diversity aspect of biology to the still emerging facet of criminality as follows:

5.1. Mutations

Through advanced technologies it is found that consumption of mutation inducing substances such as cigarettes and other drugs by parent during prenatal care induces risks to the proper development of the foetal brain. Mutagens can affect organisms during the course of their lifetime by means of environmental toxins also. Sudden changes in the genetic makeup of an individual leading to violent behavior, alcoholism, psychopathy, congenital physical disabilities might occur. Damage to the cortex due any physical or genetic level injury tends to limit the ability of the individual to control impulsivity, aggressiveness and encourage rule-breaking. Reasoning ability and cerebral functioning are also hampered. This leads to unsatisfactory performances at school and workplace which later causes the exposure of the individual to the easy means of livelihood consequently cultivating criminality. Case study 3 enunciates this particular aspect.

Alcoholism- According to various statistics it is observed that most crimes are committed under the influence of alcohol (either of the victim or the accused). Rape victims are usually administered a high amount of alcohol to reduce their cognitive ability and resistance to any subsequent activities. Aggression when combined with the undulate effects of alcohol tend to lead to other violent and impulsive crimes such as road rage, murder, assaults and likewise.

Psychopathy- According to Silver et al. "Psychopathy's defining characteristics, such as impulsivity, criminal versatility, callousness and lack of empathy and remorse, make the conceptual link between violence and psychopathy straightforward." It should be duly noted that globally the population comprises of about 1% psychopaths but the prison population comprises of more than 25% of psychopaths. This clearly shows that psychopathic nature proves to be instrumental in criminal behavior.

Other Congenital problems on the basis of which diversity and criminality can be inter-related are as follows:

-XYY Super males- Such cases might have the probability of occurring once in a population of 500-1000 individuals. The affected person is biologically a male with an extra chromosome characterized by tallness, mental deficiency, severe acne. Seldom skeletal malformations may also be seen. Large abnormalities do not occur in such males due to the presence of very few features on the Y chromosome. The additional Y chromosome seems to confer an elevated potential for aggressiveness in an individual. A large number of male prison inmates are usually afflicted with this syndrome. This clearly indicates the symbiotic relation that exists between the two, which can be better understood in Case Studies 2 and 6 aforementioned.

-Minor Physical and Integration Anomalies (MPIAs)- Anomalies such as low seated ears and other minor aural malformations may be seen in individuals due to disturbed foetal development. This disturbed development is usually caused by teratogenic agents. Studies have shown that these MPAs are strongly correlated to hyperactivity and consequently criminality. Hyperactivity in boys is related to higher rates of serious delinquency. Case study 3 annotates it to a great extent.

-Congenital physical disability- This should not be confused with MPAs in any form as according to International Classification of Impairments, Disabilities and Handicaps (WHO) disability can be defined as, "Any restriction or lack of ability to perform an activity in a manner or within the range considered normal for a human being." The disability reflects the consequences of impairment in terms of functional performance and activity by the person whereas MPIAs are not. According to the society, most of individuals suffering from any kind of physical disability are exempted from being under suspicion on sympathetic grounds. Nonetheless, it only tends to act as an added advantage in some cases. Paraplegics have been found to con people. Mugging and threatening by them are some small scale crimes that are constantly occurring in broad daylight.

In general, evidences from prior researches suggest a genetic connection with chronic offending like property crimes as opposed to violent crimes like rape and theft.

5.1.1. Biochemical Exposure

Disturbances in the chromosomes due to mutagen consumption may lead to adverse consequences on the neurotransmitters. Serotonin, norepinephrine and dopamine are three hormones linked to criminality. In simpler terms they are chemicals that are used by an organism to bring about successful communication at the cellular level. These hormones influence an individual's antisocial behavior by controlling all activities involving impulsivity. Dysfunction of these neurotransmitters is allied with felonious conduct. Conduct disorders are usually prevalent in such individuals. Serotonin inhibits behavioral responses to emotional stimuli and moderate aggression. Diminution in serotonergic activity yields amplified impulsivity. Low level of serotonin and moderate levels of norepinephrine have a strong relation with delinquent behavior. In Case Study 4, the stimulus to the subject's criminality was these neurotransmitters itself.

Disturbed levels of sex hormones like testosterone and varying estrogen-progesterone ratio triggers the criminal consequences in males and females respectively thereby conferring some level of diversity in the individual. In Case Study 1, the criminal was found to have high testosterone levels.

Chronic uses of Phenylcyclidine with other toxic drugs like marijuana tend to bring about changes in the chromosomal arms making the individual genetically different. This is usually associated with extreme self-sabotaging tendencies and violence on others irrespective of vicious behavior history.

In some cases, psychomotor epilepsy or temporal lobe disturbance is caused due to excess alcohol consumption. Moderate but regular administration might lead to psychological disorders which may ultimately aid in increasing aggressiveness. The same stands true in case of consumption of drugs.

5.1.2. Recombination

Genetic diversity can be induced in a species by means of recombination as discussed earlier. By means of this process exotic markers are incorporated in the human genome. The technique of tissue culture is usually employed for recombination; this technique introduces new genetic variations at high frequencies. This happens due to the fact that the cells are removed from the internal, physiological environment which together confers stability on the individual. Mostly they give rise to genetic instability. Such individuals are called transgenic individuals and often do not breed.

One cannot ignore the possibility of getting success through this. Thus, the extra DNA integrated into the transgenic organism's genome disrupts the structure of the chromosome and can itself cause rearrangement of the chromosome further affecting gene function. This gene rearrangement sometimes tends to induce criminality thus making these genetically diverse individuals prone to delinquency. Though the integrated vector containing the transgene has the potential to move out again or reinsert into another site causing further genetic disturbance.

5.1.3. Candidate Genes

Candidate genes are basically those genes that tend to attract attention towards the associations between genetic variations within 'pre-specified' 'gene of interest'. Criteria for the selection of the suitable candidate gene are based on the gene's biological, physiological

and functional potential. In case of criminality, these genes can be designated as carriers that contribute to the increased risk of engaging in antisocial behavior. Three pathways that are known to be investigated in association with candidate genes are:

- The serotonergic pathway- Involved in development of the brain. Improper functioning of this system increases impulsivity, aggressiveness and likelihood of ADHD.
- The dopaminergic pathway- Involved in 'reward pathways', associated with impulsivity and ADHD.
- The noradrenergic pathway- Function as the central arousal system and disturbances in this pathways are associated with psychological disorders.

Dopa decarboxylase, a lyase enzyme located on chromosome 7 is associated to dopaminergic and serotonergic pathways. Polymorphism of this enzyme is linked to the increase in the likelihood of neuropsychiatric disorders in an individual.

Monoamine oxidase A (MAOA) is a protein coding gene encoding for mitochondrial enzymes that catalyze oxidative deamination. Brunner was the first scientist to have identified an association between a mutation in the above mentioned gene and impulsive aggression. It is involved in all the three pathways discussed earlier. Case Studies 5 and 6 throw some light on this aspect.

However, we cannot hold a single gene responsible for the criminality in an individual. Each genetic variant seems to cast only a small influence on the behavior of an individual and his/her predisposition. Hence inconsistent results at the time of observing a single candidate gene should not be considered synonymous with inaccuracy or fallacy. Researchers have devised a solution to overcome this problem of inconsistency by studying multiple susceptibility genes for traits and disorders connected to criminality.

Gene	Risk	Behaviour
Serotonergic system		
Tryptophan hydroxylase	Not available	Impulsivity, aggression
Serotonin receptors	RR=1.24	Impulsivity (males), ADHD
Solute carrier family 6, member 4	RR=1.29	ADHD
Dopaminergic system		
Dopamine receptor D4	RR=1.5; OR=1.4	ADHD
Dopamine receptor D5	RR=1.57-1.67	ADHD
Dopamine receptor D3	Not available	Impulsivity, ADHD
Solute carrier family 6, member 3	RR=1.2; OR=1.5	ADHD
Noradrenergic system		
Dopamine-beta-hydroxylase	RR=1.31	ADHD
Alpha adrenergic receptor 2A	Not available	Impulsivity, hostility
Other genes		
Dopa decarboxylase	RR=1.48; 1.63	ADHD
Monoamine oxidase A	OR=2.8	Impulsivity, aggression, CD, criminal conviction

Table 3: Relative risk and associated behaviours for candidate genes; Reference- Criminal Research Council.

NOTE- RR denotes the relative risks that are consistent with the Meta analysis results; OR denotes the odds ratios of the candidate. Data is with respect to Australian population.

5.1.4. Deleterious Social Environment

Social environment cannot be directly linked to genetics but its influence on the expression of genes cannot be ignored. Denno (1988) steered a fairly comprehensive study of effects of numerous environmental and biological variables on criminal behavior, juvenile delinquency and disciplinary problems. The prototype was able to envisage 25% of impending adult criminality among males and 19% impending adult criminality in females. She concluded:

“Biological and environmental variables exert a strong and independent influences on juvenile crime.”

She also stated that ‘Crime appears to be directly related to familial instability and, most important, a lack of behavioral control associated with neurological and central nervous system disorders.’ This can be clearly seen in Case Study 1.

Summarily, individuals engage in anti social behavior when they possess a large number of variant genes and are exposed to their required social environments. On this basis we can successfully conclude that genetic diversity and criminality are linked on numerous levels and did not get sufficient importance until now.

6. Interpretation of Cases

6.1. Case 1- The Night Stalker

Richard Leyva Ramirez also known as ‘The Night Stalker’ or ‘The Valley Intruder’ was born to Julian Tapia Ramirez and Mercedes Ramirez on 29th February, 1960 in El Paso, Texas. He was called the night stalker as he usually attacked his victims at night. He succumbed to two major head injuries- first being at the age of 2 when a dresser fell on top of him, causing him to require thirty

stitches as a cure. Second was at the age of 5, on being knocked unconscious over by a swing he consequently started to get epileptic seizures. In fifth grade he was diagnosed with temporal lobe epilepsy. Miguel Ramirez, a cousin of Richard, strongly influenced him. Miguel being a U. S Army Beret himself used to boast of his exploits at the time of the Vietnamese War and shared photos of victims he (Miguel) raped. Since Richard started administering marijuana from the age of 10, he bonded with Miguel over numerous joints. Richard Ramirez began using LSD when he moved in with his sister and brother-in-law. He finally settled in California at the age of 22.

Ramirez's criminal tendencies were first noticed when he was working at an inn as an adolescent where he used his passkey to enter the guests' room to rob them. He tried to rape one of the female guests one time, consequently he was beaten to pulp by the victim's husband but criminal charges were not pressed against him. It was in the month of April in 1984 that a 9-year-old girl was found raped, beaten and stabbed to death in the basement of the hotel where Ramirez was staying in San Francisco. Later in 2009 that criminal was identified as Richard Ramirez. This was the result of the DNA analysis that was carried out to match his DNA with the one found on the crime scene. This was his first known killing. He went on to commit gruesome crimes amid April 10th, 1984 to August 24, 1985 and was finally convicted for 13 murders, 5 attempted murders, 11 sexual assaults and 14 burglaries. He was captured with the cooperative assistance of the people of Los Angeles to the police. Ramirez was sentenced to 'Death in California's Gas Chamber'. The last statement made by him to the reporters was right after he was sentenced to death in which he said, "Big deal. Death always went with the territory. See you in Disneyland."

Ramirez's father claimed that Richard was a "good boy whose marijuana consumption put him out of control". Being a huge fan of rock bands singing of Satanism, he often drew the symbol of the devil-the five-point pentagram on his body. At his first appearance in the court he shouted, "Hail Satan!" out loud. He died awaiting his execution on 7th June, 2013 due to a B-cell lymphoma.

6.1.1. Interpretation and Explanation

Having succumbed to head injuries at early stages of life Richard Ramirez became a subject to improper functioning of the mind due to disturbances in his genes. Temporal lobe epilepsy, a disorder that can endorse or constrain aggression by affecting the amygdala or hippocampus also affected Ramirez's course of action- in his case, aggression was greatly endorsed. According to Ramirez's medical examination, his testosterone levels were found to be considerably higher than normal and his habit of substance abuse was prevalent in him since the age of 10. As a result, when the malfunctioning brain (due to physical injury) was exposed to high levels of drugs and testosterone, the amygdala was periodically stimulated to such an extent that it leads to rage and direct attack.

According to one recent study by V. S Ramachandran, intrinsic religiosity is seen to have a direct link with temporal lobe epilepsy. Ramirez's continuous reference to Satan and his notion of being the pawn of Satan can be explained on this basis. Biological anomalies when coupled with his cousin's vile influence surely made Richard Ramirez the man that he went on to become later in his life.

6.2. Case 2- The XYY Criminal

Daniel Hugon was a tall (over 6 feet), big built man with a low mentality and education. He had suicidal and alcoholic tendencies. Hugon possessed an extra 47th chromosome, such that his genetic makeup was XYY. On 4th September, 1965 in the Pigalle district of Paris, Hugon strangled and killed an elderly prostitute.

Hugon's lawyer introduced scientific evidence of a link between XYY syndrome and his criminal behaviour, in front of the court. The judge believed that the XYY syndrome can be used as a mitigating factor for convicting someone, but he also believed that Hugon was sane and was aware of the consequences of his actions.

Resultantly, Hugon was convicted on 13th October 1968.

6.2.1. Interpretation and Explanation

XYY Supermale Syndrome, a condition in which a human male possesses 47 chromosomes (the 47th chromosome being an extra Y chromosome) accompanied by low IQ, developmental delays and behavioural problems. The cause of this condition seems to be associated with random event at the time of formation of sperm cells known as non disjunction. The incidence of this syndrome is 1 in 1000 and apparently Daniel Hugon was the 'one'.

Daniel Hugon had the XYY Supermale Syndrome which was held responsible for his aggressive behaviour. High amount of belligerence and abrasiveness led to delinquency or criminality in Hugon's case. His aggressive tendencies made him commit an act of criminality. It was later seen that many prisoners convicted of gruesome crimes were also inflicted with the same condition showing its direct link with misconduct. Though Daniel Hugon's sentence was not mitigated on account XYY syndrome, but its catalytic association with criminality and aggressiveness cannot be ignored.

6.3. Case 3- Sandy Hook Elementary School Shooting:

Adam Peter Lanza, the 20-year-old youth responsible for the same, was born in Kingston, New Hampshire on 22nd April, 1992 to Nancy and Peter Lanza. Lanza was never known to suffer from any kind of physical head injuries but he was diagnosed with sensory integration disorder right at the beginning of his schooling. It was a congenital abnormality which was identified when he faced hindrances at school. Later, he was known to develop obsessive compulsive disorder-had a habit of changing socks 20 times a day, frequent washing of hands and use of tissue while touching door knobs. Adam was advised medications for the same but on apprehensions raised by Lanza's mother his medication and visits were stopped. When Adam was thirteen he was also diagnosed to be

suffering from Asperger's syndrome. Physically, Lanza was supposedly anorexic and the extent of this was so severe that at the time of his death he was found to be suffering from malnutrition to the point of brain damage.

Even after his hatred for drugs, alcohol and animal cruelty, Lanza always had a keen interest in mass murders and shootings. He covered the windows of his room with black bags and never permitted anyone in. The North Illinois University shooting in 2008 and the Columbine High School massacre captured his interest. From the very beginning Adam tried to keep away from socializing and unnecessary attention because of which he never had any friends. Prior to the unfortunate incident, Adam cut all contacts with his father and brother who had started living separately after the parents' divorce. Lanza's mode of communication with his mother (who inhabited the same house as his) was through e-mail.

The Sandy Hook Elementary Shooting was considered as one of the deadliest shooting in the history of U.S. The incident took place on 14th December, 2012. Being a gun enthusiast herself, Nancy Lanza had access to various firearms at her home itself. Earlier that day, Adam shot his own mother with a .22-caliber Savage MK II-F bolt action rifle, after which he drove to the high school. Clad in black with magazine for his mother's Bushmaster XM15-E2S rifle, Lanza shot his way into the school and killed 6 teachers and 20 students. He killed himself the same day in the school premises by inflicting a shot in the rear portion of his head.

6.3.1. Interpretation and Explanation

Adam Lanza was suffering from a condition in which his sensory signals could not get organized into appropriate responses. In simpler terms, it can be perceived as a circulation congestion that prevents portions of the brain from receiving any information which is necessary for sensory interpretation. In his case, the processing lag was an outcome of prenatal complications at the time of his birth. As a result of this sensory integration disorder, disguised aggression crept into his life which was one of the reasons for his unfortunate actions. According to his teachers at school Lanza complained of foul smell in their class whereas none of the other students felt the same. One of the reasons for this was that in few cases of processing disorders, individuals tended to 'over-respond' to stimulus.

Another disorder with which Lanza was diagnosed later in life was Obsessive Compulsive Disorder (OCD). Possible causes according to recent OCD studies for the same in Lanza could have been the mutations in the Human Serotonin Transporter Gene (hSERT) and the Neuronal Glutamate Transporter Gene (SLC1A1). These mutations tend to reduce the availability of serotonin thereby causing anxiety, tinnitus and lower cognitive functioning in earlier stages followed by joylessness and anti-social behavior. His Asperger's Syndrome further proved to be synergistic in its effects with difficulty in social interaction however this syndrome is linked with autism and not criminality at any instance in Lanza's case. His biological fate and lack of medical administration at the correct time can be held responsible for Adam's action but that doesn't make the incident any less gruesome and hapless.

6.4. Case 4- Bipolar Disorder

Jeffery Hutchinson was a resident of Florida where he lived with his girlfriend, Renee Flaherty and her 3 children. On 11th September 1998, Jeffery and Renee had an argument after which Jeffery went to a local bar and consumed alcohol. Hutchinson then went back home and shot Renee and all her 3 kids. When the police reached the crime scene, Hutchinson said two men came inside the house and killed the victims. However, gun powder residue was found on Hutchinson's hand. Hutchinson had bipolar disorder. He was sentenced to death on February 6th, 2001.

6.4.1. Interpretation and Explanation

Bipolar disorder is usually caused due to imbalance of neurotransmitters like noradrenalin and serotonin. Abnormal functioning of serotonin leads to mood disorders, like depression. Bipolar disorders have a genetic basis as well and are mostly seen in identical twins. If one twin has a bipolar disorder, the other twin has greater chances of developing the disorder than the other dissimilar sibling. The flawed gene responsible for some cases of bipolarity was discovered by Kelse et al in 2003. Bipolarity also results in increased aggression and anti-social behaviour which can get aggravated in stressful conditions, which can further result into delinquency. In this case, as Hutchinson was already a subject to bipolar disorder, it is highly possible that the sudden outburst aggression which led to the killing was because of his condition. Mania caused by bipolarity is something that was evidently seen in Hutchinson's behaviour as he was violent and destructive in order to prove himself right.

The above case is a perfect example of a genetic illness causing criminality in individuals.

6.5. Case 5- The criminal with 'bad genes'

Davis Bradley Waldroup Jr. was an inhabitant of a small town Tennessee in Greasy Creak. He was the first criminal to get a relaxed sentence on account of 'bad genes'. Davis's wife, Penny Waldroup and him were married for several years and had two children. Husband and wife's relation underwent some kind of strain around October 2006.

On October 13th, 2006, the bad side of Waldroup was unleashed when his wife and one of her friends went to drop off the children at his trailer. On mildly refusing Davis's appeal to talk and suggesting the dialogue when she came to pick the children up his anger got out of control. He reportedly began to yell at his wife and her friend. Davis blamed Leslie Bradshaw (wife's friend) for the demise of his marriage, raised his rifle and began to fire. He shot her 8 times and cut her open. An attempt to kill Penny Waldroup was also made by him-he shot her once when she was trying to run away, beat her with a machete and post these events he forced to have intercourse with him despite her state. His attempt to murder the wife remained unsuccessful as a police officer drove past their driveway at which the wife ran out to seek his help. Consequently, Waldroup was arrested. In spite of being a clear death row or a

lethal injection sentence Waldroup was sentenced to an effective thirty-two years of life imprisonment and was convicted for the following- aggravated kidnapping, voluntary manslaughter and attempted second degree murder instead of an additional first degree murder. The mitigated sentence was an outcome of the genetic evidence suggesting that Davis Bradley Waldroup Jr. possessed the MAOA gene which aided an explanation to his criminal actions.

6.5.1. Interpretation and Explanation

According to Cynthia Lecroy-Schemel, the prosecutor of the Waldroup case, this criminal act was one of the most brutal ones she had come across till then. She said, "There are murders and then there are hacking to death, trails of blood. I have not seen one like this and I have done a lot."

In Davis Waldroup's case, upon medical examination it was found that his 4R allele of the MAOA gene was responsible for his erratic and unjust behavior. Monoamine oxidase A gene or the warrior gene encodes for the MAO-A enzyme. This enzyme's primary function is degradation of amine neurotransmitters like serotonin, dopamine and norepinephrine. This process is brought about by generation of oxoacids in liver and kidney. The activity of this enzyme is known to be capable of influencing standard brain functioning, feelings, mood and behavior of individuals.

With Waldroup's history of child abuse coupled with low levels of the MAOA enzyme he became more vulnerable and his condition only aggravated with time. Social banishment and ostracism made him particularly savage against his wife and her friend who he blamed for his unsuccessful marriage. His attorneys also stated that Waldroup was a victim of Intermittent Explosive Disorder, a disorder which is characterized by brief outbursts of anger and comorbidity with mood and energy changes as was prevalent in his actions. Consequently, his actions and the necessary reports were scrutinized by the jury which led to the conclusion that Davis Bradley Waldroup Jr.'s actions were not pre-mediated but impetuous, hence he was given merely a 32-year sentence to an offence that otherwise was bound to be subjected to death penalty. This was one of those cases in which the genetic predisposition of the individual presented culpability and innocence not in mere stipulations of black and white but in terms of grey.

6.6. Case 6- Inherited Criminal

In the year 1991, Stephen Tony Mobley killed a 25-year-old manager named John Collins at a Pizza store by shooting him in the neck after robbing the store. Mobley, later, joked that he would apply for the job vacancy after the manager was dead. Mobley was convicted for the murder by the State of Georgia on 1st March 2005. The chief witness for Mobley's defence was his aunt. She testified that various male members of the Mobley family, for the past 4 generations, have been aggressive, violent and criminals. In his adolescent years, he served prison sentences for forgery and armed robberies. Mobley's lawyers argued for clemency saying that the family members had a disposition towards violence and aggression. The family tree was analyzed by researchers who were interested in establishing a connection between genetics and criminality. In the course of this analysis, 4 generations including aunts, uncles and a grandfather were responsible for heinous crimes like rapes, murders, alcoholism, antisocial behaviour and domestic violence. His lawyers argued that the research that correlated a mutation in MAOA gene to antisocial behaviour could be applied in Mobley's case. However, the judge denied this as he did not think the research to be strong enough to link Mobley's criminal act to genetic mutation. Subsequently, Mobley was executed by means of a lethal injection.

6.6.1. Interpretation and Explanation

This can be clearly understood on the basis of the adoption studies discussed under the theories of criminality. This can also be seen as a setting example of epigenetics, a concept that revolved principally around the heritable changes in gene expression of active and inactive genes. It is clear that Mobley, since his childhood had delinquent tendencies that could have been inherited or just developed through the course of growing up. According to his relatives, Mobley was a difficult child and had a history of lying, stealing, cheating, setting fires, vandalizing and being cruel to animals. With the research conducted on the family, it is clear that there was a possibility of genetic mutation (like one in case of MAOA gene or XYY supermale) which results in the aggressive behavior amongst the members of the family but nothing could be said for certain. Despite of the unknown cause of criminality, its inheritance was researched and accepted later, further enunciating the fact that Mobley was born like that.

6.7. SCOPE

Crime is unquestioningly one of the most prevailing and worrying aspects in the current scenario. Criminality does not merely concern with the violation of the law but also the violation of the rights of a fellow individual. Antisocial behavior has been seen to sprout and accumulate across several generations which suggest that genetic makeup and family environment both play a role in the behavior. The same holds true for development of any disorders. The purpose of this paper is to enunciate the relationship between the genetic variability of an individual with respect to others in his species and the effect of this diversity on the Actus Reus and Mens Rea of crime.

Instead of considering criminality an outcome of either *Nature* or *nurture*, we believe that the inherent *nature* (in the form of their genetic predisposition) is further nurtured such that it leads to criminality. The accidental plight of these individuals was not out of a choice made by them but it cannot be used as an excuse to make their actions any less gruesome in any way. Genetic testing techniques should be employed to encounter any such 'natures' in order to take necessary measures for their combating therapies.

Genetic research in this field will help in diagnosing a particular criminal and further predicting the occurrence of similar acts by studying inheritance over generations. Estimation of this criminal rate can help the societal development in the long run. This research

will further aid in offender treatments and rehabilitation- new treatments can be encountered for disorders and like ADHD, OCD and other similar aberrations that synergistically encourage the antisocial behavior. Nonetheless, it should be deemed necessary by the courts to understand and consider the genetic assembly and effects of the environment while issuing a sentence for punishment and also for rehabilitation.

As the infamous inventor and writer Lewis F. Korn said, "Crime is as much a condition as an intention." Criminal 'patients' should be given appropriate treatment in order to prevent future occurrences of any violent outbursts thereby making the society safer in the long run.

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