Why Are Some People More Resilient Than Others?

The Neuroscience of Resilience

by

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Table of Contents

Abstract

Why are some people more resilient than others? Resilience is the ability to *bounce back* or adapt after a traumatic event. Over the decades, research has determined numerous factors influencing and impacting the ability to be resilient. Due to technological advances, the current topic of research in this area is the neuroscience behind resilience. Specific brain structures and systems have a significant impact on resilience. Early life experiences can compromise the development of these structures and impact the ability to cope with, and adapt to, adversity and trauma. Early attachment styles and adverse childhood experiences change the structures of the brain, resulting in long-term challenges in relationships, coping strategies, and prevalence of psychological disorders and other mental health challenges. Neuroplasticity, the brain's ability to rewire and create new neuropathways, is the key to increasing resilience regardless of early conditioning or negative patterns of behaviours. Strengthening parts of the brain that impact resilience through behavioural, cognitive, somatic, and integrative approaches may result in greater resilience. The purpose of this capstone research project is to gain a better understanding of the brain's role in resilience and the strategies and interventions involved in assisting clients in therapy to develop greater resiliency. Greater resilience is important to be able to navigate life's many challenges and live a meaningful and productive life.

Keywords: adverse childhood experiences, attachment style, brain, conditioning, coping strategies, neuroscience, neuroplasticity, resilience

Dedication

I dedicate this paper to my husband, who without his patience, understanding, and support, would not have made it possible for me to continue to work full time and complete this program. I am forever grateful for his love and support in walking beside me while I pursue my dream of becoming a clinical counsellor.

Acknowledgements

This program has been a lot of things to me. It was exhausting, stressful, time-consuming, challenging, scary, exciting, interesting, rewarding and life changing. It has always been my dream to pursue a career in counselling and I am very proud of myself for completing this milestone in my life. I am so excited to take my next step and start a rewarding career in the counselling field. I would not have been able to complete this program without the help and support of my family, friends, co-workers, City University instructors, my internship supervisor, and my classmates. This would not have been possible without your guidance and support. I want to thank all of you who listened to my whining over the last three years and celebrated every little step with me along this journey. Thank you for encouraging me, believing in me, and for constantly reminding me that I am doing what I am meant to do. I am forever grateful.

Chapter One: Introduction

Why is resiliency important?

Adversity and trauma are part of the human experience. Yet, how individuals respond to and cope with stress and trauma differs from one person to the next. Some people grow stronger and even learn from negative experiences, while others are debilitated by it and develop health challenges and psychological disorders (Cummins, 2015). Why are some people more resilient than others after a traumatic event? Is it biological or neurological? Is it dependent on the environment, social context, or cultural background? Is it due to individual characteristics or personality traits? Is it psychological or developmental? These are the questions many researchers have investigated over the decades and continue to do so today. Although many studies have agreed on some factors and circumstances impacting an individual's ability to be resilient, recent advances in technology such as brain imaging and scanning machines have shone a light on resilience research. The neuroscience of resilience highlights the brain's role in developing resilience.

Resilience has been a topic of interest for many decades. Previous research on resilience initially stemmed from the study of developmental psychology in children who have experienced adversity and trauma (Bonanno & Diminich, 2013). The term *resilience* has only become a psychological construct in the last 50 years, with research in this area growing exponentially in the last 25 years. Research studies on the concept of resiliency continue in different contexts and theoretical frameworks. The term *resiliency* has been defined and characterized in many ways. In general terms, resiliency is the ability to *bounce back* or return to normal functioning after a setback (Graham, 2013; Joyce et al., 2017) and adapt while maintaining normal psychological and physical functioning in the face of adversity or trauma (Wu et al., 2013; Zimmerman, 2020).

The construct of resilience is difficult to study due to all the variables and factors that may impact and influence an individual's ability to be resilient. Research has shown that there is no single factor or predictor of resilience. Instead, resilience results from many individual factors which change and vary over time (Bonanno et al., 2015). Furthermore, the mechanisms that impact resiliency are complex, being both contextually and culturally dependent (Ungar, 2013).

Today, neuroscience has changed how resilience is being conceptualized and studied. More and more, research on resilience is involving animal studies and comparing brain images of resilient and non-resilient individuals to gain a better understanding of the specific brain structures associated. Although research on the neuroscience and neurobiology of resilience is growing, more research is needed to support the efficacy of the different psychotherapy approaches on rewiring the brain and promoting behavioural change.

This capstone addresses the neuroscience of resilience because it is such a relevant topic of study considering the current state of the world. Global stressors such as the COVID-19 pandemic, Ukraine war, political instability, climate change, and cultural injustices in the world, undoubtedly have negatively impacted individual's mental health with increased levels of stress and anxiety about what the future holds. A global pandemic impacted aspects of everyday life on many levels, while an increase in natural disasters such as forest fires, flooding, hurricanes, and drought around the world has made the reality of climate change more apparent. More and more, people are impacted by high levels of stress and anxiety that are felt both individually and collectively in our communities. The ability to be resilient is even more important now, to cope with the ever-changing and unpredictable world.

Purpose Statements

Purpose statements for this capstone are:

1) To clearly define what resilience is and how the current understanding of resilience is informed by brain research.
2) To explore the relationships between attachment style and adverse childhood experiences in developing the foundation of resilience.
3) To review some of the psychotherapeutic models found to be useful in helping develop client resiliency.
4) Last, a hypothetical case study will be presented to illustrate how a therapist may work with a client in applying components of neuroscience and psychotherapeutic approaches to improve resilience.

Theoretical & Conceptual Framework

Strength-based and positive psychology provide the foundation for a theoretical and conceptual framework through which I will analyze the literature research. This framework is grounded in the belief that people have the capacity to be resilient, and that resilient behaviours and characteristics can be learned, despite previous conditioning or experiences of trauma. This paper is also informed by research regarding the neuroscience of resilience and the attachment theory framework.

Using an empirical framework, I will begin by reviewing and analyzing the research that explores the neuroscience of resilience and present empirical evidence to support the findings that even though the brain is greatly impacted by early childhood experiences, the brain's neuroplasticity allows people to continue to change throughout the lifespan. In addition, I will demonstrate the value of therapy to facilitate the process of change and increase an individual's capacity to be resilient from a neuroscience perspective.

Contributions to the Field of Clinical Counselling

Having a better understanding of the factors and mechanisms that facilitate resiliency is important in assisting people to cope effectively, adapt to adversity and trauma, and draw upon their own inherent adaptability. Adversity is part of the human experience. Having a better understanding of how to strengthen our resiliency muscle will assist people in coping and adapting to our unpredictable and ever-changing world (Leppin et al., 2014). Understanding the processes underlying resiliency, a therapist can assist clients by promoting more effective coping strategies, mitigating maladaptive behaviours, and identifying the best interventions, approaches, and modalities to facilitate protection against the effects of trauma (Wu et al., 2013). Empirical research also informs the possibility of developing resiliency training programs and providing psychoeducation in clinical settings (Leppin et al., 2014). In addition, the growing understanding of the neuroscience of resilience may cause the development of novel interventions targeting the neural circuitry and brain areas that enhance resilience (Liu et al., 2018), as well as pharmacological interventions targeting the neurochemical systems to treat stress-related disorders such as post-traumatic stress disorder (PTSD) and depression (Wu et al., 2013).

Reflectivity and Positionality Statement

I am a cisgender female of Filipino descent. I was born in the Philippines and immigrated to Canada with my parents and three siblings when I was seven years old. Resiliency or the ability to be resilient has a very personal meaning to me. Throughout my life, I have experienced adversity, grief/loss, and racism. Five years ago, I also experienced a serious car accident that not only changed my life but also made me recognize my own resiliency. October 7th, 2017, I was driving down the Coquihalla Highway when a work truck parked on the side of the road unexpectedly did a U-turn in front of me. I struck the truck at a speed of over 110 km/hr. This

traumatic experience catapulted me in a different direction in my life. Surviving this almost fatal car accident and coping with the resulting trauma has made me realize how resilient I am. At the moment of my car accident, I thought, “This is it for me. I am going to die today.” The realization that I survived transformed my entire outlook and motivated me to make some significant changes in my life. It made me realize how precious life is and served as a reminder for me to live my life to the fullest. This experience also led me to pursue my master’s degree in counselling, something that I have always wanted to do, but had given up on prior to my car accident.

After the car accident, I was angry, traumatized, depressed, and overwhelmed by self pity. However, my brain didn’t want to stay there. I became more focused on finding meaning behind the car accident, thinking that perhaps I was meant to do more with my life and that it was not my time to die. As I started thinking about the “why” and the “what now,” I was able to bounce back and focus more on the positive aspects of my experience, enabling me to benefit from it rather than getting lost in the negatives. I now believe that we all have the capacity to be resilient and the ability to tap into our inner strengths.

Something that has become very evident to me as I write this paper and wonder about my own resiliency is my optimism and positive outlook on life. I am realizing that I always tend to focus on the positive in every situation, instead of the negative. I dislike feeling depressed, anxious, or unhappy: instead, I surround myself with positive and supportive people and engage in daily activities that I enjoy and that make me happy. I could have died in that car accident, but I did not. I have, as a result, chosen to take my second chance and try to live in the best way I can. I also want to use this learning to help my clients have a healthier approach to life and become more resilient as they move forward with whatever they are experiencing. I am

specifically interested in learning the practical therapeutic tools needed to reinforce clients' confidence in their ability to develop their resilience.

As I started examining the literature, I realized that the factors contributing to resilience were complex and multiple. With the assistance of my capstone supervisor, I determined to focus on the neuroscience of resilience, which is the current key area of study. Having a better understanding of how the brain impacts resiliency would enable me to help others to develop and draw upon their own resilience and cope better with everyday life challenges and past traumas. In this way, I can help to instill hope in individuals who may be feeling stuck and helpless in their current reality.

Definition of Terms

Adverse Childhood Experiences (ACE): includes experiences of childhood traumas, such as child abuse and family dysfunction (Gilbert et al., 2015).

Amygdala: a brain structure, part of the limbic system, which is activated by threat and negative stimuli (Hanson, 2009).

Attachment Theory: the emotional bond between two individuals, developed initially through psychological connectedness and dependence between an infant and caregiver (Bowlby 1969, as cited in DeMaranville et al., 2022).

Bounce Back: the ability to return to normal functioning or adapt well after a setback or a traumatic experience (Graham, 2013; Guimarães, 2018; Joyce et al., 2017; Tóth, 2015).

Brain Stem: a region of the brain that sends neuromodulators (messengers), such as serotonin and dopamine, to the rest of the brain (Hanson, 2009).

Conditioning: automatic patterns of behaviour (Graham, 2013)**.**

Epigenetics: functional modifications or changes in gene expressions due to exposure to stress-related factors resulting in increased susceptibility to psychiatric disorders (Wu et al., 2013).

Explicit Memory: information that is within our awareness or conscious retention of information, such as recalling a telephone number or remembering a combination of a lock (Miller-Karas, 2015).

Hippocampus: a region of the brain (limbic system) that forms new memories and detects threats (Hanson, 2009).

Hypothalamus: the brain's primary regulator of the endocrine system and sends messages to the pituitary gland to signal the adrenal gland to release the stress hormones adrenaline and cortisol (Hanson, 2009).

Hypothalamic-Pituitary-Adrenal Axis (HPAA): a principal mediator of the impact of stress on the brain that controls stress responses and bodily processes during a flight or fight response (Russo et al., 2012).

Implicit Memory: information outside of our awareness or the unconscious retention of information where language is not required for storage or retrieval, for example, riding a bicycle (Miller-Karas, 2015).

Lateral Prefrontal Cortex (LPFC): a region of the brain that enables higher order cognitive abilities, such as, self-regulation strategies, cognitive reappraisal (reducing the emotional impact of a distressing situation) and affect labeling (explicitly acknowledging an emotion) (Tabibnia, 2020).

Limbic System: a region of the brain that includes the basal ganglia, hippocampus, amygdala, hypothalamus, and pituitary glands (Hanson, 2009).

Medial Prefrontal Cortex (MPFC): a region of the brain that is important in affect regulation

and reward network, supports self-reflective thinking (Tabibnia, 2020).

Mindfulness: the act of paying on purpose and without judgement in the present moment (Kabat-Zinn, 2003).

Neurons: cells that make up the brain (Ackerman, 2020).

Neuroplasticity: the brain's ability to reorganize itself structurally and functionally by creating new neurons and new connections between neurons, which change the way the brain is wired or connected (Ackerman, 2018; Hampton, 2016).

Neuroscience: mechanism and functions of the brain and understanding how the human brain works (Graham, 2013).

Neurobiology: focus on anatomy and physiology of the brain and nervous system (Graham, 2013).

Neocortex: largest part of the cerebral cortex (outer layer of the brain) involved in higher brain functions, such as sensory perception, emotion, and cognition (Graham, 2013).

Pituitary Gland: makes endorphins, triggers stress hormones, stores, and releases oxytocin (Hanson, 2009).

Prefrontal Cortex (PFC): executive center of the brain, integrates information with input from the lower brain areas with input from the higher brain regions, coordinates information from implicit and explicit memory (Graham, 2013).

Post Traumatic Growth (PTG): positive changes experienced due to a person's struggle with adversity or life altering circumstances (Walsh et al. 2018).

Resilience: the ability to return to normal functioning or "bounce back" (Graham, 2013) and positively adapt from stress/adversity and maintain normal psychological and physical functioning (Wu et al., 2013; Zimmerman, 2020).

Rewiring (see Neuroplasticity as well): rewiring results from neuroplasticity, the brain's ability to change or grow new connections or pathways between neurons changing the circuitry of the brain (Ackerman, 2018).

Self-directed Neuroplasticity: intentionally choosing to engage in behaviours to change a part of the brain or purposefully directing an activity to rewire the brain (Graham, 2013).

Sympathetic Nervous System (SNS): a division of the autonomic nervous system that sends signals to the major organs and muscles readying them for fight-flight (Hanson, 2009).

Thalamus: a brain structure and relay system that sends messages to the brain stem to release norepinephrine throughout the brain (Hanson, 2009).

Capstone Overview

Chapter two of my capstone will include a literature review of the neuroscience of resilience. I will begin with how the research on resilience has evolved and changed in the last few decades to now focusing on how specific brain structures and functions are associated with the development of resilience. Second, through the lens of attachment theory and adverse childhood experiences (ACE), I will discuss factors that impact the developing brain. I will explore the impacts of these early experiences on the brain and the ways they may compromise the development of resilience. Third, I will present behaviour, cognitive, somatic, and integrative therapeutic approaches geared to assist clients to rewire their brain and increase their resilience. In Chapter three, I will discuss my findings as they relate to clinical practice. I will present a case study to depict how I would apply the best therapeutic approaches to rewiring the brain and increasing resilience as I work with a client who has a long-term history of trauma.

Chapter Two: Literature Review

Components of Resilience

The word resilience is from the Latin verb *resiliere*, which means to "leap or spring back, to recoil, to rebound, to shrink back again" (Tóth, 2015, p. 70). In other words, the restoration of the individual's original state after physical or psychological strain. Other researchers such as Graham (2013) and Guimarães (2018) also referred to this concept as *bouncing back* from a setback or traumatic event. A resilient individual is characterised by Roth and Herzberg (2017), as one who experiences high self-confidence, academic and professional success, success in relationships, better health, and grit (personality trait of perseverance and passion for long-term goals). Further, Roth and Herzberg (2017) indicated that, in most studies, the resilient profile has been associated with positive outcomes and good psychological adjustments when exposed to stress and trauma. Resilience is also conceptualized as an "active and adaptive process and not simply the absence of pathological responses that occur in more susceptible individuals" (Russo et al., 2012, p. 1475). The term resilience has been defined in a variety of ways:

- The capacity and dynamic process of adapting and overcoming adversity while maintaining normal psychological/physical functioning (Liu et al., 2018; Tibibnia & Redecki, 2018; Wu at al., 2013).
- The ability to absorb life's challenges, persevere, and carry on (Leppin et al., 2014).
- The ability to remain positive despite adversity (DeMaranville et al., 2022; Feldman, 2020; Teodorczuk et al., 2017).
- The ability to bounce back, positively adapt and even grow from the negative experience (Graham, 2013; Guimarães, 2018).
- An effective response to environmental challenges and resistance to negative effects of

stress and trauma (Wu et al., 2013).

- A set of learned skills to facilitate recovery from adversity (Münch et al., 2021; Zimmerman, 2020) and maintain positive adaptation and normative functioning (Kural & Kovacs, 2021).
- The capacity of an individual to avoid negative social, psychological, biological consequences of extreme stress which would otherwise compromise their psychological and physical well-being (Russo et al., 2012).

All the above definitions refer to two components of resiliency: (1) adversity and (2) positive adaptation. In fact, Rasmussen et al. (2019) and Münch et al. (2021) stated that these are consistently referenced in literature, suggesting that resilience can be predicted by these two constructs. Graham (2013) offered another component of resilience that incorporates neuroscience: an innate capacity in the brain to handle life challenges. Masten (2001) stated that "resilience is made of ordinary, rather than extraordinary processes" (p. 227). That is, all humans have the capacity to be resilient and the ability to be resilient can be learned. Thus, if resilience can be learned, then regardless of adverse childhood traumas or previous negative learned responses, developing resilience is possible. This approach offers a more positive outlook on human development and adaptation (Masten, 2001).

Five Cs of Resilience

Linda Graham, author of *Bouncing Back: Rewiring Your Brain for Maximum Resilience and Wellbeing* (2013), described the five Cs of resilient coping that further define and conceptualize resilience:

1. Calm: the ability to stay calm in a crisis.

2. Clarity: the ability to see clearly what's happening and what needs to happen next, and

ability to see possibilities from different perspectives.

3. Connection: the ability to reach out to others and connect to resources when needed.

4. Competence: the ability to use the skills and competencies you have learned in the past and act quickly and effectively to respond to adversity.

5. Courage: the ability to persevere until the problem is resolved or accepted.

Graham clearly defined aspects of resiliency that other research studies or authors have failed to identify and provided a foundation for the belief that neuroscience can be used to assist clients in adopting more effective coping strategies and develop their resilience.

Resilience and Post Traumatic Growth

Resilience and post-traumatic growth (PTG) have been used interchangeably in the research literature. However, resilience is a different construct from PTG. Walsh et al. (2018) distinguished between the two and defined PTG as a positive change that may occur following a traumatic, life-altering event, where the traumatic event was the catalyst for change. By comparison, they saw resilience as the ability to cope with a negative or traumatic event by being able to adapt to adversity. Walsh et al.'s (2018) findings indicated that the greater the resiliency of an individual, the greater the PTG. As well, resilience acts with PTG in predicting outcomes in areas of distress, and quality of life. It is possible that the two can coincide and impact one another, but it is important to note that the two constructs have different meanings.

Resilience Research

Research on resilience in the last two decades had largely focused on a development model that studied chronic adversity and resiliency in children. According to Bonanno and Diminich (2013), the concept of resilience first appeared in childhood development literature in the 1970s when most of the research focused on the etiology of psychopathology. Michel Rutter,

one of the pioneers in resilience research, along with Norman Garmezy and Lois Murphy, facilitated the shift away from deficit-focused psychopathology of resilience towards a more positive and adaptive developmental framework (Yates et al., 2015). This shift was in line with other developmental psychologists who noticed that many children, despite their adverse circumstances, still developed into functional and capable adults. Is it possible that some adversity and negative experiences actually promote resilience? Russo et al. (2012), indicated that the potential *pro-resilience* effects of overcoming stress inducing situations during development has been observed in literature. This suggests that it is possible that moderate amounts of stress may serve to develop a sense of mastery, promoting resilience in the future. This emphasis on the positive rather than the maladaptive began the emergence of positive psychology as a major movement (Rutter, 2012). Researching the processes of resiliency allowed developmental theorists to encompass positive adaptations and individual's competence in their research (Bonanno et al., 2015).

Bonanno and Diminich (2013) categorized the evolution of research on resilience into four broad phases:

1. Measuring and defining resilience and gaining a better understanding of the factors associated with positive outcomes in adults exposed to adversity.
2. Understanding specific processes that lead to resiliency.
3. Conducting multiple levels of analysis and studying the neurobiological processes of resiliency.
4. Taking more of an integrative approach that involves genetics, neurobehavioural development, statistical analysis, moderators of risk and neural plasticity.

By the early 2000s, a growing interest in the factors contributing to resiliency in adulthood

emerged (Bonanno & Diminich, 2013). However, Guimarães (2018) believes that resilience in adulthood remains understudied in comparison to the amount of research done on resilience in children.

The research on resilience is extensive due to numerous variables, factors, approaches, and theoretical frameworks used to study and describe resiliency as a theoretical construct. The following depicts the many ways resilience has been conceptualized over the years. Tugade and Fredrickson (2007) described the concept of positive emotions in building and cultivating resiliency to stressful events. They explored the strategies needed to maintain and improve positive emotions and the mechanisms that link positive emotions to coping. They concluded that positive emotions counteract negative emotional experiences by strengthening personal resources, such as positive reappraisal (finding the silver lining), problem-focused coping (solving/managing the problem causing the distress) and infusing ordinary events with positive meaning (appreciating the little things in life), which help people deal better with negative events. Studies have shown that cultivating positive emotions results in both psychological and physical benefits in day-to-day life and promotes a better response to negative experiences, thus increasing resilience (Tugade & Fredrickson, 2007).

Ungar (2013) reviewed the relationship between factors associated with resilience and the individual's social ecology or environment that promotes or protects against the impact of trauma. They argued that resilience is not an individual construct but is determined by the quality of the environment and its capacity to facilitate growth. Thus, this social ecology model defines resiliency as the capacity for the individual and his/her environment to interact in ways to optimize development (Ungar, 2013).

Wu et al.'s (2013) article on the neurobiology of resilience outlined the genetic,

epigenetic, neurochemical mechanisms, neural circuits and pathways which are considered essential contributors to the development of resilience. Wu et al. presented a thorough and complicated summary of a range of human genes linked to resilient responses to trauma and stress. They stated that genetic factors significantly contributed to resilience responses to trauma, and that human genes have been linked to resilient phenotypes (characteristics/traits). Further, they observed that epigenetic differences are a result of exposure to stress during critical periods of development, and that these differences have been found to contribute to psychiatric disorders and the regulation of stress responses. They stated that neurobiology was a relatively new area of scientific investigation at this time and Beattie (2020) supported that the neurobiological understanding of resilience was still in its infancy.

Wu et al. (2013) also cited how developmental factors can play a crucial role in contributing to resilience. They noted that adverse events in childhood can affect development of the individual's stress response systems, resulting in damage lasting into adulthood. Psychological factors in resilience, such as cognitive processes, personality traits, individual characteristics/behaviours, and active coping mechanisms, also contribute to a level of resilience. Guimarães (2018) indicated that personality assets such as ego resilience, positive self -concept, hardiness, and optimism may help boost resiliency. Their article on resilience supported previous research on psychological factors such as self-efficacy (belief in one's own capacity to overcome challenges) and internal locus of control (belief that life events result from one's actions) that provide protection against the negative effects of stress and adversity. Individuals capable of being resilient after an adverse event are individuals who possess behaviour elasticity or flexible adaptation to stressful or traumatic events (Guimarães, 2018).

Zheng et al. (2020) explored the relationship between culture and resilience capacity in

trauma survivors. Resilience capacity is defined as a stable pattern of psychological adjustment following a traumatic event or adaptability/flexibility in handling a traumatic event. Zheng et al. explored possible cultural-related variables associated with the relationship between culture and resilience capacity in three cultural regions: the United States, Hong Kong, and China. They found that Westerners hold an independent view of the self, characterized by separateness, internal attributes, and uniqueness of individuals, while Easterners hold an interdependent image of self, characterized by connectedness, social context, and relationships. Their findings indicated that culture played a significant role in mediating resilience. All of these factors may also interact with biological factors to further influence an individual's adaptations to trauma (Wu et al., 2013) which makes the process of resiliency very complex and challenging to study.

Finally, the latest development on resilience research is the neuroscience of resiliency, which is the topic of this capstone. This current area of interest has been greatly influenced by technological advances in brain imaging and brain scanning machines (Graham, 2013; Liu et al., 2018). This technology has made it possible for scientists to view and study specific brain structures that are thought to be involved in the development of resilience. Researchers are now beginning to understand the extensive scope of the brain's role in developing resiliency. They have noticed that brain scans of individuals who are more resilient to stress differ from the brain scans of individuals who are less resilient (Tabibnia & Radecki, 2018). For example, they indicated that the more resilient an individual, the more white matter is present between the prefrontal cortex and the amygdala. Thus, educating clients about the neuroscience of resilience and the different strategies for behavioural change will ultimately promote new learning and increase successful outcomes.

Current Understanding of Resilience Informed by Brain Research

Brain Structures and Neuropathways Involved in Resilience

The brain is a social learning organ and designed to change with experiences (Hanson, 2009). Neuroscientists view the brain as a dynamic system with complex networks (Tabibnia, 2020) that is shaped by the social and interpersonal environment (Münch, 2021; Schauss et al., 2012). The brain is comprised of billions of neurons that form strong connections with other neurons and develop neural networks with specialized functions (Hanson, 2009). Neuroscience helps us understand the biological functions of common human reactions and the way human experiences can change the biology of the brain and the body (Miller-Karas, 2015). That is, a change in behaviour or thinking results in changes in the connections between neurons and ultimately the brain structure. Understanding the brain and its structures helps us better understand responses to stress and learn ways to return to the body's healthy rhythms (Miller-Karas, 2015). Therefore, providing psychoeducation in therapy regarding the nervous system and the specific brain functions has the potential to create a better understanding of the mechanism that drives the negative symptoms of trauma and stress, and in doing so, may result in people learning more effective ways to cope and increasing resilience.

According to Liu et al., (2018), the brain is inherently resilient and capable of responding flexibly and adaptively to trauma and stress. Research has demonstrated that various brain structures and pathways are involved in developing resilience, including the prefrontal cortex (PFC), hippocampus, and the amygdala (Franklin et al., 2012). Brain scans have shown that the amount of activation in the left prefrontal region of a resilient person can be thirty times that which occurs in the brain of someone who is not as resilient (Liu et al., 2018). One might then conclude that the key for increasing resiliency lies in learning ways to strengthen the prefrontal

cortex, thereby effectively strengthening all other brain functions (Graham, 2013).

The PFC is the executive center of the brain and coordinates and integrates other brain structures and circuits (Graham, 2013; Smith, 2021). PFC is a large region of the brain comprising subregions that include the left prefrontal region (LPFC), medial prefrontal region (MPFC), and anterior cingulate cortex (ACC) (Tabibnia &Radecki, 2018). Graham (2013) describes the functions of the PFC:

- Integrates information from the lower brain (base of the skull to the mid-brain) and higher brain.
- Coordinates functions of the right and left hemisphere of the brain.
- Coordinates implicit (outside of our awareness) and explicit (within our awareness) memory systems.
- Manages body-based emotions.
- Allows us to cope and thrive.
- Makes attunement (tuning into feelings of others), empathy, and self-awareness possible.

The amygdala is the fear and arousal center of the brain (Smith, 2021). It is essentially the brain's fire alarm for negative stimuli (Hanson, 2009). The hippocampus forms new memories, detects threats, and translates experiences and learning from implicit into explicit memory (Graham, 2013). For an illustration of the key structures of the brain, see Graham (2013, p. 16).

Conditioning and Neuroplasticity

As cited in Graham (2013), conditioning and neuroplasticity are two powerful mechanisms of brain functioning that work together as the brain develops and matures. The brain can learn habits of behaviours by focusing our attention on any experience. Focusing on being mindful and in the present moment, for example, stimulates neurons to fire in certain areas of the

brain. The more you focus on the present moment, the easier it will become. Neuroscientist, Donald Hebb, said that *neurons that fire together, wire together*, meaning that repeated experiences and repeated neural firing strengthen the neural connections and prepare the brain to respond in the same way when it encounters a similar situation (Hebb, 1949).

Graham (2013) described conditioning as the process that encodes stable patterns of behaviour in the neural circuitry. Essentially, conditioning is the brain's way of being efficient because without it, people would have to relearn things. Thus, conditioning can be deliberately used to create positive habits of resilience. Thus, conditioning can be deliberately used to create positive habits of resilience, for example, experiencing an unexpected flat tire while on a road trip. Previous conditioning will determine the response to this unfortunate event. There are different ways to respond: panic or problem-solve and figure out what to do. Remaining calm and remembering to call roadside assistance or call a friend for help is using resilience to learn from past conditioning. External stressors cannot be changed, but internal conditioned responses can. It is important to note, however, that in the same way the brain can rewire to become more resilient, unproductive or harmful behaviours can also be encoded or wired into the brain and engrained into the neural circuitry (Graham, 2013).

Neuroplasticity is the brain's ability to rewire or reorganize itself both physically and functionally based on the environment, behaviour, thinking, and emotions (Hampton, 2016). Neuroplasticity allows the brain to create new neurons and connect them into new networks (Ackerman, 2018). That is, learning something new creates new pathways between neurons, changing how the brain is wired. Rewiring the brain is a result of two mechanisms: neurogenesis or the growth of new neurons, and synaptogenesis or new connections between neurons where information is transmitted (Estrin & Bhavnani, 2020). Synaptogenesis is integral for creating

new neural networks and general connectivity functions of the brain. Can you teach an old dog new tricks? The answer is yes, you can teach an old dog new tricks based on the neuroplasticity of the brain. In fact, the brain is continually growing and changing moment to moment throughout the lifetime and are more neuroplastic than previously thought (Hampton, 2016; Liou, 2010; Nguyen, 2013; Smith, 2021).

Recent findings on the brain's neuroplasticity have exciting clinical implications in improving health and wellbeing. The power of neuroplasticity can ameliorate the lives of people in various ways. With neuroplasticity individuals can: (a) learn better ways to cope with life challenges and psychological difficulties, (b) recover from strokes and brain injuries, (c) enhance memory, cognitive ability, and learning, and (d) increase overall brain function (Shaffer, 2016). In psychotherapy, teaching clients' practical skills or activities to complete in and between sessions is helpful in rewiring the brain and facilitating better coping and resilience.

Automatic versus Controlled Processes

Tabibnia and Radecki (2018) stated that, "it is helpful to conceptualize the human brain as broadly supporting two sets of mental processes: one that produces instinctive and largely automatic responses and another that is deliberative and produces more controlled responses. This dual-system view…. has been variously referred to as automatic versus controlled" (p. 60). Automatic responses are instinctive, fast, spontaneous, developed earlier, and are largely sensory (i.e., cravings and emotions). Controlled responses develop later and are slow, effortful, more language-based and intentional (i.e., problem solving and self-control) (Adolphs, 2009). The amygdala, along with other brain regions, supports automatic responses while the higher-level neocortical regions of the PFC, LPFC and parts of the MPFC support controlled processes (Adolphs, 2009). Tabibnia and Radecki (2018) found that most of the discussions on resilience

focus on the interaction between the automatic and controlled processes. Controlled processes can exert control over automatic processes or reactive responses by inhibiting brain networks that support emotions, impulses, habits, and stress. For example, the fight-or-flight response can be overridden by an individual's conscious, controlled effort. Clients can learn practical tools such as deep breathing, mindfulness, meditation, and relaxation techniques to cease the stress response and consciously take control of the body. These two mechanisms are the basis for emotional regulation and impulse control (Hoffman et al., 2009, as cited in Tabibnia & Radecki, 2018). The reverse can also happen; that is, the automatic system can affect the controlled system when stress and negative emotions disrupt normal functioning of the controlled responses and compromise the functioning of the PFC. Prolonged stressors can cause long-term damage to prefrontal neurons (Arnsten, 2009). Therefore, it is important to regulate levels of stress and anxiety before they become too overwhelming and debilitating.

Fear and the Amygdala

Fear is a natural part of life, acting as a warning or a guide; however, prolonged fear turns into panic and when this happens, the PFC is flooded with the hormone noradrenaline, which causes the PFC to go offline allowing the amygdala to take over (Smith, 2021). Understanding how fear is learned and how it can be overcome is critical for developing resilience (Hanson, 2009; Tabibnia & Radecki, 2018). When potential danger is encountered, the amygdala triggers a quick and temporary physiological response that includes increased heart rate and rapid, shallow breathing. Then the thalamus sends signals to the brainstem to release norepinephrine throughout the brain, the Sympathetic Nervous System (SNS) sends signals to the major organs and muscle groups to get ready for fight or flight, and the hypothalamus prompts the pituitary gland, sending signals to the adrenal gland to release adrenaline and

cortisol. In only two or three seconds of the initial alarm, the brain is on red alert (Hanson, 2009). Adrenaline dilates pupils and increases heart rate to move more blood, norepinephrine dilates bronchioles in the lungs for increased gas exchange to be able to run and respond faster, and cortisol suppresses the immune system and further stimulates the amygdala (Hanson, 2009). Stimulating the amygdala causes further activation of the SNS and Hypothalamic-Pituitary Adrenal Axis (HPAA) systems, which produces more cortisol and suppress the hippocampus activity, resulting in the amygdala sending more messages to release more cortisol, and so the cycle continues (Hanson, 2009).

As described by Tabibnia and Radecki (2018), the body's fear response causes multiple changes in the brain which ultimately affects mental and physical health. Chronic and prolonged activation of stress hormones damages the brain on a cellular level, creating abnormal cell growth in the amygdala and causing neural damage in the hippocampus and PFC. These changes often manifest as anxiety disorders, impairments in learning and memory (Tabibna & Radecki, 2018), as well as possible PTSD, mood disorders, depression, and cardiovascular disease (Tabibnia, 2020). The ability to regulate the fight-or-flight response and calm the nervous system maintains control over the SNS and increases resilience.

Early Brain Development and Resilience

How does early brain development impact resiliency? Early wiring of the brain is based on early life experiences; however, the good news is, later experiences can undo or overwrite early learning (Graham, 2013). Research into how people react to early trauma became a topic of interest after the Second World War (King, 2016). According to King, distressing events such as death of a parent, sexual abuse, or neglect have been found to increase children's risk of depression, PTSD, and anxiety disorders. Neuropsychologist Sonia Lupien, at the University of

Montreal, stated that the brain is a detector of threatening information and the brain's most important job is to ensure survival (Lupien et al., 1994, as cited in King, 2016). Acute stress readies us for action while chronic stress results in altering the brain genetically and neurobiologically, resulting in mental health issues. The hippocampus shrinks, and the amygdala grows, which impact the release of hormones. When this happens, the ability to discriminate between threat levels is impacted and all-or-nothing behaviours can occur: "either everything seems threatening (anxiety) or else nothing does (depression or burnout)" (King, 2016 para 7). Hence, understanding the impacts of early life experiences and ACEs may provide new ways to treat and prevent mental health disorders in later life. Chronic stress in early life has long-lasting marks on the brain. According to neurobiologist Alon Chen of the Weizmann Institute of Science, (n.d. cited in King, 2016), emotional stress in pregnant women, for example, can alter their baby's epigenetics and neural connections in the baby's amygdala. Chen found that chronic stress can reduce the number of hormone receptors in the hippocampus needed to shut off the stress response. Thus, individuals exposed to chronic stress early on may be more susceptible to stress-related disorders as an adult, impacting their level of resilience.

Trauma and Adverse Childhood Experiences (ACE)

Research on ACEs and its impact on adulthood has been extensively studied in the field of psychology. The hypothesis that ACEs have a negative impact on the etiology of psychological and mental health issues in adulthood has been significantly documented (Atwool, 2006; Liu et al., 2018; Shore, 2001); however, the neuroscience of ACEs and their impact on brain development is relatively new. "Early-life traumas leave their imprint on the anatomy and physiology of the brain… and are associated with the development of dysfunctional neural circuits, behavioural dysfunctions, and mental disorders, essentially leaving functional "scars" in

emotional control, learning, and memory" (Groger et al., 2016, as cited in Grabbe & Miller-Karas, 2018, p. 77). According to Schauss et al. (2019), trauma and any ACEs during a critical stage of neurodevelopment impacts the body at a physiological level. The first two and a half years of life are crucial to the development of the prefrontal cortex and the brain in regard to learning strategies of resilience (Graham, 2013). During these early stages in development, the brain develops rapidly, establishing neural pathways and laying the groundwork for more complex structures of the brain to develop (Schore, 2001). According to Shore (2001), this critical period of development is susceptible to adverse environmental factors that impact infant mental health. Supporting the social learning model, brain development is greatly impacted by the environment and any experience-dependent disruptions at this time may lead to major abnormalities or deficits in neurodevelopment (Perry, 1997).

In the last two decades, extensive studies have found significant correlations between ACEs and a wide range of health, behavioural and psychological challenges lasting throughout the lifetime (Shore, 2001). This supports long-standing research indicating that ACEs result in long-term physiological response to trauma (van der Kolk, 1994, as cited in Schauss et al., 2019). ACE such as psychological or sexual abuse, violence against the mother, household dysfunctions, and unhealthy habits (alcoholism, depression, smoking, obesity, drug use), are strongly correlated with significant risk of physical and psychological disease (Gilbert, et al., 2015; Herringa et al., 2016; Liu, 2018; Schauss et al., 2019). Social, emotional, and cognitive impairment, as well as health risk behaviours, have also been noted (Siegel, 2012).

According to Wu et al. (2013), "rodent and primate studies have consistently shown that maternal abuse in early childhood led to high anxiety levels and increased HPA Axis activity, resulting in delayed independence and diminished stress management skills later in life" (p. 10).

Survivors of childhood trauma also exhibited changes to the central nervous system and reduced volume in the hippocampus (Wu et al., 2013). Neuroimaging studies have documented neural abnormalities during emotion processing in relation to childhood adversity such as amygdala hyperactivation and abnormal prefrontal activation (Herringa et.al., 2016). Herringa and colleagues' longitudinal study on how ACEs impacted brain regions during emotion processing found that adverse experiences in childhood altered the brain's emotion circuitry by adolescence. These findings confirm that childhood is a critical developmental period in the brain's response to adversity and in determining neural adaptation to adversity (Herringa et al., 2016).

Gilbert et al. (2015) conducted an ACE study with the largest sample of Americans (at that time) and found that 60% of their large sample reported having experienced at least one ACE in their childhood. The results of their study also supported others who found that the exposure to ACEs was associated with high instances of health problems such as mental distress, cardiovascular disease, asthma, coronary heart disease, stroke, and diabetes. In addition, excessive activation of stress hormones can damage the metabolic, cardiovascular, immune, and nervous systems. Nervous system development can be disrupted, particularly in children, and the growth of various brain regions linked to planning, problem solving, self-regulation, and emotion regulation may also be damaged (Gilbert et al., 2015).

These findings further substantiate ACEs' significant impacts on the brain and nervous system, clarifying how adult chronic illness and psychiatric disabilities most likely stemmed from early childhood experiences. Due to the high prevalence of ACEs, awareness of how these negative interactions impact development, mental health, behaviour, and physical health has grown in the counselling profession (Gilbert et al., 2015).

Attachment Theory

ACEs, understandably, have a significant impact on an individual's attachment style. According to Graham (2013), the earliest strategies of resilience are learned in infancy through interactions with parents/caregiver, forming the neurological foundations of resilience. Bowlby (1969, as cited in DeMaranville et al., 2022) defined attachment as the emotional bond between two individuals, developed initially through psychological connectedness and dependence between an infant and a caregiver. Further, caregiver-infant attachment forms a child's internalized strategies for coping, laying the early templates of interacting with others (Bowlby, 1973, as cited in DeMaranville et al., 2022), influencing future attachment bonds (Hasim et al., 2018), and significantly influencing behaviour and mental health. Bowlby called these constructs *internal working models*. Internal working models provide guidance about what to expect from others and influence later attachment behaviours (Kural & Kovacs, 2021), thereby influencing the individual's resilience and vulnerability to stressful life events (Bowlby, 1988, as cited in Pascuzzo et al., 2015).

According to Graham (2013), humans' basic need for reassurance and protection are wired from birth, and successful soothing and empathic relationship forms secure attachments described as resilient behaviour. If parents consistently and calmly respond to a baby's cries, for example, then the baby learns to soothe itself and its neural circuits are created with the sense of: "I am loved" and "I am important". When calls for help are consistently answered and a baby's needs are met, they learn how to communicate their wants and needs effectively and learns to believe that they are deserving of it. These feelings of "deserving" and "worthiness" become the first experiences of resiliency and translate into a positive self-image and a sense of self-confidence that is then wired into the brain. These early experiences are crucial in determining

how the brain grows and develops, suggesting that "attachment acts as a pathway to resilience" (Rasmussen et al., 2019, p. 1286).

The quality and characteristics of the child/caregiver relationship will determine the individual's attachment style. Mary Ainsworth (1969, 1978, as cited in Rasmussen et al., 2019) categorized attachment style in the following ways: (a) secure attachment, (b) insecure anxious, (c) insecure avoidance, and 4) disorganized attachment (additional category by Main et al., 1985, cited in Atwool, 2006). According to Ainsworth, representations of these unique attachment styles become internal working models that manifest in adult relationships and social interactions.

Secure Attachment. Individuals who develop a secure attachment experienced a consistent, responsive, and adequate child-caregiver relationship and developed a positive view of the self and others (Kural & Kovacs, 2021). They are comfortable with close relationships and feel in control of their lives. They have learned to express their emotions and developed a sense of internal security that facilitates resilience or a positive and appropriate response to negative situations. Secure attachment provides the optimal environment for brain development (Atwool, 2006), especially the prefrontal cortex (Graham, 2013). The consistent and sensitive responsiveness by the primary caregiver facilitates the development of positive internal working models crucial for early brain development; that is, neural integration is promoted, allowing flexible and complex networks to develop (Atwool, 2006). Thus, secure attachment is essential for resilience and has been shown to be a protective factor against psychopathology and symptoms of anxiety, depression, dissociation, and antisocial behaviours (Pascuzzo et al., 2015).

Attachment Anxiety. Individuals who experienced a history of inconsistent and inadequate child-caregiver relationship tend to develop a negative view of self, are dependent on

others, lack self-control, easily conform to other's needs, are hypervigilant to threat, and have fears of abandonment (Graham, 2013). Attachment anxiety leads to coping that is flexible but not always stable. These individuals are anxiously preoccupied with what others think about them and their pattern of coping may be described as chaotic (Graham, 2013).

Attachment Avoidance. Individuals who experienced consistently unresponsive caregivers develop negative models of others and positive models of self (Bowlby, 1969/1982, as cited in Kural & Kovacs, 2021). It is important to note here that attachment avoidance, positive models of self, are based on defensive self-enhancement and self-inflation rather than on being loved, accepted, and valued by their attachment figure (Miller et al., 2013). They are uncomfortable with closeness and intimacy and place a high value on independence (Kural & Kovacs, 2021). Attachment avoidant individuals tend to cope by shutting down emotions. They fear intimacy, and have difficulty relating to others (Graham, 2013).

Disorganized Attachment. Individuals who experienced parental abuse and associate parents as a source of fear and pain develop coping styles that are neither stable nor flexible (Graham, 2013). Disorganized attachment reflects a breakdown or lack of any organized strategies of coping (Rasmussen, 2019).

According to Graham (2013), coping styles learned from attachment behaviours stabilize in the neural security by 18 months and are relatively stable, lasting the entire lifetime. Unless new ways of coping are learned and old circuits are rewired, the patterns of coping learned from early child-parent experiences become the default responses. Bowlby and other attachment theorists have found that a secure attachment style is the most effective in developing the prefrontal cortex and teaches the brain to be resilient. As neural circuits mature and integrate feelings of trust and being loved, the individual develops a sense of inner security which forms

the template for resiliency and serves as a buffer from stress and trauma. However, as with insecure attachments styles, learning unproductive and harmful behaviours can also be encoded into the brain (Graham, 2013).

Research on the role of secure attachment as a potential core feature of resilience has shown these to be significantly correlated (Kural & Kovacs, 2021; Rasmussen et al., 2019). Rasmussen et al.'s (2019) systematic review and meta-analysis of the literature supporting the association of attachment as a core feature of resilience found statistical significance between quality of attachment and presence of resilience. Both internal (e.g., affect regulation, mood repair, self-esteem) and external (e.g., stable relationships, partner support) factors have been described as core features of resilience and can all be traced back to attachment experiences (Atwool, 2006; Rasmussen, 2019). Interestingly, Rasmussen et al. also discovered that stable attachment relationships do not have to only be with the parent or primary caregiver; attachment to other members of the family, teachers, and counsellors can also build resilience.

Kural and Kovacs (2021) studied the association of attachment style to resilience in the context of the current COVID-19 pandemic. Their study looked at how attachment styles influenced coping strategies and how coping strategies impacted resilience. Their study supported the important role early attachment experiences have on resilience. Kural and Kovacs hypothesized that differences in attachment style would influence the individual's perception of stress and therefore affect their ability to cope. Securely attached individuals tend to use problem-focused coping strategies, while insecurely attached individuals' default to emotion-focused coping. Problem-focused coping (or solution-focused coping) looks at finding solutions to a problem in order to reduce distress. Problem-focused individuals trust their abilities to lessen the impact of a negative situation, resulting in greater resilience. Emotion-focused individuals

tend to put more emphasis on their negative emotions, such as self-blame, self-criticism, and feelings of helplessness or failure rather than the actual problem that is causing the distress. They perceive themselves as incapable of dealing with stress. Kural and Kovacs' (2021) study lent support to their hypothesis that securely attached individuals tend to use problem-focused coping strategies, resulting in greater resilience. These findings show the importance of assisting clients in a clinical setting to develop better problem-focused coping strategies that will enhance their resilience and reduce adverse outcomes to negative events (Kural & Kovacs, 2021). Thus, the definition of resilience can be expanded to incorporate attachment theory, making it "a dynamic process moderated by internal and external factors and facilitated in the presence of strong and stable relationships with significant others" (Rasmussen et al., 2019, p. 1286).

Neurobiological studies into the relationship between attachment and resilience are fewer, but also point to the assumption that attachment is a precursor or prerequisite to resilience (Rasmussen et al., 2019). Stress compromises brain development and when severe difficulties are experienced in early attachments, the brain becomes inefficient in regulating emotions and coping with stress, resulting in maladaptive infant health (Schore 2001). Allan Shore (2001) integrated neuroscience with attachment theory and described how early development of an infant's right hemisphere is deeply connected to the limbic and autonomic nervous system, which is important for the human stress response. The limbic system is responsible for mediating stress-coping strategies throughout the lifespan; therefore, early instances of ACEs or negative attachment experiences may inhibit right brain development and directly impact individuals' emotion regulation capacities, thus affecting adult mental health and resilience (Shore, 2001).

Psychotherapy for Rewiring the Brain

Neurocounselling, the integration of neuroscience into the practice of counselling,

although relatively new, has changed how counsellors conceptualize and treat clients (Russell-Chapin, 2016). Understanding the neuroscience of resiliency offers hope for people impacted by trauma and negative life experiences. Even though early experiences set the foundations for resiliency, later experiences, especially healthy relational experiences, can make long-lasting change as new pathways, brain structures, and circuits are created, strengthening the functioning of the prefrontal cortex (Graham, 2013). The more skillful the prefrontal cortex becomes, the better it can integrate information from other parts of the brain and increase resiliency (Graham, 2013). The practical application of neuroscience in counselling informs the tools and techniques to teach clients to best harness the brain's neuroplasticity and realize humans' innate capability to be resilient (Chapin, 2016).

How can therapists assist clients in increasing their resilience? Therapists can teach clients practical skills that help to rewire the patterns of early or previous conditioning and rebuild brain structures needed for rewiring in a variety of different ways. Neuroscientists have discovered that all mental activities and experiences rewire the brain (Chapin, 2016). In counselling, therapists can facilitate this by choosing specific interventions/experiences for specific rewiring. Jeffrey Schwartz calls this self-directed neuroplasticity (Graham, 2013). Rick Hanson (2009) stated that building a more resilient brain is similar to strengthening muscles through lots of little efforts resulting in real functional and physical changes in the brain. The brain can learn to be more resilient by practicing inner strengths such as compassion, attunement, mindfulness, grit, gratitude, generosity, empathy, and self-acceptance. Exercises that develop these elements strengthen the prefrontal cortex, thus enhancing the capacity for self-awareness and self-reflection (Graham, 2013).

Research has shown that even something as simple as focusing on the breath can increase

cell volume in specific structures of the brain (Graham, 2013). The more a person uses structures in the brain, the more new cells grow in the brain and new connections are made. Brain changing exercises such as practicing mindfulness strengthen the functioning of the prefrontal cortex. Southwick (n.d. as cited in Smith, 2021), like Hanson, described the brain as similar to a muscle that can be strengthened or weakened; that is, the more we "work out" the brain, the stronger the networks and structures of the brain are and the more the brain will respond. Thus, engaging in activities that strengthen the brain's executive control centre (prefrontal cortex) so that it does not get overrun by the brain's fear and arousal center (amygdala) provides protection against chronic stress (Smith, 2021). Most therapies aim to include these types of exercises as part of their treatment plan and can, therefore, contribute to rewiring the brain; however, it is likely that some therapies are better than others. The following psychotherapeutic approaches are based on the latest research that supports effective ways to rewire the brain and assists clients in developing and increasing resilience.

Behavioural Approaches

Tabibnia and Radecki (2018) reviewed the latest research on behavioural (learnable behaviours and habits) and cognitive (learnable cognitive/linguistics) strategies that change the brain, resulting in sustained and long-lasting changes in the nervous system. These are learned strategies rather than environmental or genetic factors, and they both change the brain and boost resiliency. Behavioural strategies focused on behaviours that (a) down-regulated fear and stress, including facing fears and controlling stressors; (b) boosted physical health and resilience, such as sleep, exercise, and diet; and (c) engaged the person in social activities, such as connecting with others and expressing gratitude.

Based on their research, Tabibnia and Radecki (2018) identified specific behavioural

strategies that reduce fear and stress responses and rewire the brain to promote resilience. These are:

1. Exposure: gradually and repeatedly facing a feared situation in a safe environment until a new association is learned.
2. Reconsolidation: recalling a memory and rewriting it to reconsolidate it into long-term memory, based on the premise that facing a fear is an important part of overcoming it.
3. Active coping: engaging in action to reduce physical or psychological harm, such as spending time with others or breaking down a stressful action into small steps, which serve to change the circuitry in the amygdala by suppressing the fear response and strengthening neural pathways.
4. Stress inoculation: exposure to manageable stress using imagery, role-playing, and simulations.
5. Boosting physical health: adopting good sleep habits and getting daily exercise increases resilience by improving mood, reducing the stress response, and boosting cognitive function.
6. Connecting socially: having meaningful close relationships has immediate and long-term effects on the nervous system by strengthening the PFC and decreasing activation of the amygdala.
7. Expressing gratitude: writing in a journal or writing a thank you note to someone stimulates the MPFC which is important for emotion regulation and social reward.

Cognitive Approaches

Tabibnia and Radecki's (2018) review of the latest research on cognitive approaches to

resiliency focused on: (a) emotion-regulation strategies such as verbal expressions of emotion, affect labeling, and cognitive reappraisal; (b) cognitive training such as cognitive-bias modification, mindfulness training, and cognitive therapy; and (c) resilience coaching such as neural basis of expectations, growth mind-set, and self-affirmations.

Emotion Regulation. Emotion regulation is helpful when the stressor is out of our control or when confronting or manipulating a stressor is not possible or enough (Tabibnia & Radecki, 2018). The ability to regulate the way stressors are interpreted or attended to is key to coping and resilience. Empirical studies have shown that writing about a traumatic experience or other forms of verbal expressions of emotion for 20 minutes can improve both physical and psychological well-being in the long term (Frattaroli, 2006). Evidence has shown that verbally re-experiencing past trauma allows implicit amygdala-based memories to be re-encoded in explicit neocortex-based memory where it can be intentionally accessed and better regulated (Brewin, 2001). Emotional memories are primarily stored in the limbic regions of the brain where they can unconsciously trigger autonomic and hormonal responses (Tabibnia & Radecki, 2018). Essentially, when a traumatic event is recounted, it is re-experienced and re-encoded in the neocortex, resulting in intentional cognitive regulation of the negative experience. Therefore, words can bring emotions out of the autopilot limbic system or activation of the autonomic fear and stress responses and into the more controlled, higher functioning neocortex. Further, the simple act of labelling an emotional experience (affect labelling) activates the LPFC and reduces autonomic arousal and amygdala activation. Cognitive reappraisal is “reframing or reinterpreting an event in order to alter its emotional impact” (Tabibnia & Radecki, 2018, p. 70). John and Gross (2004) reported that people who utilize cognitive reappraisal exhibited better psychological health and resilience to trauma and other negative life events. According to 48

neuroimaging studies by Buhle at al., (2014) cognitive reappraisal also recruits the LPFC and reduces activation of the amygdala. Repeated cognitive reappraising of a negative image led to a diminished amygdala response to the negative image seven days later.

Cognitive Training. Cognitive bias modification is a relatively novel form of cognitive training to reduce clients' negative biases using computer-based exercises to shift habitual and automatic thinking away from negative thinking (Tabibnia & Radecki, 2018). Mathew and MacLeod (2005) indicated that people who are prone to depression or anxiety tend to focus on negative or threatening cues and interpret ambiguity negatively. Cognitive bias modification works to change these negativity biases with training, resulting in a decrease in depression and anxiety symptoms (Koster & Hoorelbeke, 2015).

Mindfulness Training. Mindfulness training has also been extensively studied to boost resilience in many ways. Mindfulness was adapted from the traditions of Buddhism. It is referred to as "the heart" of Buddhist meditation and defined as "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2013, p. 145). According to Yang and Oka (2022), there is evidence that individuals who pay attention to the present moment with a non-judgmental attitude are able to choose their behaviours, facilitate more adaptive behaviours, and exhibit greater resilience. Yang and Oka conducted two studies to test whether mindfulness was associated with greater resilience. Their results were consistent with previous research indicating that mindfulness significantly predicted resilience.

Mindfulness is: (a) paying attention on purpose, to a specific aspect of the human experience; (b) bringing the focus back into the present moment, not the past or future; and (c) allowing whatever experiences arise with acceptance (Crane, 2017). "When one is mindful, the

mind responds afresh to the unique patterns of experience in each moment instead of reacting mindlessly to fragments of a total experience with old stereotyped habitual patterns of the mind" (Teasdale, 2000, p. 618). When patients are focused on the present moment, the chance of falling into old ruminating patterns of negative thinking decreases (Hoffman et al., 2010).

Previous studies have shown the effectiveness of mindfulness training in buffering against the brain's stress response, decreasing stress-related symptoms, and improving executive functions, positive affect, well-being, and relationships (Creswell & Lindsay, 2014). "Mindfulness facilitates a capacity to receptively observe stressors as they arise with acceptance and equanimity" (Creswell & Lindsay, 2014, p. 405). By simply changing reactions to stress with acceptance and curiosity, mindfulness has been shown to alter the brain's stress processing pathways by inhibiting activity in these regions and activating the stress-regulatory regions of the PFC. Further, Creswell and Lindsay pointed to electroencephalographic (EEG) evidence supporting the effectiveness of mindfulness as a buffer against threatening stimuli. Lastly, other studies on mindfulness training have shown biological changes in the brain, such as functional and structural changes in the amygdala and PFC (Guendelman et al., 2017).

Cognitive Behavioural Therapy (CBT). CBT has been studied and found to be effective in treating mood and anxiety disorders, chronic pain, and sleep disorders using both cognitive and behavioural interventions to change faulty cognitions (Joyce et al., 2017; Padesky & Mooney, 2012). CBT emphasizes the idea that cognitions (thoughts) determine feelings and behaviours (Hutnik et al., 2016). In other words, the way experiences are framed, whether it is negative or positive, determines how we react to it. CBT encourages clients to challenge their negative thoughts and develop more flexible ways of thinking about a difficult situation. Psychological flexibility was a term popularized by Steven Hayes and is a core concept in

acceptance and commitment therapy (Hayes et al., 2006). The idea of psychological flexibility, the ability to adjust positively to change or difficulty, appears to be "key to being resilient" (Hutnik et al., 2016, p. 115). Further, from a neuroscience perspective, CBT changes the brain by reducing amygdala activation, increasing grey matter volume in the LPFC and enhancing prefrontal function (Tabibnia & Radecki, 2018).

Padesky and Mooney (2012) introduced a strength-based CBT for assisting clients in building resilience. Therapists assist clients in identifying their existing strengths that are then used to construct a personal model of resilience. Strength-based CBT is a collaborative four-step approach to building positive qualities of resilience, which includes searching for strengths, constructing a personal model of resilience, applying this model to areas of difficulty, and then encouraging clients to practice resilience. For more details on strength-based CBT, see Padesky and Mooney's (2012) article, "Strength-Based Cognitive-Behavioral Therapy: A Four-Step Model to Build Resilience". According to Joyce et al.'s (2017) systematic review and meta-analysis of resilience training programs and interventions, CBT and mindfulness techniques were found to be the most effective in having a positive impact on enhancing individuals' level of resilience.

Resiliency Coaching. Resiliency coaching involves developing certain mindsets to influence learning and behaviour change. Three brain-friendly mindsets to facilitate resilience as described by Tabibnia and Radecki (2018) are: 1) positive expectations, 2) growth mindset, and 3) self-affirmations. Research has shown that expectations have a significant impact on experiences. Adopting a positive mindset, specifically having positive expectations, can cause positive outcomes. A growth mind-set can also improve resilience by teaching clients to believe in their own ability to learn and change. People's mindsets determine to what degree they will

exert effort in difficult circumstances. People with a growth mindset believe that their abilities are malleable and changeable, are more likely to improve and develop resilience as opposed to believing their abilities are fixed (fixed mind-set). Fixed mindset individuals believe their abilities cannot be improved or changed, making them vulnerable to feelings of helplessness, and unable to regulate their emotions or cope with stress. For example, fixed mind-set individuals view mistakes as a failure and quit or disengage, while growth mind-set individuals' views mistakes as opportunities to learn. Functional magnetic resonance imaging (fMRI) studies have shown greater functional connectivity and enhanced networks in certain parts of the brain in individuals who practice growth mindset (Tabibnia & Radecki, 2018). Last, a self-affirmation mindset affirms self-integrity (being true to your values, morals, and ethics). Self-affirmations can help against threats to self-integrity by facilitating behaviours that remind us of adequacy and affirm self-integrity. For example, describing a personal experience that made you feel successful or proud, or writing about core values, allows individuals to adapt or respond to negative experiences with greater flexibility or resilience. fMRI studies of self-affirmation showed greater activation in the MPFC and reward circuitry of the brain (Tabibnia & Radecki, 2018).

Somatic Approaches

Somatic therapy is a body-centered approach aimed to connecting the mind and the body (Porter, 2020). Somatic therapists believe that emotional trauma can cause instability in the autonomic nervous system (ANS), and thus therapists use body-based techniques (mindfulness, meditation, mind-body exercises, yoga) to calm the ANS and bring it back to a state of balance. One of the pioneers of somatic therapy, Peter Lavine, developed a psychotherapy technique called somatic experiencing, which focuses on the biology of trauma responses by getting in

touch with suppressed emotions in the body (Levigne, 1997, as cited in Grabbe, 2020). Clients are taught sensory awareness skills and body sensation awareness to process trauma and calm the nervous system. The goal of somatic therapy is to enhance the individual's relationship between mind, body, brain, and behaviour as a tool to heal trauma and other mental health challenges (Porter, 2020). Somatic experiencing is a key concept in the following somatic approach to increasing resilience and enhancing mental well-being.

Trauma Resiliency Model (TRM). TRM is a novel and innovative approach to connect to one's inner resources and sensations of well-being (Grabbe & Miller-Karas, 2018; Troeger, 2018). TRM de-pathologizes an individual's negative symptoms and recognizes that trauma, stress, and adversity are the body's biological reactions to fear (Miller-Karas, 2015). TRM assists clients in calming the body and activates and develops their level of resiliency (Troeger, 2018).

Neuroscience has greatly impacted the development of TRM (Miller-Karas, 2015). Clients are taught skills to help educate, understand, stabilize, and reset the natural balance of the nervous system (Attachment and Trauma Network, 2015). Biological interventions are used to enhance sensory awareness (Grabbe et al., 2020) and reduce the impact of traumatic stress by helping stabilize the individual's nervous system and returning it to, or keeping it in, the *resilience zone* (Miller-Karas, 2015). This concept was derived from Dan Siegel's work on the *window of tolerance* (1999, cited in Grabbe & Millar-Karas, 2018). The resilience zone represents the natural rhythm or balanced flow of energy or internal state of balance (Grabbe, 2020). According to Grabbe and Miller-Karas (2018), being in the resilience zone allows for balanced thinking, feeling, and functioning. That is, neural networks are integrated, memory systems are synchronized, and the mind and body are working as one (Miller-Karas, 2015). Being able to adapt to challenges and learn from them is possible in the resiliency zone.

However, when extreme stress or trauma are experienced, an individual may be pushed outside of the resilience zone, derailing their resiliency. TRM teaches skills that enable a person to connect to the sensations associated with their resilience zone and strengthen their ability to bounce back when pushed outside the zone (Grabbe & Millar-Karas, 2018).

Therapists assist clients in accessing the body's natural resilience, resulting in improved integration of the brain and the body (Miller-Karas, 2015). Clients learn stabilizing or self-care skills, such as tracking, resourcing, and grounding (Grabbe & Miller-Karas, 2018). Tracking is paying attention to sensations within the body and monitoring physical reactions to stress. In resourcing, clients are asked to describe personal resources that bring comfort, peace, or joy, such as a person, animal, place, memory, or activity, and then intensify that resource by requesting more description and sensory details. Tracking the sensations connected to their resources and holding these memories in awareness for 12 or more seconds transfers the sensations from short-term to long-term memory and develops neural pathways to break the cycle of dwelling on the negative. Finally, in grounding, clients are guided to be in the present-moment awareness of their body, providing a sense of safety and control and increasing their resilience. The goal of TRM is to create a trauma-informed and resiliency-focused approach that provides a common understanding of the impact of trauma and chronic stress on the nervous system.

Integrative Psychotherapy

According to Tabibnia and Radecki (2018), fostering resilience involves multiple approaches that work together in synergy. Interestingly, Prochaska and Norcross (2018) predicted the top three psychotherapies of the future (in order) to be: 1) mindfulness therapies, 2) cognitive behavioural therapy, and 3) integrative therapy. The current literature review validates

that the growing trend appears to be a blending of the three approaches, along with a strong emphasis on neuroscience and somatic or body-based interventions to support brain-body healing. In fact, Bradshaw et al. (2011) also stated that the future of psychotherapy will involve the incorporation of neuroscience. As there are many other approaches and theories of psychotherapy that encompass the area of integrative psychotherapy, the following focuses on neuroscience and the brain-body connection.

Eye Movement Desensitization and Reprocessing (EMDR). EMDR is an evidence-based psychotherapy method effective in rapidly healing painful traumatic experiences (Shapiro, 2014). EMDR has become one of the preferred ways to treat PTSD and is as effective as other well-established therapies (Sares, 2017). The brain's ability to store information enables us to process and make sense of new information. However, trauma memories can get stuck, thereby preventing the traumatic event from being effectively processed by the brain (Shapiro 2001, as cited in Lee, 2021). When traumatic memories are stuck, individuals may experience distress triggering the body's fight-flight-freeze autonomic response (Lee, 2021) and as explained previously, the functioning of the PFC is reduced, and the amygdala and hippocampus become overstimulated. According to Pagani et al. (2017), EMDR is similar to what happens in the brain during REM (rapid eye movement) sleep when memories are processed and consolidated from the hippocampus to the neocortex. Normal memories are moved out of the amygdala-hippocampal complex and processed by the rest of the brain. It is thought that EMDR temporarily slows down the over stimulated amygdala and synchronizes the brain waves, thus facilitating the processing of a traumatic memory (Pagani et al., 2017).

EMDR is a series of experiential activities to assist the brain to process unpleasant memories, so when remembered or triggered, they are no longer as distressing (Lee, 2021).

EMDR encourages the traumatic memory to be brought up, reconsolidated in a more adaptive manner, and then integrated with the rest of the individual's life experiences (Sares, 2017). EMDR uses bilateral stimulation of the brain using eye movement, alternating hand-tapping, or alternating sounds to help clients process traumatic memories or desensitize its negative impact (Lee, 2021).

Observed and Experiential Integration (OEI). OEI was developed by Rick Bradshaw and Audrey Cook in the mid 1990's and is based on the theory that when trauma memories are formed, they are stored as fragmented slivers (Bradshaw et al., 2011). OEI emerged from 45,000 hours of experiential psychotherapy (expressive therapy using tools/activities to reenact or recreate specific situations from the past/present), relational psychoanalytic (role of relationships with others) and behavioural concepts (Bradshaw et al., 2011). Bradshaw stated that experiential psychotherapy is at the heart of OEI. Therapists are constantly observing and noting tiny shifts in facial expressions, eye movements, and body posture of the client.

OEI uses the visual pathways of both hemispheres of the brain so that information flows smoothly, allowing experiences that were frozen in time to become unstuck. OEI works on conscious and non-conscious experiences, and change can be rapid and lasting. Bradshaw et al. (2011) stated that, "covering and uncovering the eyes and tracking movement through visual fields result in major shifts, not only in affective and somatic intensity but also in perceptions of self and others" (p. 105).

The therapy process of OEI asks the client to cover or uncover one eye at a time (switching) while following the therapist's moving fingers (Bradshaw & Cook, 2008). The purpose of OEI is to assist clients to increase their awareness rather than dissociate from their intense emotions. Clients are continually encouraged to self-reflect and prompted to pay

attention to their thoughts, feelings, or physical sensations that may arise, as well as to any changes in their visual field. Any distortions or glitches in the visual field are indicative of unresolved trauma (Bradshaw et al., 2011). As these glitches are cleared and traumatic aspects of their experience are integrated, the traumatic symptoms begin to integrate, dissolving distortions. OEI clients' experiences change in cognitions, emotions, and physical sensations depending on which eye is covered. Therapists may individualize adaptations and combinations of OEI techniques and are attuned to any small intensity markers such as reddening or moistening of the rims of the eyes, facial flush, sighs, tension in the jaws, or conflict markers such as halts/hesitations of speech, and furrowing of the brow (Bradshaw et al., 2011). OEI and EMDR have some similarities and differences (Bradshaw et al., 2011). Certainly, they can be administered effectively together, depending on what the client is experiencing.

MBCT. Mindfulness based cognitive therapy (MBCT) is an innovative brief therapy model delivered in a group-based format that incorporates aspects of cognitive behaviour therapy (identification of automatic negative thought patterns) for depression, mindfulness meditation practice (MMP) and mindfulness-based stress reduction (MBSR) (Crane, 2017), to break the cycle of negative thoughts, feelings, and physical sensations (Murphy & Lahtinen, 2015). The introduction of mindfulness in a clinical setting is a new phenomenon and forms the foundation of MBCT (Crane, 2017). Initially created to prevent people with recurrent depression from relapse, Segal (2014), one founder of MBCT stated that their goal was not to reduce or eliminate symptoms of depression but to stay feeling well. MBCT has been empirically tested and has been proven to be an effective therapeutic approach to preventing depressive relapse (Crane et al., 2017; MacKenzie & Kocovski, 2016; McCay et al. 2016; Querstret et al., 2020; Schimelpfening, 2020).

Participants in the program learn the skills to disengage from habitual and automatic dysfunctional cognitive thoughts and are encouraged to cultivate acceptance and mindfulness (Teasdale, 2000). Participants commit to two-hour weekly sessions and a one hour a day meditative homework assignment such as body scan, moment to moment awareness, mindfulness breath and body, mindful walking, three-minute breathing space, mindful stretching, yoga or sitting mediation (Murphy & Lahtinen, 2015). Other examples of MBCT techniques are walking, mindfulness stretching, listening to recorded guided mediations, and cultivating mindfulness in their daily lives (Schimelpfening, 2020).

MBCT has also been found to be effective in empowering and freeing people from other psychological distress/disorders and providing the skills to have more control over their emotional difficulties (Querstret et al., 2020), ultimately increasing resilience. Due to its strong empirical evidence, skill building, structured treatment methods, and brief therapy approach, MBCT is considered to become the most widely used therapy modality, as compared to others, in the next decade (Prochaska & Norcross, 2018).

Summary and Synthesis of Findings

As noted, resilience has been defined in many ways. The two elements that were found to be common, however, are the presence of adversity and some form of positive adaptation or ability to positively cope and bounce back to normal functioning (Fletcher & Sarkar, 2013, as cited in Liu et al., 2018). The history of resilience research has evolved over the past 25 years from developmental and biological models (Liu et al., 2018), that focused on the etiology and psychopathology of resilience (Bonanno & Diminich, 2013) and understanding the process and factors associated with resilience, to currently exploring the neurobiology and neuroscience of resilience and how early brain development compromises or strengthens an individual's ability to

be resilient.

The current literature on the neuroscience of resilience and the brain's role in developing resilience reinforces that it is greatly impacted by early experiences. Early experiences, based on attachment theory and instances of adverse childhood experiences, affect the brain structures responsible for laying the initial templates of resilient behaviours and explain why some people are more resilient than others. There are many factors that shape and mold resilience that are beyond the scope of this paper; however, the common understanding in current literature and among many researchers, is that a secure attachment to a primary caregiver greatly increases resiliency and decreases the prevalence of adult psychopathology and maladaptive coping strategies.

Understanding the brain structures and systems involved in developing resilient behaviours or derailing the ability to be resilient is foundational to making changes and learning new and more effective ways to cope and increase resilience. Neuroplasticity, the brain's ability to rewire and change previous conditioning, makes this possible.

Psychological interventions to support and grow resiliency focus on skills development (Southwick et al., 2016). The human brain is *plastic* or extremely flexible and can learn to become more resilient (Tabibnia & Radecki, 2018). Individually, the different behavioural, cognitive, and somatic strategies of therapy can contribute to rewiring the brain to increase resilience; however, many of the strategies mentioned above can work together in synergy, further enhancing the positive impacts on the brain and strengthening neural mechanisms for better coping and resilience.

Chapter 3: Discussion, Case Study, Next Steps, and Conclusions

The purpose of this capstone was to find practical ways to assist clients to increase their resilience, regardless of where they are at in their journey and regardless of their background or psychological diagnosis. Finding ways in therapy to be able to support and facilitate clients to change in ways that are more efficient, effective, and sustainable than that achieved by traditional talk therapy is crucial for today's busy and stressful lifestyles. Understanding the neuroscience behind the development of resilience and implementing psychotherapy that supports this approach is helpful for clients who are feeling stuck, struggling to survive, dissociated from their emotions, or have difficulty articulating their experience on an emotional level. Developing resilience is the first step in facilitating clients to move towards positive change. The quote from Louisa May Alcott, "I'm not afraid of storms, for I am learning how to sail my ship" is relevant here; resilience is learning how to sail your ship. Neuroscience is one way to make this possible.

Understanding the neuroscience of resilience can be helpful in therapy by informing and influencing the interventions that may be implemented with counselling clients. Choosing specific interventions specifically to rewire the brain, such as EMDR and OEI, has been used to facilitate the processing of traumatic memories and calming the nervous system (Bradshaw & Cook, 2011). Furthermore, any of the neuroscience interventions previously mentioned can be implemented alongside other therapy modalities. In fact, research has indicated that an integrative approach is the growing trend in psychotherapy (Prochaska & Norcross, 2018) and can be beneficial when working with unique individuals with unique experiences. What works for one client may not be as effective for another client.

As indicated by the literature review, the latest advances in neuroscience have proven that

capacities for resilience are *hard-wired* or innate in the brain (Graham, 2013). How well these brain structures develop depends on life experiences. The specific brain structures that are associated with resilience can be compromised by earlier experiences of attachment and adverse childhood experiences (Schauss et al., 2019). This framework explains many of the struggles and challenges clients may be facing and when explained in this manner creates a better sense of awareness and understanding that whatever they are currently experiencing is not their fault, nor does it mean they are damaged beyond repair. The neuroscience of resilience provides hope and meaning to people experiencing distress and negative emotions. Having the awareness and knowledge that no matter what a person's earlier conditioning or previous traumas are, people can move forward and learn new ways of coping and regulating their emotions. This change in cognitive thought patterns can be transformational for clients. Neuroscience can teach people how to change negative patterns of coping and adopt more effective ways to increase resilience (Tabibnia & Radecki, 2018). This change in cognition can be freeing for many people who may have been struggling with depression or anxiety, past trauma, and other psychological challenges for many years.

Neuroscience also explains the benefits of many practical skills that are implemented in counselling and can be presented in a way that makes sense to clients. For example, deep breathing and mindfulness are helpful for overall wellbeing and are effective in calming the nervous system (Graham, 2013; Hanson, 2009; Smith, 2021). Deep breathing and attending to the present moment without judgement sends messages to the amygdala that we are not in danger and turns off the alarm bells, decreasing the secretion of stress hormones and replacing them with calming hormones to relax and calm the body (Hanson, 2009). When stress hormones are not flooding the brain, the prefrontal cortex, the executive center of the brain, can take control

over the amygdala, allowing the prefrontal cortex to return to coordinating other higher brain functions. Understanding the neuroscience of how the brain works, how information is processed, and how experiences change the structure and function of the brain will assist clients in learning how to stop the automatic stress responses and rewire the brain to learn new patterns of behaviour resulting in increased resilience regardless of past condition. This is exciting and self-empowering for both clinicians and clients.

Hanson (2009) stated that "when your mind changes, your brain changes, too" (p. 5). Releasing years of emotional pain, gaining an understanding of deeply rooted negative beliefs about ourselves, and lessening the impact of trauma are all possible through 'neurocounselling" (Russell-Chapin, 2016, as cited in Schauss et al., 2019), using the brain's mechanisms to facilitate change. Simply doing something different rewires the brain in some way (Graham, 2013). For example, (a) practicing empathy and expressing gratitude rewires the brain, (b) visualizing and imagining a calm, safe place rewires the brain and facilitates a feeling of calm and safety, (c) noticing thoughts and feelings and being curious about current awareness rewires the brain, (d) simply doing something different stimulates the brain to make new neurons and pathways for rewiring new behaviours, and (e) engaging in certain activities, such as walking, exercising, or simply deep breathing, activates the PFC, and allows for better brain function and coordination of other brain systems. Cognitive, behaviour, and somatic approaches to therapy provide many ways to rewire the brain and facilitate long-lasting change.

Linda Graham's book, *Bouncing Back: Rewiring the Brain for Maximum Resilience and Wellbeing,* offers many practical exercises to clinicians to rewire the brain (Graham, 2013). The exercises stemmed from over 20 years of experience with clients in clinical practice. Graham further explains the neuroscience of each exercise and the mechanism by which the brain is

being rewired. One example from her book is “Wiring for Resilience by Finding the Gift in the Mistake” (Graham, 2013, p. 243). This exercise is simply getting together with a couple of safe friends. Each person begins by sharing a common mistake people may experience, such as missing an important appointment or accidentally running a red light. Then each person shares a mistake with bigger consequences, such as not seeing a doctor and then ending up sick in the hospital. Sharing a small mistake first reminds everyone that these are common human experiences and that there is comfort in listening without judgement to the imperfections of being human. Next, the group then shares how the bigger mistake made them feel, what was the cost, what have they learned, and how would they respond next time? Taking the time to think about past mistakes allows new learning to take place and rewires the brain. Research has found that learning something new, such as learning more adaptive ways of coping, increases resilience (Graham, 2013).

Case Study- James

The following is a hypothetical case study demonstrating how neuroscience may be used in therapy to facilitate change and increase resilience. The client is a 47-year-old white male, referred by Mental Health for counselling services. James grew up as the eldest of three children. He has a brother two years younger and a sister five years younger. His parents divorced when he was 9 years old. He recalls early years of frequently seeing his alcoholic father verbally and physically abusing his mother. He undertook the responsibility of protecting his younger siblings whenever his father came home drunk. His mother was passive compliant, trying to maintain a peaceful home environment. His mother re-married when he was 11 years old and his stepfather worked away from the house, weeks on end, and had little contact with the children. At age 11, he was diagnosed with autism spectrum disorder. He reports that he never felt accepted by his

classmates and was often bullied. He attempted suicide once when he was 19 years old. At that time, he came under the care of a psychiatrist and was given the status of persons with a disability. James has tried multiple times to access counselling, but reports that this only makes him feel worse by having to re-tell his story repeatedly. Over the years, he has struggled to find any kind of consistent employment and has difficulty developing meaningful relationships. He currently lives in his mother's basement. James has a hard time with sleep and often experiences nightmares. He is on an antidepressant/anti-anxiety medication that does not completely control his anxiety. Due to his social anxiety, he has learned to shop online so that he does not have to leave the house. He spends the majority of his waking hours playing computer games to escape his current reality. He stated that he has not done anything socially since he was in his early 20s. He has no social life and is very lonely. He feels extremely stuck and helpless with his current situation and hates who he has become.

James has a history of trauma and his current level of anxiety, negative thought patterns, and behaviours have become deeply entrenched in their neural pathways. According to Donald Hebb (1949), *neurons that fire together wire together*; that is, every instant James thinks or talks about how depressed and anxious his current reality is, negative core beliefs he has developed about himself over the years become even more entrenched and strengthened in his brain. His constant state of flight or fight continuously floods his brain with stress hormones, negatively impacting the PFC, debilitating his ability to cope, and compromising his ability to be resilient (Arnsten, 2009; Hanson, 2009; Tabibna & Radecki, 2018). The fact that James has been in a chronic state of extreme anxiety for so long and is still impacted by traumatic events that occurred over his lifetime is evidence that he has not processed his trauma. In addition, as James experienced, talking about his past traumas would only re-traumatize him, more deeply

entrenching his negative cognitive and behavioural patterns and highly activating his autonomic stress responses.

Since James has not been able to trust anyone, or develop strong and healthy relationships, obtaining his trust, validating his experiences, and creating a safe therapeutic space is not only crucial but necessary. Neuroscience research has shown that positive relationships have immediate and long-term effects on the nervous system, rewire the brain and strengthen the executive functions of the PFC (Tabibnia and Radecki, 2018). Developing a strong therapeutic alliance with James will not only assist in laying the foundation of rewiring his brain for greater resilience (Graham, 2013), but also teach him that healthy relationships with others are possible. Further, psychoeducation and teaching James the skills to be able to self-regulate his emotions and calm his highly aroused nervous system would facilitate him to learn more effective coping skills and better control his anxiety/depression instead of feeling debilitated by them (Arnsten, 2009). Self-regulation is crucial for James to reduce further damage to his prefrontal neurons, as research has shown that prolonged activation of stress hormones damages the brain on a cellular level (Ansten, 2009; Tabibnia & Radecki, 2018). Thus, psychoeducation regarding characteristics of trauma, the body's autonomic stress response, as well as on the neuroscience of coping and resilience, would hopefully shine a small light of hope in his life moving forward.

Introducing relaxation and affect regulation strategies to implement on a daily basis would assist James to gain control of his heightened anxiety, calm his nervous system, and re-wire his brain from automatically going into fight-or-flight mode (Graham, 2013; Hanson, 2009). The following relaxation and grounding techniques to activate the relaxation response of the parasympathetic system come from Bradshaw and Cook's (2008) client manual: *Toward Integration: One Eye at a Time*: (a) deep diaphragmatic breathing, (b) progressive muscle

relaxation, (c) autogenic (self-statements of heaviness and warmth to certain parts of the body), (d) imagery (recalling and vividly imagining a safe, relaxing place), and (e) grounding (connecting to the present moment and paying attention to all the senses). These techniques may provide James with the tools to gain control over his stress and anxiety instead of his stress and anxiety controlling him.

The next step is to provide James with psychoeducation regarding how the brain processes and stores trauma memories in implicit memory (Bradshaw et al., 2011). Explaining to James how body sensations, emotions, views, and beliefs from past traumas are encoded in the brain, as if they are still in the present moment, would allow James to make sense of his current reality (Bradshaw & Cook, 2008). Next, EMDR and OEI interventions can assist him to begin to reprocess his trauma by reducing the intensity of his somatic reactions to them and re-consolidating his trauma as past memories that are no longer happening in the present (Bradshaw et al., 2011; Lee, 2021; Pagani et al., 2017; Shapiro, 2014). Outside of therapy, James could continue with bilateral stimulation, implemented in EMDR and OEI, to integrate/balance both sides of the brain and assist him to continue to calm the nervous system and process information (Bradshaw & Cook, 2008; Shapiro, 2014). The butterfly technique (crossing the arms in front of the chest and tapping alternately) and cross-crawl (when standing or sitting, touch the elbow of one arm to the knee of the leg on the opposite side of the body, then repeat on the other side) may both be helpful in gaining control of negative emotions (Bradshaw & Cook, 2008). Last, the EMDR phone applications for anxiety release are another resource for James to use between therapy sessions.

Other considerations for James are to assist him in finding a psychiatrist who will work with him to determine if he may need other medications for anxiety and depression. Also, it

would be helpful to connect him to community resources to expand his social circle when he is ready.

Next Steps

The surge in research into the neuroscience of resilience in the past few years has increased the understanding of the brain's role in developing resiliency and informing mental health clinicians in identifying strategies to promote better mental health. The findings in the literature review have also brought to light the importance of informing clients on how the brain greatly impacts behaviours and on rewiring the brain by completing simple exercises implemented at home and between sessions. By providing clients with the psychoeducation to make sense of their personal day-to-day challenges and the tools to develop better coping skills, clients can then begin to move forward with greater resilience.

Next steps would include the development of a resiliency program that highlights the neuroscience of resilience and teaches clients practical tools to rewire the brain for greater resilience. This program would be informative, effective, and motivational in supporting clients in their therapeutic journey towards developing resiliency and effective coping skills. The program would include the following elements:

1. Defining and describing what resilience is.
2. Identifying the main brain structures and functions that impact the ability to be resilient.
3. Explaining how early childhood experiences impact brain structures, thereby laying the foundation of resilience.
4. Explaining the components of trauma and how trauma memories are stored and reprocessed.

5. Explaining the body's autonomic stress response and mechanisms for regaining control.
6. Describing the steps to develop greater resilience despite previous traumatic experiences or learned behaviours.
7. Outlining exercises geared at rewiring the brain and promoting more effective coping skills and adopting resilient behaviours.
8. Providing online resources and phone applications that can be utilized to further provide support outside of therapy.

The program would also be infused with encouragement and self-empowering quotes and stories to motivate and encourage clients along their journey. Finally, this program will also provide opportunities for clients/participants to share their experiences and support one another.

Future Research

A literature review of this topic brought to light some limitations and recommendations for future research in the next four to five years. These include:

1) Studies on adult resiliency, which is still relatively understudied compared to resiliency in children (Guimarães, 2018).

2) Studies that specifically target the neuroscience of resiliency and identify effective evidence-based treatment interventions (i.e., OEI) and their effectiveness on rewiring the brain and promoting resiliency.

3) Research that can more accurately apply findings from animal studies on resilience to the human population.

4) Evidence-based resilience training and education, as well as therapeutic group-based interventions studies (Ungar, 2013).

5) Empirical evidence for TRM and other somatic-based therapies.

Grabbe and Miller-Karas (2018) stated that the lack of research for somatic-based therapy is due to the slow response in understanding and acknowledging the long-lasting impact of adverse childhood experiences since persons with complex trauma are often excluded from research studies. In short, with the growing understanding of the neuroscience of resilience, more evidence-based studies are needed to inform therapists and mental health professionals on the best empirically based interventions and strategies to promote and sustain resiliency.

Conclusions

Adversity and traumatic events are part of the human experience. Individual responses to stress and trauma differ from person to person. Some people grow stronger and learn from their negative experiences while others are debilitated by it (Cummins, 2015). Resiliency is the ability to *bounce back* and positively adapt to a traumatic event (Guimarães, 2018; Tugade & Fredrickson, 2007). Adopting skills to develop resilience is even more crucial today as people are forced to not only navigate the many stressors that are part of day-to-day existence, but also global stressors such as a pandemic, political unrest, war, climate change, and cultural injustice.

Why are some people more resilient than others? There are many factors that impact the ability to be resilient; however, due to technological advances in the last ten years, the study of the neuroscience of resilience is the current focus in today's literature. Neuroscience has greatly influenced the study of resilience and has identified specific brain structures and functions that are key in developing resilience. Early experiences, such as attachment to a primary caregiver, adverse child experiences, and other traumas, may have significant impacts on how resiliency develops into adulthood.

Treatment techniques for rewiring the brain have informed the most effective approaches to facilitating change and increasing resilience in a therapeutic setting. Various behaviour, cognitive, and somatic psychotherapy interventions have been used to rewire the brain and promote adaptive ways to increase resilience to stress. Furthermore, an integrative approach to developing resilience has been suggested by research as being a more effective way to provide a client-centered approach that is based on the unique needs of each client. The information in this capstone can be applied in therapy to assisting counselling clients to take steps towards positive changes and develop resilience. “Resilience is like the keel of a sailboat. As the winds of life blow, resilience keeps you balanced and moving forward. And when the really big squalls come – no life is without them – resilience lets you right your boat as soon as possible… you’ll be able to chart your course with confidence across the great seas of this precious life.” (Rick Hanson, 2012, as cited in Graham, 2013, p. xxi).

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