Psychology of Criminal Behaviour A Canadian Perspective (Canadian) 2nd edition Brown Solutions Manual

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CHAPTER 2: THEORIES OF CRIME: BIOLOGICAL AND EVOLUTIONARY EXPLANATIONS

LEARNING OBJECTIVES

1. Describe the range of biological explanations of crime, including genetics, neurochemistry, hormones, psychophysiology, and more.
2. Explain the basic principles of evolutionary psychology and demonstrate how these principles are used to understand crime in general as well as specific forms of crime and specific types of criminal offenders.
3. Demonstrate that biological and evolutionary theories of crime are as much about the environment as they are about biology and evolution.
4. Demonstrate that biological and evolutionary explanations are not incompatible with traditional theories of crime (e.g., social learning theory, presented in Chapter 3), but rather are complementary.

CHAPTER SUMMARY

There are multiple pathways to crime. This chapter has focused on evolutionary and biological explanations. Multiple pathways exist within each perspective including biological factors such as genetics, neurochemistry, hormones, and psychophysiology. Evolutionary perspectives are complex and comprised of a series of micro-evolutionary theories (e.g., life history theory and frequency dependent selection).

Biological and evolutionary explanations of crime underscore the importance of the environment. Environmental insults (e.g., a mother who drinks during pregnancy) change the biological makeup of an individual such that he or she is now predisposed to a future criminal lifestyle. A distant environment shaped evolutionary mechanisms. Evolution itself determined our minds such that they adapt and change to current environmental cues. The theory of evolution has more in common with environmental theories such as social learning (discussed in Chapter 3) than one might think. The only difference is that evolution focuses on the learning environment of the entire species whereas social learning theories focus on the learning environment of an individual.

It is a myth that evolutionary accounts of crime contradict traditional theories. Evolutionary perspectives simply focus on providing ultimate explanations, while traditional criminological theories focus on more proximate explanations. These perspectives tend to complement rather than contradict. When theories do diverge it indicates that one perspective is incorrect.

This chapter has shown that research unequivocally supports the influence of genetics on criminality. It has also demonstrated that the path to crime is complex and that a number of biological subsystems interact with one another to increase risk of future criminality, with the environment greatly influencing whether certain biological predispositions will manifest. Evolution is uncontested in scientific circles; however, evolutionary

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psychology, in particular, evolutionary forensic psychology, is in its infancy. More research from different perspectives is required.

The link between evolutionary and biological explanations of crime is a natural one. In the evolution section, we focused on psychological mechanisms that have evolved in response to ancestral selection pressures. This does not negate the existence of evolved biological mechanisms such as those reviewed in the first part of the chapter.

LECTURE OUTLINE

1. Introduction

- This chapter focuses on biological and evolutionary explanations for antisocial behaviour, crime, and violence.
- Biological explanations are varied and include genetics, brain neurochemistry, and diet for example.
- Evolutionary psychology principles will be described and used to explain certain types of offenders including psychopaths and crimes such as homicide.
- Paradoxically, biological and evolutionary explanations include the environment.
- Discussions will explore how our past hunter and gatherer ancestral environment shaped the evolution of the human species and how it continues to influence our biology.

2. Context

- Lombroso (1835-1909) is commonly known as the "father of criminology."
- Lombroso argued that criminals possess distinctive physical features (e.g., sloping foreheads and twisted lips not observed in his "normal" subjects).
- Lombroso referred to these features as atavisms and suggested that criminals were evolutionary throwbacks who had more in common with Neanderthals than modern-day man.
- Darwin published *On the Origins of Species* in 1859, almost 17 years before Lombroso published the first volume of *The Criminal Man.*
- Darwin posited that humans evolved from ancestral species via the mechanisms of natural selection.
- Darwin's cousin, Galton, misused Darwin's work and founded eugenics – the theory ultimately responsible for not only the forced sterilization (or worse) of thousands of "unfit" individuals in the United States during the early part of the twentieth century but also the atrocities under Hitler's regime (forced abortion, sterilization, and death camps).

3. Definitions

- Defining crime is a complex task.
- Some researchers examine the link between biology and crime by comparing normal individuals to individuals who have been officially diagnosed with antisocial personality disorder (ASPD), conduct disorder (CD), or psychopathy.

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- Other researchers use measures of aggression or composite indices of antisocial behaviour obtained via self-report surveys or, in the case of children, parents/teachers.
- Researchers often define crime using current legal definitions and examine whether biological factors correlate/predict official criminal offending in the form of arrests/convictions.
- Target of study vary, focusing on males, females, children, adolescents, or specific groups such as violent or sexual offenders.

4. Why Do We Care?

- *What Makes a Strong Theory?*:
- Numerous textbooks and experts have defined the meaning of theory.
- The definition here represents an amalgamation of perspectives: a theory is an explanation of a particular phenomenon.
- A strong theory:
  1. is parsimonious;
  2. clearly identifies the causal mechanisms and corresponding mediators and moderators underlying the phenomenon of interest;
  3. is testable and hence falsifiable via hypotheses and predictions;
  4. is based on empirical data and modified in response to new data;
  5. possesses interdisciplinary compatibility; and
  6. respects gender, ethnicity, and culture.
- It is helpful to ask, "Does this perspective provide a good theory of crime?" For example, are certain explanations stronger (causal evidence is presented versus correlational evidence).

5. Methodology

- *How is Biology-Focused Research Conducted?*:
- Behavioural genetics researchers use twin methodology to ask whether identical twins are more likely to commit crime than non-identical twins..
- Molecular biologists compare the genetic makeup of a group of "criminals" to one of "non-criminals" to look for distinct genetic differences between the two.
- Neurochemical approaches examine how genes actually express themselves in terms of the brain's neurotransmitter systems.
- Other researchers rely on brain-imaging techniques such as computer tomography (CT) to assess brain functions and impairment in antisocial individuals.

6. Biological Theories of Crime

- *Genetics and Crime - Twins, Adoption, and Molecular Genetics*:
- *Twin Studies*:
- To examine the role that genetics plays in criminal conduct, it is necessary to employ methodologies that allow researchers to separate genetic and environmental influences.
- Behavioural genetics relies heavily on the study of twins and adoptions that can help separate genetic from environmental influences (to some degree).

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- Every human being shares about 99 percent of his or her DNA sequence with the rest of the human species.
- The 99 percent of every human's DNA is shared with the rest of the human species and is fixed (not free to vary) and accounts for our basic similarities.
- Behavioural genetics focuses on the remaining 1 percent of human DNA that is free to vary.
- Monozygotic (MZ), or identical twins, are genetically identical and share 100 percent of their genes (including the free to vary 1 percent).
- Dizygotic (DZ), or fraternal twins are no more alike than non-twin siblings, sharing on average about 50 percent of the 1 percent that is free to vary.
- Frequency of criminal behaviour is converted into a concordance rate that represents the percentage of both twins classified as criminal.
- Concordance rates would be calculated separately for MZ and DZ twins and then compared.
- A concordance rate of 30 percent for the DZ twins would mean that if one of the DZ twins was criminal, then there was 30 percent chance that the other DZ twin was also criminal.
- Evidence for a genetic contribution to crime is inferred if concordance rates are higher between MZ than DZ twins.
- Concordance rates are typically converted into a heritability coefficient—a descriptive statistic that represents the proportion of phenotypic variance in a given behaviour (e.g., criminal) that can be attributed to genetic variation among individuals.
- More complex statistical approaches such as biometric modeling have been used to estimate heritability coefficients.
- Statistical modeling methods permit the estimation of two types of environmental factors:
    1. shared environmental factors (i.e., aspects of the environment shared by all family members, such as living in poverty) and
    2. non-shared environmental factors (i.e., aspects of the environment not shared by all family members, such as exposure to different peer groups or differential treatment by parents.
- Genetic studies are as much about genes as they are environment.
- This type of twin study may overestimate or underestimate the genetic contribution for several reasons:
    1. parents are more likely to provide similar environments for MZ twins than their DZ counterparts;
    2. heritability estimates for MZ twins may be confounded by prenatal factors that by definition aren't necessarily genetic e.g., MZ twins usually share one placenta and DZ twins usually have two separate placentas; and
    3. earlier twin studies were also criticized for using small sample sizes and for being subject to political influence.
- *Adoption Studies:*
- Adoption research has taken one of two forms:

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1. Parent – offspring: concordance rates (or correlations) between adoptive parents and adoptees' antisocial behaviour are compared to concordance rates (or correlations) between biological parents and adoptees. If the concordance rates/correlations are higher for the biological parents and the adopted offspring than the adoptive parents and the adopted offspring, genetic contributions to antisocial behaviour are inferred.
2. Sibling – offspring: concordance rates between adoptive siblings are compared with concordance rates between biological siblings.

- One strong adoption study of 14 427 non-familial adoptions in Demark between 1924 and 1947 found:
  1. if both the biological and adoptive parents had no criminal record, then only 13.5 percent of adopted sons had criminal records;
  2. if the adopted parent had a criminal record and the biological parent did not, this percentage increased marginally to 14.7 percent;
  3. if the biological parent had a criminal record and the adoptive parent did not, this percentage rose to 20 percent; and
  4. if both biological and adoptive parents had a criminal record the percentage was the highest at 24.5 percent.
- The Danish study demonstrates that genes play a role in explaining crime and that environmental effects are important.
- A meta-analysis of 10 independent adoption samples and 42 independent twin samples studies (55 525 total participants) show the variance in antisocial behaviour can be divided as follows: heritability (41 percent) shared environment (16 percent), and non-shared environment (43 percent).
- Both genetics and the environment contribute to variance in antisocial behaviour.
- Research increasingly shows that the gene–crime link is most likely not direct but rather a function of the mediational effects of inherited characteristics that predispose an individual to antisocial behaviour (e.g., lower intelligence, impulsivity, attention deficit hyperactivity disorder).
- Pathways to antisocial behaviour are not usually direct nor unidimensional.
- Genetics might reduce or magnify the effects of environmental risk factors.
- Behavioural geneticists ask if there may be interactive effects between genes and the environment (gene X environment effect).
- The evidence demonstrates that childhood maltreatment (e.g., physical abuse, emotional abuse, sexual abuse, neglect) contribute to the development of antisocial and criminal behaviour.
- Less clear is why 50 percent of maltreated children do not engage in delinquency, aggressive behaviour, or criminality.
- One twin study used a genetic risk continuum (low to high risk) in studying conduct disorder. The experience of maltreatment increased the probability of the child receiving a conduct disorder diagnosis by 1.6 percent among children deemed lowest genetic risk and 23.5 percent for children deemed high genetic risk.
- *Molecular Genetics Research:*
- Twin and adoption studies illustrate that there is a clear link between genetics and antisocial behaviour (the actual functional gene(s) involved have not been identified).

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- The main function of a gene is to produce proteins comprised of amino acids – the basic building blocks of life.
- Proteins are responsible for the phenotypic expression of our genotype.
- Faulty genes either reduce too much or too little of a particular protein.
- Human genes are stored in 46 chromosomes (23 pairs).
- Caspi and colleagues (2002), using an epidemiological study, demonstrated an interaction between a specific gene (monoamine oxidase A [MAOA], a sex-linked gene) and a well-known risk factor – childhood maltreatment.
- The MAOA gene is responsible for encoding the MAOA enzyme, which is responsible for metabolizing key brain neurotransmitters such as norepinephrine (NE), serotonin (5-Ht), and dopamine (DA), all of which have been implicated in aggression and various forms of antisocial behaviour.
- The two existing versions of the MAOA gene—low activity and high activity—are the result of a polymorphism.
- Researchers found evidence for a strong gene by environment interaction across all four measures of antisocial behaviour—conduct disorder, violent convictions, violent disposition, and antisocial personality disorder symptoms.
- While maltreatment by itself had deleterious effects, its effects were exacerbated by the presence of a low-activity MAOA gene.
- Thus there is increasing evidence that the low-activity version of the MAOA gene plays a significant role in the expression of antisocial behaviour, particularly aggression and violence when maltreatment is present.
- *Neurochemistry and Crime—Hormones and Neurotransmitters:*
- Genes are largely responsible for the expression of hormones and neurotransmitters.
- The endocrine system regulates hormone production and distribution.
- The nervous system regulates the production and function of neurotransmitters.
- *Hormones and Crime:*
- The endocrine system governs more than 50 hormones.
- Hormones are released into our bodily fluids typically via the bloodstream.
- Hormones not only regulate metabolism, growth, and development, they also impact behaviour.
- Imbalances may be minor, resulting in mood swings, or severe, resulting in serious illness or death.
- Testosterone is a steroidal hormone of the family of androgens responsible for developing and maintaining male primary and secondary sexual characteristics
- Testosterone is implicated in criminal behaviour, violence and aggression,
- Two meta-analyses have found a positive correlational relationship between testosterone and aggression; however the average effect size is relatively small.
- The relation between testosterone and aggression is complex (and far from causal) and most likely indirect in the expression of aggression and antisocial behaviour.
- *Neurotransmitters and Crime*:
- Neurotransmitters are chemical messengers that operate in the brain and are the messengers of the nervous system.
- Neurons or nerve cells transmit commands from one part of the body to another and neurotransmitters play a critical role in this communication process.

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- There are two types of neurons: pre-synaptic (senders) and postsynaptic (receivers).
- The postsynaptic cell receives messages using its dendrites.
- Narrow gaps or synapses exist between the pre-synaptic and postsynaptic cells.
- Some of these synapses are electrical and some are chemical (electric impulses are converted to chemical signals by the neurotransmitters).
- An electrical impulse travels along the presynaptic cell but cannot cross the synaptic cleft to the postsynaptic cell without being temporarily converted into a chemical signal, the neurotransmitter.
- Neurotransmitters are stored in synaptic vesicles.
- Three neurotransmitters in particular have been studied in relation to crime as related to information processing, mood regulation, and communication: serotonin, dopamine, and norepinephrine.
- Serotonin
- The neurotransmitter serotonin plays an important role in behavioural inhibition and mood regulation.
- Serotonin is produced from the essential amino acid, tryptophan.
- Tryptophan is not produced naturally within the body but must be obtained from diet (protein-based foods such as turkey and chocolate).
- There is a link between a malfunctioning serotonin system and impulsivity, irritability, and aggression (towards self/others) – found in studies that operationalize malfunctioning serotonin systems as low levels of serotonin, low levels of its precursors such as tryptophan, low levels of its metabolites, and faulty serotonin receptor sites on the postsynaptic neuron.
- Serotonin, its precursors, and metabolites are measured in blood, urine, and cerebrospinal fluid (CSF). CSF studies are considered the most reliable.
- One meta-analytic review of 16 studies illustrated that serotonin levels were substantially lower among antisocial individuals than non-antisocial individuals (with effect size unrelated to gender, target of violence, history of suicide, or alcoholism). Results confirmed a moderate (positive) correlation between blood serotonin levels and violent criminal behaviour but it must be kept in mind the studies were correlational in nature and based on predominantly non-random and small samples (less than 30).
- Research clearly suggests that there is a correlation between a malfunctioning serotonin system and aggression; however the extent to which serotonin is predictive or causally related to violence/aggression requires further study.
- Newer studies that artificially manipulate tryptophan to examine the impact on aggression (in laboratory setting) suggest a causal link; however more studies are needed as this study is preliminary and requires replication.
- Other studies show low levels of serotonin increase impulsivity (a known correlate of aggression) and suggest serotonin may exert its influence indirectly on aggression through the mediator of impulsivity or negative mood.
- *Psychophysiology and Crime:*
- A psychophysiological theory uses physiology (e.g., low resting heart rate) to explain psychological constructs (e.g., emotions, motivation, and learning).

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- Various theories have tried to link measures of autonomic response (e.g., heart rate, electrodermal activity/galvanic skin response/skin conductance) to various measures of antisocial conduct.
- Electrodermal activity (EDA) measures the amount of electrical current between two points on the skin.
- Increases in heart rate and EDA are related to general emotional responses such as fear, anger, or anxiety.
- Two meta-analyses show a small to moderate correlation between various indices of antisociality and low levels of autonomic arousal.
- Individuals who engage in antisocial behaviour have a tendency to exhibit low heart rates and low EDA.
- Two competing theories have been developed to explain these findings: fearlessness theory and stimulation-seeking theory.
- Fearlessness theory argues some individuals do not experience much fear when stressed thus these individuals possess the requisite level of fearlessness to engage in crime.
- Some research suggests children who experience chronic childhood stressors learn to habituate to life stress and are predisposed to fearlessness and a proclivity to antisocial conduct.
- Stimulation-seeking theory explains the relationship between low resting heart rate and aggression as a need for stimulation. Individuals find their chronic state of low arousal as unpleasant and seek to alleviate it by engaging in risky activities including crime.
- *The Brain and Crime - Neuroimaging and Neuropsychology*
- The story of Phineas Gage is the first documented natural experiment linking the brain to personality and behaviour.
- Scientists have since accumulated much knowledge about the brain and antisocial behaviour using brain imaging studies and neuropsychology.
- *Brain Imaging:*
- Brain imaging (neuroimaging) research examines the structural (e.g., size of grey matter, tumours, lesions) and functional characteristics (e.g., blood flow, glucose metabolism) of the brain.
- Brain structure is typically studied with magnetic resonance imaging (MRI) and computed tomography (CT), while brain function is studied through positron-emission tomography (PET) and single photon emission computed tomography (SPECT).
- Brain imaging studies are complex and diverse and involve assessing a small number of known antisocial individuals to a comparison group.
- Earlier studies compared brain structures and/or functions of the two groups.
- Recent studies have compared brain function while test subjects were engaged in a cognitive activity (such as viewing emotionally negative pictures).
- A meta-analysis by Yang and Raine (2009) concluded that functional and structural impairments to the prefrontal cortex are more common among antisocial populations than comparison groups.

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- Three areas in the pre-frontal cortex responsible for regulating emotional processing, decision-making, impulse control, and cognitive flexibility are more likely to be impaired among antisocial populations.
- While this body of research is intriguing, it has been built on small samples of incarcerated offenders (predominantly sex and violent offenders) and is typically without non-criminal comparison groups which precludes the ability to determine whether brain abnormalities cause antisocial behaviour or whether engaging in antisocial behaviour changes the structure and/or function of the brain.
- *Neuropsychology*:
- Neuropsychology studies brain function indirectly using a battery of paper/pencil and/or motor tests designed to diagnose what part of the brain is malfunctioning.
- Experts in the field of neuropsychology have studied whether deficits in executive functioning (cognitive functioning involving future goal-oriented behaviour, purposive attention, organizational skills, and inhibitory control) are related to antisocial behaviour.
- While these functions have been associated with the frontal lobe other components of the brain such as the connector pathways also play a role.
- Two narrative reviews reached inconclusive results regarding the link between executive functioning and antisocial behaviour but a recent meta-analytic study showed a robust effect indicating that poor executive functioning is related to antisocial behaviour; however there was considerable variability from study to study.
- *Other Biological Considerations—Pregnancy, Birth Complications, Toxins, and Diet:*
- Certain environmental insults change our biology in a manner that heightens our propensity toward antisocial behaviour.
- Inadequate prenatal (during pregnancy) conditions, perinatal (during birth) complications, improper diet, and environmental toxins (e.g., lead) result in changes to our biology that may in turn make us more likely to engage in antisocial behaviour.
- There is some evidence of a link between hypoglycemia (low blood sugar—known to result in panic, irritability, nervousness) and aggression and antisocial behaviour.
- In a double-blind study the effects of a healthy, sugar-reduced diet were found to reduce antisocial behaviour by 48 percent.
- Researchers investigated the impact of lead neurotoxins on brain development determining that while there was no effect at the age of 7 in boys, elevated levels of lead were linked with significant increases in antisocial behaviour by the age of 11 even when controlling for other factors such as socioeconomic status and parental quality.
- Abnormal fetal development due to a variety of factors including maternal smoking, drinking, fetal alcohol spectrum disorder, poor nutrition, and birth complications may predispose an individual to antisocial behaviour.
- Hypoxia or lack of oxygen to the brain at birth can have a profound impact on development, increasing the probability of learning disabilities, impaired cognitive functioning, and intelligence.
- The environment (e.g., positive parenting) can reverse the potentially deleterious effects associated with pregnancy and birth-related insults and thus serve to protect

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individuals from their biology and the environment (e.g., poor parenting) can aggravate biological risk such as children born with subtle neurological impairments.
- It is important to underscore the complex interactions occurring within the biological subsystems as well as between them.
- Complex interactions occur at the environmental level (e.g., the positive impact of diet on hyperactive children is magnified when accompanied by a supportive home environment).
- It is critical to ascertain how all the factors fit together to determine the true causal risk factors, mediators, and moderators that will result in a stronger theory of crime and in turn lead to efficient allocation of limited treatment resources.

7. Evolutionary Theories of Crime

- Proximate explanations identify which factors in a person's immediate environment cause certain behaviours and how the behaviour develops over an organism's lifespan (questioning causation and development at the individual level).
- Ultimate or distal explanations ask questions about function and adaptation for an entire species.
- Darwin made two critical points in his book: 1) species did not always exist in their current form but rather evolved or transformed from ancestral species; and 2) the evolutionary mechanism for this transformation was natural selection.
- *Evolution 101: Natural Selection, Adaptation, and Beyond:*
- Evolutionary psychology seeks to understand human psychology from a Darwinian perspective.
- Evolutionary perspective has been applied to a vast array of psychological constructs ranging from altruism, phobias, emotions, group dynamics, and antisocial behaviour.
- Evolutionary psychology posits that the human mind comes equipped with numerous psychological mechanisms that have been designed and maintained through selection over thousands of years of evolution.
- These psychological mechanisms are sometimes conceptualized as a series of mini computer programs that have been designed by one master programmer (the environment itself).
- Our ancestral environment was comprised of various selection pressures and adaptive problems—finding a mate, hunting, gathering, protecting children, avoiding predators, and finding shelter.
- "Hunters" and "gatherers" who successfully responded to adaptive problems and/or selection pressures not only survived, but lived long enough to reproduce children and pass these successful adaptations on to the next generation.
- Unsuccessful responses resulted in death or reduced capacity to reproduce.
- Successful adaptation – be it biological or psychological – is housed in an individual's genetic makeup, so the only way adaptations can be passed on is through genetic rather than cultural transmission.
- A prerequisite to becoming a potential adaptation is that the "candidate" adaptation must first appear in the organism's genetic makeup by chance or a genetic mutation.
- If the mutation enhances the organism's reproductive fitness – how good an organism is at reproducing plentifully and keeping offspring alive long enough for them to

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reproduce - it will be retained and passed on to the next generation and eventually make it's way into the species' genome (on average a few thousand generations).
- Adaptations that increase reproductive fitness by as little as 1 percent (on average) are naturally selected over other less beneficial characteristics.
- Evolution takes so long, our existing psychological mechanisms are the result of selection pressures that existed during the hunter and gatherer era rather than the industrial or even the agricultural revolutions and thus may not be adaptive in contemporary society.
- Existing psychological mechanisms were adaptive in a typical hunter-gatherer environment characterized by life in small, face-to-face nomadic bands of less than 100 people, most of whom we were genetically related.
- We are the way we are because existing attributes (ability to walk upright, to feel fear, to fight) were adaptations in the distant past that enhanced our reproductive fitness and consequently were naturally selected for and became part of the human genome.

8. Methodology

- *How is Evolutionary Research Conducted?*
- Researchers use an array of methods to test evolutionary theories and hypotheses, including historical, anthropological, and cross-cultural methods.
- Researchers also use methods that are routine among psychologists (e.g., paper/pencil questionnaires, interviews, computer simulation studies) with the key difference being in how evolutionary theorists frame questions and interpret results.
- A social learning psychologist might interpret aggressive behaviour between two males as pathological, stemming from each individual's interpretation of the rewards outweighing the costs for such behaviour, an evolutionary psychologist would look for an ultimate explanation and explore whether the behaviour served some adaptive function in an ancestral environment such that the reward/cost ratio favours the species.
- If it were not an adaption, evolutionary psychologists would test whether it is a by-product of another adaptation or the result of a malfunctioning adaptation.
- *Evolution and Crime: What Do We Know?*:
- The application of evolutionary principles to criminal behaviour is a growing yet novice field.
- Evolutionists posit that recurring conflict (e.g., over resources, mates, or offspring) drove the selection pressures that shaped evolutionary adaptations, manifesting in a wide range of antisocial behaviours including violent (rape, homicide) and non-violent offenses (sexual harassment, theft).
- Researchers have applied certain micro-level theories that exist within the framework of evolutionary psychology in four ways including life history theory used to explain antisocial behaviour, frequency dependence selection used to explain psychopathy, male-male competition to explain homicide, and parental investment and mating effort theories to explain gender differences in crime.
- *Life History Theory and Antisocial Behaviour*:

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- Our ancestors had several competing demands on their time including hunting and gathering, finding and attracting a mate, and protecting and nourishing offspring all of which enhanced survival and reproduction fitness.
- The challenge was in how individuals could establish the most effective trade-off between these activities because allotting time to one activity would offer an important benefit (nourishing and protecting offspring, also known as parental investment, offers important reproductive benefit in that the offspring would live long enough to mate and transfer his/her and your genetic material to the next generation) but had a trade-off in cost (protecting offspring takes time away from siring other children for males and reduces survival and/or fertility for females).
- There was always a trade-off between the costs and benefits associated with the various activities that defined our ancestors' lives.
- Life history theory argues that natural selection favours allocation strategies that, on average, optimize reproductive fitness.
- Life history theory is unequivocal on the assumption that the psychological mechanisms that regulate how we spend our time have evolved to be highly flexible and responsive to environmental cues which is known as "adaptive phenotypic plasticity".
- If environmental cues suggest that life is likely to end at any time (e.g., constant food scarcity and/or predatory threats) or that the future is bleak and unpredictable, our evolved psychology will direct a life strategy characterized by riskier activities that are more likely to attract and retain a mate such as demonstrating mate worthiness by physically attacking competing male suitors in front of a prospective mate.
- This life strategy gets your genes into the next gene pool more quickly and before too late (e.g., before you starve to death) but comes with a price of less time spent protecting and nourishing existing offspring.
- In present day society, riskier activities are more likely to result in criminal justice involvement.
- Researchers tested life history theory by following 165 individuals from birth into their early 20s and found that those whose early childhoods were characterized by chaos and unpredictability (parents who were sporadically employed, multiple changes in residences, changes in cohabitation status) had more sexual partners and engaged in more aggression, delinquency, and crime later in life.
- *Psychopathy*:
- Typified by a constellation of affective, interpersonal, and behavioural characteristics including superficial charm, grandiosity, manipulation, and lying, absence of remorse, inability to feel empathy, impulsivity, risk-taking behaviour, irresponsibility, and living a parasitic lifestyle.
- Evolutionary forensic theorists have hypothesized that the pathway to psychopathy can be explained using an evolutionary framework – specifically, the principle of frequency dependent selection.
- Polymorphisms are when two or more forms of a discrete character exist (e.g., eye colour – blue eyes, brown eyes, green eyes or blood types – A, B, AB, and O) the contrasting forms are called morphs.
- One way that natural selection maintains diversity in a population is through frequency dependent selection, which states that the reproductive success of a

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particular morph relative to another morph (hence its ultimate survival) depends on its frequency (or, more accurately, its phenotypic expression) in a given population.

- If a morph becomes too common, its phenotypic expression will no longer be adaptive because its success is dependent on its rarity in comparison to its sister morph(s).
- Experts argue that psychopathic behaviour is a morph that has arisen as a direct result of frequency dependent selection.
- Cheater strategies enhanced one's reproductive success in our ancestral environments if, and only if, a small minority of individuals engaged in such tactics (e.g., 1 out of 100).
- As the number of cheaters increases, so does the probability that non-cheaters will find out and thus nullify the cheaters' success.
- Cheater strategies require a substantial pool of honest, trusting, cooperative individuals to manipulate in order to be successful.
- There are two lines of evidence in support of psychopathy as an adaptive life history strategy. First, the existence of psychopathic-like behaviour in the animal world (e.g., sneaker salmon) and second, indirect evidence those psychopaths are not competitively disadvantaged in a reproductive sense.
- If there is nothing wrong with psychopaths yet they still adopt a high mating effort/risk taking/criminal lifestyle, it can be inferred that their particular life history strategy must have been adaptive, evolutionarily speaking.
- *Homicide*:
- In 1988, Daly and Wilson used evolutionary perspective to understand various forms of homicide including spousal, blood-relative, casual acquaintance, revenge killings, and so forth.
- Despite media reports, most homicides occur as the result of altercations arising from arguments, insults, or rivalries between male acquaintances.
- Usually, the men involved are unmarried and unemployed.
- Daly and Wilson (1988) argue that a man's reputation depends largely on his ability to maintain a credible threat of violence and that the apparently trivial motives for most homicides may not be trivial at all, suggesting that homicide perpetrators are actually responding to perceived reputational or status threats.
- Failure to restore one's reputation in an ancestral environment would have resulted in dire consequences from a reproductive fitness standpoint for two reasons: first, responding with violence prevents current and future exploitation of one's resources (e.g., territory, shelter, food) and second, it signals to a prospective mates that a man will be a strong provider for herself and her future children, enhancing her reproductive fitness.
- Daly and Wilson (1988) do not argue that the act of killing has been naturally selected for, but rather that the broader spectrum of violence and aggression has been selected for, which at times can go too far and result in death.
- This argument posits that homicide is an evolutionary by-product of the more encompassing, evolved mechanism of violence and aggression that occurs in response to environmental cues or threats to status/reputation.

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- An alternative evolutionary account of homicide argues that natural selection has selected for the act of homicide in and of itself.
- It is therefore argued that violence, aggression, and homicide exist today because in an ancestral environment they enhanced reproductive fitness, particularly among men.
- A recent study of Genghis Khan and his descendants provides evidence in support of the hypothesis that violence, status, and power can dramatically enhance one's reproductive fitness.
- Genghis Khan and his male descendants established the largest land empire in history.
- Historical accounts indicate that Khan and his descendants were extremely violent as well as excellent progenitors of their genes, each keeping multiple wives and concubines as a direct result of war conquests.
- In an examination of the Y-chromosomes of over two thousand men from across Asia, 8 percent had Y-chromosomes that were virtually identical, indicating a common forefather.
- Approximately 16 million men across Asia possess this particular Y chromosome.
- While there is not 100 percent certainty this chromosome originated with Khan, researchers are reasonably confident that this chromosome belonged to his paternal grandfather.
- It is estimated that there are 20 direct descendants alive today for the average man alive at the time of Khan in comparison to the 16 million descendants of Khan.
- *Female-Perpetrated Crime*:
- Men commit more crime, particularly more violent and serious crime, than women.
- Campbell, and evolutionary theorist argues that risky behaviours were naturally selected for adaptation because they enhanced survival and reproductive success under certain environmental pressure particularly during scarcity of resources (e.g., food, money, and shelter).
- Campbell (2001) argues that resource scarcity drives both property and violent offending in women with property offenses reflecting women's attempts to provision themselves directly and violence reflecting female – female competition for provisioning males (indirect source of resources).
- Evolutionary pressure including the critical importance of maternal survival to females' reproductive success with attendant dependency of offspring on mother for survival resulted in females' lower threshold for fear, relative to males, when faced with the same level of objective physical danger.
- This adaptation inhibits women's involvement in crime, making them more likely to be involved in property rather than violent crimes and, when direct confrontation is inevitable, causes them to use low-risk or indirect tactics (e.g., verbal aggression).
- Poverty (the immediate cause of resource scarcity) may be a necessary but not necessarily sufficient precursor to female crime.
- Individual differences in fear thresholds among women explain why some poverty-stricken females resort to crime while others do not.
- There are a number of important direct and indirect factors that mediate the relationship between poverty and crime.

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- These factors operate at both the macro (e.g., overcrowding) and individual levels (e.g., poor parenting) and are derived from existing criminological theories such as social learning theory, social control theory, and life course perspectives.
- Life history theory can be used to examine the costs and rewards associated with mating effort versus parental investment and why these differ between men and women.
- Reproductive fitness variance describes the differing rewards and costs associated with mating effort and parental investment for men and women and explains why women commit less crime both in seriousness and volume than men.
- Women's fitness variance is restricted in comparison to men's because over the course of her life, it is impossible for a woman to produce more offspring than a man could.
- The number of offspring a woman can produce and care for during her lifespan is relatively small compared to her male counterparts.
- Women carry a finite number of eggs and must devote considerable time and resources to raise one child (e.g., nine months gestation and lengthy lactation period especially in ancestral times). It also takes time before she is physically able to conceive another child following birth. Hence a woman's fitness potential is restricted.
- In contrast, these limitations do not exist for men because, in theory, men can produce significantly more children and with little effort.
- Male reproductive fitness potential is considerably wider varying from none to several hundred
- In an ancestral environment, the cost/benefit ratio favoured high mating effort over parental investment (on average) for men, whereas it favoured high parental investment for women.
- On average, men who focused more of their energy on finding and maintaining sexual partners versus parental investment were more successful in propagating their genetic material.
- Conversely, women who were more selective about mates (pairing up with someone who would keep them and their children alive) and who devoted more time to protecting their offspring were, on average, more successful in propagating their genetic material.
- Natural selection favoured evolved psychological mechanisms that supported high mating effort in men and high parental investment in women.
- For women, the cost of engaging in high mating effort and consequent risk-taking and aggressive behaviours simply weren't worth the risk of dying and not being able to ensure the survival of offspring.
- Offspring survival wasn't nearly as dependent on the father's life.
- There is considerable evidence that men invest more energy in mating effort than women and that women are more partial to parental investment.

9. Future Directions

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- Many disciplines such as criminology that historically shunned biological and/or evolutionary approaches are not slowly starting to recognize the strengths of these perspectives.
- Science has begun to gain a better appreciation of the complexity of criminal behaviour.
- There is no magic bullet theory; however scholars will continue to develop interdisciplinary theories of crime that actively integrate biological and evolutionary perspectives alongside social learning perspectives.
- The field of molecular genetics is coming closer to understanding the actual mechanisms through which genes and environment interact to produce human behaviour.

TEACHING SUGGESTIONS

Videos:

The Brain (1997)
Annenberg Learner
"Video teaching modules for college and high school classrooms and adult learners; 32 video modules (from 5 to 20 minutes in length) and a guide.
Developed from the original series, *The Brain*, these flexible resources offer extensive footage and research into the inner workings of this amazing human organ, including findings on Alzheimer's disease, schizophrenia, autism, Parkinson's disease and many other topics. The modules are appropriate for general and advanced courses in psychology, abnormal and physiological psychology, neuropsychology, and occupation therapy."
Colorado State University
www.learner.org

The Brain: The Enlightened Machine (1984)
Authors: John Hemingway, WNET (Television Station)
"First program in a documentary series on the study of the brain and its workings. Among the topics covered in this program are the parts of the brain and their functions, the technology used to study brain activity, and some samples of brain disease or malfunction (epilepsy, Huntington's disease, hydrocephaly) and the methods used to research and treat them. Choreographer, Agnes de Mille discusses the stroke she suffered in 1975. Her slow but determined recovery, described by herself and her neurologist Dr. Fred Plum culminates in her return to the dance studio where she is seen rehearsing young dancers in her choreography."
WNET
Available from OCLC WorldCat and public/university libraries
www.worldcat.org

The Brain That Changes Itself (2008)
Author Normal Doidge

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"There's so much about the human brain that continues to baffle and mystify our top medical researchers, but one aspect of its complex design is starting to come into focus. Contrary to previous widely held beliefs, the human brain exists in a perpetual state of constant change. The documentary *The Brain That Changes Itself* explores these groundbreaking findings as heralded in a book of the same title by psychiatrist and researcher Dr. Norman Doidge.

For four hundred years, the common perception was that the brain worked much like a computer, and its functionalities were set as firmly in place as any machine. But what if the brain is actually morphing and maturing at all times based upon the stimuli of its environment? Such a notion, as argued by Dr. Doidge, would alter our perspectives on brain disease and dysfunction, and revolutionize our understanding of human nature itself.

The revolution began with the discovery of neuroplasticity, a term used to describe the structural changes of neurons in response to factors like environment, thought processes, and bodily injury. The phenomenon of neuroplasticity provides evidence of the brain's stunning malleability, and its inherent capacity to overcome and adapt to even the most severe challenges. Ongoing studies are indicating that in many cases, the healthy parts of the brain can be recruited to supplant those that are defective.

Dr. Doidge has not come to these conclusions on his own. They result from the tireless efforts of some of the world's most progressive medical scientists. *The Brain That Changes Itself* introduces us to many of these brilliant figures as well as a host of patients who have benefited from their brave new world of research. Their findings offer hope to victims of crippling neurological conditions like stroke, cerebral palsy, and chronic depression.

The implications set forth are not limited to the treatment of traumatic injury. This exciting realm of medical science can point the way to a more enlightened existence, and unlock a potential in the human species never before believed possible. For that reason alone, this film is a fascinating exploration that is relevant to all viewers."

CBC: The Nature of Things

Available from multiple sources including YouTube

SUGGESTED CLASS ASSIGNMENTS/ACTIVITIES

In class/group discussions on:

- Should at-risk children be genotyped and given full neurological assessment? Who should have access to this information?
- What are the potential social policy ramifications related to the criminal justice system using biological explanations for criminal behaviour? How do we protect against these?
- What might happen to rehabilitation programs and/or restorative justice programs if fully biological/evolutionary theory approaches were taken to criminal behaviour?

ADDITIONAL WEB RESOURCES

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Association for Psychological Science
www.psychologicalscience.org

Human Behaviour and Evolution Society
www.hbes.com

The Evolution Institute
www.evolution-institute.org

Interactive Map of the Human Brain (Interactive website of how the brain functions) (2012)
"Map of the human brain: A region-by-region exploration of how the brain works - Its functions and symptoms of damage."
CBC News
www.cbc.ca

KEY TERMS

Amino acids
Ancestral environment
Antisocial behaviour
Anti-social personality disorder
Autonomic arousal
Behavioural genetics
Causal mechanisms
Computed tomography (CT)
Concordance rate
Conduct disorder
Distal/ultimate explanations
Dizygotic twins
Dopamine
Electrodermal activity (EDA)
Endocrine system
Enhanced reproductive fitness
Environmental risk
Epidemiology
Eugenics
Evolutionary forensic psychology
Executive functioning
Fearlessness theory
Fetal alcohol spectrum disorder
Genotype
Heritability coefficient
Hormones
Hypoglycemia

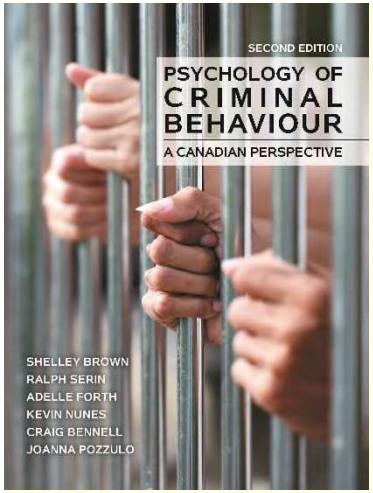
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Hypoxia
Life history theory
Macro-level factors
Magnetic resonance imaging (MRI)
Mating effort
Mediators
Metabolites
Moderators
Monoamine oxidase
Monozygotic twins
Natural selection
Neuroimaging
Neurons
Neuropsychology
Neurotoxins
Neurotransmitters
Norepinephrine
Parental investment
Phenotype
Phenotypic variance
Polymorphism
Positron-emission tomography (PET)
Post-Synaptic neuron
Prefrontal cortex
Pre-synaptic neuron
Primary, Secondary sex characteristics
Principle of Frequency-dependent selection
Proximate explanations
Psychopathy
Psychophysiological theory
Reproductive Fitness Variance
Selection pressures/adaptive problems
Serotonin
Single photon emission computed tomography (SPECT)
Stimulation-seeking theory
Synapse
Testosterone
Tryptophan

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Chapter 2

Theories of Crime: Biological and Evolutionary Explanations

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Historical Context

- Cesare Lombroso: criminals possess distinctive physical features; they are evolutionary throwbacks
- Charles Darwin: evolution and natural selection
- Francis Galton: eugenics

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Biological Theories of Crime

- Genetics and crime
- Neurochemistry and crime
- Brain and crime
- Other biological considerations

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Genetics and Crime

Link between genetics and antisocial behaviour:

- twin studies
- adoption studies
- molecular genetics research

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Neurochemistry and Crime

- Hormones and crimes
  - correlation between testosterone and aggression
- Neurotransmitters and crimes
  - Correlation between malfunctioning serotonin system and aggression
- Psychophysiology and crimes
  - Some correlation between low level of autonomic arousal and antisociality

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Neurotrasmitters: Serotonin

- Role in behavioural inhibition and mood regulation
- Low level of serotonin ⇨ impulsivity, irritability, aggression

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Psycophysiology and Crime

- Link between measures of autonomic response (i.e., heart rate, electrodermal activity) and antisocial behaviour
- Competing theories:
  - Fearlessness theory
  - Stimulation-seeking theory

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Brain and Crime

- Brain imaging
- Neuropsychology

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Brain Imaging

- Examines structural and functional characteristics of the brain (uses MRI, CT, PET, SPECT)
- Comparison of brain structures/functions of antisocial and non-antisocial individuals

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Brain Imaging (Cont'd)

- Raine and Yang (2009): correlation between impairments to the prefrontal cortex and antisocial behavior
- Note: prefrontal cortex regulates emotional processing, decision-making, impulse control and cognitive flexibility

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Neuropsychology

- Study of potential links between deficits in executive functioning (goal-oriented behaviour, purposive attention, organizational skills, inhibitory control) and antisocial behaviour
- Morgan and Lilienfeld (2000): poor executive functioning is related to antisocial behaviour

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Other Biological Considerations

- Role of prenatal and perinatal complications in antisocial behaviour
- Link between hypoglycemia and antisocial behaviour
- Impact of neurotoxins (e.g., lead) on brain development and antisocial behaviour
- Abnormal fetal development and predisposition to antisocial behaviour

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Evolutionary Theories of Crime

- Understanding human psychology of Darwinian perspective
- Psychological mechanisms developed through natural selection
- Role of ancestral environment: selection pressures and adaptation (successful adaptation works its way into the species' genome)

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Evolution and Crime: What Do We Know?

- Recurring conflict (over resources, mates, etc.) shaped evolutionary adaptations to include antisocial behaviours
- Application of evolutionary psychology:
  - Life history theory
  - Frequency dependence selection
  - Male-male competition
  - Parental investment and mating effort

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Life History Theory

- Natural selection favours allocation strategies that optimize reproduction fitness
- Adaptive phenotypic plasticity (Durrant and Ward 2015): riskier and shorter life ⟹ risker activities to attract and retain a mate; less time dedicated to nourishing offspring

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Life History Theory and Antisocial Behaviour (Cont'd)

- Simpson et al (2012): unpredictable and chaotic childhood ⟹ more aggression, delinquency and crime later in life

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Frequency Dependent Selection

- Used to explain psychopathy
- Psychopathic behaviour is a morph resulting from frequency dependent selection (reproductive success of a morph depends on its frequency in population)
- Psychopathy as an adaptive life history strategy

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Male – Male Competition

- Used to explain homicide
- Daly and Wilson (1988): man's reputation depends on ability to maintain credible threat of violence; homicide as a response to perceived reputation/status threats
- Violence, aggression, power as means to enhance reproductive fitness

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Parental Investment and Mating

- Used to explain female-perpetrated crime
- Campbell et al (2001):
  - resource scarcity ⟹ poverty and offending in women
  - property offences as women's provision for themselves
  - importance of maternal survival ⟹ lower threshold for fear ⟹ inhibits involvement in crime

(continued)

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Female-Perpetrated Crime (Cont'd)

- Reproductive fitness variance between men and women
- Natural selection: psychological mechanisms of high mating in men and high parental investment in women

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