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An overview and Introduction: Neuroscience for Counselors

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An overview and Introduction: Neuroscience for Counselors

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A research project submitted to the Graduate Faculty of

JAMES MADISON UNIVERSITY

In

Partial Fulfillment of the Requirements

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Dedication

This project is dedicated to the loving memory of my mother Donna Rene Saunders, whom I loved so dearly, and whose life ended so tragically on July 8, 2008. I also dedicate this work to my children, who have been waiting on this moment for many years, and to my foster mothers, Rebecca Coleman and Mary McGowan, for the years of unconditional love and guidance. Thank you. To the men and women who are or who have been incarcerated – if you don't like the way your life is going then change the way you live. Last, but certainly not least, to all my friends who have lost their lives prematurely from the horrors of addiction and the many forms of mental illness. You will forever be missed.

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Abstract

This project is literary review of current neuroscience research that can document the impact of counseling. Neuroscience is providing support for the counseling process. The research findings of neural plasticity offer promising support for the therapeutic process. While counseling offers a new environment in which a person can re-learn, neural plasticity proves that at the neural network level these possibilities are now a reality. Counseling does, in fact, help change the brain.

Introduction

In December 1989, the Romanian communist regime of Nicolae Ceausescu was overthrown and soon the western world became aware of the thousands of children languishing in Romanian orphanages. These children were raised in deplorable conditions and consequently, they were extremely passive and quiet. Developmental delay was obvious, and few, if any, had formed an attachment to a caregiver (Ames, 1990). After beginning life under duress, these children no doubt suffered grave developmental setbacks and emotional delays. This is well documented in a growing body of research (Ames, 1990). Adopted children from this population were noted to have more behavior problems, needed more psychiatric intervention, were more likely to be insecurely attached, were more likely to be in one-parent households, had greater family stress, and were less popular with their peers (LeMare, 2001). Interestingly, within the Romanian orphanage group, the children who experienced more nurturing and stimulation at home by age 4 demonstrated better attention abilities at age 10 (LeMare, 2001). This supports findings by neuroscience that the brain can change and adapt to the changing environment (Cozolino, 2002).

There is a growing body of evidence suggesting that both survival and proliferation of newly formed neurons can be affected by experience (Price, Adams, & Coyle, 2000). Although these children faced neglect and situational abuse, their resilience is most notable. This group of children seemed to be doomed in their most critical formative years, yet somehow they recovered. Their recovery is an example of the bidirectional influences of genes and environment. Furthermore, the influence of emotion also has an impact on the shaping of young minds and brains. Structure and function of

the brain and mind are influenced by experiences and emotional relationships (Cozolino, 2002). The brain, its neurons, and neural networks began to reflect the environment that shaped them. A good environment is one that helps the brain grow and function in an effort to ultimately increase the likelihood of survival for the organism.

The purpose of this project is to help inform counselors how neuroscience positively influences our field of work and how neuroscience is providing evidence that counseling may be as effective as chemical treatments. Articles and studies concerning how counseling is affecting the brain are surfacing more and more. There is a history between neuroscience and psychotherapy that dates back to Freud's earlier days; however, the two fields have since traveled different theoretical paths. The current status of the relationship between the two fields is one of respect and discovery. This project will help counselors understand some of the barriers that exist when reading and researching articles that are written from a neuroscience perspective. The terminology associated with neuroscience, with its complexities and many meanings may elude counselors who could benefit from understanding this language. The regulation of genes' expression by social factors makes all bodily functions, including all function of the brain, susceptible to social influences (Baer, 2006). This bidirectional system suggests some of the mechanisms by which counseling works. As discoveries in neuroscience explain "how" these mechanisms work from a neural network perspective. Furthermore, as technology is progressing in the field of neuroimaging, viewing the brain as it functions is now possible (Baer, 2006). The aforementioned articles are among a growing body of research that is providing insight into an area that was once foreign.

Bringing neuroscience to counseling is to understand that while psychotherapy emphasizes the importance of the subjective human experience, neuroscience focuses on measureable, quantifiable data at the level of neural anatomy. In order to cross the line between these two schools of thought, we may begin with embracing a view that promotes subjective experiences as important as quantifiable data (Cozolino, 2002). To counselors, subjective experiences are the hallmark of the counseling experience. It is the world view of the client that is being counseled, and this subjective view is as important to the client and counselor as research is to the scientist (Baer, 2006); Viamontes and Beitnem, 2009). When counselors begin to more fully explore findings in neuroscience, it will bring them a richer understanding of how neural connections and neural networks grow, develop, and affect human behavior, emotion, and cognition. Using the knowledge of brain functioning in conjunction with psychotherapy's theories and techniques will lead to a more insightful, empathic, and confident therapist. These improvements will improve the therapeutic alliance which will lay the foundation of changing the brain and subsequently changing undesired behaviors and feelings. It may also influence what treatment plans will be most effective for specific diagnoses. Informed therapists can be better equipped to, as Linden (2008) points out, "improve indication and prognosis, inform the choice of parallel pharmacotherapy, provide outcome measures and potentially even aid in the development of new treatment protocols."

The first section of this paper provides a historical overview of psychotherapy and neuroscience. Broca and Jackson's findings in the area of brain functioning localization are discussed. Freud is introduced with his pre-psychodynamic theories and hypotheses that point to the possibilities of neural autonomy being connected to behavior and

cognition. This portion of the project is very important to other concepts and theories throughout the remainder of the paper, as this discussion offers counselors context and background on how the two fields have grown apart and are now moving toward one another.

The second section is a presentation of basic concepts in neuroscience, and dedicated to helping counselors become acclimated to the more specific language of neural anatomy. The biology of the brain, developmental discoveries, and neural plasticity will be discussed. These three findings in neuroscience are gateway discoveries that can bridge the gap between neuroscience and psychotherapy. Explanations will be offered as to how these processes affect the therapeutic alliance, in later sections. The third section discusses how research and experiments are influencing counseling. There have been findings that compare psychoactive drugs and cognitive behavioral therapy, and the results are promising for the field of counseling. This section brings together the research of neuroscience with the implications for counselors. Section four introduces some of the relevant techniques that are used in counseling and reiterates their importance to the clinician. This section leads into a sample reading on memory and how the counselor can affect memories with reframing, reconstructing and co-creating techniques. The conclusion of this paper promotes the foundation of the therapeutic relationship and empathy, among other core conditions, as vital to helping heal and change the brain of our clients. At this point, I will have illustrated the positive potentiality of counseling and how counseling theories and techniques predate the proof provided by neuroscience.

History

An early attempt to unify psychotherapy and neuroscience came from Freud. After abandoning a project in which he postulated that what we see as conscious and unconscious is reflective of the neural architecture of the brain and nervous system. His paper, "Project for a Scientific Psychology", attempted to link brain functioning with his understanding of psychopathology (Arden & Linford, 2009). Freud drew sketches of interconnecting neurons that represented human emotion, behavior, and psychological defenses, and conjectured that the small gaps between cells are what allow mental activities (Arden & Linford, 2009). This gap was later named "synapse" by Sir Charles Sherrington (Arden & Linford, 2009).

Despite his insight, Freud was discouraged with neuroscience and turned to another passion. He had a stronger desire to uncover greater meaning of psychological phenomena (Arden & Linford, 2009). Freud's rejection of neuroscience sparked a long battle line that has been standing for many years. Freud moved toward a case study method based on mutual introspection, meaning that two people are investigating the same information. Freud founded psychoanalysis, and his metaphors for psychoanalysis are rooted in literary themes and anthropology (Cozolino, 2002). Regardless of what one makes of classical psychoanalytic theory, Freud's contributions of neurodynamic ideas were the beginnings of neuroscience as it is currently. Freud believed that psychoanalysis would be reunited with its neurobiological origins when the time was right for such a union (Cozolino, 2002). Neuroscience and psychotherapy were like twins separated at birth and grew up one not being aware of the other (Arden & Linford, 2009). Once intimately connect in Freud's work, neuroscience after Freud, "turned its gaze back to bench work and experimental psychology (Arden & Linford, 2009, pg. 49). The result of

these events left neuroscience regarding counseling as sloppy and unscientific, while counselors have tended to view neuroscience as focusing on minutiae with little importance to clinical work. As of yet no concerted effort has been made to integrate neuroscience and the scientific study of counseling.

The idea that brain functioning was related to anatomical localization was no more than a hypothesis in the mid 19th century; however, this idea began to gain currency after controlled experiments were conducted “by Broca (1861) and Jackson (1873)” (Peres & Nasello, 2008). The 19th century French surgeon, Paul Broca, is noted for his work with a patient who, following localized damage to the rear part of his left frontal lobe lost the ability to produce speech. The man's comprehension remained intact, leading to the popular conclusion that the rear part of the brain's left frontal lobe (known as Broca's area) is important for speech production, but not comprehension. This discovery indicates that specific areas of the brain have some correlated behavioral function.

Neuroscience and Research

Physician J. Hughlings-Jackson studied seizures, nervous-system disorders, and speech defects caused by brain disorders. He was a leading proponent of the idea that convulsions are a symptom, not a disease, and he co-founded the neurological journal *Brain*. Based on observation and autopsy, without animal experiments or a microscope, he correctly determined that different bodily functions are controlled by specific regions of the cerebral cortex, and that some forms of epilepsy are caused by localized cortical disorders in the cerebrum (Kerr, Caputy & Horwitz, 2005). By showing that there are specific areas in the brain for specific bodily functions these findings promote the idea that there are areas of the brain that are more responsible for specific behaviors than other areas of the brain. These findings are very important to neuroscience as they define the term localization. This means that there are in fact different parts of the brain responsible for specific function in our behavior, emotions and our cognition.

The Society for Neuroscience defines Neuroscience as “the study of the nervous system,” which consists of two main elements: central and peripheral (<http://www.sfn.org/index.cfm?pagename-whatIsNeuroscience>). The central nervous system is the brain and spinal cord. The peripheral nervous system includes nerves that serve the neck, arms, trunk, legs, skeletal muscles, and internal organs. Critical components of the nervous system are molecules, neurons, and the processes within and between cells. These are organized into large neural networks and systems controlling functions such as vision, hearing, learning, breathing, and ultimately, all of human behavior. Much of what is known about the mechanisms underlying these functions was first discovered through animal studies and then confirmed in humans.

At the center of our discussion are specialized nerve cells or neurons and their electric-chemical method of communication -firing. Neurotransmitters are released from terminals at the end of the axon. Once released, some neurotransmitter molecules will diffuse across the space between the axon of one neuron and the dendrite (receiving end) of an adjacent neuron and bond with a specific receptor in the membrane of the adjacent cell. The movement and binding of neurotransmitter molecules across the tiny space between neurons is the first step in synaptic transmission. The space between the neurons is the synaptic cleft. The neurotransmitter molecule is released from the “pre-synaptic” membrane and then binds to a receptor site on the “post-synaptic” membrane.

Neurons are fluid-filled cells and the brain is entirely bathed in fluid: the two types of fluid that exist on the outside and inside of a neuron differ only in their concentrations of ionic components. In other words, because of the difference in ionic composition, there is a difference in voltage across the neuronal membrane. The neuron is slightly more negative inside the cell than outside the cell.

The major consequence of a neurotransmitter molecule binding to a receptor site is the instantaneous opening and closing of a tiny ionic pore that is permeable to either cation (positive ions) or anions (negative ions). At the binding of an appropriate neurotransmitter and the opening of an ionic pore, the influx of positive ions from the fluid surrounding the cells will allow the cell to become more positive relative to the outside. This is due to simple physical chemistry laws that govern the movement of ions in fluid. If the influx of positive ions reaches a specific voltage level in the inside of the post-synaptic cell, the “threshold” will activate voltage sensitive ion pores along the axon shaft resulting in the release of neurotransmitters. Hence, the cell that was on the

receiving end is now able to release its own neurotransmitter molecules to another cell along the pathway.

When the post-synaptic cell is permeable to anions the threshold voltage is more difficult to reach, and those cells must receive an even greater amount of pre-synaptic stimulation to allow them to reach the threshold voltage. Since synaptic transmission is associated with all brain activity, at any given moment, most of the cells in the brain are not firing. Only selected cortical cells necessary for the specific behavior are excited, while others are being inhibited - this is known as neuronal modulation. Neuronal modulation is the range in variation of neuronal voltage that either causes a cell to be prone to be excited or inhibited at any given moment.

Neurons continuously integrate signal strength in an effort to determine when groups of cells should fire and when they should not. In early development the signal strength associated with certain behaviors, such as sucking is relatively strong. Cortical neurons governing every aspect of feeding (rooting reflex, sucking, and oral sensation for example) have abundant dendrites for receiving neuronal signals. In addition, the axons are covered in special types of cells that serve as a type of electrical insulation, and allow for faster transmission of the electrical signal that causes the release of neurotransmitters. The insulation is known as the myelin sheath. The information is to inform counselors of the biological functions of the brain. This will help inform counselors of where the change actually happens and gives them a mental vision of frame work of how the brain goes about its functioning and how a counseling session can promote these changes at this level in a positive way.

While a behavior such as newborn sucking may appear to be simple, from a neuronal perspective, it is extremely complex. Many groups of cells from various cortical regions are necessary for the muscle movements, tactile sensations, and internal physiological mechanisms that allow for feeding. Together these cells form a neural network, and at birth the neural network associated with feeding is fairly well developed.

On the other hand, the neural development necessary for intentional grasping is much less developed at birth. Behavioral stimulation is necessary for the cortical neurons associated with more complex behaviors to develop greater dendritic branching and an increase in myelinated axons over time. A neural network can consist of millions of neurons. These networks encode and organize all our behaviors - not just feeding and grasping- but also sensations such as vision, and the even more complex behaviors associated with emotion and cognition (Cozolino, 2002).

The central and peripheral nervous systems are comprised of an intricate array of neural networks that enable all parts of the body to communicate with the brain and areas within the brain to communicate with each other. The brain is divided into anatomical regions such as the brainstem, which adjoins the spinal column in the back of the brain, and the cerebral cortex, which in humans is the more convoluted top and front portion of the brain. The cortex is then divided into specific regions such as the occipital lobe, temporal lobe, parietal lobe, and prefrontal lobe. The cerebral cortex governs our interaction with the world – the main networks for sensation, perception, cognition and movement located. This system allows us to have mental images of ourselves, other people, and the world around us. Cortical neural networks are affected by experience, and both nurturing and traumatic experiences can change the anatomical features of neurons

in the cortex. Also having a bidirectional affect on neural networks are Instantiations. They are neural pathways within a neural network that has in some way been encoded to fire in a pattern with other neurons this process is believed to determine which neurons will fire in a network. Instantiations are created by experience and encode all of our emotions, memories, dreams, and capabilities (Cozolino, 2002).

The strengthening or weakening of synaptic connections, and the growth or decline of neural networks, is the physiological equivalent of learning. When cells connect learning occurs through changes of synaptic strength between neurons in response to some inner or outer stimulus. The ongoing firing of two cells causes metabolic changes in both cells involved in the process. Continued firing increases efficiency in their joint activation. "The general idea is an old one; that any two cells or systems of cells that are repeatedly active at the same time will tend to become 'associated', so that activity in one facilitates activity in the other." (Hebb 1949, p. 70) In other words; "neurons that fire together, wire together" (Hebb, 1949, p.63).

Not only does cell-cell interaction contribute to brain changes associated with learning, but the entire environment inside the skull may have an influence on the way connections are formed. For instance, in organisms with a mature central nervous system there is a continuous expression of the same type of molecules that are required for the formation of neuronal networks during embryonic development. Neurochemicals such as growth factors, axonal-guidance molecules, and embryonic forms of cell adhesion molecules, and proteins that determine cell fate suggest that the potential degree of network remodeling in the mature central nervous system may be quite extensive. There is a growing body of evidence suggesting that both survival and proliferation of newly

formed neurons can be affected by experience (Price, Adams, and Coyle, 2000). Cozolino (2002) reports “once these neural patterns are established, new learning modifies the relationship of neurons within these networks.” Therefore, the link can be made between the extremely small units of behavior - the neuron - and the environment in which an individual lives. “The brain...is stimulated to grow and learn through positive and negative interactions” (Cozolino, 2002, p.16). Neurons, as the basic building blocks of brain, form anatomical structures called neural nets that are associated with types of behaviors. These structures are influenced by the interactions of the organism with the environment and may also influence the way an individual perceives its environment, thus creating a bidirectional interaction between brain behavior and environment.

The above explanation of brain plasticity provides a picture of biological changes that occur over the life span of an individual as a result of environmental interaction. Interaction includes not only physical sensations but social interactions. The most significant of those social relationships is between the children and parents. From the perspective of brain plasticity if a child’s environment is toxic, unfit, or traumatic then the structures of the forming brain will develop around this input. The child may inherently have developmental gaps for example; emotional delays, cognitive delays and physical delays that are stemming from neural connection and neural networks that have grown in response to their environment. Therefore, “we are unable to engage in random actions because our behaviors are guided by patterns established through previous learning to which we automatically return” (Cozolino, 2002, p.20).

One way of seeing neural plasticity that has been overlooked is the negative effects of this phenomenon. Take for instance the soldiers of the Vietnam War. Before

they were deployed most of those young men were psychologically stable. Upon the Wars' ending we have seen the negative effects of neural-plasticity on the brain via Post Traumatic Stress Disorder and other Anxiety based mental illnesses. This is the same neural-plasticity that we as counselors are promoting as a healing agent.

The influence of emotion also has an impact on the shaping of young minds and brains. Structure and function of the brain and mind are influenced by experiences and emotional relationships (Cozolino, 2002). The brain, its neurons, and neural networks will reflect the environment that shaped it. A good environment is one that helps the brain grow and function in an effort to ultimately increase the likelihood of survival for the organism. "Animals raised in enriched environments have more neurons, more synaptic connections among neurons, a greater number of blood capillaries, and more mitochondria activity" (Cozolino 2002, p. 23). For the human brain this may mean an environment that is filled with enough challenges to promote growth and healthy neural network connection.

Unfortunately, there are many experiences in life that are not positive. One way the brain can change and re-learn is through counseling. The relationship between client and therapist can be as significant as the parental relationship in altering behavioral patterns and associated neural networks that were encoded early in life. "When psychotherapy results in symptom reduction or experiential change, the brain has, in some way, been altered" (Cozolino, 2002, p.16). Moreover, to have a healthy functioning adult requires proper development and functioning of neural networks organizing conscious awareness, behavior, emotion, and sensation (Cozolino, 2002).

Understanding the findings of neuroscience can help counselors understand the process of how the brain is built and shaped by early interpersonal experiences, as well as how counseling creates an interpersonal matrix capable of rebuilding it (Cozolino, 2002). Cozolino reports that an early interpersonal environment may be imprinted in the human brain by shaping the child's neural networks and establishing the biochemical setpoints for circuitry dedicated to memory, emotion, and attachment. Those structures and processes then serve as the infrastructure for later developing intellectual skills, affect regulation, attachment, and the sense of self (Cozolino, 2002).

The brain after birth is slow to develop, which gives the environment greater influence over its development. Grawe, (2006) report, "the nervous system of social animals after birth initially functions as a system of open homeostatic feedback loops, which require external input for the maintenance of internal system homeostasis. This input is created via social contact and synchronization of affective physical transactions in the attachment relationship" (p. 180). For the human child, it is well understood that early toxic environments, traumatic experience, neglect and failure to bond with caregivers can have significant long-term negative effects on developing brains (Grawe 2006). To some degree, good and bad events have equal representation in the inner neural connections and developing brain structures. When this process includes a toxic environment for the young brain, such as poor caregiver attachment, the resulting brain has under undergone a developmental process that reflects those early experiences. The behaviors that reflect such a developmental environment may become more readily apparent to counselors and neuroscientists as they understand how the brain has been affected and developed in its formative years. Harlow, Bowlby, and Mears illustrate this

phenomenon in research on attachment theory (Presbury, Echterling, McKee, 2007).

Their research and theory shows just how these early relationships can have long-term effect on the individual (Bowlby, 1973). Research studies performed on attachment show that unhealthy relationships early in children's lives have long lasting consequences.

Theorists who are object relations-oriented believe that a primary motive of human growth is to establish and maintain emotional connectedness to a primary parent figure(s) (Teyber, 2006). In short, object relations theory explains one view of the needs and meanings of attachment theory and the importance of relationships with others.

The "Mother-Infant Affectional System in Monkeys" experiment performed by Harry Harlow (1965) provides insight as to how much early relationships play a part in long-term development. Harlow found that there was powerful and persistent bonding between parent and child, and that this bond in monkeys and humans could come to interfere with other affectional relationships, if the bonding was extreme or deficient. He determined that just enough mothering or the just the right amount of mothering produces a secure infant; Winnecott (1986) called this *good enough mothering*. Good enough mothering implies that the mother is providing the right amount pressure and care to force the child to learn and grow in ways that promote healthy adjustment in the future of the child's life (Winnecott 1986). This study means that there is developmental time which mothering can have the right amount of impact on a child, and that the child will not be affected negatively in the long-term development of interpersonal skills.

In addition, Bowlby (1973) observed the behaviors of human children who had been separated early from their mothers. He reported that the children actively protested, which means they screamed and cried more, and they exhibited what Bowlby called

despair and a residual detachment even when returned to their mothers. It seems that the bond was broken and the child was unable to cope in a way that was self-soothing. This reaction reflects an insecure type of attachment. Furthermore, Harlow and Mears report the most devastating effects on infants being prematurely separated from their mothers is seen in the socialization of the child (Presbury, Echterling, & McKee 2007).

Bowlby (1973) believed that the relationship between caregiver and child has a dramatic impact on the way in which the child will come to understand many important factors about life, self, the world, and others. Imagine the brain of an infant, and the affect that the attempts to become attached to an emotionally and physically unavailable person can have on its brain. Failing to become securely attached affects many levels of development. Object relation and attachment theorists have a belief that the child-parent interaction promotes the development of cognitive schemas (Teyber, 2006). These schemas become the center point for organizing one's sense of self, the organization of an internal world and the foundation for future relationship interactions.

Counseling and Neuroscience

Counselors can benefit from neuroscience by increasing their understanding of brain development, neural connection, neural networks, and their influence. Counselors apply scientifically validated procedures to help people change their thoughts, emotions, and behaviors. Counseling is a collaborative effort between two individuals, and provides a supportive environment to talk openly and confidentially about concerns and feelings.

Neuroscience research has provided important new insights into the processing of intense emotions. The laboratories of Antonio Damasio, Joseph LeDoux, Jaak Panksepp, Steve Porges Rodolfo Llinas, and Richie Davidson have shown that creatures more or less automatically respond to incoming sensory information with relatively stable neuronal and hormonal activation, resulting in consistent action patterns-predictable behaviors that can be elicited over and over again in response to similar input (Van Der Kolk, 2006). This explanation seems to be a way neuroscience can help counselors understand more about schema development. During normal conditions the executive and symbolizing capacities of the prefrontal cortex can modify these behaviors by providing the ability to observe, know, and predict by inhibiting, organizing, and modulating those automatic responses (Van Der Kolk, 2006). This allows people to direct and safeguard their affairs with their fellow human beings on whom they so profoundly depend for meaning, companionship, affirmation, safety, and relations (Van Der Kolk, 2006). In other words, human cognition and behavior are emerging from the bidirectional interplay between neuronal development, genetics, and social forces. Peres and Nasello (2007) found that behavior may be learned and improved through experience, which alters the voltage of neural networks synapses to prompt formation of new neural circuits and new

memories that will subsequently be accessible. Objective and subjective experiences can alter the flow of neural information as well (Baer, 2006). One noteworthy explanation of the importance that neuroscience brings to counseling comes from Belsky and Pluess (2009), who write “knowledge of plasticity should pave the way for the most effective intervention, be they seeking to prevent problems before they develop, remediate them once they have emerged, or promote well-being without concern for developmental risks (pg 4).” The understanding that the brain can, in fact, change and alter itself from internal and external forces is the key point of psychotherapy.

Viamontes and Beitman (2009), in their textbook *Brain Processes Informing Psychotherapy*, argue that successful counseling is correlated with discrete brain changes and that psychotherapy must attempt to define a cohesive set of neurobiological concepts that apply specifically to psychotherapy. Furthermore, Porto et al (2009), reports that “the arrival of neuroimaging techniques makes it possible to investigate the neurobiological consequences of psychological treatment (p. 114).” Such investigation is highly important, as a better understanding of the brain mechanisms underlying therapy can promote improvements in the therapeutic interventions as well as increase our knowledge on the formation and maintenance of symptoms. A reduction in symptoms may be one measure of effective treatment.

An “interpersonal neurobiology” of human development enables us to understand that the structures and function of the mind and brain are shaped by experiences, especially those involving emotional relationships (Cozolino, 2002). One clear event of our new era in psychotherapy is that neuroscience provides us with theoretical models and research data that allow us to begin to understand what happens in the brain during

counseling (Cozolino, 2002). Helping to improve the field of psychotherapy by incorporating neuroscience's advancements in research will promote the better use of therapeutic techniques, treatment plans, and interventions. Using cutting edge imaging techniques has offered an ever growing body of research that is vitally important to the field of psychotherapy.

For instance, a study using fluorodeoxyglucose- positron emission tomography scans, or FDG-PET scans, was used to determine if brief cognitive behavioral therapy (CBT) could induce functional brain changes previously shown after longer periods of pharmacotherapy or standard cognitive behavioral therapy (Saxena, Gorbis, O'neill, Baker, Manudelkern, Chang, Salamon, Brody, Schwartz, London, Maidment, 2008).

- Cerebral glucose metabolism was measured with [18F]- FDG-PET in all subjects before and after 4 weeks of intensive, daily CBT;
- PET brain scans were obtained on 10 patients with obsessive-compulsive disorder, or OCD, before and after four weeks of intensive individual CBT;
- 12 normal controls were scanned twice, several weeks apart, without treatment.
- Regional glucose metabolic changes were compared between groups.

The results illustrated OCD symptoms, depression, anxiety, and overall functioning improved robustly with treatment. Saxena et al. (2008) further reports OCD patients showed significant increases in right dorsal anterior cingulate cortex activity that correlated strongly with their degree of improvement. Therefore, “response to intensive CBT may require activation of dorsal anterior cingulate cortex, a region involved in reappraisal and suppression of negative emotions” (p. 204). The dorsal anterior cingulated cortex is responsible for slowing down negative emotional responses and

allows the brain slower re-action time in certain situations (i.e. anxiety disorders). Activation in this region could be correlated with improvement in OCD symptoms (Saxena et al., 2008). If the dorsal anterior cingulate cortex region is engaged the thalamic system response which could be the reason for negative symptoms, the responses are lessened resulting in fewer OCD symptoms. The findings that CBT was as effective as psychoactive drugs is encouraging for counselors, as they suggest that using brain imaging technology can lead psychotherapists to better treatment plans, more efficient intervention, and a reduction in symptoms. This study confirms the idea that therapy can be a process that promotes and encourages changes at the neuronal and neural networking level. If CBT can possibly promote the same effects as drug therapy and the results are measurable, then psychotherapy could one day offer clients with OCD more choices of treatment. An exploration of the neural functional and neural physiology of the brain is the next step in helping counselors and psychotherapist come to a better understanding of how treatment and interventions can impact neuronal functioning.

Reframing, Reconstruction, Memories and Schemas

The brain's ability to continue to make new connections and change itself from the outside environment inward (and, conversely, from the inside environment outward) suggests that reframing, reconstruction and co-creating can be effective treatment interventions for various counseling situations. This paper supports the use of reframing and reconstructing a co-created new version of the client's story. By re-constructing a new narrative of a client's story, it is meant that the client will a) share their story b) have critical parts of their story reflected back to them and c) in some way the counselor has found some new aspect of the story that influences the way the client remembers the story when it is told again. For instance, Wild, Hackmann and Clark's (2008) study on reconstructing found "the experimental session led to significant improvement in negative beliefs, images and memory distress and vividness, fear of negative evaluation and anxiety in feared social situations" (p. 49). This study focused on the origins of social phobias. However, the phobia construct is basically the same in most anxiety-based psychological malfunctions. Reframing is a process that can help change the emotions attached to specific memories that have adverse and debilitating effects on the individual in the present.

To reframe a person's story, therapists listen to what is being told to them very carefully. They find an alternative explanation for the outcome and offer it to the client. If the explanation is accepted, it can then be used in reconstructing the event in the client's memory, as well as in the subsequent retelling of the same story. Reframing and reconstructing the client's story will change the way the client remembers the story when he or she remember it again. By injecting a newly co-created story using reframing and

reconstruction, therapists can affect the way in which a person remembers a story. This use of reframing and reconstruction also adds meaning to the individual's life story and experiences. This technique widely used in crisis intervention and in the brief model of psychotherapy (Wong and Moulds, 2007). What underlies the efficiency of these techniques, as previously mentioned, is the brain's ability to change and be changed.

Because memories play a major role in post traumatic stress disorder, depression, and anxiety disorders, using reframing and reconstructions of those memories may help in relieving negative symptoms. Wong & Moulds (2007) reported that memory processes have long been considered important cognitive aspects of depressive disorders. Wong and Moulds (2007) further noted that "there is convincing evidence in the emotional memory literature area of preferential retrieval of negative material in depressed people (pg 50)". There are areas of the brain that help aid the storage and retrieval of memories. Specifically, the area called the hippocampus is known to have an effect on memory storage and recall.

How a person retrieves memories takes cognitive resources for storage and retrieval and this energy effects they way memories are recalled. According to Kuyken (2006) "strategic retrieval deploys considerable cognitive resources as memories are reconstructed in relation to current goals, as relevant information is activated and irrelevant information is inhibited. Involuntary memories are bottom-up, cued by external or internal cues (e.g. a sensory cue like smell); include intrusive traumatic memories; require few cognitive resources; and override the content of current awareness" (p. 279). Therefore, while in a depressive mood, the energy used to think positively is drained by a more powerful automatic system. This adds to the depression because the person cannot

avoid depressive memories, meaning that they do not have the cognitive resources to pull through a depressive mood on their own willingness to do so. The information presented here only skims the surface of the issue; however, it is helpful for understanding how memories are affected by many contributing factors. For example, interference, rehearsal, retrieval, and cognitive energy are all contributing factors. Neuroscience offers cutting edge research that may lead to exactly how to intervene, and how pharmacotherapy and counseling could assist in the therapeutic process of reframing and re-construction. For the counselor, this information is priceless- having insight into depression at the cognitive functioning level can only bring the use of proven effective core condition to the forefront of importance to therapy session. For instance, the relationship between client and counselor is one core condition that is imperative.

The relationship between the client and therapist is what accounts for a major portion of the healing in therapy. Edward Teyber, in *Interpersonal Process in Therapy: An Integrative Model*, says “the relationship between the therapist and the client is the foundation for therapeutic change. Across different theoretical approaches, and in short or longer-term modalities, researchers find that the therapist’s ability to establish a strong working alliance early in treatment may be the best predictor of treatment outcomes (p.xix).” Within the therapeutic relationship when the counselor can empathically listen to the client’s memories and shed light on specific areas then both brains (counselor and client) become more active (Posner, 2004). To this end, Viamontes and Beitman (2009) write that “not only does successful psychotherapy correlate with discrete changes in the brain, that psychotherapy, like medication, ultimately targets neuroanatomical structures and modulates their function and that direct correspondence of the therapeutic process to

specific neural phenomena is a powerful discovery and knowing more about these findings can only strengthen the therapeutic alliance “(p. 781). While accounting for a significant portion of the change process resulting from therapy, the relationship between counselor and client has different theatrical approaches and techniques that accomplish those results. It has been established that the brain develops new neural connections throughout the life span and changes in response to new situations or experiences in the environment for which it is developing to live (Goleman, 2006). In addition, new life experiences modify brain systems (Draganski, et al., 2004). One new life experience that ultimately affects the way brains are changing can be the therapeutic alliance. This alliance promotes empathy, and empathy is the doorway to the thinking, feeling, hurtful, conscious, and unconscious parts of our client’s mind. The therapeutic environment creates an experience that can promote the brain’s use of neural plasticity in an effort to heal and reduce symptoms. Therefore, creating a new environment within the therapeutic relationship allows the counselor to help heal the brain and subsequently the symptoms that brought the client to therapy.

Counseling can be thought of as an enriched environment that can promote the growth of behavioral, emotional, and cognitive abilities. A therapeutic relationship is of grave importance to effective and meaningful change within the therapeutic process. The therapeutic relationship allows access to the unconscious and conscious processes that occur in the brain and neural networks. It is the therapeutic relationship that makes healing possible. Being armed with a neuroscience perspective the psychotherapist and counselor, regardless of theoretical orientation, enters the relationship with a deeper, richer, empathetic understanding of how the brain has developed, which will enhance a

purposeful alliance. This is not a new concept to the counseling world. The relationship between counselor and client provides safety, security, warm and acceptance while simultaneously using techniques like perturbations, confrontations, and challenges that promote successful and meaningful work. That result in reductions of maladaptive symptoms and foster a relearning of strengths and self sufficiency.

Conclusion

Neuroscience offers a glimpse inside the brain of a client, which in theory could reflect what the brain had been exposed to when the current presenting issue was developing. This is helpful to a counselor because any information as to where a client may be developmentally, and any insight that may further effective interventions and treatment plans also influences the necessity and validity of therapy while ultimately helping the client. At the core of most therapists is a desire to be helpful to others. This is evident when one considers the characteristics of a professional therapist - kindness, warmth, unconditional positive regard, and a non-judging demeanor, to name a few. Neuroscience has provided exciting evidence that counseling really works. In fact, the psychological process of counseling can have a profound impact on the neuronal pathways of the client's brain. In the past, "hard-core" scientists considered psychopharmacology to be the ultimate answer because it involved chemistry changing the functioning of the brain. Now we know that the interpersonal experience of a counseling relationship can have an effect at the level of neural pathways. Information is shedding light on the once unknown realm of what happens to brains as a result of therapy. Exploring some therapies and theories may expand our understanding of how therapeutic interventions reduce symptoms and help the brain heal. By becoming acclimated to the ongoing discoveries made by neuroscience counselors will improve themselves. We know that in the end the client's well being is our greatest motivation. This paper supports, encourages and promotes the use of counseling as a viable means of treatment and effective brain based healing. Counselors can back up their optimism with reputable evidence that people do change and that counseling is a reliable way of helping

them. The outcome of project is clear; counseling is a real scientifically based, at the neuronal level, profession that is helping clients by ultimately healing their brains and changing their minds.

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