

**PSYCHOPATHY AND RESILIENCY IN YOUTH CRIMINAL OFFENDING ACROSS
THE LIFESPAN: A NEUROBIOLOGICAL OVERVIEW**

By

Mackenzie Frampton



Under the supervision of

Dr. Janne Holmgren

Mount Royal University

An Honours Project submitted in partial fulfillment of the Degree requirements for the degree of
Bachelor of Arts-Criminal Justice (Honours)

Mount Royal University

Date Submitted: April 11th, 2024

MRU Territorial Land Acknowledgement

Mount Royal University is located in the traditional territories of the Niitsitapi (Blackfoot) and the people of the Treaty 7 region in southern Alberta, which includes the Siksika, the Piikani, the Kainai, the Tsuut'ina and the Iyârhe Nakoda. We are situated on land where the Bow River meets the Elbow River. The traditional Blackfoot name of this place is "Mohkinstsis," which we now call the city of Calgary. The city of Calgary is also home to the Métis Nation.

Dedications and Acknowledgements

First and foremost, I want to extend a sincere and heartfelt thank you to my supervisor, Dr. Janne Holmgren who I consider myself very lucky and fortunate to have been able to work with. Her unwavering support and guidance and her experience in not only this profession and research, but her experience in teaching made for exceptional feedback and encouragement throughout this research study. I would also like to thank my professors that I have been fortunate enough to learn from throughout my years in this program. Their lessons and stories elicited passion and excitement for what is to come in the pursuit of a career in this line of work. I want to also say thank you to the staff at the library who have provided a great amount of time and effort in helping me shape my work. A big thank you to my partner for always believing in me and my passions and for your encouragement as well as your patience throughout the duration of my research study. Last but definitely not least, to my parents and siblings, who have allowed me to pursue such a passion with limitless support, conversations, and time in shaping my research, thank you.

Abstract

This research study takes the form of a literature review that provides a foundation of current knowledge of psychopathy and resiliency in youth offenders. Child development and the importance of sensitive periods and possible life trajectories based on negative or positive influences during development are explored. The implications of child maltreatment on a neurobiological level is a focus throughout this paper to help aid in the explanation of psychopathy and its tendencies relating to crime. The analysis of brain architecture is discussed with possible relationships in connection to psychopathy or resilience, with the use of evidence through brain imaging, in relation to changes that are observed in individuals who experienced childhood maltreatment. In terms of future research, the possibility of developing targeted treatment efforts could be created to treat the root cause of psychopathy more precisely and promote resiliency, such as identifying abnormal brain structure and function. Finally, the implications of such a study are demonstrated to be crucial in continuing efforts to reduce childhood maltreatment by recognizing, understanding, and educating the general population in its possible detrimental lifespan consequences, with the ultimate goal of reducing crime and helping those who may not have a voice.

Table of Abbreviations

Abbreviation	Descriptions
ACEs	Adverse Childhood Experiences
CP	Conduct Problem
ASPD	Antisocial Personality Disorder
PCL-R	Psychopathy Checklist-Revised
CU	Callous-Unemotional
CM	Child Maltreatment
PFC	Prefrontal Cortex
HPA	Hypothalamic-Pituitary-Adrenal
FASD	Fetal Alcohol Spectrum Disorder

Table of Contents

PSYCHOPATHY AND RESILIENCY IN YOUTH CRIMINAL OFFENDING ACROSS THE LIFESPAN: A NEUROBIOLOGICAL OVERVIEW	1
MRU TERRITORIAL LAND ACKNOWLEDGEMENT	2
DEDICATIONS AND ACKNOWLEDGEMENTS	3
ABSTRACT.....	4
TABLE OF ABBREVIATIONS.....	5
TABLE OF CONTENTS	6
INTRODUCTION	8
METHODS.....	10
<i>METHODOLOGY</i>	<i>10</i>
LIMITATIONS	12
CHILD DEVELOPMENT	12
<i>INFLUENCING FACTORS.....</i>	<i>13</i>
Sensitive Periods.	13
Stress and Toxic Stress.....	14
<i>SIBLING, TWIN, AND ORPHAN STUDIES.....</i>	<i>14</i>
RESILIENCE.....	15
PSYCHOPATHY	19
CHILD MALTREATMENT.....	20
<i>SEXUAL ABUSE</i>	<i>22</i>
<i>EMOTIONAL ABUSE</i>	<i>22</i>
<i>SOCIOLOGICAL FACTORS.....</i>	<i>23</i>
NEUROBIOLOGICAL IMPLICATIONS	25
<i>AFFECTED BRAIN ARCHITECTURE.....</i>	<i>28</i>
Amygdala.....	28
Hippocampus.	28
Corpus Callosum.	29
Prefrontal Cortex.....	30
Hypothalamic-Pituitary-Adrenal Axis.	30
<i>GENETICS AND NEUROLOGICAL GROWTH.....</i>	<i>31</i>
<i>GENERAL IMPLICATIONS OF NEUROBIOLOGY IN CHILDHOOD MALTREATMENT.....</i>	<i>33</i>
CONNECTION TO CRIME.....	34
<i>RELATIONSHIP TO TYPES AND SEVERITY OF CRIME</i>	<i>37</i>
DISCUSSION	38
<i>PREVENTION, TREATMENT, AND POLICY CHANGES.....</i>	<i>38</i>
<i>IMPLICATIONS FOR FUTURE RESEARCH</i>	<i>39</i>

REFERENCES.....	43
-----------------	----

Introduction

Neurobiological, meaning the combination and influence of the neurology and biology that makes up an individual (Viding & McCrory, 2017), underpinnings of one's genetic makeup could have a greater implication in the role of crime than previous research has implied.

Although it is well-known that there is never just one explanation for crime, the neurobiological concept of an individual may play a bigger role in the action of a criminal event than originally thought. Therefore, several different theories will be discussed to account for the fact that there is no "one-size-fits-all" model (Roeckner et al., 2021). Some neurobiological expressions have demonstrated the impressionable nature of one's genetic markers during their crucial years of development, that is, while they are a child (Child Welfare Information Gateway, 2023). There is the possibility that adverse childhood experiences (ACEs) that happened before an individual reaches adulthood could have a correlation and a role to play in the eventual outcome of criminal behaviour. This is not to say that every child who is abused, neglected or has an unstable upbringing, is going to become a career criminal (Zhang et al., 2023). Herein lies the nagging question of why some individuals become involved in crime and why others don't.

Recent research has uncovered a possible answer to the aforementioned question; resilience. Although still a broad consideration and "very little is known about the exact mechanisms by which positive, socially supportive environments gets under the skin to promote resilience" (Bowes & Jaffee, 2013, p. 203), it has allowed some criminologists to account for the reasons of why crime occurs for individuals of ACEs. Some current research suggests that there are protective factors or even genetic predispositions that encourage a child towards a positive life trajectory as opposed to a negative one (Eaton et al., 2022).

This study will aim to provide a comprehensive overview of current research in the neurobiological expressions that may provide a child with a sense of committing a crime. It will also examine the limitations in research so as to direct any possible future research with the goal of policy change and intervention to encourage a positive life trajectory for children despite any already accumulated ACEs.

The question that this research study will aim to answer is, can a link between adult offenders who have experienced ACEs be connected through an analysis of their neurobiological expressions? The goal of this study is to provide readers with the current, and future research that aims to understand how knowledge about the neurobiological makeup of an individual can influence the action of crime.

This study aims to create a very broad understanding of the neurobiological factors that play a role in the action of crime, as well as the possibility of resilience within an individual. When discussing resilience, this study will hopefully provide answers as to how some individuals have the resilience to stay away from crime, how resilience is generated within an individual, as well as some crucial stages in life and development to encourage or discourage resilience.

Current research is starting to shine a spotlight on the importance in acknowledging the role that a child's ACEs and its neurobiological influences has on an action of crime (Cooke et al., 2023). Therefore, this research study will mainly focus on the child's neurobiology and its influences, the connection to crime that neurobiological influences have, and any future implications of this research which include ideas for policy change as well as prevention, intervention, and treatment methods.

Methods

This study will take the form of the research design of an exploratory research study. That is, this study will demonstrate the curiosity and eagerness to explore all the possible relations to the research topic as well as the research question. Throughout the study, there will be a sense of seeking a deeper understanding to the answers that may lead to more questions in order to create a full sense of immersion into the research topic. This study can act as the base of future research due to its potential of depth of exploration to all possible ends and relations to the research topic.

Due to the exploratory focus of this study, the research method will be highly qualitative as opposed to quantitative. Theories that will be analyzed consist of sociological, psychological, and criminological, and neurobiological aspects will also be discussed with supplemental evidence through brain imaging used by the literature being reviewed to ensure proper knowledge on the research topic.

Methodology

Since this study is a literature review, the primary data collection is secondary. The databases used consisted of Google Scholar, PubMed, Psyc Info, Research Gate, and Sage Journals. All data collected must be approximately published within the last ten years, therefore, the years of publication range was set to 2013-2024. Key words used during the collection of data consisted of “child”, “children”, “youth”, “abuse”, “neglect”, “maltreatment”, “crime”, “offenders”, “neurological”, “biological”, “neurobiology”, “brain”, “resilience”, “development” “psychopathy” and “resilient”.

The data analysis was a combination of notes for each theme and highlighting with colour coding for main themes and concepts. The colours used to highlight corresponds with proposed headings or main ideas that are addressed throughout the paper. Due to the flexible nature of technology, all articles used in the study were read, highlighted, marked, and notes were taken on the laptop or iPad as opposed to paper. The rationale for using these methods for data analysis is to visually understand the overlaps and amount of findings dealing with the crucial influences that impact neurobiology of an individual.

Headings and main ideas consisted of child development, child maltreatment, sociological factors, psychological factors, neurobiological implications, resilience, psychopathy, connection to crime, and discussion. The main idea of child development was colour coded to blue and includes ideas such as influencing factors, sensitive periods, and twin studies. The main idea of child maltreatment, colour coded to purple and pink, includes physical, sexual, emotional, and psychological abuse and neglect, and sociological factor which includes family and friends and the impact on the neurobiology of an individual. The main idea of psychological factors, colour coded to orange, includes psychological disorders and the impact on the neurobiology of an individual. The main idea of neurobiological implications, colour coded to green, includes brain scans and talks about the regions of the brain. The main idea of the connection to crime, colour coded to yellow, includes the type of crime. Finally, the main idea of discussions, colour coded to red, includes policy change, prevention and treatment, and implications for future research. Red will also be used to highlight discussions and implication of resilience and psychopathy to all of the above headings and themes.

Limitations

Due to the significant interdisciplinary nature of this topic, is it difficult to ensure adequate coverage of all concepts and factors involved. This study will only be able to provide a portion of information that is available, therefore it should be noted that every aspect of this study can be continued on further in future research. Each concept should be expanded upon when considering conducting research in this area. There is also limited research thus far as to what kinds of maltreatment may affect the lack of resilience more than other factors, or what kinds of protective factors could lead to a child being more resilient in the future. The same can be said about the concept of psychopathy, especially in children. Specifically, neuroimaging studies are still limited, and each one differs in its focus (Feder et al., 2019). Longitudinal studies, as will be discussed, which allows for researchers to understand the effects of child maltreatment across the lifespan. However, due to the nature of these studies, it clearly takes time which makes them limited in number at this moment (Feder et al., 2019).

For this study in particular, the time constraints have created limitations in what can be achieved. This goes for both the research aspect of collecting data, as well as for the writing portion, and for the possible dissemination of this project as well. Finally, this research study represents this information as an overview of the literature only. Therefore, this paper consists strictly of secondary research data.

Child Development

“Any acts, or series of acts, by a parent or caregiver that results in the (potential for) harm, or threat of harm, to a child” is defined as child maltreatment (CM) (Ioannidis et al., 2020, p.1, para.1). Caregiver-child interactions strengthen baby’s neuronal pathways regarding social

interactions and how to get their physical and emotional needs met (Child Welfare Information Gateway, 2023). When children and youth live in a chaotic or threatening world, their brains may become hyperalert for danger and not fully develop, therefore associated CM with alcohol abuse, impulse control problems, suicidal behaviours, interpersonal difficulties, increased peer rejection, social withdrawal, aggression and criminality, physical health difficulties, cognitive problems, and mental health disorders (Child Welfare Information Gateway, 2023; Ioannidis et al., 2020).

Influencing factors

Sensitive Periods. Sensitive periods are the windows of time in the development process when certain parts of the brain may be most susceptible to particular experiences (Child Welfare Information Gateway, 2023). If certain synapses and neuronal pathways are not activated repeatedly during a particular time period, they may be diminished or discarded (Child Welfare Information Gateway, 2023). Research has shown that childhood is an important period in setting the foundation to life trajectories and life-long development (Sattler et al., 2023). The childhood and adolescent periods are characterized through dramatic changes in brain structure and function that cause an increase the plasticity of one's neurobiological functions, which demonstrates an optimal window for the neurobiological development of resilience (Zhang et al., 2023), or psychopathy. The importance of understanding the level of vulnerability as a child and young adult speak to the fact that although the changes witnessed in the neurobiology of a child who has experience CM and/or ACEs is noted to be minimal, damage caused in childhood do amount devastating behavioural and health outcomes over one's lifespan (Cooke et al., 2023). Children from the Romanian institutions who had been severely neglected, tended to have a

much better attachment response if they were placed in foster care, receiving more stable parenting, before they were 24 months old than those who were not (Child Welfare Information Gateway, 2023). This indicates a sensitive period for attachment.

Stress and Toxic Stress. Positive stress, tolerable stress, and toxic stress are three types of stress responses outlined by The Center on the Developing Child (Harvard University 2023b; Child Welfare Information Gateway, 2023). A toxic stress response is a major, frequent and/or prolonged stress, such as physical or emotional abuse, chronic neglect, caregiver substance abuse or mental illness, exposure to violence, or accumulated burdens of family economic hardships without adequate adult support (Harvard University 2023b; Child Welfare Information Gateway, 2023). Toxic stress is the kind of stress that can disrupt the development of brain architecture and increase the risk of disease and cognitive impairments or caused elevated perception of fear and a quick shift to a defensive mode when faced with stressors (Harvard University 2023b; Child Welfare Information Gateway, 2023).

Sibling, Twin, and Orphan Studies

Twin and sibling research designs have provided support in that experiencing CM and/or ACEs are shown to be attributable in negative health outcomes, and have helped to separate other influences at play in the development of behavioural problems through one's development and life (Cooke et al., 2023). Longitudinal studies have proved to be a powerful tool for identifying neural structure and function that influence and contribute to resilience and it's development (Roeckner, et al., 2021). Orphan studies provide insight into the consequences of physical and emotional neglect during childhood (Teicher & Samson, 2016). One study of significant importance related to such research is that of the Bucharest Early Intervention Project

which included the some of the well-known research findings from the Romanian Orphanages, where orphans were assigned to either a newly established system of high-level foster care versus continued institutional care, through which studies provided data on the impact and reversibility of early neglect on brain development (Teicher & Samson, 2016).

Some studies involving twins have shown a strong heritable factor of disruptive behaviours accompanied by high levels of callous-unemotional (CU) traits whereas disruptive behaviours accompanied by low levels of CU traits appeared to be more strongly linked to environmental factors (Viding & McCrory, 2017). These twin studies have also observed strong genetic influence in CU/psychopathic traits (Viding & McCrory, 2017). Through the research and findings of a national Swedish twin sample, the researchers and authors estimated that the heritability of all criminal convictions are about 45%, which are similar the that of the estimates for the heritability shown in studies of antisocial personality disorder (ASPD) and its associated behaviours (Kendler et al., 2015).

In the context of resilience, twin studies have also been implicated. Through a longitudinal study of 7500 adult twins who modeled resilience and based on a number of experienced life stressors, it showed that resilience has a moderate heritability and was equally influenced by both genetic and environmental studies (Feder et al., 2019).

Resilience

In in the context of this current study, a significant proportion of individuals who have experienced CM function better than expected when compared to others who experienced CM (Ioannidis, et al., 2020). Moreso, when maltreatment does alter the child's brain structure or activity, some children do not present any psychopathologies (mental disorders or functional

impairments) or have outcomes that are much better than expected considering the circumstances they have endured (Child Welfare Information Gateway, 2023). Some cohort studies that look at symptoms and their levels of PTSD ranging from hours to years of post-trauma show that many individuals experience high levels of depression, anxiety, and other related symptoms of PTSD in the first days after a traumatic event, but that the majority recover naturally (Roeckner, et al., 2021). This type of outcome is called resiliency, the ability to adapt to adversity (Child Welfare Information Gateway, 2023; Ioannidis, et al., 2020). Important to note is that resilience is the most common response to a traumatic event, according to Roeckner et al., (2020), as only a small group of individuals who experience such traumatic events go on to maintain persistent impairing symptoms. The significance of resilience in the context of child maltreatment is that individuals who have higher trait resilience tend to exhibit constrictive coping abilities which contribute highly to recovery (Watters et al., 2023)

Resilience is inherently dynamic in that the trajectories and predictors of resilient functioning may change over time (Ioannidis, et al., 2020), and can be defined as the set of complex and dynamic processes that allow individuals to maintain psychological well-being, rebound, maintain stable equilibrium, or positively adapt from disruptive life challenges in the face of adversity (Roeckner et al., 2021; Watters et al., 2023). The American Psychological Association defines resilience as “the process of adapting well in the face of adversity, trauma, tragedy, threats, or significant sources of stress such as family and relationship problems, serious health problems or workplace and financial stressors. It means “bouncing back” from difficult experiences” (De Wit et al., 2016, p. 543). On a related note, a definition of trauma, proposed by the 2008 Presidential Task Force on Posttraumatic Stress Disorder and Trauma in Children and Adolescents, states a traumatic event being as “one that threatens injury, death, or the physical

integrity of self or others and also causes horror, terror, or helplessness at the time it occurs”, continuing on they, state that traumatic events “include sexual abuse, physical abuse, domestic violence, community and school violence, medical trauma, motor vehicle accidents, acts of terrorism, war experiences, natural and human made disasters, suicide, and other traumatic events” (Kelley et al., 2014, p. 143). Trauma can also be defined, as meeting the criteria of the DSM-5 as trauma- or stress-related disorders, such that participants experienced, witness, or were confronted with the threat of death or serious injury or threat to personal integrity (Roeckner, et al., 2021), and this expands to consider other major life event stressors such as death of family members, job loss, or medical illness.

Resilience is often viewed being on a continuum with resiliency and vulnerability on opposing ends (Feder et al., 2019; Rogers et al., 2013). Recent studies have started to recognize that resilience often presents itself in one of two ways, resilience as a trait or resilience as a process. Resilience as a trait is understood as characteristics of an individual whereas resilience as a process is understood as an individual acquiring what is sometimes known as the triad of traits (Rogers et al., 2013). This triad of resilient traits encompasses personal characteristics such as an easy temperament, having a supportive family, and having other external positive role models, however, another version of this has been proposed which consists of individual-level factors, that exists in the social-level factors, which together exist within the societal-level factors (Rogers et al., 2013; Jorgensen, 2019). Another study considers a third way that resilience presents itself, which is resilience as an outcome which demonstrates the positive adaptation despite adversity exposure (Eaton et al., 2022).

One aspect of resilience, which brings to light its puzzling nature, is because resilience is simply not the absence of a psychiatric disorder, it is important to note neural predictors

(Roeckner, et al., 2021). Many studies and researchers view resiliency through the lens of a multisystem of development, and therefore there are several approaches to resiliency (Masten et al., 2021). Some of these approaches include stating that resilience changes over time as a result of multiple processes and development, resilience capacity is distributed across multiple systems both internal and external to the child, resilience can manifest in multiple possible pathways over time, and interventions to nurture or bolster resilience can target different processes within levels or linking system levels (Masten et al., 2021).

Many measures of promoting resilience include focusing on the attributes of the child's family, the child themselves, as well as other external support, which include good-quality parenting, warm relationships, family cohesion, cognitive skills, optimism, friends, religious affiliations, and effective schools and teachers (Masten et al., 2021). Data has demonstrated that approximately 50% of individuals with a history of CM showcase resilient psychological functioning in childhood and adolescence (Haslam & Taylor, 2022). This brings to light the mindset to have about the positive outcomes of individuals with complex childhoods, as well as a positive nudge in that it could be possible to gain an understanding as to why some individuals are able to demonstrate resilience and not others, with the hopes of making resilience an attainable goal for everyone in such a situation.

As it will be discussed, just like how psychopathy has hypothesized models of its development, so does resilience. Specifically, one study suggested the biopsychosocial model of resilience (Feder et al., 2019). The model states that the genes interact with environmental influences that shape the function of the neural circuit and associated systems, then these environmental influences create a lasting impact on neural and stress systems through epigenetic modification, then at the neural level, there is the activation of the brain regions that primarily

responsible for mediating threat responses, emotion regulation, as well as stress responses to the changing environment to support accurate attention of the event and facilitate adaptive coping mechanisms (Feder et al., 2019). The Center on the Developing Child at Harvard University has provided a way to visualize how resiliency is developed. In visualizing a seesaw or a teeter-totter, protective factors sit on one side while on the other side sits significant adversity. Therefore, we can clearly see that the child has both positive and negative factors they have experienced. Then, the seesaw's fulcrum manages the weight load of both sides but shows resiliency when the positive factors can lean in favour of the protective factors or allow for a balance so as to not completely compromise and hide away the protective factors, which in turn helps in the promotion and development of resiliency (Harvard University, 2023c).

Psychopathy

Although there is no specific diagnostic category of psychopathy, it is a personality disorder that is often characterized by lack of empathy and guilt, shallow affect, manipulation of other people, and sometimes severe and violent, antisocial behaviour (Viding & McCrory, 2017). A closely related and similar disorder that is recognized by the DSM-5 and consists of specific criteria is antisocial personality disorder which includes aggression, impulsivity, and violation of the rights of others (Viding & McCrory, 2017).

Researchers and clinicians understand that features associated with psychopathy and/or ASPD are not fixed during childhood, but that being said, current research has started to show evidence that psychopathic features are predictive of increased risk for persistent antisocial behaviour and adult psychopathic presentation (Viding & McCrory, 2017). Psychopathy itself is reported to be infrequent within the general population at about 1%-2%, but within the

population of criminal offenders, about 15%-25% meet the criteria of psychopathy, of which its characteristics just mentioned, tend to be one of the strongest predictors of chronic and violent offending (Moreira et al., 2020).

Child Maltreatment

Childhood maltreatment is the most important risk factor for psychopathology (Teicher et al., 2020), as well as general household dysfunction being a major risk factor for psychopathology too (Ohashi et al., 2019). Maltreatment can affect both the structure and chemical activity of a child's brain as well as their emotional and behavioural functioning (Child Welfare Information Gateway, 2023). The specific effects of maltreatment may depend on factors such as the age of the child at the time of the maltreatment, if the maltreatment was a one-time incident or chronic, and the identity of the individual who engaged in the maltreatment (Harvard University 2023b; Child Welfare Information Gateway, 2023). Those who have experienced CM show a higher prevalence of depression, anxiety, substance abuse, eating disorders, suicidal symptomatology, psychosis, personality disorder, diminished cognitive functioning, and poorer treatment response (Teicher & Samson, 2016). One study found that children who were chronically maltreated showed greater executive function deficiencies and impacts to network vulnerability than children who were not maltreated or those with less chronic maltreatment (Child Welfare Information Gateway, 2023; Teicher et al., 2020). The effects of the maltreatment on the child's brain are viewed as psychopathology and these alterations in development may be viewed as adaptations for immediate survival (Child Welfare Information Gateway, 2023). The harsh environment that the child adapts to may not be the same environment they find themselves in later in life, and therefore, the adaptations that once allowed

the child to survive in a toxic and stress-prolonged environment may cause behaviours that are inappropriate to a healthy environment (Child Welfare Information Gateway, 2023).

Some studies have been able to provide results that show solid evidence for specific trauma subtypes being associated with specific changes in one's neurobiology. For example and to be expanded on in the next sections, sexual abuse was associated with deficits within the reward circuit as well as showing amygdalar hyperreactivity, while emotional maltreatment was associated with widespread abnormalities in fronto-limbic activity and connectivity especially in the networks involved in emotional processing, and neglect was also associated with widespread deficits in the integrity of white matter and connectivity involved in an array of functions (Cassiers et al., 2018). Through the analysis of numerous studies, physical abuse and neglect have shown to be a hit-or-miss in either having obvious abnormalities in brain structure and function, or some studies on the other had have stated "no apparent structural or functional effects were found" (Cassiers et al., 2018, p. 14).

In recent years of research, there have been more calls to understand the differences, if any, in the neurobiology basis of the effects of child maltreatment and its subsequent effects on resilience and psychopathy between males and females. It is understood that many forms of psychopathology are often more prevalent in one sex over the other, such as more externalizing disorders, for example ADHD, experienced by males and more internalizing disorders, for example anxiety disorders, experienced by females (Cornwell et al, 2023). What is not as well-known or understood is the role these implications play in relation to resiliency or psychopathy, if any.

Physical Abuse & Neglect

Parental neglect includes physical neglect that consists of failing to provide for the child's basic needs, such as food, clothing, physical safety, adequate supervision, medical and dental health (Teicher & Samson, 2016). Some cases of physical abuse can cause immediate structural damage to a child brain such as abusive head trauma which can include shaking that can lead to brain swelling and bleeding (Child Welfare Information Gateway, 2023). Physical abuse predicted characteristics of externalizing and aggressive behaviour whereas physical neglect was more so associated with internalizing and withdrawn behaviour (Cassiers et al., 2018).

Sexual Abuse

Sexual abuse can be defined as “touching one's breasts or genitalia, forced touching of another's genital area, vaginal or anal penetration” (Jorgenson, 2019, p. 9). Both physical abuse and neglect and sexual abuse have been associated with reduced executive functioning, working memory, reduced cognitive functioning in healthy adults, and intelligence scores within a psychiatric population (Cassiers et al., 2018).

Emotional Abuse

Key aspects of emotional maltreatment include verbal abuse, manipulation, denigrating or destroying things of value to the child, or placing the child in situations that are harmful (Teicher & Samson, 2016). Parents who demonstrate to be emotionally neglectful may be emotionally unresponsive to a child's distress, fail to attend the child's social needs, or expect the child to routinely manage situations that are known to be beyond the child's maturity level or are deemed to not be safe (Teicher & Samson, 2016). The observations of the effects of sexual

abuse are not observable within populations who experienced emotional abuse and neglect (Cassiers et al., 2018). Surprisingly, emotional maltreatment shared some similarities with that of physical abuse, which both were predictive of aggressive behaviour (Cassiers et al., 2018). Furthermore, emotional trauma was more reliable in predicting the later development of depressive symptoms than physical or sexual abuse was (Cassiers et al., 2018). Emotional abuse was the only trauma subtype that was not associated with self-injury (Cassiers et al., 2018).

Sociological Factors

Unfortunately, parents with genetic risk factors related to psychopathy and/or antisocial behaviour are more likely to display parenting styles related to harsh parenting versus a warm parenting style (Viding & McCrory, 2017). A key feature of receiving appropriate stimuli is developing a secure attachment with a caregiver. Attachment is the emotional bond between people, such as a child and their caregiver (Child Welfare Information Gateway, 2023). When the attachment is secure, the child knows that the caregiver will care for and support them, allowing the child to explore their environment safely and in a confident manner (Child Welfare Information Gateway, 2023). This type of secure attachment promotes healthy brain development, social and emotional development, and self-regulation (Child Welfare Information Gateway, 2023). The opposite can be said for children who do not develop secure attachments because their caregivers are threatening, or erratic, and therefore the child may experience suboptimal development or progress (Child Welfare Information Gateway, 2023). Research has consistently shown that having at least one stable and responsive supportive adult in a child's life is a key factor for the development and presentation of resiliency (Child Welfare Information

Gateway, 2023). Family support in adolescence as well as peer support is associated with reduced depressive symptoms and promotes resilient functioning (Ioannidis, et al., 2020).

Overall, children affected with maltreatment compared to children not experiencing maltreatment, and those with disruptive behaviours and callous-unemotional traits are less likely to attend to, react to, and recognize affective stimuli, including distress cues such as fearful and sad experiences of others, are more likely to show blunted empathy, are less likely to direct attention to the eyes of attachment figures, and don't adapt well to change regarding situations with reward-punishment contingencies (Viding & McCrory, 2017).

The developmental trajectory of a child is known to be determined by an interplay of genetic predispositions and factors that influence how those genetic dispositions are expressed, and these genetic dispositions influence how we as individuals interact with our environment, known as gene-environment correlation (Viding & McCrory, 2017). One study demonstrated the interplay and influence of neurobiology and sociological factors as one particular genetic component related to the hormone of serotonin, which was found to be related to low amygdala reactivity which was shown only as a risk genotype for high levels of CU traits in lower socioeconomic status (SES) background (Viding & McCrory, 2017; Green et al., 2023). This finding is critical in that it suggests the degree of genetic vulnerability is expressed dependent on the degree to which a child is exposed to environmental disadvantage (Viding & McCrory, 2017).

Although it is recognized that child maltreatment can occur at all levels of SES, higher levels of CM occur in the lower levels as it often associated with more violence, overcrowding, and limited community resources which allows to more opportunities for children to engage in violence and substance use which then allows for higher rates of psychopathology (Green et al.,

2023). Higher levels of financial sufficiency during childhood may have acted as a protective factor in at-risk participants (Teicher et al., 2020).

Neurobiological Implications

When an individual is exposed to ACEs, this type of stress triggers a “neuro-inflammatory response that alters neuro-immune development which underlies some psychiatric illnesses” (Kenny, 2016, p. 24). One study proposed a model that suggested that traumatic experiences overwhelm the executive functioning of the brain, which in turn, causes impairments in thought processes, behaviours, and emotions (Marsiglio et al., 2014). According to this theory, if this state of physiological, as well as psychological, distress is dragged on for a period of time, the child experiences a decreased ability to regulate emotions and therefore learns fewer coping strategies (Marsiglio et al., 2014). If these stress symptoms are ignored by the child’s social network, the youth takes on victim coping, which is a “perceived justification to take any means necessary to avoid revictimization” (Marsiglio et al., 2014, p. 2). In conclusion of this model, victim coping presents as many of the characteristics observed in psychopathy such as the loss of empathy, lack of impulse control, and the overall increased tendency towards delinquent behaviour (Marsiglio et al., 2014).

Recent advances in research as well as technology has allowed for the use of functional magnetic resonance imaging (fMRI) in studies of children exhibiting disruptive behaviours and CU traits (Viding & McCrory, 2017). Thanks to these studies, the implication of reduced activity and altered connectivity in individuals with behaviour issues and high level of CU traits in a network of the brain regions have shown to be associated with empathy in those considered to be healthy individuals (Viding & McCrory, 2017) compared to individuals with CU traits. Any

ACEs that a child accumulates has profound effects on the functioning and development of their brain. Such brain circuits that are impacted by ACEs include the amygdala which mediates the fear and pleasures responses, the hypothalamic-pituitary-adrenal (HPA) axis which regulates stress, the prefrontal cortex which regulates mood and emotional and cognitive responses (Kenny, 2016, p.24).

Another disruption to the neurological functioning of children, and eventual adults, is that of traumatic brain injuries (TBI). In a study conducted in 2015 (Hughes et al., 2015, p.94) it was stated that childhood TBIs has been associated in a number of neurocognitive impairments and developmental difficulties that in turn, impact aspects of functioning and behaviour such as deficits in socio-cognitive skills, social or pragmatic communication, impulse control and regulation of aggressive responses to treat, cognitive empathy, and therefore the ability to have appropriate responses to other's emotions is also highly impaired (Hughes et al., 2015). The same study goes on to state that impairments due to TBIs in childhood have been identified as risk factors that increase the risk of criminality (Hughes et al., 2015, p.95). Some research has estimated that over 60% of adult prisoners have experienced a head injury accompanied with the loss of consciousness (Nicholas et al., 2015) and the same research has shown reports of between 32% and 46% of youth offenders in custody that have experienced a head injury, also accompanied by loss of consciousness. Sadly, deficits in empathy, implying a reduction or an inability to empathize with others, is noted as a common sequence of pediatric TBI (Nicholas et al., 2015).

Therefore, this section provides argument for more research to be done in this area. Insight into such brain circuits that can be affected by ACEs or potential behaviours that could be the cause of TBIs could allow for preventative measures to be put in place once a child is known

to have accumulated any ACEs or TBIs. Current research is becoming more focused on understanding the possibility of specific trauma subtypes leading to specific structural and functional brain alterations, which is speculated, could underlie the differential cognitive-behavioural effects associated with psychopathology and resiliency (Cassiers et al., 2018).

Fetal alcohol spectrum disorder (FASD) is another disorder that consists of a range of behavioural, physical and cognitive deficits that is the consequence of prenatal alcohol exposure (Rogers et al., 2013). Unfortunately, this disorder comes with a number of disabilities associated with deficits as the result from CNS injury due to the prenatal alcohol exposure that consists of executive functioning impairments including deficits in memory and decision making and planning, poor judgement, engage in lying and stealing, as well as having little remorse for consequences for their actions (Rogers et al., 2013). One study identified adverse outcomes that are common in individuals living with FASD, which included 50% reporting experiences of confinement in either in-patient treatment facilities or being incarcerated for criminal behaviours (Rogers et al., 2013). This statistic speaks to fact that FASD is becoming increasingly noticed with the justice system, and as such, is a population that is becoming overrepresented with 60% of those with FASD having some sort of contact with the justice system (Rogers et al., 2013). Furthermore, of that 60%, the youth remanded to forensic psychiatric facilities for inpatient assessments accounted for 23.3% (Rogers et al., 2013).

As a final note and as a simplified summary of the neurobiological implications just discussed to ensure a direct understanding the research thus far, psychopathy and antisocial personality disorder are neurodevelopmental disorders influenced by genetic and environmental factors (Kolla et al., 2013).

Affected Brain Architecture

Unfortunately, there are a number of architectural changes to the gross neuroanatomy as well as the physiology and functioning of the brains of individuals, either children and/or adults, who have experienced maltreatment while developing, and childhood abuse specifically found to be associated with alterations in brain structure and function (Teicher & Samson, 2016). Areas of specific interest to this field of work and research consists of regions involved in threat inhibition and regions involved in threat response (Roeckner, et al., 2021) and circuits related to emotion regulation.

Amygdala. The amygdala, a key structure within the limbic system that is involved in encoding of implicit emotional memories (Teicher & Samson, 2016) and also helps to determine if a stimulus is threatening and triggers an emotional response, tends to be overactive in those who have experienced maltreatment (Child Welfare Information Gateway, 2023; Teicher et al., 2020). Psychiatric disorders that presented in individuals who have shown to have structural or functional abnormalities within the amygdala include PTSD, social phobias and specific phobias, unipolar and bipolar depression, drug addiction, autism, borderline personality disorder, as well as schizophrenia (Teicher & Samson, 2016). Interestingly, a unique characteristic of abnormal amygdala structure and function includes the presentation of a stress-induced amygdala hypertrophy that unlike hippocampal hypertrophy, endures long after the cessation of a stressor (Teicher & Samson, 2016). Effects of early exposure to maltreatment has been shown to sensitize the amygdala to further stress that inevitably led to the reduced volume that becomes most observable in late adolescence or adulthood (Teicher & Samson, 2016).

Hippocampus. Peak periods of sensitivity for the hippocamps range between 3-5 years of age (Teicher & Samson, 2016). The hippocampus is a key region that is involved in the

formation and retrieval of memories (Teicher & Samson, 2016) as well as being a stress-sensitive brain structure that is involved in learning and memory responsible for emotional regulation (Kenny, 2016, p.24). Reduced volume in the hippocampus, central to learning and memory, is seen in adults who were maltreated (Child Welfare Information Gateway, 2023; Teicher et al., 2020). Abnormalities of the hippocampus have been noted in several psychiatric disorders and therefore if reduced hippocampal volume is a noted consequence of CM, it would help explain why this finding has been seen across an array of psychiatric disorders including PTSD, depression, schizophrenia, and bipolar disorders (Teicher & Samson, 2016). On another note, reduced hippocampal volume has been reported within studies looking at resilient individuals who were exposed to maltreatment who have been noted to have not developed any psychopathologies (Teicher & Samson, 2016).

Corpus Callosum. Decreased volume in the corpus callosum, responsible for left-right brain communications as well as emotion and higher cognitive abilities are seen in maltreated adults and children (Child Welfare Information Gateway, 2023; Teicher et al., 2020). During studies related to the Bucharest Early Intervention Project, it was found that the corpus callosum showed significant reductions in volume in orphans who remained in an institutional setting (Teicher & Samson, 2016). Furthermore, the corpus callosum was non-significantly reduced relative to controls in orphans who were assigned at approximately 15 months of age to higher-level foster care, which suggested that the effects of very early neglect were substantially reversed or that the corpus callosum was affected by experiences taking place in the institutionalized setting between the assignment of the setting and the assessment (Teicher & Samson, 2016). Disorders associated with reduced thickness and volume of the corpus callosum

includes ADHD, specifically in children, and bipolar disorder in adults (Teicher & Samson, 2016).

Prefrontal Cortex. Peak periods of sensitivity for the prefrontal cortex (PFC) are between 14-16 years of age (Teicher & Samson, 2016). In addition to the aforementioned regions of the brain associated with CM, psychopathy, and resilience, the PFC is critically involved in the executive control of cognitions, emotions, and stress response (Ioannidis et al., 2020). Those with a history of CM present with altered volumes of the PFC (Ioannidis et al., 2020). Unlike the other mentioned differences in brain architecture, larger PFC volume may be related to resilient functioning after CM since larger PFC volume has been associated with academic achievement, conduct, relationships, and emotional health (Ioannidis et al., 2020). One aspect that is not clear is whether the increased PFC volume is a pre-existing vulnerability in those at risk or if it represents adaptive growth in response to stress in resilient individuals (Ioannidis et al., 2020), which may be a factor in the development of resiliency. The PFC plays an important role in inhibiting stress in the limbic regions and has been noted to have increased inhibitory activity in the anterior cingulate cortex which has been linked to resiliency after CM (Ioannidis et al., 2020).

Hypothalamic-Pituitary-Adrenal Axis. Reduced activity of the limbic system is a key component since limbic activity activates the hypothalamic-pituitary-adrenal axis (HPA), a core component of the neuroendocrine system that controls stress reactions, immune functions, and other physiological processes (Ioannidis et al., 2020; Feder et al., 2019). A hormone known as cortisol that helps mediate the body's stress response, has shown a link to maltreatment and irregular cortisol levels, which can cause heightened levels of stress, and lower levels of cortisol can cause a blunted responses to stress (Child Welfare Information Gateway, 2023).

Genetics and Neurological Growth

When considering the research done in child maltreatment and its affected neurobiology, it is important to understand that, even despite specific implications about genetics, there are no genes that directly give rise to the development of psychopathy (Viding & McCrory, 2017). Hence explaining the perplexing nature of resiliency, psychopathy, and criminal behaviour. Although no direct cause-and-effect of genes to psychopathy, what we do know is the genes code for proteins that influence our characteristics that contribute to making us who we are which includes neurocognitive vulnerabilities that may in turn, increase the risk for developing features related to psychopathy (Viding & McCrory, 2017). Some biobehavioral studies of resilience focuses on the possibility of “undoing” or “reprogramming” systems of the individual affected by CM regarding intergenerational transmission of programming effects through the process epigenetic modification (Masten et al., 2021). This path of thinking and research could highlight that since trauma effects can be transmitted across generations, protective factors could also be transmitted or, experiences after birth could undo epigenetic changes in order to protect the child (Masten et al., 2021) from consequences of abnormal brain architecture and its subsequent functioning. Neuronal pathways that are developed and strengthened under negative conditions prepare children to cope in that negative environment, and their ability to respond to nurturing and kindness may be impaired (Child Welfare Information Gateway, 2023).

Positive environmental factors may support more resilient functioning through acting on core neurobiological processes (HPA axis) even after the maladaptive environmental experiences occurred (Ioannidis et al., 2020). Findings through fMRI studies show that youth who demonstrate resiliency show a number of changes in brain architecture, including but not limited

to, lower amygdala response to negative stimuli and increase activation of the PFC while amygdala showed reduced activation which suggests enhanced emotional regulation abilities (Eaton et al., 2022).

As the brain develops, it creates, strengthens, and discards connections called synapses (Child Welfare Information Gateway, 2023). The development of synapses occur at a high rates during a child's early years in response to a child's experiences, and based on these experiences, some synapses are strengthened but others are gradually pruned away as part of normal development (Child Welfare Information Gateway, 2023). Each brain regions grows in relation to the stimuli received, and if a child does not receive appropriate stimuli during a period of growth, certain neuronal pathways may not be fully developed (Child Welfare Information Gateway, 2023).

The human brain continues to develop until an individual reaches their mid-twenties and right before puberty, the adolescent brain experiences a growth spurt that mainly occurs in the frontal lobe (Child Welfare Information Gateway, 2023). The frontal lobe oversees planning, impulse control, and reasoning (Child Welfare Information Gateway, 2023). It should be noted that impulsive behaviour, poor decisions, and increased risk-taking are part of the normal teenage experience (Child Welfare Information Gateway, 2023).

A concept known as plascity allows us to learn and adapt and make up for missed experiences later in life (Child Welfare Information Gateway, 2023). Because the brain adapts to its environment, it can adapt to a negative environment just as much as it would with a positive environment which can lead to children adopting what are viewed as negative traits as a reaction to the maltreatment they have endured and experienced (Child Welfare Information Gateway, 2023).

Epigenetics refers to alterations in how genes work and are expressed (Child Welfare Information Gateway, 2023). A modification occurs when a chemical signature attaches themselves to genes which helps turn genes “on” or “off” (Child Welfare Information Gateway, 2023). These modifications may be permanent and can be inherited. Studies of one particular gene, NCR3C1, been associated between childhood maltreatment and increases in methylation (a chemical signature), and these increases in methylation are related to increased externalizing behaviours and higher depressive symptoms (Child Welfare Information Gateway, 2023).

General Implications of Neurobiology in Childhood Maltreatment

Relating brain architecture and brain development to those who have experienced CM, reduced gray matter volume, blood flow, or thickness has been reported in orbitofrontal cortex of the Romanian orphans as well as in populations with physical or sexual abuse, or Department of Social Services documented abuse, and maltreated individuals without psychopathy (Teicher & Samson, 2016). Overall, children who have been maltreated present with reduced brain volume compared to non-maltreated children which includes reductions in various areas of the cortex (Child Welfare Information Gateway, 2023), also, the experience of maltreatment may affect the connections between different brain regions.

One aspect of an individual’s brain structure and function has to do with their reward pathway. Reward sensitivity in the brain of an adolescence’s brain development is highly vulnerable to environmental contingencies (Kenny, 2016). One study explains that prosocial behaviours results in pro-social rewards, and antisocial rewards that reinforce criminality results in further antisocial behaviours, if there is no prosocial behaviour available at this time (Kenny, 2016). Heightened reward responses and stimuli are associated with higher levels of dopamine,

which has been shown to peak during the adolescence and puberty phases of individual development (Kenny, 2016). Dopamine has shown to be a crucial factor in decision-making, fun-seeking, risky behaviour, as well as decreased harm-avoidance which speaks to this hormone's influence on incentive-driven behaviours (Kenny, 2016).

Network architecture vulnerability increases in maltreated individuals and reaches a plateau around 21 years of age (Teicher et al., 2020), and the increasing network vulnerability in maltreated individuals during adolescence and early adulthood likely results from the combined consequences of the pruning of general fiber pathways and failure to adequately develop frontal association pathways underlying these frontal network regions (Teicher et al., 2020). Therefore, the increasing network vulnerability during adolescence and early adulthood in maltreated individuals leads to the emergence of psychiatric symptoms and problems with substance use that manifests when network vulnerability reaches a stage when the networks can no longer effectively compensate for abnormalities (Teicher et al., 2020). Neuroplasticity of the developing brain is now starting to be viewed as a central component to resilience, suggesting that resilience to stress is a key element of a healthy brain (Masten et al., 2021).

Connection to Crime

Taken together, both criminologists and psychologists have found that adults who commit serious and violent crime often have higher rates of child maltreatment, in comparison to the general public, of trauma and abuse (Jorgensen, 2019). In a study by Kenny (2016, p. 23) it was stated that in the Children (Criminal Proceedings) Act of 1987, a guiding principle is that “children who commit offences bear responsibility for their actions, but because of their state of dependency and immaturity, require guidance and assistance”. Unfortunately, delinquent youth

are often caught in the cycle of violence, which integrates the social learning theory of crime that the is child learning the parental styles of violent behaviour and then the child is re-creating this behaviour throughout their life (Doelman et al., 2023).

Although past studies have varied in their cause-and-effects of crime as well as the type of crime, one common pattern has persisted. That is, evidence shows an increase of general delinquent behaviour and violent delinquent behaviour in juveniles with a history of CM, where between 14% - 34% of the general population of children have experienced at least one traumatic event, and it becomes increasingly more significant when looking at youth who have had encounters with the justice system, as estimates rise to 75%-93% of children who have experienced at least one traumatic event (Doelman et al., 2023, p. 530; Kelley et al., 2017).

Another study shows an overall increase of trauma history among the population of all incarcerated men, women, and youth to be as high as 90% (Jorgenson, 2019). That being said, there is mixed evidence of the effect of CM on a specific type of offense (Doelman et al., 2023, p. 531), therefore, there is a gap for future research to fill, in order to discern if a difference or connection exists in the type of CM and its possible connection to crime.

Of note, while a majority of individuals with a history of childhood adversity are involved in crime, it is noted that only a small number of this population with a history of CM have a life committed to that of criminal offending and behaviour (Haslam & Taylor, 2022). The impairments noted early associated with TBIs has often been associated as risk factors within the research of criminology and its related fields (Hughes et al., 2015; Nicholas et al., 2015), so much so that these impairments have been strongly associated with early-onset and being a life-course persistent offender as well as its observed neurocognitive impairments. One interesting statement made by this same study is that they found that the number of times an individual has

experienced loss of consciousness in relation to their TBIs was found to be higher among the population persistent offenders (Hughes et al., 2015).

The other side of understanding the neurobiology of an offender and understanding the “why” of crime, is the understanding of resiliency. The development of resiliency is said to occur when environmental, individual, and social factors exist which disrupt the pathway leading to adverse outcomes (Mueller & Carey, 2022, p.131). The general theory of crime, used in a 2022 study by Mueller and Carey, view crime as easy and gratifying to individuals with low levels of self-control, and has been found to predict criminal behaviour (Mueller & Carey, 2022, p.130). This same study suggests that through a child’s accumulation of ACEs, self-control decreases. The impact of PCEs (positive childhood experiences) however, according to the study, suggested that PCEs retain their beneficial impacts on self-control, but this is not to say that they override any ACEs (Mueller & Carey, 2022, p.141-142).

By applying another theory of crime known as the general strain theory, it could be explained that the experience of child maltreatment increases the risk of negative or maladaptive coping strategies in order to try to alleviate strain (Haslam & Taylor, 2022), and this theory goes on to argue that this could result in further being a victim as well as the offender. Even more so, it has been noted that those who work within the justice system, specifically the juvenile justice system, are not always equipped with handling youths with a traumatic past (Kelley et al., 2014). Therefore, there are reports that young offenders who enter the justice system often do not receive treatment and rehabilitation and are often re-traumatized through the processes of arrest and confinement (Kelley et al., 2014). Speaking to this pattern, it was found that life-course-persistent offenders are more likely, generally speaking, take part in more severe and violent

criminal behaviour, whereas strictly youth offenders take part in more minor acts of delinquency such as rule breaking (Kendler, 2015).

The above literature review has exemplified that there is indeed some sort of connection between the expressions of an individual's neurobiology and their actions in crime. The severity and simplicity of the connection, however, is far from being established and allows for future research to continue.

Relationship to Types and Severity of Crime

Most violent crime is committed by a small group of men who display conduct problem (CP) in childhood and ASPD (Kolla et al., 2013). A minority also meet the criteria for psychopathy as assessed by the PCL-R (psychopathy checklist-revised) (Kolla et al., 2013). As children they present CPs and CU traits and impairments in the recognition of sadness that is also observed among adult offenders with psychopathy (Kolla et al., 2013). One specific study looked at the relationship between CM and gang activity (Haslam & Taylor, 2022). They found that “neglect-experienced individuals were more than twice as likely to be consistently involved in gangs” (Haslam & Taylor, 2022, p. 8).

Among violent offenders, those with psychopathy reported greater childhood physical abuse but not more sexual or emotional abuse than those without psychopathy (Kolla et al., 2013).

In terms of promoting the goal of being resilient, research has demonstrated that in the context of recidivism, resilience may actually be more applicable in preventing against the onset of offending altogether instead of resilience being a protective factor against recidivism (Fougere et al., 2015).

Discussion

Prevention, Treatment, and Policy Changes

Plasticity and sensitive periods demonstrated by the studies conducted about the Romanian institutions highlights the importance of early intervention in helping children adapt and not only survive, but to be able to strive throughout the remaining duration of their life (Child Welfare Information Gateway, 2023). Intensive, and early interventions that occur when the brain is most plastic is much more effective than reactive services as the child ages (Child Welfare Information Gateway, 2023). Some research has shown evidence for assessment and intervention to start during the peri-traumatic period in order to take advantage of this key window of time for the deployment of early interventions to boost resilience and recovery (Roeckner, et al., 2021).

Some studies have been able to show that different types of maltreatment as well as the specific age of the child experiencing maltreatment has been associated with specific neurobiological abnormalities of the brain's structure and function (Teicher & Samson, 2016). This is an important acknowledgement as this sort of information may prove critical in designing and providing the optimal treatments (Teicher & Samson, 2016) for recovery as well as prevention to CM.

Keeping in mind that a child's brain may adapt to the environment they are exposed to while developing can help caseworkers better understand and empathize with why a child or adult may be acting in a seemingly maladaptive manner in a situation that the caseworker themselves do not view as being stressful or deserving of a particular reaction (Child Welfare Information Gateway, 2023). Further to this point of thought, research has come so far that one study has hypothesized that brain alterations associated with childhood trauma might be adaptive

in response to maltreatment, (Cassiers et al., 2018), but only in the initial stages of experiencing such trauma, allowing the child to cope with the situation. This study goes on to state that “in the long run they may lead to maladaptive behaviour in other (normative) environments, thus formatting a latent vulnerability for the development of (psycho)pathology” (Cassiers et al., 2018, p.3).

Children may display unusual and/or difficult coping behaviours, and therefore, being able to understand the neurobiology underlying these behaviours may help caregivers in shaping their responses more effectively (Child Welfare Information Gateway, 2023). Additionally, some caregivers may have encountered maltreatment in their own childhood, and being able to understand how that affects brain development may help them better understand their own history and current coping mechanisms (Child Welfare Information Gateway, 2023).

Despite behaviours, neurobiological implications, and past experiences, it is recognized that caregivers with a child presenting with psychopathic traits can be extremely challenging to raise and care for, and research has shown this to be the case, as these children often evoke different parenting reactions (Viding & McCrory, 2017), which creates a cycle of negative caregiver and child interactions, as well as an overall negative tone to their relationship. This highlights the importance of seeking help outside family networks to ensure the best intervention and treatment for both the child as well as those within their social network.

Implications for Future Research

Little is known about the mechanisms (Bowes & Jaffee, 2013, p. 203) of how resilience develops and expresses itself. Research thus far has suggested that the “one-size-fits-all” model of prevention and intervention efforts is unlikely to benefit all individuals (Bowes & Jaffee,

2013, p. 203). When considering the serious nature of psychopathy and its effects, both researchers and clinicians are motivated to understand how psychopathy develops and how it might be prevented (Viding & McCrory, 2017). Considering this statement, continuing research in this area of interest presents as a crucial aspect in understanding those individuals that commit crime, and therefore, determining effective policy changes as well as changes in prevention and intervention that is more catered to the individual instead of the overall general population.

Another point consideration for future directions in research, is the urge to start efforts in the preschool years (Moreira et al., 2020, p.11). If intervention and treatment efforts were to begin in the younger years of a child's life, intervention efforts could be made more impactful and conducive in order to promote resilience against all odds already handed to the child. Therefore, benefiting not only the child and their future, but also benefiting society and the potential impacts that could occur if a child were to go on to live a life of criminal behaviour and offending.

One study found that children who showed resiliency had different levels of connectivity between various regions of the brain than those who showed symptoms, even though both had the same levels of brain alterations (Child Welfare Information Gateway, 2023). Researchers are still trying figure out why this is, and some implications could include pre-existing neurobiological characteristics of a child that allow them to be resilient, certain protective factors, conditions, or attributes that reduce risk and promote healthy development (Child Welfare Information Gateway, 2023).

Conclusion

This research study has provided a very broad literature review of secondary research data on the topic of the presence and development psychopathy and resiliency, related to child development and child maltreatment in the context of criminal offending in youth, as well across the lifespan. This topic started with the discussion of child development as a whole and brought to light the significance of child and caregiver interactions (Child Welfare Information Gateway, 2023), and discussed how these relationships can play a large role in influencing the neurobiological expressions of either psychopathy or resiliency. The concept of toxic and sensitive periods were briefly discussed due to their prevalence throughout the rest of the study. The relevance of toxic stress to psychopathy and resilience, and what creates toxic stress such as, harsh parenting styles and traumatic experiences that creates a prolonged stress response (Harvard University 2023b; Child Welfare Information Gateway, 2023), as well as the outcomes of toxic stress relating to antisocial personality disorder as well as increasing risk factors towards psychopathy. Sensitive periods provided insight to plasticity of the developing child's brain and the vulnerability this creates when experiencing maltreatment, all while being influential in determining one's life trajectory (Sattler et al., 2023). To assist in adding evidence to this research, studies looking at sibling, twin, and orphan studies which highlighted the importance in understanding behaviour that is attributable to genetics or environment, the debate of nature versus nurture.

A key component of this study is its attempt to uncover possible associations of psychopathy and resiliency to specific trauma subtypes such as physical abuse and neglect, sexual abuse, emotional abuse, as well as looking at the contributions of sociological factors. A major part of this research was to understand the implications that psychopathy and resiliency has on the development of brain structure and its following functions. This included the effects

of child maltreatment, traumatic brain injuries, as well as disorders such as fetal alcohol spectrum disorder. Regions of interest in the study of brain structure and function in relation to child maltreatment includes the amygdala, hippocampus, corpus callosum, prefrontal cortex, and the hypo-pituitary-adrenal axis. This, however, is not an exhaustive list of the regions affected by child maltreatment. These findings demonstrated possible explanations to account for behavioural problems often associated with psychopathy as well as evidence for the development of resiliency.

A prominent component of this study was related to criminal offending, and therefore an analysis of some specific connections between child maltreatment and criminal behaviour was made. A key take away here is that research has shown that, in general, incarcerated populations had a higher prevalence of having a history of child maltreatment compared to those who have not been incarcerated (Jorgensen, 2019).

Finally, this study was able to highlight the critical and urgent nature of the prevention of psychopathy and the need to push for methods and programs to promote resiliency. Prevention is key in ensuring that children and young adults stay out of the justice system to avoid being retraumatized by the processes of the justice system (Kelley et al., 2014). Treatment to start the healing process for people who have been victims of any sort of child maltreatment is a crucial component of promoting resiliency in order to give youths the chance at a positive life trajectory (Eaton et al., 2022). In conclusion, this study and related research creates the opportunity to give a voice to those who don't have the ability to use their own.

References

- Bowes, L. & Jaffee, R. S. (2013). Biology, genes, and resilience: Toward a multidisciplinary approach. *Trauma, Violence, and Approach*, 14(3), 195-208.
<https://doi.org/10.1177/1524838013487807>
- Cassiers, M. L. L., Sabbe, C. G. B., Schmaal, L., Dick, J. V., Penninx, H. J. W. B., & Van Den Eede, F. (2018). Structural and functional brain abnormalities associated with exposure to different childhood trauma subtypes: A systematic review of neuroimaging findings. *Frontiers in Psychology*, 9(329), 1-17. <https://doi.org/10.3389/fpsyg.2018.00329>
- Child Welfare Information Gateway. (2023). *Child maltreatment and brain development: A primer for child welfare professionals*.
https://www.childwelfare.gov/pubpdfs/brain_development.pdf
- Cooke, M. E., Connolly, J. E., Boisvert, L. D., & Hayes, E. B. (2023). A systematic review of biological correlates and consequences of childhood maltreatment and adverse childhood experiences. *Trauma, Violence, and Abuse*, 24(1), 156-173.
[10.1177/15248380211021613](https://doi.org/10.1177/15248380211021613)
- Cornwell, H., Toschi, N., Hamilton-Giachritsis, C., Staginnus, M., Smaragdi, A., Gonzalez-Madruga, K., Rogers, J., Martinelli, A., Kohls, G., Raschle, M. N., Konrad, K., Stadler, C., Freitag, C., De Brito, S., & Fairchild, G. (2023). Identifying structural brain markers of resilience to adversity in young people using voxel-based morphometry. *Development and Psychopathology*, 1-13. [10.1017/S0954579423000718](https://doi.org/10.1017/S0954579423000718)
- De Wit, S., Wierenga, M. L., Oranje, B., Ziermans, B. T., Schothorst, F. P., Van Engeland, H., Kahn, S. R., & Durston, S. (2016). Brain development in adolescents at ultra-high risk for

- psychosis: Longitudinal changes related to resilience. *NeuroImage: Clinical*, 12, 542-549. <https://doi.org/10.1016/j.nicl.2016.08.01>
- Doelman, H. E., Luijck, P. M., Marshall, H. I., Jongerling, J., Enzmann, D., & Steketee, J. M. (2023). The association between child maltreatment and juvenile delinquency in the context of situational action theory: Crime propensity and criminogenic exposure as mediators in a sample of European youth? *European Journal of Criminology*, 20(2), 528-547. <https://doi.org/10.1177/14773708211013300>
- Eaton, S., Cornwell, H., Hamilton-Giachritsis, C., & Fairchild, G. Resilience and young people's brain structure, function, and connectivity: A systematic review. *Neuroscience and Biobehavioural Reviews*, 132, 936-956. <https://doi.org/10.1016/j.neubiorev.2021.11.001>
- Feder, A., Fred-Torres, S., Southwick, M. S., & Charney, S. D. (2019). The biology of human resilience: Opportunities for enhancing resilience across the life span. *Biological Psychiatry*, 86(6), 443-453. <https://doi.org/10.1016/j.biopsych.2019.07.012>
- Fougere, A., Daffern, M., & Thomas, S. (2014). Does resilience predict recidivism in young offenders? *Psychiatry, Psychology, and Law*, 22(2), 198-212. [0.1080/13218719.2014.936333](https://doi.org/10.1080/13218719.2014.936333)
- Green, J. M., Piotrowska, J. P., Tzoumakis, S., Whitten, T., Laurens, R. K., Butler, M., Katz, I., Harris, F., & Carr, J. H. (2023). Profiles of resilience from early to middle childhood among children known to child protection services. *Journal of Clinical Child & Adolescent Psychology*, 52(4), 533-545. <https://doi.org/10.1080/15374416.2021.1969652>
- Harvard University. (2023a). Center on the developing child. *Harvard University*. <https://developingchild.harvard.edu/>

Harvard University. (2023b). Center on the developing child. *Harvard University*.

<https://developingchild.harvard.edu/science/key-concepts/toxic-stress/>

Harvard University. (2023c). Center on the developing child. Harvard University.

<https://developingchild.harvard.edu/science/key-concepts/resilience/>

Haslam, Z., & Taylor, P. E. (2022). The relationship between child neglect and adolescent interpersonal functioning: A systematic review. *Child Abuse and Neglect*, 125, 1-13.

<https://doi.org/10.1016/j.chiabu.2022.105510>

Hughes, N. Williams, H. W., Chitsabesan, P., Walesby, C. R., Mounce, T. A. L., & Clasby, B. (2015). The prevalence of traumatic brain injury among young offenders in custody: A systematic review. *Journal of Head and Trauma Rehabilitation*, 30(2), 94-105.

<https://doi.org/10.1097/HTR.000000000000124>

Ioannidis, K., Askelund, D. A., Kievit, A. R., & Van Harmelen, A. (2020). The complex neurobiology of resilient functioning after childhood maltreatment. *BMC Med*, 18(32), 1-16. <https://doi.org/10.1186/s12916-020-1490-7>

Jorgenson, C. (2019). The impact of multiple types of childhood trauma on juvenile delinquent behaviour. *ProQuest*.

<http://libproxy.mtroyal.ca/login?url=https://www.proquest.com/dissertations-theses/impact-multiple-types-childhood-trauma-on/docview/2273363962/se-2>

Kendler, S. K., Maes, H. H., Lonn, L. S., Morris, A. N., Lichtenstein, P., Sundquist, J., & Sundquist, K. (2015). A Swedish national twin study of criminal behaviour and its violent, white-collar and property subtypes. *Psychological Medicine*, 45(11), 2253-2262.

[10.1017/S0033291714002098](https://doi.org/10.1017/S0033291714002098)

- Kelley, M. T., Pransky, J., & Sedgeman, A. J. (2014). Realizing resilience in trauma exposed juvenile offenders: A promising new intervention for juvenile justice and prevention professionals. *Journal of Child & Adolescent Trauma*, 7, 143-151.
<https://doi.org/10.1007/s40653-014-0018-8>
- Kenny, T. D. (2016). The adolescent brain: Implications for understanding young offenders. *Judicial Officers' Bulletin*, 28(3), 23-27.
<https://search.informit.org/doi/10.3316/informit.008923637458274>
- Kolla, J. N., Malcolm, C., Attard, S., Arenovich, T., Blackwood, N., & Hodgins, S. (2013). Childhood Maltreatment and Aggressive Behaviour in Violent Offenders With Psychopathy. *The Canadian Journal of Psychiatry*, 58(8), 487-494.
<https://journals.sagepub.com/doi/pdf/10.1177/070674371305800901>
- Marsiglio, C. M., Chronister, M. K., Gibson, B., & Leve, D. L. (2014). Examining the link between traumatic events and delinquency among juvenile delinquent girls: A longitudinal study. *Journal of Child Adolescent Trauma*, 7(40), 217-225.
[10.1007/s40653-014-0029-5](https://doi.org/10.1007/s40653-014-0029-5)
- Masten, S. A., Lucke, M. C., Nelson, M. K., & Stallworthy, C. I. (2021). Resilience in development and psychopathology: Multisystem Perspectives. *Annual Review of Clinical Psychology*, 17, 521-549. <https://doi.org/10.1146/annurev-clinpsy-081219-120307>
- Moreira, D., Moreira, S. D., Oliveira, S., Riberiro, N. F., Barbosa, F., Favero, M., & Gomes, V. (2020). Relationship between adverse childhood experiences and psychopathy: A systematic review. *Aggression and Violent Behaviour*, 53, 1-14.
<https://doi.org/10.1016/j.avb.2020.101452>

- Mueller, C. K., & Carey, T. M. (2022). How positive and negative childhood experiences interact with resiliency theory and the general theory of crime in juvenile probationers. *Youth and Violence Juvenile Justice*, 21(2), 130-148.
<https://doi.org/10.1177/15412040221131278>
- Nicholas, R., Nathan, H., Celia, G., Stefanie, R., Cathy, C., & Anderson, A. V. (2015). Prevalence and predictors of externalizing behaviour in young adult survivors of pediatric traumatic brain injury. *Journal of Head Trauma Rehabilitation*, 30(2), 75-85.
[10.1097/HTR.0000000000000123](https://doi.org/10.1097/HTR.0000000000000123)
- Ohashi, K., Anderson, M. C., Bolger, A. E., Khan, A., McGreenery, E. C., & Teicher, H. M. (2019). Susceptibility or resilience to maltreatment can be explained by specific differences in brain network architecture. *Biological Psychiatry*, 85(8), 690-702.
<https://doi.org/10.1016/j.biopsych.2018.10.016>
- Roeckner, R. A., Oliver, I. K., Lebois, M. A. L., Van Rooij, H. J. S., & Stevens, S. J. (2021). Neural contributors to trauma resilience: a review of longitudinal neuroimaging studies. *Translational Psychiatry*, 11(508), 1-17. <https://doi.org/10.1038/s41398-021-01633-y>
- Rogers, J. B., McLachlan, K., & Roesch, R. (2013). Resilience and enculturation: Strengths among young offenders with fetal alcohol spectrum disorder. *First Peoples Child & Family Review*, 8(1), 62-80. <https://doi.org/10.7202/1071407ar>
- Sattler, K., Yoon, S., & Lutolli, A. (2023). Trajectories of resilience among young children involved with child protective services. *Development and Psychopathology*, 1-11.
[10.1017/S095457942200133X](https://doi.org/10.1017/S095457942200133X)
- Teicher, H. M., Ohashi, K., & Khan, A. (2020). Additional insights into the relationship between brain network architecture and susceptibility and resilience to the psychiatric sequelae of

- childhood maltreatment. *Adversity and Resilience Science*, 1(1), 49-64. [10.1007/s42844-020-00002-w](https://doi.org/10.1007/s42844-020-00002-w)
- Teicher, H. M., & Samson, A. J. (2016). Annual research review: Enduring neurobiological effects of childhood abuse and neglect. *Journal of Child Psychology and Psychiatry*, 57(3), 241-266. [10.1111/jcpp.12507](https://doi.org/10.1111/jcpp.12507)
- Viding, E., & McCrory, J. E. (2017). Understanding the development of psychopathy: Progress and challenges. *Psychological Medicine*, 48(4), 566-577. <https://doi.org/10.1017/S0033291717002847>
- Watters, R. E., Aloe, M. A., & Wojciak, S. A. (2021). Examining the associations between childhood trauma, resilience, and depression: A multivariate meta-analysis. *Trauma, Violence, & Abuse*, 24(1), 231-244. <https://doi.org/10.1177/15248380211029397>
- Zhang, L., Rakesh, D., Cropley, V., & Whittle, S. (2023). Neurobiological correlates of resilience during childhood and adolescence- A systematic review. *Clinical Psychology Review*, 105, 1-12. <https://doi.org/10.1016/j.cpr.2023.102333>