

Old Brains in a New World: A Manuscript Thesis

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Abstract

The human brain and nervous system have both adapted in direct response to the specific environmental pressures that existed tens of thousands of years ago. More recently (approximately the past 200 hundred years) societal evolution has occurred at a rate which has greatly outpaced human physiological evolution, and resultantly, in the year 2020 our ancient brains find themselves thrust into an intensely urbanized, high stimulus, post-industrial environment for which they have had inadequate time to adapt. This manuscript thesis describes, via five distinct examples (chapters), the manner in which our *old brains* struggle to function in this, the *new world*. Each chapter relies heavily on quite recent publications from the field of neuroscience to make its case, as it is contemporary neuroscience alone that is in position to elucidate the highly material underpinnings of the multiple psychological states or conditions which emanate from this old brain/new world conundrum.

In addition to examining several challenges that arise from the aforementioned condition, the thesis also looks at the manner in which our brains and nervous systems have evolved to thrive in the natural world and the extent to which a return to very old ‘ways of being’ can be restorative. While there may be little that can be done to combat urbanity and its corresponding assault on our senses, the literature on this topic provides both hope and wisdom for those in the counselling professions wishing to provide clients with the means to ‘go back to nature’ in hopes of mitigating the symptoms of psychological distress that arise from life in the 21st century.

The psychological basis of the metropolitan type of individuality consists in the intensification of nervous stimulation which results from the swift and uninterrupted change of outer and inner stimuli...with each crossing of the street, with the tempo and multiplicity of economic, occupational and social life, the city sets up a deep contrast with small town and rural life with reference to the sensory foundations of psychic life. The metropolis exacts from man as a discriminating creature a different amount of consciousness than does rural life. Here the rhythm of life and sensory mental imagery flows more slowly, more habitually and more evenly. Precisely in the connection the sophisticated character of metropolitan psychic life becomes understandable as over against small town life which rests more upon deeply felt and emotional relationships.(Simmel, 1950, p. 410)

Introduction and Thesis Statement

Exactly 30 years ago, neuroscientist Paul MacLean dropped a massive stone in the biopsychological pond, the ripples of which continue to be felt in the realms of neurology, behavioural psychology, traumatology and counselling. MacLean asserted that human beings have three distinct and fairly compartmentalized brain structures; the reptilian brain, the limbic system and the frontal cortex, all of which evolved in completely unique phases in human evolution and in response to unique selection pressures. The oldest structure, the reptilian brain was thought to be distinctly under control of most physiological functions (heart rate, respiration) as well as the mobilization of our ‘fight or flight response’ and is directly linked with adaptive, survival oriented behaviours (in fact, these brain region is also commonly referred to as the ‘survival brain’) (Bath, 2005). Wrapped around the ‘survival brain’ is the limbic system, a region of the brain associated with the generation and integration of emotion and memory (Bath, 2005). Finally, the neocortex (which, quite literally translates from latin to “new brain”), the most recently evolved brain structure, rests on top of the others and is responsible for the vast majority of the cognitive work that is unique to humans (e.g., planning, reasoning, interpreting language) (Reiner, 1990). In the thirty years of neuroscience research that has followed, Maclean’s model has functioned as somewhat of a ‘lightening rod’ in the brain science field to the extent that it has been alternatively; lauded, criticized for its over-simplicity or hierarchical nature (in which emotion is conceptualized as ‘less evolved’ than logical thought processes) or elaborated upon in an attempt to construct a more accurate model of human neurology which better explains why we are, the way that we are. What seems to remain within the academic literature is the notion that our brains, composed of both ancient and somewhat ‘newer’ components, often have trouble with the task of processing and integrating information from the world outside.

The function of this manuscript thesis is to examine, in some depth, several phenomena in the academic psychology/neuroscience literature that effectively characterize the challenges that our ancient brains (and nervous systems) face when attempting to function in the modern (read, post-industrial) world; an environment which can present as confusing in the best case, and terrifying in the worst. Two primary thesis statements, both of which are explored in the chapters below, emerge from a review of the literature. These are:

1. Our physiology (both neurological and physical), which adapted over tens of thousands of years in response to highly specific selection pressures, has not, in-any-sense, adapted to the stressors that the modern, highly urbanized world presents. In fact, the contemporary literature illustrates that many of the conditions that our clients live with, and that ultimately lead them into the counselling space, can be attributed to a breakdown in the ability of the ancient brain to function effectively in the modern context.
2. While the challenges our ancient brains face in navigating the contemporary world are daunting, we are not without hope. In fact, the literature on this topic describes a multitude of deceptively simple (and notably, non-pharmaceutical) interventions that have the capacity to both heal and re-integrate our ancient brains and bodies. These curative interventions are, in many cases, as old or older than human culture and often powerfully intertwined with our species evolution. It also worth noting that these ‘old world’ brain/body interventions are well within the domain of expertise of the modern-day counsellor/psychotherapist and appropriate as psycho-educational topics to be visited in the therapy space.

This topic is important as it directly addresses the manner in which the brain and nervous system physiology we all possess, collides with the modern urban environment (a context we are

not in-fact adapted to thrive within) as well as the mental health challenges that arise as a consequence of navigating this ‘new world’ with an ancient brain. There is not a single member of our species that can claim to enjoy access to upgraded physiological ‘hardware’ or ‘software’ that is specifically adapted to the industrialized world as it is in the year 2020. We are all in the same boat, therapist and client alike, tethered to our ancient physiology for-better-or-for-worse, and if we are to survive this marriage intact, we may need to better attend to those parts of ourselves which pre-date virtually all of our most precious cultural and technological innovations; for like many difficult partners, they are not changing any time soon.

Overview of Chapters

As opposed to examining the abovementioned phenomena more globally, I have elected to write a manuscript thesis and, in doing so, explore five areas of the literature that describe the ancient brain/modern world conundrum more intimately. These are described below.

- Paper number one, “*The Polyvagal Theory: Our Ancient Threat Detection Systems on High Alert*” examines some new understandings in the field of neuroscience with respect to the way in which our brain is ‘wired’ to detect and respond to threat and the manner in which the constant perception of danger in the modern world impacts our mental health. This chapter also describes the importance of both verbal and non-verbal communication in social and psychotherapeutic contexts.
- Paper number two, “*Psilocybin, A Novel Treatment for an Age-Old Existential Concern*” discusses the psychological phenomenon of death anxiety and examines the very contemporary literature on the use of psilocybin as a highly effective, non-pharmaceutical treatment option.

- The third paper “*Even Better than the Real Thing: An Examination of Internet Pornography Addiction Amongst Males and the Neurobiological Structures that Sustain it*” looks the role of the Ventral Striatum, an ancient brain structure involved in the generation of motivation, in the unintentional creation and maintenance of addiction to internet pornography.
- Paper number four, “*The Ancient Pathogen-Host Response: Inflammatory Origins Beget Modern Day Depression*” discusses the interplay between modern urban environments, stress induced inflammation and the genesis of mental health conditions. This paper also examines a number of ‘natural’ strategies aimed at reducing systemic inflammation.
- The fifth and final paper “*Blue Light Isn’t as Fun as it Used to Be: Artificial Light, Confused Biological Rhythms and the Production of Disease States*” focusses on the impact that artificial light (specifically blue wavelength light) has on our sleep/wake cycles and again, the mental health outcomes that stem from exposure to the wrong type of light at the wrong time.

About the Author

Ryan Payne is an M.A. candidate at the City University of Seattle and is completing his degree in Clinical Counselling. Prior to this degree, he completed a B.A. at McGill University in Montreal, PQ. He is responsive to both the ‘concreteness’ that the field of Neuroscience contributes to our understanding of human experience and consciousness and the abstract components of therapy relationships and client realities which may not be amenable to measurement. He hopes to work with humans once this degree is completed.

Definitions of Key Terms

* (all of the definitions below were derived from www.merriam-webster.com)

- Autonomic Nervous System: a part of the vertebrate nervous system that innervates smooth and cardiac muscle and glandular tissues and governs involuntary actions (such as secretion and peristalsis) and that consists of the sympathetic nervous system and the parasympathetic nervous system.
- Circadian: being, having, characterized by, or occurring in approximately 24-hour periods or cycles (as of biological activity or function)
- Cytokine: any of a class of immunoregulatory proteins (such as interleukin or interferon) that are secreted by cells especially of the immune system
- Diurnal: active chiefly in the daytime
- Dopamine: a monoamine $C_8H_{11}NO_2$ that is a decarboxylated form of dopa and that occurs especially as a neurotransmitter in the brain
- Dopaminergic: liberating, activated by, or involving [dopamine](#) or related substances
- Existential: of, relating to, or affirming [existence](#)
- Functional Magnetic Resonance Imaging (fMRI): magnetic resonance imaging used to detect physical changes (as of blood flow) in the brain resulting from increased neuronal activity

- Hyperarousal: excessive arousal : an abnormal state of increased responsiveness to stimuli that is marked by various physiological and psychological symptoms (such as increased levels of alertness and anxiety and elevated heart rate and respiration)
- Inflammation: a local response to cellular injury that is marked by capillary dilatation, leukocytic infiltration, redness, heat, and pain and that serves as a mechanism initiating the elimination of noxious agents and of damaged tissue
- Limbic System: a group of subcortical structures (such as the hypothalamus, the hippocampus, and the amygdala) of the brain that are concerned especially with emotion and motivation
- Melatonin: a vertebrate hormone that is derived from serotonin, is secreted by the pineal gland especially in response to darkness, and has been linked to the regulation of circadian rhythms
- Mysticism: the experience of mystical union or direct communion with ultimate reality reported by mystics
- Neurobiology: a branch of the life sciences that deals with the anatomy, physiology, and pathology of the nervous system
- Neuroplasticity: the capacity for continuous alteration of the neural pathways and synapses of the living brain and nervous system in response to experience or injury
- Neuropsychology: a science concerned with the integration of psychological observations on behavior and the mind with neurological observations on the brain and nervous system

- Neurotransmitter: a substance (such as norepinephrine or acetylcholine) that transmits nerve impulses across a synapse
- Para-Sympathetic Nervous System: the part of the autonomic nervous system that contains chiefly cholinergic fibers, that tends to induce secretion, to increase the tone and contractility of smooth muscle, and to slow heart rate, and that consists of a cranial and a sacral part
- Photo-Entrainment:
- Polymorphism: existence of a gene in several allelic forms
- Psilocybin: a hallucinogenic indole $C_{12}H_{17}N_2O_4P$ obtained from a fungus (such as *Psilocybe mexicana* or *P. cubensis* synonym *Stropharia cubensis*)
- Psychadelic: of, relating to, or being drugs (such as LSD) capable of producing abnormal **psychic** effects (such as hallucinations) and sometimes **psychotic** states
- Suprachiasmatic Nucleus: either of a pair of neuron clusters in the hypothalamus situated directly above the optic chiasma that receive photic input from the retina via the optic nerve and that regulate the body's circadian rhythms
- Sympathetic Nervous System: the part of the autonomic nervous system that contains chiefly adrenergic fibers and tends to depress secretion, decrease the tone and contractility of smooth muscle, and increase heart rate
- Vagal Tone: impulses from the vagus nerve producing inhibition of the heartbeat

- Vagus Nerve: either of the 10th pair of cranial nerves that arise from the medulla oblongata and supply chiefly the viscera especially with autonomic sensory and motor fibres
- Ventral Striatum: the part of the corpus striatum consisting of the caudate nucleus and putamen
- Vestigial: remaining in a form that is small or imperfectly developed and not able to function

Paper # 1 The Polyvagal Theory: Our Ancient Threat Detection System on High Alert

Our culture teaches us to focus on personal uniqueness, but at a deeper level, we barely exist as individual organisms. Our brains are built to help us function as members of a tribe...if we look beyond the list of specific symptoms that entail formal psychiatric diagnosis, we find that almost all mental suffering involves either trouble in creating workable and satisfying relationships OR difficulties in regulating arousal as in the case of becoming perpetually enraged, shut down, overexcited or disorganized...The standard medical focus on trying to discover the right drug to treat a particular ‘disorder’ tends to distract us from grappling with how our problems interfere with our functioning as members of our tribe (Van Der Kolk, 2013, p. 81)

Introduction & Orientation to the Paper

The notion that our modern urban existence, replete with its deadlines, traffic jams and other various outcomes of ‘progress’ (the list of which is too long to cite) has a direct impact on the functioning of our nervous systems is so self-evident, it hardly justifies a citation. Chronic overstimulation of our sympathetic nervous systems or *Sympathetic Overdrive* (Carnagarin et al., 2019) is not merely described within the academic literature. It’s played out in the mainstream media’s portrayal of the contemporary human condition and perhaps most pertinently, in the faces of our clients, many of whom come to therapy in the throes of the ‘downstream’ symptoms of chronic sympathetic activation (which include, but are not limited to, depression, anxiety and ‘burnout’).

Our contemporary medical system is quite literally overwhelmed with the sheer volume and scope of clinical outcomes that arise from these conditions; the psycho-pharmaceutical

complex, for all of its many advances, fails to keep up. The function of this paper is to examine emerging understandings pertaining to the function of the human nervous system and the implications that these understandings might have for the practicing clinician. And while the understandings (and potential clinical implications) themselves are novel, the physiology itself is as old as the human species and linked inextricably with the long and slow processes of evolution. The areas of foci within this paper are threefold:

- 1) To briefly describe the autonomic nervous system and the consequences of chronic, long-term dysregulation.
- 2) To review the major tenets of the Polyvagal Theory and explore three very diverse and contemporary (2017 and onwards) publications that describe its utilization.
- 3) To consider the implications of both the theory itself and the clinical work that has been performed/published *to date*, for current and future practitioners.

The Autonomic Nervous System and “Vagal Tone”

The Autonomic Nervous System (ANS) has two branches; the sympathetic branch, which is responsible for up-regulation of physiological status (“fight or flight”), and the para-sympathetic branch, which is responsible for the opposite. Engagement of the ANS is physically mediated by the Vagus nerve which originates in the brain, runs through the face, and terminates (and thereby communicates) in multiple organs within the human body. A limited capacity to ‘recruit’ or effectively mobilize the para-sympathetic branch of the ANS, or poor *vagal tone* as it is commonly described with the body of literature on ANS dysregulation, can result in prolonged states of *hyper-arousal*. In lay terms, poor vagal tone results in the ability to escalate physiological speaking, without being able to de-escalate in proportional fashion.

Within the literature, poor vagal tone and sympathetic overdrive are positively associated with aggressive behaviour (Scott & Weems, 2014), risky decision making (Acikalin & Shiv, 2016) as well as a host of negative physiological and disease states and negatively associated with the capacity to defer gratification (Sturge-Apple et al., 2016) and the expression of pro-social emotions such as empathy (Miller, Kahale & Hastings, 2017). In essence, what the literature suggests is that under conditions of ANS dysregulation we are somewhat different people than we might be otherwise. In a heightened or up-regulated state we are generally more fearful, more impulsive and over the long term, far sicker than we should be (the literature on ANS dysregulation and its relationship to physical well-being is far too broad to even consider within a paper of this scope). Given the breadth of social, interpersonal and physical consequences associated with ANS dysregulation, it seems fitting that we ask ourselves how, via the process of therapy, we might access the ANS in an effort to mitigate these outcomes? In what ways is the condition of ANS dysregulation amenable to therapy?

Enter The Polyvagal Theory: What is it, and Why Does it Matter Clinically?

Historical models of vagus nerve mediated ANS stimulation over-simplified the physiological pathway involved by pre-supposing a ‘uni-vagal’ model in which there is merely one site or ‘branch’ from which the vagus nerve originates in the human brain. Stephen Porges’ somewhat recently articulated polyvagal theory, perhaps not surprisingly posits that multiple pathways or ‘circuits’ within the human body, each of which were formed at distinct stages of human evolution, are involved in the activation of the vagus nerve (Flores & Porges, 2017). The most ancient, the dorsal-vagal complex evolved in early humans to facilitate a ‘freeze’ response in the face of threat (this response is well documented in the case-accounts of the victims of extreme trauma). The more recently evolved ventral-vagal complex is associated with the ‘fight

or flight' response in which the organism can activate the sympathetic nervous system to mobilize resources (i.e., increased heart rate, increased respiration, adrenaline) and respond to threat in an effective and adaptive fashion.

Perhaps the most important tenet of Porges' theory is the idea that the modern ventral-vagal complex is sensitive to input from the sensory-interpersonal domain. In essence, activation of the autonomic nervous system is mediated, to a great extent, by the cues we get not only from other people (facial expressions, body posture, tone of voice, etc) but from our own set of biological cues (as above, facial expression, body posture, tone of voice, etc) in the form of biofeedback. Put simply, as we evolved as a social (arguably a socially dependant) species, our brain physiology evolved concurrently to enable us to make judgements about the relative safety or threat that another human represented and mobilize resources accordingly. According to Porges' model, social interaction (in the healthy and "well adjusted" human brain) can catalyze both the sympathetic branch of the ANS (where threat is detected) causing escalation of physiology or the parasympathetic branch (where safety is detected) restoring calm. This psychological phenomenon is beautifully articulated by notable trauma therapist Bessel Van Der Kolk in his seminal work, *The Body Keeps the Score* (2013)

The Polyvagal Theory provided us with a more sophisticated understanding of the biology of safety and danger, one based on the subtle interplay between the visceral experiences of our own bodies and the voices and faces of the people around us. It explains why a kind face or a soothing tone of voice can dramatically alter the way we feel. It clarifies why knowing that we are seen and heard by the important people in our lives can make us feel calm and safe, and why being ignored or dismissed can precipitate rage reactions or mental collapse. It helped us understand why attuning with another

person can shift us out of disorganized and fearful states. In short, Porges's theory makes us look beyond the effects of fight or flight and put social relationships front and centre in our understanding of trauma. It also suggested new approaches to healing that focus on strengthening the body's system for regulating arousal. (p. 88)

Implications and Applications of the Polyvagal Theory

Porges' Polyvagal theory offers a powerful explanatory model for ANS dysregulation as well as a highly applicable theoretical paradigm for treatment. Porges asserts that accumulated traumatic experiences impact our clients' ability to properly engage in the evolutionarily honed process of *neuroception* (i.e., the process via which our nervous system collects sensory information and makes a determination about the safety of another person) which impacts their ability to correctly integrate and interpret *afferent* inputs from their social environments (e.g., facial expressions, vocal tones, body language, etc). This, in turn, functionally limits the extent to which they are able to mobilize their ventral-vagal complex and utilize their *vagal brake* (Flores & Porges, 2017) to limit escalation of the sympathetic nervous system (which, if left unchecked, can result in a fight/flight or immobilization/dissociation response). Within Porges' model, this represents the failure of a *phylogenetic hierarchy* or autonomic ladder of sorts in which the more recently evolved and pro-social ventral-vagal complex or *smart vagus* is meant to kick-in and regulate the ANS. To describe this phylogenetic hierarchy in lay-terms, one might state the we, as a species, have evolved brain structures which are adapted to recognize the intentions of others via their facial expressions, body postures and voices. When our interactions with others fail to make us feel safe and secure, we 'drop-down' an evolutionary 'ladder' and allow older brain structures that are responsibility for our safety and survival to take the wheel.

If, as according to Porges, an impaired neural/cortical response which occurs at the ‘level’ of social interaction and afferent input is the problem, what then, is the solution? How do we, as a professional group, utilize Porges’ theory in the design and application of treatments? Perhaps not surprisingly, highly pro-social, interactive therapies which are entirely focused on both the provision and interpretation of social information and subsequent the re-conditioning of the neuroceptive response and the ventral-vagal complex appear to be the answer.

Polyvagal Group Therapy.

In a 2017 piece, Flores and Porges describe how group psychotherapy, informed by polyvagal theory can aid clients in regulation of their ANS. According to the authors, the group functions as a real-time “neural exercise” which affords participants the opportunity to make “bio-behavioural adjustments of several psychosocial processes that are associated with attachment styles, emotion regulation, stress reactivity, and social relationships” (p. 202). In essence, group therapy informed by Polyvagal theory allows participants to bring their existing (and likely insecure) attachment styles into a setting which features both safe and realistic social conditions and effectively modify their emotional and physiological response to stimuli via a therapist mediated process. The group environment represents a safe and controlled space for participants to ‘do the work’, the end goal being that in-group improvements pertaining to attachment style, stress reactivity and ANS regulation (which the authors assert represents improvement in vagal tone) are also realized in the world outside of the therapy space. Flores and Porges (2017) describe the goals of the group:

The product of these (neural) exercises provides a more resilient “neural” substrate for the regulation of affect and interpersonal behaviours that can be used outside of therapy.

While it is important for attachment to occur, the neural exercises regulating

physiological state via neural (vagal) mechanisms provide the biobehavioral flexibility necessary to promote resilient and adaptable behavioural and emotional regulation.

(p.203)

In essence, group therapy functions as an exercise in *corrective neuroception*. The clients in the group often feel unsafe in social interactions and routinely interpret the physical cues of others as being threatening even when they are not intended to be, a vestige of human evolution (our neuroceptive responses are designed to keep us safe) that is complicated for group participants by a history of trauma.

The authors offer practical recommendations for those who might wish to conduct group therapy informed by polyvagal theory: Firstly, they suggest that we remain mindful of the social and environmental features that bias neuroception and endeavour to create an environment that feels *safe* for clients. Creating a context for neuroceptive safety requires maintenance of both environmental (e.g., soft lighting, chairs placed in a circular position to aid in social engagement) and social/interactive (e.g., body position, facial expression, voice prosody) variables. The authors posit that a safe neuroceptive environment is essential where this work is concerned as it enables clients to lower their evolutionary defences and bring their pro-social systems online, an event which necessarily precedes the beginning of meaningful adaptive work. Once the social engagement system has been activated and clients' sympathetic nervous systems are sufficiently subdued, the goal of therapy is to "exercise the vagal brake". In essence, this involves harnessing the attachment oriented 'conflicts' that arise as a function of authentic group communication (most typically described elsewhere as 'enactments') and taking time that might not exist in a 'real-world' context to pause, examine current state thoughts, affect and somatic states and ultimately, respond differently. According to the authors, aiding clients in the regulation of their

response to conflict (i.e., exercising the vagal brake) can, over time, improve vagal tone and correspondingly enhance ANS regulation. In summary, this exercise aids clients in strengthening the ventral-vagal circuit which is our first (hierarchically speaking), and most evolved pathway where ANS regulation is concerned.

Parent-Infant Attachment Therapy.

Perez and Sundheim (2018) describe a single case study in which the principles of polyvagal theory were harnessed to support an insecurely attached and subsequently hyper-aroused infant over a two-year period. Jon (the infant in the case) was gestated in challenging conditions that included maternal mental illness, homelessness, drug misuse and poor prenatal care. Jon's first two weeks of life were spent in the neonatal intensive care unit which the authors speculate further exacerbated his condition (from excessive handling via multiple caregivers). The study authors conceptualize the case as an example of multi-generational transmission of nervous system dysregulation as Jon's mother (Susan), having endured her own traumas, found herself unable to effectively co-regulate Jon's emotions. The function of the therapy was to utilize therapist attunement skills to create conditions of neuroceptive 'safety' for mother and child and, as in the example of group therapy above, lower their evolutionary defences and position themselves to engage in the adaptive work required to repair attachment relationships. The authors articulate the foundational role of polyvagal theory to their approach in the following passage:

Prosody of voice and facial expressions are important features of safety that set in motion the process of calming the limbic system and allowing an individual to participate in social engagement. Emotionally attuned interactions that are presented face to face with kind gestures and a soothing tone rather than signs of disapproval more

reliably mitigate fear and interrupt defensive behaviours. These favourable exchanges have the potential to regulate autonomic state so that infants can relate to their caregivers, especially if their neuroception is impaired due to a traumatic event that may undermine their sense of physical or emotional safety. (p. 146)

The authors of the study (who were also the mother-child dyad's therapists) applied the principles of polyvagal theory to multiple facets of the therapy work they engaged in with Susan and Jon. Firstly, as mentioned above, they created conditions of neuroceptive safety for both mother and child so that the dyad could begin therapeutic activities within their respective 'windows of tolerance'. The authors characterize this process as a 'lending' of attunement so that Susan, via the therapists regulated autonomic nervous system might, in turn, be able to respond to Jon in ways that had been previously not possible for her. Secondly, the authors provided Susan with psycho-educational support by working with her to identify and list the attachment behaviours that Jon used to signal distress and coaching her as to how to respond in a fashion that might support ANS co-regulation. Finally, the authors *modelled* for Susan, "how to respond in sensitive ways" to her son's early signs of distress, a process of observational learning which is speculated to have alleviated Susan's own symptoms of distress as she was able to see another caregiver successfully attune to her son.

Polyvagal-Informed Dance Therapy.

Gray (2017) describes the use of dance movement therapy (DMT) as a healing modality for survivors of the 2010 earthquakes in Haiti. The focus of what Gray calls polyvagal-informed dance therapy is to aid clients in shifting from a state of negative physical embodiment to a state of positive physical embodiment, or to quote Gray directly, allow clients to "inhabit their bodies in ways that they choose". The technical focus of DMT, as described by Gray, is to aid clients in

moving (via dance) through the physical “state shifts” associated with the various “bio-intelligent” responses to trauma in a way that acknowledges their important role in our survival.

Grey describes:

Rather than view negatively the dissolution to more primitive behavioural strategies and states that occurs when we are faced with unsafe and potentially traumatic events, the fear-based responses of mobilization (fight or flight) or immobilization (shut down) that can become the blueprint for traumatization are recognized and acknowledged as in service of survival and therefore worthy of celebration...When these bio-emotional reactions to a traumatic exposure leave long lasting imprints, resulting in states of traumatization and/or clinical diagnoses of PTSD, the state-shifts that occurred are also central to the restorative process. (p. 44)

In essence, DMT facilitates a ‘moving through’ of learned physical trauma as participants use physical movement to shift between feelings or experiences of neuroceptive danger and neuroceptive safety. The dance itself represents a form of full-body biofeedback (recall that our own facial expressions represent afferent data that can mobilize our ventral-vagal circuit) that aids participants in developing embodied feelings of physical safety.

Implications for Counsellors & Final Reflections

If we accept the proposition that ANS dysregulation is as prevalent as the literature suggests that it is, then the practical implications of implications of the polyvagal theory for counsellors are far reaching. It stands to reason that a great number of clients will *find their way* to therapy because they are “struggling” in some form or another, however many of these clients may lack perspective on the extent to which *trauma* has played a part in their lives, and manifests

within their bodies. Our first task as ‘polyvagal informed’ therapists is to utilize our own powers of neuroception in client interactions, not to assess our own safety of course, but rather, to allow our nervous system to collect information about the arousal level of the client sitting across from us. What are we feeling or, better yet, ‘getting’? How is their arousal level moving and shifting throughout the time we are spending together? What is their awareness around what is happening for them? Our second task (and arguably concurrent) task is to create conditions of neuroceptive safety for clients as described in the case examples above. The way that we sit, speak, use gestures and eye contact are all critical if we intend to let our clients know that they are indeed safe with us. It is this *present tense* safety that creates conditions in which clients can experience, over time, the kind of meaningful recalibration of the *smart vagus*’ response to threat that is described in the examples of group, attachment and dance therapy described above.

In concluding my reflections on the implications of polyvagal theory, I’d like to share the story of my very first client encounter, which was very much a lesson in polyvagal theory gone awry. I was working with a female domestic abuse survivor, and before we were even 30 seconds into our interaction, she described the many ways in which my general ‘way of being’ in the world was not working for her. “I don’t like the way you are sitting”, “I don’t like the way you are looking at me,” and “I don’t like the cadence of your speech” were the first three things she said to me (this was a lot to process in a first meeting). To be honest, the interaction made me highly defensive. I didn’t want to have to take responsibility for my face, my voice or my gender and my most powerful instinct was to conclude that this was all about her history of relational trauma and it had nothing to do with me at all (and perhaps further, that there was probably nothing I could do to help this person because she clearly need a female therapist). Encountering the writing of Porges has given me an entirely new perspective on this encounter, which is thus;

The failed interaction was all at once *all about her* and her here and now neuroceptive response (who else would it be about, she is the client) AND *all about me*, my size and my gender and the qualities of my voice. Perhaps most importantly, applying polyvagal theory to this case makes it clear that I, may have been exactly the person to help her given her history of traumatic interactions with her male partner. Perhaps, given time, we might have been able to foster trust and a sense of safety in our interactions that might have allowed for deeply reparative work to occur that, from the perspective of corrective neuroception, could be enhanced for this woman via working with a male therapist. It is interesting for me to consider the ways in which exploring Porges' work has dramatically changed the meanings I had initially assigned to this client interaction. I think this represents nothing less than a translation of theory to practice as the integration of a new idea (the polyvagal theory) lends new perspective on a past 'failure' and offers new potential responses or 'ways of being' where future interactions are concerned.

Paper # 2: Psilocybin: A Novel Treatment for an Age-Old Existential Concern?

The fear of death always percolates beneath the surface. It haunts us throughout life and we erect defenses - many based on denial - to help cope with the awareness of death. But we cannot keep it out of the mind. It spills over into our fantasies and dreams. It bursts loose in every nightmare...from the beginning of written thought humans have realized that everything fades, that we fear the fading, and that we must find a way to live despite the fear and the fading. Psychotherapists cannot afford to ignore the many great thinkers who have concluded that to learn to live well is to learn to die well. (Yalom, 2002, p. 124)

Introduction & Orientation to the Paper

Death has been with us for as long as has been life, and presumably, so has the uniquely human sense of existential dread that accompanies impending death. The goals of this paper are to, a) explore the concept of death anxiety as it exists in the academic literature as well as its psychological origins, and b) delve into the very contemporary literature on the use of psilocybin (a.k.a. “magic mushrooms”) in psychotherapeutic contexts as a means to alleviate the distress associated with end-of-life and, c) examine both the experiential and neuropsychological ‘mechanisms’ that facilitate improvement in both symptoms of distress and quality of life experienced by clients using psilocybin in end-of-life contexts.

End-of-Life Distress and “Death Anxiety”

Within the academic literature, two distinct search terms pertaining to the emotional and psychological burden associated with end-of-life amongst the aging yield results. The first, “end-of-life distress” tends to be both more clinically oriented (meaning that it shows up in studies about terminally ill clients in hospital settings) and broader in scope (meaning that it is applied to terminally ill populations of all ages). The search term “death anxiety” on the other hand, yields a broad array of literature that describes, quite specifically, the cognitive, emotional and deeply existential experiences that aging members of society, ill or otherwise, face when confronting their own mortality, Lehto and Stein (2009) define death anxiety as the “state in which an individual experiences apprehension, worry, or fear related to death and dying... a vague uneasy feeling of discomfort or dread generated by perceptions of a real or imagined threat to one’s existence” (p. 31). Cicirelli (2006) breaks this definition down further by clarifying the distinction between the dread of annihilation that is more generally related to the awareness of a future state in which there is an absence of existence versus the fear of the unpleasantness of death itself. Definitions aside, it is clear from even a cursory search of the literature that death anxiety is a verifiable and even quite palpable construct that intrudes upon the minds of aged members of society both within and outside of the context of palliative care.

Perhaps a first question that arises when contemplating the subject of death anxiety is *where does it come from and how and why exactly does it plague us?* Within the academic literature, there exist multiple answers to this question within the realms of psychology, religion and philosophy. Developmental psychologist Erik Erikson espouses the view that death anxiety is an end-of-life manifestation of the regret and despair that results from a lack of fulfilment and/

or self-realization. Erikson's lifespan, developmental perspective on death anxiety are described succinctly by Wink (2008) below:

On this view, a healthy developmental sequence leads from a basic sense of trust in childhood to self-realization in adulthood, followed by the attainment of ego integrity that allows the older adult to accept death with equanimity. In other words, a "healthy view" of death anxiety is based on the premise that in individuals are not so much afraid of death as of an incompleteness in their lives or the lack of self-fulfillment. (p. 94)

This lifespan identity-integrative view of the processing of life and death is encouraging as it provides somewhat of a roadmap or guide for 'how to live' one's life in such a way that, as death approaches, existential dread and anxiety will be lessened. Wink (2008) describes an alternative understanding on death anxiety (which he calls "the morbid view") which is somewhat of a departure from the integrative perspective described above. Within the morbid view, death anxiety results from the enormity and inescapability of the existential dread of death, a force so powerful that the very fabric of our society and content of our daily lives (e.g., rituals, social roles, values, customs, etc...) have been put in place to, in essence, numb us against the unbearable discomfort that accompanies death anxiety.

The above positions support the notion that death anxiety is a real, almost tangible construct that either a) arises as a late-stage developmental conflict of sorts (the Eriksonian view) or b), lies in the reeds for our entire lives and is masked only by the machinations of daily life (which are little more than a defence mechanism that keep our fears of death at bay). The commonality between a and b above is the lack of agency that those at end of life possess where

actually processing or ‘moving beyond’ powerful end-of-life fears, cognitions and emotions are concerned. In the Eriksonian view, the individual is at the end of their life looking backwards hoping to achieve the sort of ‘ego integrity’ that may bring inner peace as death draws near, however, the dying individual, in this instance, does not have the opportunity to ‘go back’ and make different decisions about their life should they find themselves in existential “despair”. In the ‘morbid view’, humanity is burdened with death anxiety throughout life; its manifestation in the subconscious is totally unavoidable. If we accept the proposition that death anxiety is an inevitable consequence of living, the question arises; what can be done to combat death anxiety and/or otherwise mitigate the unpleasant experiences that so many of us are required to live with at the end of our lives?

While the literature describes multiple avenues for the treatment of death anxiety, for the purposes of the present paper, the utility of psilocybin (a.k.a. ‘magic mushrooms’) will be described. Following a long (decades long) dormancy within mainstream academics, the medicinal and psychotherapeutic potential of traditionally recreational psychedelics (e.g., Ketamine, LSD, MDMA, Psilocybin) is once again being explored by mainstream researchers (in the case of Psilocybin, this work is occurring at Johns Hopkins in Baltimore). The objective of the remainder of this paper will be to explore, a) the history of psilocybin research within mainstream academia and a description of the current context, b) the *very* current clinical findings pertaining to the use of psilocybin as a treatment for death anxiety and, c) both the measurable neurosynaptic and more ineffable ‘mechanisms of action’ that seemly drive the transcendent clinical experiences that are described in the literature.

A Brief History of Psilocybin Research

The human species has had a long and complicated relationship with Psilocybin, the naturally occurring psychoactive compound found in over 100 species of “magic” mushrooms. Various indigenous societies have harnessed their transcendent psychedelic properties for millennia, often incorporating them into important sacramental contexts (Johnson & Griffiths, 2017). In the 1960s, the therapeutic potential of psilocybin drew the attention of mainstream Western academia but by the 1970s however, this emerging area of research was thwarted because “classic psychedelics were being used outside of medical research and in association with the emerging counter culture” (Johnson and Griffiths, 2017, p. 734), a happening which is described by Hendricks (2014) as “one of the greatest missed scientific and medical opportunities of our time” (p. 981). Quite recently however (the majority of the recently published research that includes human subjects is from 2015 and onwards), psilocybin research has experienced a renaissance of sorts as a ‘new wave’ of researchers has re-initiated formal academic inquiry into this important and long dormant domain.

Psilocybin and End-of-Life Distress

Much of the early research formal research on Psilocybin has focussed on its ability to ease distress associated with end-of-life. In a study that explored the potential for Psilocybin to reduce negative affect (both anxiety and depression) in patients with a life-threatening cancer diagnosis, Ross et al. (2016) found that a Psilocybin-based treatment “produced immediate, substantial, and sustained improvements in anxiety and depression and led to decreases in cancer-related demoralization and hopelessness, improved spiritual wellbeing, and increased quality of life” (p. 1173). In another study that examined potential therapeutic benefit of

Psilocybin for patients suffering from existential distress linked to cancer diagnosis, the authors identified a dose-effect with those consuming larger doses of psilocybin experiencing a proportionally larger reduction in negative affective symptoms; a finding the authors attributed to the “mystical” and “ineffable” qualities that occur only when higher, psychedelic doses of Psilocybin are administered (Griffiths, Johnson & Carducci, 2016). Psilocybin has also been utilized in the treatment of refractory depression (as a stand-alone diagnosis) and produced both immediate and sustained treatment effects in this context as well, and in many cases, yielding a remission in symptoms so profound that patients discontinued their use of antidepressants (Carhartt-Harris et al., 2018).

Mysticism as Mechanism; The Experiential Component

The mystical and experiential component of the psilocybin research seems to be, all-at-once, the most important *and* most confounding area of investigation in this burgeoning space. On the one hand, study participants across all of the literature reviewed, attribute time spent in this state as having been the key driver or catalyst of change where overcoming fear of death was concerned, and the academic researchers in the space (broadly speaking) can be described as accepting of this idea. On the other hand, the underlying neurobiological mechanisms associated with mystical brain states (or consciousness in general for that matter) are poorly understood at present which makes the application of traditional scientific methodologies challenging. Pahnke, (1969) provides both a classic and concise definition of mystical experiences:

Mystical experiences, whether drug-induced or not, include a sense of unity or oneness, transcendence of space and time, a sense of sacredness, a sense of deep truth or ultimate meaning (noetic quality), deeply felt positive mood, and ineffability (the inability to

describe the experience in words). These experiences were thought to enable lasting change in habitual patterns of thought, behaviour, experience of emotion, and personality. (p. 152)

As the quote above effectively illustrates, the mystical states that are so critically associated with change can be challenging for psilocybin users to ‘put into words’. In fact, within the literature in this area there exists significant debate as to whether the psilocybin ‘uninitiated’ are even capable of understanding or communicating about such states, the (controversial) extension of this idea being that therapists who would seek to harness the power of psilocybin as an adjunct to talk therapy need themselves, be psilocybin users.

Synaptic and ‘Whole’ Brain Level Mechanisms

While the existing body of literature illustrates that most hallucinogens (Psilocybin included) act on multiple serotonin receptors across multiple brain regions, it is speculated that their effect on 5HT_{2A} receptor density is of critical import (Bogenschuts & Forcehimes, 2015). 5HT_{2A} receptor over-density (i.e., too many receptors) is linked to a wide breadth of clinical symptoms including depression, anxiety, impulsive aggression and completed suicide, and is speculated to be involved in the *very pathogenesis* of these disorders (Eison & Mullins, 1996). Administration of Psilocybin in rat models has been shown to produce down-regulation of 5HT_{2A} receptors, a process which is speculated to be involved in the very powerful and sudden clinical responses described in the literature (Gresh et al., 2005.) Researchers, Bogenschuts and Forcehimes speculate that psilocybin, in addition to causing down-regulation of 5HT_{2A} receptors, also induces neuroplastic changes within the brain “suggesting a possible biological

basis” for the clinical outcomes attained in early psilocybin research (Bogenschutz and Forcehimes, p. 394).

While the above-mentioned research on the effect of psilocybin at the neurotransmitter/receptor level is critical where understanding the underlying mechanisms of biological action is concerned, it does little to explain the inducement of the highly ‘mystical’ states which research participants in the rapidly growing body of publications on the effect of psilocybin so strongly attribute to change. Perhaps contemporary brain imaging studies have a greater capacity to inform our understanding of what is happening during ‘the trip’ itself. It appears that Psilocybin has the effect of reducing the amount of “within region” communication within the brain while at the same time increasing the amount of “between region” communication (Carhartt-Harris,2018). Put simply, the brain shifts from a highly compartmentalized mode of functioning in which various brain regions perform their duties, segmented from each-other to a more *integrated* form of functioning in which greater interconnectivity between regions is observed.

Implications for Counsellors & Final Reflections

It seems that an important question to ask ourselves (as therapists) is what does this burgeoning area of research actually mean to us? In what ways might significant shifts in how mainstream science views the use of certain psychedelics influence us in our work? Are there potentially new avenues via which we might better serve our clients? Are there ethical responsibilities that we now face (e.g., education, additional training and licensure) or will soon face as our field potentially shifts around us? While the questions posed above may not have answers at present, counsellors (both new to the field and experienced) need reconcile

themselves to the following truth: Our clients are beginning to view psilocybin (and psychedelics in general) as potential therapeutic options, both as an adjunct to talk therapy and as a ‘stand-alone’ treatment.

As registered clinical counsellors/psychotherapists, we constantly contend with the very real challenge of working in an unregulated professional environment in which our clients can, without prejudice or limitation, seek out the services of unregulated counsellors (who may offer psychedelically aided interventions) should they decide that our methods are not allowing them to ‘go deep’ enough or progress quickly enough. When considering all of the above, it seems important that we as counsellors and the various colleges and legislative bodies that both support us and define (read, limit) the scope of our services continue to move in lockstep with both our clients who may be demanding these services and the academic institutions which are rapidly constructing a body of evidence that describes the therapeutic efficacy of psilocybin. Failure to adapt our services in these times of changing public perception and scientific reality could result in both a loss of clientele and an erosion of trust between the members of our ‘guild’ and the public-at-large whom might like to believe that we will do whatever we can to alleviate their suffering.

A review of the early academic research in this domain yields two truths. The first, is that there is seemingly tremendous potential to uncover a ‘new’ paradigm for the treatment of death anxiety. The second, is that the formal research in this area is only in its infancy and the mechanisms of action poorly understood. One might surmise that those of us in the mental health field that are interested in harnessing the potential of psilocybin in our work with clients facing end-of-life will need to either wait for the research process to unfold on its own time or risk stepping outside of the boundaries that our respective colleges may be prepared to maintain. In

any case, it appears that the use of psychedelics in mainstream therapy applications may be an idea whose time has come.

Paper #3: “Even Better Than the Real Thing”: An Examination of Internet Pornography Addiction Amongst Males and the Neurobiological Structures that Sustain it”

I'm in my room, consuming, cyber, and confused. I don't remember the last time I made something besides blunts, cum, minimum wage, bad grades, a noose. Sometimes I know I'm just twiddling my thumbs in front of a screen, That the songs about the money make me fake feel rich too. That the porn gets weirder, life gets shorter, and I eat shit stew. That these unrealistic characters I play make me feel strong. That I'm screaming at plastic that did nothing wrong.

That I'm hurting and escaping and yearning and breaking. That underneath this hole, I may actually have some flair. Sometimes I'd like to leave my room and go see what's out there.

Would you like to go with me?

— Karl Kristian Flores, Can I Tell You Something?

Introduction & Orientation to the Paper

Male consumption of pornography has changed. The rapid development of the internet has, in one generation, led to a massive increase in the sheer volume of pornography that is easily accessible to males of all ages (Wallmyr & Welin, 2006). This is coupled with an upward trend in both the sexual intensity of the genre as well as the diversity of depictions of human sexuality that can be explored (Porn Hub, the world's most utilized, web-based pornography streaming service has over 100 possible categories to browse, allowing the viewer to curate their pornographic experience with remarkable specificity). In response to this proliferation of material and increased ease of access, males are watching more pornography than ever before,

with the majority of men (59%) viewing internet pornography weekly and a smaller subset (14%) viewing daily (Sun, Bridges, Johnson & Ezzell, 2016). This ‘perfect storm’ of variables has resulted in the American Psychiatric Association’s inclusion of pornography addiction in the DSM 5 as a classifiable disorder with “bio-behavioural markers” that overlap with other substance-related addictions (Ruffle, J.K., 2014).

If there exists an increase in the availability, intensity and diversity of pornography that is available, the following questions arise. Firstly, can excessive pornography consumption truly be considered an addiction, and if so, what is the specific biological mechanism(s) via which this addiction is both created and maintained? Secondly, and in keeping with the overarching theme of this thesis, in what sense has the ancient brain been effectively ‘hijacked’ by stimulus it encounters in the modern context and in what sense has the evolutionary function of specific brain regions been thwarted? Finally, what are the ‘downstream’ developmental, emotional and relational impacts that pornography addiction is having on those living with it and what are the implications for those in the counselling professions?

The Ventral Striatum & Its Evolutionary Function

In order to contextualize addiction in general in neuroanatomical and evolutionary terms, it is of critical import to highlight the role of the ventral striatum (VS) brain region. The VS is embedded within the brain’s basal ganglia structure, a region which is primarily responsible for coordinating motor activity, and communicates heavily with, and between the cortex (higher thought processes) and the limbic system (survival, fight or flight). The VS is a critical component of both the motor and reward systems and is core to the functioning of dopaminergic reward circuitry in humans (Behrendt, 2012). The specific role of the VS is to anticipate and

detect rewarding stimuli and is directly linked to the creation and maintenance of both motivation and behaviour in humans. Additionally, the VS, in concert with a number of other brain regions (specifically, the amygdala and hippocampus which are associated with the processing of emotions), encodes memories and provides important contextual information necessary for adjusting motivation. Our genetic ancestors' ability to thrive, or even survive was inextricably linked to this specific reward circuitry as it directly increased 'fitness' by perpetuating behaviours that produced rewarding, or survival oriented effects. The VS provided for our ancestors, the neural machinery to distinguish potentially fruitful behaviours from fruitless ones, the motivation (via dopamine mediated reward circuitry) to act, and perhaps most importantly, gifted them (via linkage to the amygdala and hippocampus) the emotional memory associated with fitness oriented behaviours that served as the precursor to behavioural maintenance (Behrendt, 2012).

Very contemporary research suggests that the VS has played an even greater role in our evolution than originally thought. Raghanti et al., (2018) take the position that the VS is linked to the evolution of complex, and uniquely human pro-social and emotional responses such as empathy, conformity and altruism and that the ability to both produce and experience these emotions gave rise to our (humans) capacity to live communally in tribes. The authors describe:

It has always been difficult to account for the evolution of certain human characters such as language, empathy, and altruism via individual reproductive success. However, the striatum, a subcortical region originally thought to be exclusively motor, is now known to contribute to social behaviours and "personality styles" that may link such complexities with natural selection. We here report that the human striatum exhibits a unique neurochemical profile that differs dramatically from those of other primates. The

human signature of elevated striatal dopamine, serotonin, and neuropeptide Y, coupled with lowered acetylcholine, systematically favours externally driven behavior and greatly amplifies sensitivity to social cues that promote social conformity, empathy, and altruism. We propose that selection induced an initial form of this profile in early hominids, which increased their affiliative behavior. (p. 1108)

This research suggests that while the VS, in early humans, facilitated survival-based behaviours at the individual level, as we continued to evolve, the VS played an important role in bringing us together at a collective level. Further, the VS and its highly specific, dopamine mediated, reward and reinforcement mechanisms became forever enmeshed with our social reality and very human needs to derive safety, security and ultimately, reward from our interactions with fellow members of our species. All told, the importance of this small, and uniquely human brain region is difficult to overstate. When we ‘feel good’ because we have stuck with our exercise plan, experienced the benefits of hard work, made a new friend or simply provided aid to a neighbour in need, our VS is behind it.

The Ventral Striatum & The Neuroscience of Addiction

Considering the important role that the VS plays in both the motivation and reinforcement of behavior, it is perhaps not surprising that it has been demonstrated in the scientific literature to be centrally involved in the development and maintenance of a wide variety of addictions/addictive behaviours (note; the literature on this subject is sufficiently vast as to warrant its own thesis). Deserno et al., (2015) describe succinctly, the process by which this ancient brain region is effectively commandeered by modern day addictive stimuli. The authors describe in the passage below:

Drugs of abuse elicit dopamine release in the ventral striatum, possibly biasing dopamine-driven reinforcement learning towards drug-related reward at the expense of non-drug-related reward. Indeed, in alcohol-dependent patients, reactivity in dopaminergic target areas is shifted from non-drug-related stimuli towards drug-related stimuli. Such 'hijacked' dopamine signals may impair flexible learning from non-drug-related rewards, and thus promote craving for the drug of abuse. (p. 478)

The research on the implication of the VS in establishment and maintenance of addiction is both vast and broad (i.e., there is a lot of it and it is described in the context of a multitude of addictions). Linnet et al. (2010) demonstrated the involvement of the VS in a study of pathological gamblers and were able to establish that neurological activity and dopamine metabolism were heightened in the VS as gamblers 'chased their losses' (a finding which is consistent with the evolutionary function of the VS to motivate activity via the anticipation of positive outcomes). The involvement of the VS has been demonstrated via functional magnetic resonance imaging, (fMRI) a somewhat novel and highly dynamic brain imaging technology in which electrical changes in the brain's various regions can be observed in real-time, in both alcohol (Deserno et al., 2015) and cocaine (Contreras-Rodriguez et al., 2015) misuse disorders.

The Ventral Striatum and Pornography: An Evolving Lens

The idea that internet-based pornography addiction is comparable to substance addiction is within the literature, somewhat contentious. As a result, the field of neuroscience has been 'late to the game' with respect to the examination of a possible neurobiological basis for pornography addiction with the vast majority of studies having been published in 2015 and

beyond. That being said, this area of inquiry appears to be rapidly evolving as there are a number of compelling studies within this burgeoning space.

Brand et al. (2016), in a study of nineteen heterosexual males, were able to demonstrate elevated VS activity when subjects were viewing preferred pornographic content (when compared with a condition in which they viewed non-preferred or neutral content). The authors also determined that VS activity was positively correlated with subject self-report of pornography addiction. These findings, taken together are important as they suggest that the activation of the VS occurs in response to highly specific vs more general sexual stimuli (which is consistent with neurological models of addiction from other domains) and that there may be a magnitude effect, meaning that there is seemingly more activity where there is greater self-report of addiction. Gola et al. (2017) found increased VS activity amongst males with self-reported pornography addiction in a specific experimental condition in which cues predicting erotic images were presented. This finding is salient as it demonstrates that pornography addiction does, in neurobiological terms, very much function like gambling or substance addictions to the extent that the “neural and behavioural mechanisms associated with the anticipatory processing of cues predicting erotic rewards relate to clinically relevant features of pornography addiction” (Gola et al., 2017, p. 2021). Put simply, it is the ‘excitement’ associated with sexual imagery that is to come that drives brain activity as opposed to the actual viewing of explicit imagery.

Pornography Consumption and Behavioural Outcomes Across the Lifespan

If we accept the proposition that a) pornography is in fact addictive and b) pornography addiction, neurobiological terms, resembles substance addiction the question following question arises; What are the behavioural outcomes of this addiction and how are those living with it

adversely impacted? An exploration of the literature suggests that exposure to pornography has a negative impact on adolescent self-assessment of sexuality via comparisons to others (in this case, male pornographic actors serve as a reference group as opposed to same-aged peers). Sun et al. (2016) found that adolescent males that regularly accessed pornography developed a broad range of insecurities which included concerns about their ability to perform sexuality, the size of their penis, premature ejaculation and even their ability to maintain an erection for an adequate period of time. Research by Weber, Quiring and Daschman (2012) concluded that regular exposure to pornography during adolescence is correlated with poor overall body satisfaction as well as beliefs that similar others (*in this case peers*) engage in comparatively more frequent sex and sex that more closely resembles that which is portrayed in pornographic films (*i.e., more partners, more variety of sexual positions and greater female arousal/enjoyment*).

In addition to impacting adolescent attitudes towards themselves, their bodies and their sexual behaviours, exposure to pornography has downstream consequences in the behavioural domain as well, as exposure is directly related to earlier and more pronounced sexual experimentation, unsafe sexual practices amongst teenagers and increased sexual objectification of females (DasGupta, 2017). The available research suggests that pornography presents adolescent males with an airbrushed and orgasm saturated representation of human sexuality that is challenging to attain in reality. Although a great many adolescent boys are not sexually active, this does not preclude them from deeply processing pornographic images as they seek to define their own sexual identity, sense of self-worth and concept of self in relation to others.

The preponderance of research that looks at pornography exposure amongst young men leans heavily on social script theory in order to understand both the process by which young men integrate information from pornographic films into their own identity, as well the downstream

behavioural outcomes. Social script theory, first described by Psychologist Silvan Tompkins, posits that most people's social behaviours are guided by patterns that are comparable to written scripts which provide a cognitive template that suggests which events should happen, when they should happen, and how (Simon & Gagnon, 1984). The work of Zhou and Paul (2016) illustrates that social scripting occurs in the context of pornography exposure/identity development as well, as pornography provides users with a sexual template that instructs young men as to what a sexual situation *is* (e.g., a business meeting between two colleagues, house-call from a repairman or an audition for a part in a film) the events that should or should not happen in said situation (e.g., who initiates sex and how sex transpires), how people should respond in/to the sex situation (i.e., the level of openness and erotic reposes of the female) and finally, what the consequence of the sex situation will be. In subsequent research on pornography and sexual scripting by Sun et al. (2016), the authors state the following:

We, too, find that pornography is not mere fantasy or an individualized experience for men. Instead, our findings are consistent with a theory suggesting that pornography can become a preferred sexual script for men, thus influencing their real-world expectations...our research indicates that such pornographic preferences are not benign for either the male consumer or his sexual partner(s)
(p. 990)

While the process of identity development via pornographic scripts is troubling, it is again, the potential downstream behavioural outcomes exhibited by males that over-integrate pornographic scripts that are most worrisome. These include enhanced sexual aggression toward female partners (Sun et al., 2016), decreased gestures of intimacy such as laughing and kissing (McKee, 2010) an increase in higher-risk sexual behaviours (Das Gupta, 2017) and acquired

sexual dysfunctions (e.g., intimacy, inability to ejaculate) that are the result of a rewiring of the brain's arousal system (Park et al., 2016).

The research surrounding male pornography consumption and isolation is troubling as it draws direct relationships between pornography, and the tendency to withdraw from real-life intimate relationships. Lambert, Negash, Stillman, Olmstead and Fincham (2012) found that pornography consumption has a directly inverse relationship with commitment in males (i.e., the greater the porn consumption the less likely the viewer was to engage in a monogamous relationship). Malcolm and Naufal (2016) expand on this finding by asserting that for many males, pornography serves as a full-out substitute for marriage as it represents a low pressure, low cost and ultimately low-effort alternative to engaging in an actual relationship. While these studies seem to suggest that pornography consumption is a function of a desire for ease and simplicity, other research suggests that it is-in actuality-an acute symptom of a complex and pre-existing tendency to struggle in relationships. In pornography and loneliness by Butler et al. (2018) men who identified as regular pornography users gave higher scores on the following survey questions; *“How often do you feel that your relationship with others are not meaningful? How often do you feel that no one really knows you well? How often do you feel isolated from others? How often do you feel that people are around you but not with you?”* These responses, as well as the broader study conclusions of the authors point to a complex and bi-directional relationship in which loneliness led to more porn consumption, which in turn led to more loneliness. The authors describe:

Long term effects of pornography use include increased loneliness and relational isolation and deterioration, potentially setting up a behavioural entrapment.

Pornography use that is only temporarily palliative while failing to address root

causes of loneliness, and which in turn intensifies triggering conditions, qualifies it as a maladaptive coping strategy and creates the possibility of destructive entrapment in a recursive cycle of pornography use and loneliness. (Butler et al. p. 135)

Interestingly, Research by Popovic (2011) suggests that men who regularly use pornography don't in truth wish to experience detachment and isolation, and that in fact, more regular pornography users exhibit a greater craving for intense and authentic intimacy than their peers who are not regular pornography users. Amongst married men (those who have arguably already succeeded in the intimacy vs isolation stage) research indicates that adult males who watched pornography in the past year were more likely to be divorced and/or engaged in extramarital affairs and less likely to be happy in their marriage than their peers (Doran and Price 2014).

Implications for Counsellors & Final Reflections

The implications of the above analysis for counsellors in the field are many. Firstly, familiarity with the recent findings pertaining to the behavioural outcomes of pornography addiction could be useful both diagnostically and from a treatment perspective. Those in our field are (often) trained to understand the various behaviours and emotions associated with the more common and well understood substance addictions (e.g., compulsion, action, guilt, shame) and this training provides us with the ability to normalize these behaviours for our clients as we support them in moving through the inevitable 'stages of change' journey they must undertake as they challenge the role of the addictive agent in their lives. The reviewed literature tells us (thus far) that pornography addiction may cause men to develop unrealistic ideas about their own

bodies and the bodies of their potential partners, integrate unrealistic and sometimes violent ‘scripts’ pertaining to what constitutes normal or expected conduct. They are also lonelier and less often satisfied with the rewards that real companions can offer, opting instead for the dopamine rush proffered by an endless stream of anonymous companions offering the promise of ‘something exciting’ around the corner (or alternatively, a few mouse-clicks away). These behaviours, and their associated outcomes at the relationship level could be viewed as the symptoms of the addiction and serve as very helpful ‘goalposts’ for the supporting therapist.

Understanding the role that the VS plays in the creation and maintenance of pornography addiction is critical as well as it contextualizes both the addiction and its behavioural outcomes in biological terms, effectively making the case that, as far as our evolutionary brain is concerned, there is nothing at all unique about pornography addiction. In fact, when understood via brain imaging techniques, it is the same as most all other addictions and is a disease of anticipation to a greater extent than it is a disease of gratification. Put another way, it is not the viewing of pornography itself that is reinforcing but rather, the anticipation of viewing explicit images that the clinician might choose to attend to. It is through understanding our ancient brain structures, their evolutionarily honed functions and the manner in which these functions have been ‘co-opted’ that we can understand our modern-day clients at the behavioural level. In the case of the VS, it is this understanding that allows us to aid our clients (individual or couple, gay or straight) in understanding why it is they feel, on a deep level, that their computer is even better than the real thing.

Paper #4: The Ancient “Pathogen-Host” Response: Inflammatory Origins Beget Modern Day Depression

Depression and inflammation are intertwined, fuelling and feeding off each other. This bidirectional loop, in which depression facilitates inflammatory responses and inflammation promotes depression, has clear health consequences. Heightened inflammation characterizes a number of disorders and systemic diseases, including cardiovascular disease, diabetes, metabolic syndrome, rheumatoid arthritis, asthma, multiple sclerosis, chronic pain, and psoriasis; each of these also features an elevated risk for depression. (Kiecolt-Glaser, J. K., Derry, H. M., & Fagundes, C. P; 2016, p. 1076)

Introduction & Orientation to the Paper

Our inflammatory response has been with us since the beginning; a predictable and very natural response to ancient environmental stressors. When our ancestors’ skin was pierced by a sabre-toothed tiger (or unfriendly neighbour), an inflammatory response kicked in and closed their wound before harmful and often life-threatening pathogens entered the bloodstream. While this evolutionary “pathogen-host response” (Miller & Raison, 2016) was key to the survival of ancient humans, something has gone awry where this protective ‘mechanism’ where modern humans are concerned. In the present context, we are beset by stressors at every turn; Poor drivers, deadlines at work, the bills we have to pay, etc, all of which are stressors that our ancient brains have trouble distinguishing from the life threatening ones that our ancestors were forced to contend with. Enter, the evolutionarily honed inflammatory response, which is deployed by our bodies to facilitate safety, but in the process, wreaks havoc on our physical and mental health on

a variety of levels. The purpose of this paper is to examine this ancient response and its specific role in the development of mental health pathology amongst modern humans.

The above quote, borrowed from the 2015 journal article titled “Depression Fans the Flames and Feeds on the Heat” describes the clear linkage that exists between inflammation and depression. Despite this established relationship, the vast majority of treatments for depression are focussed on neurotransmitter modulation, an approach which proves ineffective for a significant subset of patients for whom symptoms of depression are driven, to a great extent, by the presence of inflammatory cytokines. The following literature review, which describes a small number of seminal studies in some depth, focuses firstly on the evolutionary role of inflammation and its harmful manifestation in present day humans as well as specific genetic factors that contribute to risk. Secondly, this review examines (briefly) modern pharmacological approaches to the management of inflammation, contrasted with some ‘not so modern’ behavioural approaches in hopes of providing a limited overview of a multi-pronged approach to treatment.

Inflammatory Depression: Our Genetic Legacy

Authors Miller and Raison, in an article aptly titled “The Role of Inflammation in Depression” (2016) assert that the inflammatory response was helpful to early humankind as it allowed for the organism to continue to attend to their environment in real-time (which was of course, key to survival) while inflammation protected a wound or fought a pathogen. They argue that this response is less adaptive in the modern context in which organismic survival is less of a minute-to-minute proposition. They cite the facts that a) the inflammatory response, replete with a flood of harmful cytokines, is exhibited in modern humans engaging in behaviours that pose no

real threat to survival (such as public speaking) and b) the probability of depression is proportionally related to the magnitude of the inflammatory response (i.e., the larger the experience of the stressor, the greater its impact). The authors posit that humans have inherited an “inflammatory bias” or genomic susceptibility to inflammation and subsequent depression as a function of the adaptive advantages that this response conferred in a pathogen rich and threat filled environment. In short, modern humanity’s battle with depression is in large part attributable to a vestigial mechanism passed down from our early ancestors. Further, the authors identify common behavioural symptoms of depression and anxiety such as anhedonia (leading to withdrawal and retreat) and hyper-vigilance (resulting in hyper attentiveness to one’s environment) as evolutionarily adaptive responses to prolonged periods of inflammation.

Barnes, Mondelli and Pariante (2017) synthesize a wide breadth of primary research on the topic of inflammation and depression and looks specifically at genetic susceptibility to inflammation and it’s corresponding influence on the presentation, incidence and severity of depression. The authors reviewed 113 separate studies that looked at the relationships between genetics, inflammation and depression and limited study inclusion to those published between 2000 and 2016 in order to synthesize current perspectives. This review begins where the research by Miller and Raison left off by establishing the evolutionary function of inflammation in protecting our ancestors from exposure to pathogens and violent conflict (they compare our present-day inflammatory response to heavy artillery that has been abandoned at the site of a battle that is no longer being waged). Barnes, Mondelli and Pariante add clarity and depth to the evolutionary/geonomic position by describing the genes in which polymorphisms (detailed explanations of specific gene polymorphisms have been omitted from this paper but can be found

in the full review) contribute to depression and the specific impact these genes have on the actual presentation of illness. The table below summarizes key findings presented.

Gene	Review Findings on the Effect of Polymorphism
IL1b	Earlier onset, greater severity, less response to SSRIs
IL6	Cluster of fatigue, pain, sleep disturbance and depression
IL10	Associated with major depressive disorder
MCPI	Associated with MDD, BPD and increased suicidality
TNF	Major depression within the elderly
CRP	Severe depression, anxiety and adolescent emotional difficulties
Phospholipase A2	Increased experience of somatic symptoms

The authors generate a variety of conclusions and potential implications/applications from their synthesis of the current research on this topic. Firstly, they argue that understanding how genetic variants (polymorphisms) impact the development of depression will allow for advances in the identification (via genetic biomarkers) and pharmacological treatment (via highly tailored interventions) of vulnerable individuals. Secondly, the posit that an enhanced understanding of the role that genetics plays in inflammation could facilitate the development of a new “framework” or “theoretical model” that can draw together the fields of pharmacology, nutrition and behavioural/psychosocial approaches to patient care.

Novel Pharmacological Approaches?

Pharmacological interventions for depression most typically act at the level of the neurotransmitter (as is the case with selective serotonin reuptake inhibitors, or SSRIs) and while they are effective for a great many sufferers of depression, for many ‘refractory’ depression sufferers, they are not. Could a pharmacological approach that aims to address and mitigate the

ancient, inflammatory roots of depression be of utility? In a 2013 animal study conducted by Maciel et al., the authors sought to examine the effect that the administration of a selection of anti-depressant and anti-inflammatory drugs would have on mice with medically induced, chronic inflammation. Laboratory mice in this study were administered (via unilateral paw injection) with either an inflammatory agent in the experimental group or saline in the control group. A variety of different pharmacological agents were tested on the mice in the experimental condition and their inflammation measured via both biological indicators and behavioural tests. Biological indicators included IL-1b, BDNF (markers of inflammation) and were measured at multiple points throughout the four-week study. Behavioral measures included the tail suspension test (in which the mouse is suspended in the air by its tail and the time it takes for the rat to become immobile measured) and the forced swimming test (in which the mouse is forced to swim and the time to immobility measured). The working model or assumption in the above behavioural tests is that there is a correlation between time to immobility and depression with a lower time to immobility signifying greater depressive symptoms.

While several pharmacological agents were utilized in this study the authors observed a pronounced change in both physiological and behavioural measures in the specific condition in which mice were administered a combination therapy consisting of sub-clinical, oral dosages of both Celoxib and Bupropion. In this condition, depression and inflammation indicators in mice in the experimental condition (FSA injection) mimicked those of mice in the control condition (saline injection only). The authors attribute this outcome to a 'synergistic effect' that occurs when these two agents are administered simultaneously and conclude that this combination approach may effective in preventing or reversing symptoms of depression in those managing chronic inflammatory diseases.

Behavioural Interventions Which Address Systemic Inflammation

What does the contemporary research tell us about non-pharmacological interventions for depression with inflammatory origins? What might those without prescription pads (i.e., clinical counsellors) discuss with their clients while collaborating to develop behavioural strategies to improve well-being? Authors Miller and Raison (2016) offer a shockingly simple intervention for combatting depression which is to simply ‘get back to nature’. The authors posit that all humans co-speciated (which, in lay terms simply means to evolve ‘alongside of) with the flora and fauna that were abundant in their native genetics environments, and that a proximal relationship to these “old friends” as the authors describe them conferred substantial anti-inflammatory benefits. Miller and Raison (2016) describe this relationship in detail below.

Increasing evidence suggests that this pattern of widespread immune dysregulation may result from disruptions in our relationship and/or contact with a variety of co-evolved, non-lethal immunoregulatory microorganisms and parasites, especially commensals and symbiotes in the microbiotas of the gut, skin and nasal and oral cavities, that were ubiquitous in the natural environments in which humans evolved. Although widely disparate, these organisms (often referred to as ‘old friends’) share a tendency to reduce inflammation and suppress effector immune cells through the induction of IL-10 and transforming growth factor- β (TGF β) while promoting the development of anti-inflammatory immune cell populations, such as alternatively activated (also referred to as ‘M2’) macrophages and regulatory to various cultural changes, including the loss of exposure to microbial diversity with the advent of sanitation practices, modern humans

now lack this immunoregulatory input — especially during infancy and childhood.(p. 24)

Walsh et al. (2016) examined the impact of a mindfulness-based therapy intervention (MBI) on inflammation (measured through inflammatory markers present in saliva) in a cohort of moderately depressed university-aged women. The authors assessed depression via the “Centre for Epidemiological Studies for Depression Scale” (CES-D) and divided subjects (those with a score greater than 16 on the CES-D) into a four week mindfulness group (N= 31) consisting of mindfulness training, body scan, sitting meditation and yoga *or* a contact control group (N = 33) in which participants merely filled out questionnaires with the research team. Members of both groups were subjected to a baseline assessment prior to the research intervention in which salivary levels of IL6 and TNF-a (both of which are inflammatory cytokines with specific linkages to depression in the literature) were measured. Salivary IL6 and TNF-a were assessed in both groups at the conclusion of the four-week research period and again in the mindfulness group at three months post-study.

The results of this study were somewhat surprising as the MBI group showed a greater reduction in salivary IL6 and TNF-a (which the authors correlate with a greater reduction in inflammation) while *both* groups showed similar improvements in depression scores (based-on follow-up CES-D scoring). Those with higher baseline depression scores were correlated with greater reductions of inflammatory cytokines in the MBI group compared with the control group. The authors conclude MBI training may be more beneficial to those suffering with more severe depression.

Holt-Lunstad et al. (2011) examined the influence of spiritual well being on cardiovascular risk in a sample of 100 adults (both male and female). A wide range of physiological markers correlated with heart disease were measured including blood pressure, CRP (which was the only direct marker of inflammation taken), blood glucose and blood lipids. The Functional Assessment in Chronic Illness Therapy - Spiritual Well-Being Expanded Scale (FACIT-Sp-Ex) was used to assess spiritual well-being. In addition to items that measure spirituality directly, this assessment tool also includes items that look at the variables of meaning, peace, faith, love, gratitude and fulfillment. The authors reported a statistically significant correlation between spiritual well-being and CRP which was independent of stress, depression, alcohol consumption and exercise (possible confounds within this study). The authors call for more studies that examine the multiple components of religiosity and spiritual well-being to further elucidate the mechanistic pathways.

Implications for Counsellors & Final Reflections

The studies summarized in this paper are a sampling of the burgeoning literature around a novel paradigm for understanding depression and implications for treatments that target inflammation. Future directions in pharmacological research on this subject may focus on the optimization of combination therapies which harness knowledge from the disparate fields of Psychiatry and Internal Medicine (e.g. Rheumatology, Cardiology). Advances in genetic science may continue to elucidate the specific inflammatory mechanisms which give rise to depression in vulnerable individuals, allowing future generations of clinicians to develop genetically tailored approaches that prevent inflammatory depression before it begins. Finally, the literature reviewed suggests that many of the solutions to the problem of inflammation may be found in very old, and often forgotten cultural behaviours (e.g., spirituality, meditation) that have been

with us much longer than modern science. The sum total of all of the information on this topic may well yield a multi-disciplinary approach that is inclusive of multiple fields of medicine, modern genetics, behavioural science and religion. To conclude (and add some perspective), our once protective inflammatory response co-evolved with us over tens of thousands of years and only recently, and in a very modern context, has this mechanism failed us. Perhaps if we, over the next few decades, can understand and address the problem of inflammatory depression, we can claim to be making 'good time'.

**Paper # 5: “Blue-Light Isn’t As Fun As It Used to Be” : Artificial Light, Confused
Biological Rhythms and the Production of Disease States**

Thomas Edison’s seminal invention of the electric light bulb in 1879 brought unprecedented possibilities, and the American inventor is attributed with once remarking, “The doctor of the future will give no medicine, but will instruct his patient in the care of the human frame, in diet, and in the cause and prevention of disease.”

Little was he aware that mistimed use of his great gift to the world is now one of several human-imposed environmental changes that predispose us to many diseases by way of circadian rhythm and sleep disruption (Potter et al, p. 584)

Introduction & Orientation to the Paper

One of the hallmarks of modern human society is our desire, and corresponding capacity, to re-shape the natural world so that it better conforms with our preferred reality. In our species-wide quest for the attainment of ‘more of everything’ we have refused to be limited in our productivity by the cycles of the natural world in which we live; ancient cycles that for eons governed both the sleep-wake and seasonal energetic patterns of our ancestors. As the quote above describes, the development of stable artificial light in 1879 ushered in a new era and in fact, a complete and total new way of being for our species. In a single leap, the dull orange glow of candlelight was replaced by a vivid incandescent pseudo-sun which, in addition to keeping our workspaces alight, sent a powerful message to our ancient brains. “It remains day.”

While this technological innovation undoubtedly allowed us to make tremendous progress on a variety of fronts, it is not without consequences. The function of this paper is to examine both the physiological and psychological illnesses that plague post-industrial humanity

as a function of our departure from our natural relationships with time, light, seasons and sleep. Framed as a question, how have we, a species that evolved over tens of thousands of years to have a highly intricate relationship with the sun, responded to a shift in our relationship to light which has been both sudden and virtually ubiquitous? How are our ancient brains and bodies adapting to this rapid ‘modern world’ shift?

The Science of the Circadian Rhythm & Photo-Entrainment

An exploration of the physiological effects of artificial light first invites an explanation of the sleep wake cycles that have governed our species for millennia. Humans are a diurnal species (the opposite of nocturnal) which, put simply, means that our species evolved to be wakeful and productive when the sun is up, and to sleep when it is not. According to Perelman et al. (2011) this evolutionarily honed sleep/wake pattern conferred many survival advantages for our ancestors (e.g., hunting and gathering during the day, being active while predators might be viewable). Photo-entrainment is the specific process by which the organism effectively synchronizes its diurnal sleep/wake schedule with its external environment, which-in plain terms-allows the organism to intrinsically ‘sense’ the time, which in turn gives rise to the grounding biological rhythm that catalyses a host of other important physiological processes (Bedrosian and Nelson, 2013).

Specifically, photo-entrainment is “mediated by intrinsically photosensitive retinal ganglion cells that project light information to the suprachiasmatic nucleus (SCN) region of the hypothalamus” (Bedrosian and Nelson, p. 751). The SCN is widely understood to be the ‘molecular clock’ amongst almost all species of mammals and is completely dependant on both light and dark input in order to establish and maintain sleep/wake rhythm. In either the complete

absence of light or alternatively in prolonged and unnatural exposure to light (which is of course the phenomenon up for discussion within this paper) this internal clock becomes confused.

Altered Rhythms: A Problem of Both ‘What’ and ‘When’

While it is established that the disruption of our circadian rhythms is a ‘brain level’ phenomenon (albeit, one which is mediated by retinal input), the question that arises from the above description of the specific physiology involved is ‘how is artificial light, (and specifically, light at night or LAN), in the modern industrial era essentially hijacking our ancient sleep/wake physiology’? As it turns out, the answer to the above question contains both ‘when’ and ‘what’ variables. The ‘when’ refers to the secretion of melatonin, the neurochemical that is responsible for the onset of ‘sleepiness’ and which is rhythmically secreted from the Pineal gland, a small pinecone shaped structure at the very core of our ancient brains. The production of melatonin has a direct and proportional relationship to light exposure which can be understood simply as ‘more light equals greater suppression of melatonin’ whereas light deprivation produces the opposite (Busceimi et al., 2005) . For our ancient ancestors, the role of light in their lives was remarkably simple (i.e..when the sun retreated from the sky, they had no access to a light source which would mimic natural light) and correspondingly, their melatonin metabolism was as well. In summary, the timing of, or exactly ‘when’ we as humans encounter large doses of natural light (or, for the purposes of this paper, light which our brain interprets as natural light which can be generated by a variety of sources including televisions, cell-phones, laptop devices overhead lights) matters greatly as it is this, and only this, which triggers either melatonin production or suppression, a biological occurrence which effectively catalysis our diurnal sleep wake pattens (Busciemi et al., 2005).

The 'what' within the overall equation refers to the type, or specifically the wavelength of light that is so abundant in the modern world. While the flicker of candlelight or the flame from a fire may have kept our ancestors awake, in no way did it commandeer our melatonin metabolism by effectively mimicking the light of the sun in the fashion that contemporary lighting does. Modern light sources increasingly emit a 'blue' wavelength of light which maximally activates the photosensitive cells in the retina, thereby impacting melatonin metabolism. Pauley (2004), in a paper in which the author characterizes fluorescent lighting as a public health issue, explains:

Because, much of the daytime work force in the industrialized world is exposed to dim office lighting instead of bright sunlight, and because at night we are often exposed to bright lights with blue wavelengths instead of natural darkness, some researchers believe that adequate human circadian entrainment does not take place. Without a normal cycle of MLT inhibition and production responding to cycles of light and dark, human health may be negatively affected (p.590)

To summarize, modern humans, particularly those of use living in highly industrialized environments, are exposed to the wrong type of light (what) and often at the wrong time of day (when); a convergence of factors which is too great for our ancient brains to override. The logical question that follows is; what are the consequences of this so-called public health issue? What are the specific physical and psychological effects of circadian rhythm disruption and how are these effects distributed across the global population?

Influence of the Modern Light Environment on Physical and Mental Health

Within the literature, circadian rhythm disruption has been linked to a wide variety of physical and mental health disorders. Ekkel-Mehan (2013) reported that exposure to LAN directly alters feeding behaviours and has direct influence on both insulin metabolism and body mass. The authors also found that, amongst a sample of shift-workers, LAN (and corresponding circadian rhythm disruption) was associated with increased risk of obesity, type 2 diabetes, high blood pressure and coronary artery disease. He, et al. (2011) established a relationship between circadian rhythm disruption and the development of breast cancer amongst European shift workers, and further, demonstrated a linear relationship between years of shift work and disease prevalence at a population level.

With respect to mental health presentations specifically (which is, of course, the jurisdiction of those in the counselling professions) circadian rhythm disruption has been linked to a number of common conditions. According to Walker et al. (2020) there is a clinical relationship between both the presentation and severity of major depressive disorder and circadian disruption. The authors describe below:

Clinical studies demonstrate that the severity of MDD is correlated with the degree of misalignment of circadian rhythms. Further, examination of circadian patterns of gene expression within postmortem brains of patients with MDD demonstrate reduced amplitude, shifted peaks, and altered phase relationship between genes, particularly in canonical clock genes. (p. 5)

Circadian rhythm disruption has been directly associated with the development of anxiety disorders in animal models (Tapia-Osorio, 2013) and indirectly linked with the induction of

bipolar episodes amongst those travelling between time zones (Young, 1995). What is perhaps most striking about the available body of literature describing the psychological effects of circadian rhythm disruption, particularly that which is the result of blue wavelength light exposure, is the consistent call for additional investigation. It is quite clear (to this author at least) that this is an area of inquiry that is in its infancy in some regard. Perhaps this is a function of the fact that, despite artificial lighting having been a staple of our existence for over 100 years, the widespread use of compact fluorescents (i.e., blue lights) is relatively novel.

Geography and Urbanity as Key Drivers

Unlike the vast majority of modern-day illnesses, socio-demographic status is not protective (and may in fact be predictive) where the consequences of circadian rhythm disruption are concerned. Cinzano et al. (2016) estimate that 99% of the population of the developed world is exposed to LAN on a nightly basis, and it stands to reason that exposure is amplified amongst those living in densely concentrated urban areas (rich and poor alike). Secondly, where geography is concerned, there is evidence that populations in northern latitudes have greater year-round exposure to artificial light as a function of necessary infrastructure (i.e., more blue wavelength light exists in these areas as a matter of necessity in the wintertime when the days are short) (Monsivais et al., 2017). These findings taken together are quite interesting as they fly in the face of generations of ‘social determinants of health’ research which serves to support the fact that the poor, not the rich, bear the burden of both mental and physical illness in unequal proportion. The emerging research on LAN and circadian rhythm disruption moves in the exact opposite direction, suggesting that both urbanity and distance from the equator, both of which are often associated with development and wealth, are positively correlated variables. This is an

interesting finding for those of us providing counselling services in the Lower Mainland of B.C. and supporting clients for whom the abovementioned mental health conditions persist.

Implications for Counsellors & Final Reflections

While the various presentations of anxiety and depression are not new to the field of counselling and psychotherapy, much of the novel evidence in this emerging domain of research may very well not be. The question what to do with the findings generated via this new paradigm comes to the fore for counsellors and medical professionals alike. In a 2016 systematic review on the subject titled “Circadian Rhythm and Sleep Disruption: Causes, Metabolic Consequences, and Countermeasures” Potter et al., offer a number of practical solutions for health care professionals who might be interfacing with clients impacted by disrupted sleep and therefore in a position to provide psycho-educational resources on this topic (interestingly, this is the only publication the author could locate that offered such insights). Pragmatic behavioural interventions include sleep extension (which is merely ‘science-ese’ for spending more time in your bed), improved sleep hygiene (which mostly pertains to the maintenance of highly regular sleep patterns) and regular exercise. Additionally, it is well within the control of the individual to evaluate and potentially reconsider their relationship with ‘screens’ in general, at least where use in the home is concerned. While these interventions are easily understandable and are perhaps even within the domain of common sense, the authors also provide some additional suggestions which may be less intuitive. Time restricted feeding (TRF), a process in which all calories are consumed within an eight hour window, thereby leaving the remaining 16 hours of the day for a cycle of fasting, is associated with the correction of gene clock rhythms due to the fact that “the molecular clock is intertwined with the metabolic state of the cellular environment” (p. 608).

Exogenous consumption of melatonin is also cited as a simple, non-pharmacological intervention which is proven effective in restoring healthy sleep/wake cycles.

While the above interventions are both a) readily implementable at the individual level and, b) appropriate for discussion within the counselling space where and when clients are seeking behavioural strategies to manage their sleep, challenges at the broader societal level will inevitably remain. The sheer ubiquity of objects emitting 'blue-light' in the home, and perhaps more to-the-point, in the workplace and society at-large represents a very real and quite difficult to reverse challenge to our collective sleep/wake status. It may be wise for those in the counselling professions to distinguish that which is within our clients' realm of control and that which is not and direct client conversations towards the former in hopes of creating client agency and efficacy in a world that seemingly never sleeps.

Conclusion

The five chapters above, when taken together, make a compelling case that our human brains and nervous systems are facing significant challenges in adapting to our immediate environment, and that these challenges can often manifest themselves in the types of clinical presentations and symptomatology that are so often seen in the counselling space (e.g., interpersonal distress, nervous system dysregulation, depression, anxiety, addiction, etc...). It is worth noting that the chapter topics selected by the author within this thesis represent only a fraction of the overall subject space. That is, there are innumerable additional topics, most of which are significant areas of clinical research in their own right, that demonstrate with equal force, the fact that our old brains struggle, and even suffer, in this new world.

The collected chapters above make the case that human evolution has unfolded in direct response to conditions which in very few ways resemble life in highly urbanized, post-industrial societies, and that, on a physiological level, we are by no means perfectly suited for our environment. As the chapters within this thesis illustrate, our current brain and nervous system physiology is the direct by-product of a complex ecological 'web' of systemic relationships that have included our sun, the flora and fauna present in our native genetic environment and other members of our own species. Over hundreds of thousands of years it was these relationships that, via the processes of evolution and cospeciation, shaped us. The end product of this highly intricate process is a somewhat ironic or even cruel paradox; The client sitting across from you is all-at-once a remarkable member of a species that has adapted to survive *and* an individual whose highly specialized brain and nervous system is failing to cope.

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