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## The Effects of cellular theta breathing meditation on cell mediated immune response: A controlled, randomized investigation of altered consciousness and health

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THE EFFECTS OF CELLULAR THETA BREATHING MEDITATION ON CELL  
MEDIATED IMMUNE RESPONSE: A CONTROLLED,  
RANDOMIZED INVESTIGATION OF ALTERED  
CONSCIOUSNESS AND HEALTH

by

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A dissertation submitted in partial fulfillment of  
the requirements for the

**Doctor of Philosophy in Anthropology  
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May 2010**

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**The Graduate College**

**We recommend the dissertation prepared under our supervision by**

**Marjorie Diane Hardgrave**

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**May 2010**

## ABSTRACT

### **The Effects of Cellular Theta Breathing Meditation on Cell Mediated Immune Response: A Controlled, Randomized Investigation of Altered Consciousness and Health**

by

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Medical anthropology is well positioned to make contributions to consciousness research based on biocultural approaches that integrate methodologies from the biological, behavioral and social sciences to explore aspects of human health. The ubiquity and perseverance of health related activities involving altered states of consciousness (ASC) across cultures past and present suggest that these potentials are deeply rooted in human sociocultural evolution. Analyzing the relationship between immune function and meditative ASC represents an effort to empirically investigate the adaptive value of these human potentials.

A controlled, randomized investigation of two meditation practices was conducted at the University of Nevada, Las Vegas to determine how ASC-meditation might influence immune function. In the 3 week study of 13 subjects, a gentle breathing meditation technique called Cellular Theta Breathing (CTB), was compared against a mindfulness guided meditation (GM) technique and a reading control activity with respect to quantitative and qualitative outcome measures. Biomarkers including antibodies against the Epstein-Bar Virus (EBV) and salivary cortisol were measured in addition to qualitative assessments of consciousness states, reported levels of anxiety, and perceived personal meaning associated with each activity.

CTB meditation activity was found to generate statistically significant reductions in measured anxiety. CTB also produced statistically significant increased frequencies of ASC when compared to GM and the control activity. CTB and GM resulted in statistically significant occurrences of 5 ASC characteristics (sound, temperature, physical sensations, emotion and time distortion) compared to the control activity. CTB generated a statistically significant frequency of 2 ASC characteristics (sound and physical sensation) compared with GM. Results suggest that increased episodes of altered consciousness characterized by changes in physical sensation, sound, temperature, emotion and time distortion during CTB and GM are linked with lowered anxiety and subsequently have an indirect influence in immune competence. No significance for salivary cortisol was indicated in either meditation technique or the control. CTB was found to have a measurable impact on EBV ( $p=0.06$ ) antibody titer levels. However this finding should be tempered by the presence of outlier and disproportionate leverage values. EBV antibody reduction was statistically significant for all subjects during the first week of the study and 62% of subjects ended the study with reduced EBV antibodies compared to beginning baseline levels, suggesting that participation in the study improved immune system functioning for study participants. Results also show that when ASC characteristics, lowered anxiety and ascribed meaning were simultaneously present, EBV antibodies were reduced twice as much as during CTB compared to GM, and 4 times as much compared to the control. Findings suggest the combination of ASC, ascribed meaning, and lowered anxiety impact EBV antibodies. The presence of ascribed meaning and perceived anxiety reduction implicate socio-cultural factors in cell-mediated immune function and provides supportive evidence for the biological efficacy of

culturally mediated healing-orientated practices involving ASC so common in the ethnographic record.

In loving memory of Marjorie Nell Pearsall and Herbert Elmer Nell  
Your guidance, wisdom and love demonstrated  
no star is beyond reach.



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## CHAPTER 1

### INTRODUCTION

#### Problem Statement

Meditation is a mental exercise practiced with the intent of achieving a heightened state of awareness which often involves an altered state of consciousness (ASC). Historically, meditation practices have predominately been connected with eastern religious traditions (Walsh 1983) although nearly all major religious traditions have some form of focused contemplative practice (West 1987). In western cultures, the practice of meditation in association with health and well-being is immensely popular and widespread. Salmon et al. (2004) point out that meditation in western psychology emerged as a strategy to reduce suffering associated with psychological distress and illness. A significant and growing interest in the clinical applications of meditation (Goleman 1990), have fueled endeavors to incorporate meditative practices in medical and health care domains. This is most evident in the area of stress reduction within complementary and alternative medicine programs (Stoyva and Carlson 1993; Shapiro and Schwartz 2000).

The term meditation represents a variety of practices and methods that intentionally self-direct attention through a systematic focus on specific aspects of internal and/or external experience (Walsh 1990; Austin et al. 2003). A central feature across divergent meditation methods is the regulation and allocation of attention (Davidson and Goleman 1977). In practice, meditation is a complex mental process involving physiological changes in cognition, affect, perception and autonomic activity (Winkelman 1996; Newberg and Iverson 2003) and has been shown to be beneficial for clinical and non-

clinical populations. Research on the effects of meditation indicate lowered respiration, heart rate and blood pressure (Yen et al. 1996; Stone and DeLeo 1976), moderation of emotional arousal (Aftanas and Golosheykin 2005) and decreased symptoms of anxiety (Speca et al. 2000; Carlson et al. 2001; Brown and Ryan 2003; Carlson et al. 2003; Shapiro et al. 2003; Tacon et al. 2004; Tacon et al. 2005). These findings have encouraged investigation into meditation's influence on a host of medical conditions such as chronic pain, eating disorders, psychological and physical distress (Baer 2003; Chiesa and Serretti 2009). While the vast literature on meditation from a variety of disciplines attributes numerous health benefits and favorable biological concomitants to various forms of meditative practices, research in this area is far from exhaustive. This is, in part, due to the many different types of meditation and the methods used to study them.

#### Altered States of Consciousness (ASC)

A key characteristic of meditation is the alteration of consciousness where distinct states of awareness are induced. Winkelman (1986b, 1992, 2000) specifies three forms of ASC: possession, shamanic and meditative. During possession an individual is 'occupied' by a spirit or entity with abrupt and dramatic behavioral alterations. Possession ASC is exemplified by physical convulsions, memory loss and seizures that result in a dramatic change in appearance, behavior and vocalization. Possession is generally found in stratified hierarchal societies and linked to socio-political oppression. Shamanic forms of ASC involve ritual activity that operate through the sympathetic nervous system via auditory driving (drumming, chanting etc) or physical exertion (dancing, physiological extremes etc.). Soul flight is commonly associated with

shamanic forms of ASC where the individual leaves their physical body, while maintaining awareness during interactions with the spirit world. Meditative ASC is linked with numerous spiritual traditions, and generally induced by decreased sensory exposure and internal focused attention (Walsh 1990). The objective is to achieve a non-judgmental emotional detachment in the experience of one moment to the next.

### The Ubiquity of ASC in the Cross-Cultural Record

Nearly all societies entertain one or more culturally sanctioned procedures for the induction of ASC (Bourguignon 1973). The persistence of socially sanctioned ritual activities involving ASC across cultures in both the past and the present (Winkelman 1986, 1993, 2000) suggests that the practice of meditative ASC may reflect long-standing adaptations of consciousness embedded in the nervous system of humans (Freese and Kulcsar 1989; Bouguignon and Evascu 1977; Winkelman 2009). Fischer (1992) posited that varied forms of ASC can be considered in terms of those that activate the sympathetic nervous system and those that are controlled by the parasympathetic nervous system. The involvement of the paleomammalian or the limbic brain during altered consciousness and the cross-cultural prominence of ASC suggest that evolutionary factors may have contributed to adaptations that selected for the capacity for ASC during the course of human evolution. A relationship between immune function and the practice of altered consciousness through meditation would lend evidence to the selective advantage of ASC.

### Understanding the Potential Health Benefits of Meditative ASC

Divergent techniques of meditative ASC share primary physiological similarities that entail parasympathetic control of brain and somatic functions that are potentially health

promoting. Clinical applications of meditation continue to gain prominence in health settings, especially in area of stress reduction, emerging in the 80's with the mindfulness work of Kabat-Zinn (1982). Presently, mindfulness meditation is commonly applied in outpatient behavioral medicine settings as part of a complementary and alternative intervention method (see Salmon et al.) The regulation of mental focus during meditative ASC has been shown to influence attention and emotion processes with a potentially durable impact on the brain and behavior (Lutz et al. 2004; Brefczynski-Lewis et al. 2007; Lutz et al. 2008). Teasdale et al. (1995) found the attentional control of meditation beneficial in preventing reoccurring episodes of depression cognitive therapy patients. Meditative ASC has also been connected with changes in endogenous neurotransmitter release within the brain (Kjaer et al. 2002; Meyer and Quenzer 2005) and decreased age-related reduction in cortical thickness (Lazar et al. 2005; Xiong and Doraiswamy 2009). Perhaps the most widely agreed upon health benefit of is stress reduction (Kabat-Zinn 1982, 2005; Kabat-Zinn et al. 1992). It is also widely agreed upon that the need for further interdisciplinary study of meditative ASC as it relates to health is warranted (Baer 2003; Shigaki et al. 2006; Toneatto and Nguyen 2007).

### Overview of Cellular Theta Breathing (CTB)

Cellular theta breathing (CTB) is a meditative technique believed to alter consciousness. The purpose of CTB is to intentionally enter an altered state of consciousness, specifically the 'theta [brainwave] state' through a slow rhythmic breathing process. Practitioners describe specific and non-normative visual experiences often accompanied by audio and physical sensations during CTB. Reduction in pain,



deep insight to personal problems, extraordinary experiences, and improved health and well-being are also attributed to this meditation practice. A preliminary study of CTB and its effects on language (Hardgrave 2003) demonstrated statistically significant changes in language patterns that suggested practitioners entered an altered state of consciousness during the meditation. The study also found altered language patterns were greatest when participants reported having an experience they felt was meaningful (Hardgrave 2003).

### Research Aims and Questions

The overall aim of this research explores the potential health benefits of CTB as a specific form of meditative ASC by extending the parameters of the pilot study where personal accounts of experience and meaning during the practice of CTB are considered alongside identifiable bio markers for immune response. In addition, this research seeks to determine if the potential health benefits of CTB are distinct from relaxation response characteristics associated with mindfulness-based meditation less often and strongly associated with ASC Specifically, this study asks:

1. Does CTB as a meditative ASC practice show any measureable effect on immune response biomarkers?
2. What relationship, if any, exists between the meditative ASC practice of CTB and stress as indicated by the State-Trait Anxiety Inventory and measured hormone levels of salivary cortisol?
3. How are the subjective experiences of persons engaged in CTB described and evaluated by those who experience them?
4. How does CTB compare with the mindfulness-based GM practice with respect to immune response biomarkers, experience and measured stress?

5. How does this inform medical anthropology and further our understanding of the health benefits attributed to meditative ASC in cross cultural contexts?

### Overview of Dissertation

Chapter 2 situates the investigation of ASC and health in the broad context of evolutionary theory and further contextualizes the meditative ASC within the framework of medical ecology and psychoneuroimmunology. A literature review on states of consciousness in general, and within the discipline of anthropology in particular, is presented in Chapter 3. This chapter also reviews current research on meditation health in terms of physiology, stress reduction and immune function. Chapter 4 addresses research methodology, study design and protocol, in addition to methods of assessment and analysis. Qualitative and quantitative study results are discussed in Chapter 5. A discussion of study findings and implications for future research are addressed in Chapters 6 and 7 respectively.

## CHAPTER 2

### THEORY

#### Theoretical Contexts

Anthropology's initial and long standing analytical method addressed social variation in terms of cultural structures, processes and function. This comparative method gave way to the theory of 'cultural evolutionism' in the later nineteenth century era of Darwin. Cultural evolutionists of this period such as Tylor (1871) and Morgan (1877) linked cultural evolution with progress. As inferior beliefs were replaced by more logical superior concepts, a society's condition would improve in what Sanderson (1990) refers to as a unilineal doctrine of progress. By the mid-Twentieth Century, evolutionary typologies such as the processual distinction between bands, tribes, chiefdoms and states (Sahlins and Service 1960) represented the theoretical extension of these earlier ideas.

About the same time, a new evolutionary approach in anthropology began to take hold. Cultural ecology narrows in on the available resources and subsistence mechanisms that enable humans to successfully adapt to the natural environment (Steward 1955). The role of the environment, demography, technology, social structure and economy are considered in determining a society's mental and social conditions. Proponents of cultural ecology argued for comparing and contrasting structure and function in past and present societies from which relationships can be hypothesized. The results were explanatory models that correlate social organization (White 1949) and complexity (Service 1958) with economic (White 1959), political (Harris 1968, 1979) and subsistence activities (Steward 1955). Within this context, adaption rather than progress was primarily used to explain cultural forms of development, preservation and change.

During the Sixties, cultural ecology began to move away from an evolutionary centered approach toward a focus on specific elements of culture for their specific adaptive attributes. Harris (1966) and Rappaport (1967) characterized this approach utilizing systems theory as a model to investigate how cultural practices function to optimize adaptation and uphold an existing ecosystem. More recently, Kottak (1999) has stated there are no isolated ecosystems. Human cultures and populations are interlaced at local, regional, national and global levels that require both theoretical and practical applied approaches to ecological issues and their implications (Kottak 1999).

### Evolutionary Medicine

Classic Darwinian evolutionary theory rests on the premise that specific characteristics within a population change over time from one generation to the next through adaptation where individuals with biological characteristics, acquired through randomized variation, best suited to a given environment, survive and reproduce with greater frequency than do individuals who lack those features. This process is the hallmark of Darwin's (1859) theory of natural selection where reproduction, inheritance, variation and competition functioned as the driving mechanisms of evolution. During the 1930s a major paradigm shift emerged based on the heredity unit of genes referred to as the Modern Synthesis (Mayr and Provine 1980). A key distinction in Modern Synthesis theory is the recognition of several driving mechanisms of evolution in addition to natural selection. Genetic variation within a population occurs by mutation, alterations in gene frequency, genetic drift and gene flow (Smocovitis 1996).

Evolutionary medicine perspectives on disease produced a gene centered view of evolution (Williams 1957; Nesse and Williams 1994; Dawkins 2009). Within a bio-medical context, illness is viewed as a departure or differentiation from health and is approached in terms of bringing the specific biological units, and systems back to a state of healthy functionality (Trevathan 2007). Weiner (1998) argues that medicine has taken a mechanistic or proximal approach to disease although the basis for a given physiological function is both proximate and ultimate. This position is echoed by Nesse (2008) who posits that while proximate bio-medical explanations for disease indicate what is happening within the body of an individual, an evolutionary approach is required to explain why and how societies, populations and individual humans are similar in way that render them vulnerable to disease. The significance of this perspective is evident in Livingstone's (1958) work on the relationship between genes, disease vectors and culture where the highly prevalent sickle cell allele offers selective resistance to malaria. Ewald (1993) dismisses the view that genes alone dictate disease, arguing that a disease simply caused by genetic factors alone would be eliminated by natural selection over a period of time. Ewald (1995) proposes that many diseases are really the result of slow acting viral and bacterial infections.

Humans have the unique capacity to apply cultural features consisting of symbols, ideas, behaviors and technologies toward an integrated strategy of adaptation. Jablonka and Lamb (2005) acknowledge this holistic capacity in presenting four key inheritance systems of evolution on which natural selection can operate: genetic, epigenetic (non-DNA inheritance), behavioral and symbolic. Working from the recently developed paradigm of the Developmental Origins of Health and Disease (DOHAD), biological and

medical anthropologists have shown how many non-genetic physiological illnesses may be adaptive responses to environmental cues (Kuzawa 2008), and that these traits can be inherited over multiple generations (Benyshek et al. 2006; Drake and Walker 2005). Anthropological researchers have also identified the utility of evolutionary medicine regarding contemporary health challenges facing modern populations. This is exemplified by evidence that mother-infant co-sleeping is not only beneficial but may protect against sudden infant death syndrome (SIDS) (McKenna 2000; Ball 2003) especially when joined with breastfeeding (McKenna and McDade 2005). Anthropological contributions to evolutionary medicine provide socio-cultural, political, ecological contexts regarding health that highlight both proximate and ultimate cause of health and disease.

### Medical Ecology

Medical Ecology is a holistic approach to health that utilizes concepts from the four major fields of anthropology, as well as biology and ecology to consider a broad range of factors that influence health and disease (Fabrega 1972). As such, all facets of health are viewed as a dynamic, adaptive process where genetic and biological processes and systems are irrevocably integrated with environmental factors mediated through cultural behavior within an ecological framework. The basic principle of medical ecology rests on the assumption that health can be investigated using ecological models. A broad spectrum of disease and health issues can be approached from this perspective that range from neurophysiological aspects of the brain and inherited immunological stress responses, to population genetics and socio-cultural ideologies of illness. There are several dimensions to medical ecology. One of these reflects the notion that humans are biological beings

with an evolutionary legacy of physiological and genetic characteristics that provide resistance and vulnerability to disease (Eaton et al. 1988). Medical ecology has been drawn upon extensively by paleoanthropologists and paleopathologists in their efforts to understand the selective factors effecting past populations, particularly hunter-gather and early Neolithic groups (Moran 1979). Understanding adaptation in the context of earlier human populations also provides perspective on contemporary health and disease issues challenging modern society which is the essential focus of evolutionary medicine.

Another dimension of medical ecology involves the examination of cultural healing systems. This is exemplified by the work of Scotch (1960) on the epidemiology of hypertension among urban and rural Zulu populations in South Africa. Scotch found that individuals in urban settings, disconnected from traditional family and healing modalities suffered significantly higher mean blood pressure levels when compared to their rural counterparts (Scotch 1963). A third dimension of medical ecology contributes to applied aspects of health prevention, policy and intervention. An example of this is the “kabilo approach” in mobilizing the demand for contraceptives in The Gambia, West Africa. Kabilos are ancestral networks that disseminate cultural information, mediate marriage, birth and death, ritual activity and facilitate access to land and agricultural resources (Save the Children/Agency for Development of Women and Children 1996). Female kabilo leaders were found to be especially effective in promoting contraception use and a menu of health practices among women of child-bearing age compared to any other previous intervention efforts (Luck et al. 2000). Additionally, the holistic orientation of medical ecology allows for the discovery of relational factors that previously evaded detection, such as the political and economic pressures now linked with the high

prevalence of Type 2 diabetes among various high prevalence Native American groups (Benyshek et al. 2001).

Figure 1 illustrates an ecological model for health. Humans as a species represent one constituent within an ecosystem that is integrated with the cultural environment, the physical, or abiotic, environment and the biotic or biological environment. The cultural environment consists of social structure, beliefs systems, ideologies and technology, all of which can either protect against or contribute to morbidity and mortality. This includes cultural lenses through which experience is interpreted. The biotic environment is made up of food resources, materials, other populations and organisms, species pathogens and vectors. The abiotic environment includes climate, energy sources, geological and planetary processes and non-biotic materials such as minerals.



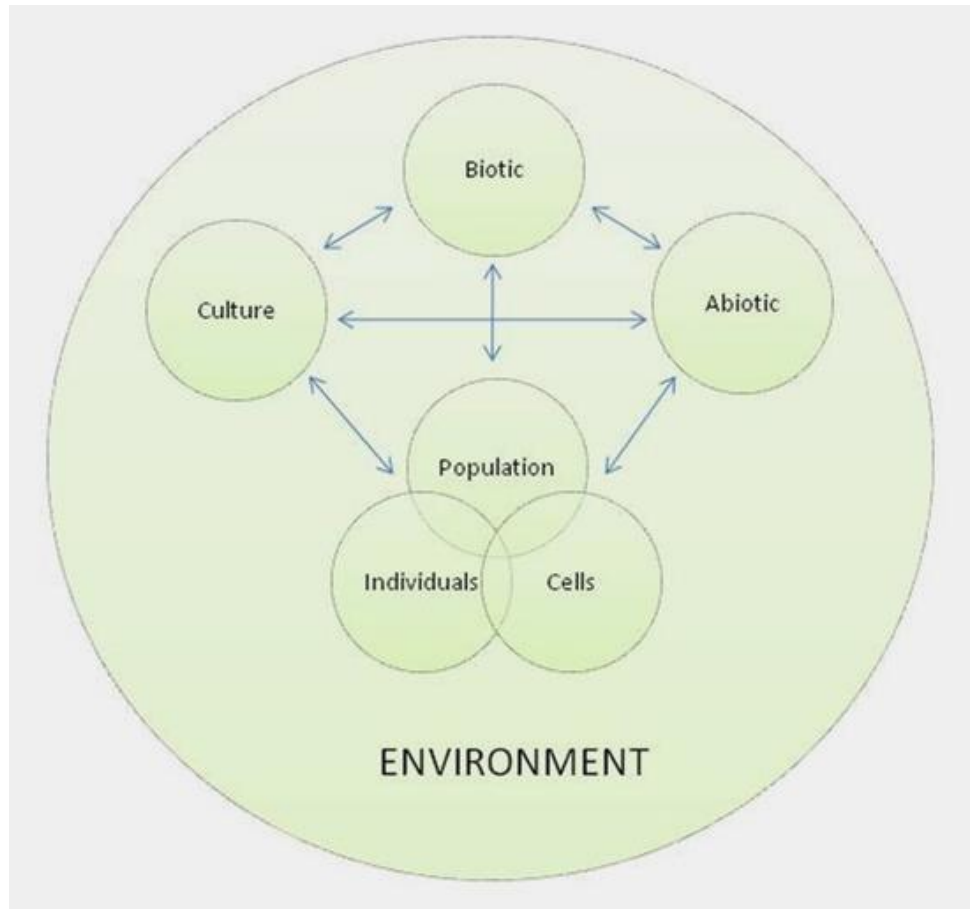


Figure 1 Ecological Model for Health

Within this ecological model, the relationships between cultural, biotic and abiotic factors influence human health (Alland 1970) in a never-ending dynamic relationship. Conditions and behaviors found in societies thus represent the latest adaptive responses to illness and disease where a population's health is essentially the measure of its ability to use biological and cultural resources to adapt to their environment (Lieban 1973). Winkelman (2009) states that specialized environmental adaptations of a given population represent an ecological niche that simultaneously exposes it to and protects it from disease.

Critiques of medical ecology state it is reductionist because its premise rests on the assumption that all cultures behave rationally and that whatever persists in societies are adaptive and health enhancing (Good 1994; Singer 1989). Medical ecology's holistic approach does have limitations in that it is nearly impossible to account for every environmental variable that might exist. Furthermore, not all environmental variables share equal influences on health. Inequities in dissemination of and access to health services and allocation of resources, economically marginalized populations and divergent public health policy all have impact on health. Political economic medical anthropology (PEMA) theory concentrates on addressing and improving the ways in which health is influenced by political and economic factors. Medical ecology theory provides an environmental context (McElroy 1990) through which PEMA and other theoretical premises can be understood.

Evolutionary approaches in general, and medical ecological models in particular, benefit our understanding of meditative ASC in terms of its influence on biotic elements such as cell mediated immune response, stress and perceptions of anxiety, emotion and meaning within the individual as well as how meditative experiences are culturally situated and relation to larger environmental ideologies and world views. Medical anthropology more than any other discipline, is well-positioned to make exceptionally valuable contributions to consciousness research based on an ecological approach that employs integrated methodologies from the biological, behavioral and social sciences.

## Psychoneuroimmunology

Biomedicine has traditionally held that the immune system cannot be conditioned through behavior via the nervous system although a growing a body of evidence exists to the contrary (for review see Ader 1981). The volume of research conducted on the immune, endocrine and central nervous systems forged the development of the field psychoneuroimmunology which recognizes symbols and personal experience as operating variables in immune function and health (Lyon 1993). Neurological research works on the premise that integrative neural systems develop in response to evolutionary pressures that result in ever-increasing behavioral flexibility and adaptability (Dietrich 2003). Neurological studies on consciousness and health have begun to identify interactions between behavior and biology--specifically brain function (Ashbrook and Albright 1997; Ramachandran and Blakeslee 1998; Rayburn and Richmond 2002; Davidson et al. 2003) Such studies as well as advancements in medical technology have and continue to allow for the discrete measurement of brain activity, behavior and physiological correlates that benefit anthropological inquiry of ASC.

Within a medical ecological framework, the field of psychoneuroimmunology offers a context for interdisciplinary research that integrates social life with immune response (Wilce 2003). According to Lyon (1993) adaptive responses to the environment such as emotions, feelings and thoughts impact the immune system functionality at a cellular level. Psychoneuroimmunology functions as both a theoretical premise and methodology that integrates mind (behavior and culture), brain (the nervous system) and body (the immune system).

“Psychoneuroimmunology a trans-disciplinary scientific field concerned with interactions among behavior, the immune system and the nervous system. Its clinical

aspects range from an understanding of the biological mechanisms underlying the influence of psychosocial factors of onset and course of immunologically resisted and mediated diseases, to an understanding of immunologically-induced psychiatric symptoms. Its bioregulatory aspects include understanding the complex interaction of neuroendocrine and immunologically-generated networks in maintaining health and combating disease. Psychoneuroimmunology aims at clarifying the scientific basis for humanistic medicine and at developing new models of health and illness” (Solomon et al. 1999)

Solomon and Cousins (2001) suggest that the nervous and immune systems are an integrated ‘adaptive- defense’ system. Casitllo (1979) states that enculturation and cultural adaptation have neurobiological consequences that is fundamental to the formation of hormones, neurotransmitters, brain cells. This is supported by Lyon (1993) who proposes a personification of the immune system where cognitive functions of discernment, deduction and memory establish what he call an ‘immunological self’. Alternately, Varela (1997) views the immune systems as a self-monitoring mechanism that controls the body’s reactions to the environment. The hardware of the nervous system is shaped through the experience of learning, stress, adaptation and the cultural perceptions and meaning attributed to them. Taking an ecological perspective, McDade (2005) sees the immune system as an adaptive product of natural selection that operates in humans who are in turn, integral parts of their environment.

The field of psychoneuroimmunology is at the forefront of research signifying the effect of relaxation and guided trance states on immune activation (Hall, 1983; Zachariae et al. 1990; Davidson et al. 2003), psychosocial stimulation and cardiovascular disease (Henry and Meehan, 1981), and positive affect and immune function (Applegate et al. 1997). The implications for medical anthropology are obvious. The evidence for an interactive relationship between the nervous and immune systems postulates that alterations in immune response function can be conditioned and that activation of the

immune system is correlated with altered neurophysiological, neurochemical, and neuroendocrine activities of brain cells (Applegate et al. 1997; Blalock, 1994; Futterman et al. 1994; Zachariae et al. 1990; Cohen et al. 1989; Solomon 1985; Levy 1983; Hall 1983). In anthropological terms, immune response can be conditioned through cognitive reactions mediated by cultural symbols, perceptions and behavior, which in turn have direct biological consequences. Medical anthropologists in particular recognize the immune system as an adaptive system that operates in social contexts. Examples of anthropological approaches to psychoneuroimmunology include the work of Pennebaker et al. (1988) on early life trauma and its role in illness such as high blood pressure and cancer later in life. Measured immunological benefits were derived in cases where previously undisclosed traumatic experience was verbally expressed. Booth and Davison (2003) found derived benefits of verbal disclosure were influenced by ethnicity in their cross-cultural study among Asian, Polynesian and Caucasian medical students in New Zealand. Their findings suggest the immune and health benefits of emotional disclosure are modulated by social and cultural parameters of self-expression. This idea is taken further by Wilce and Price who propose the notion of cultural immunology suggesting that socio-cultural images can alter biological processes because “culturally variable images of body and healing are variably embodied within and across societies” (Wilce and Price 2003:51). Evidence for the cultural mediation of immune function and response is illustrated in the role of care-giving and family environment. The presence of nurturing in a stable family environment was found to produce decreased average cortisol levels and illness frequency (Flinn and England 2003). Emotional support was also shown to be a positive operating factor on physical health (Berkman et al. 1992).

Additionally, psychosocial stress has been correlated with slowed wound healing, impaired vaccination reactivity and increased likelihood of infection (Cohen et al. 1991; Glaser et al. 1992). Taking a broader perspective, Cone and Martin (2003) state that cultural elements are mediated by political ecologies and propose the increased consumption of processed foods, produced and distributed through global food industries have resulted in immune reactivity which contributes to the increased rate of allergies and autoimmune disease.

Given the stress reducing attributes associated with meditative ASC which have immunological implications, and the evolutionary-minded perspective of medical ecological models of health, psychoneuroimmunology and medical ecology provide a solid theoretical foundation to further investigate the ways in which meditative ASC, so prevalent throughout the cultural record, might provide health benefits.

## CHAPTER 3

### LITERATURE REVIEW

#### Consciousness

Defining consciousness is inherently challenging and according to Baruss (1992) after 30 years of relative acceptability in science, the study of consciousness is, ironically, in a mystified state. The vast multi-disciplinary literature of consciousness contributes to an already daunting task by often neglecting to recognize the assortment of referents linked with the term (Helminiak 1984; Miller and Buckhout 1973). Consciousness is associated with a range of multifaceted phenomena linked with systemic internal and external functioning (Luria 1978; Winkelman 1994; Edelman and Tononi 2000; Edelman 2003) that is both objective and subjective, and, where more often not, the investigating discipline emphasizes one ontological perspective over the other (Natsoulas 1986-87; Baruss 1990, 1996).

The biological sciences seek to understand the physiological and neurological mechanisms, components, and processes that give rise to, and effect, human consciousness (Kinsbourne 1988; Metzinger 2000; Bland 2004; Keri 2004; Mizuhara et al. 2004; Roth 2000; Elderman 1993, 2003; Searle 2000). From a neurobiological standpoint, however, these models fall short of explaining common subjective experience. The focus of consciousness study within the social sciences is often psychotherapeutic (Walsh 1980; Harner 1982 Baars1988; Klein 1984; Natsoulas 1986-87), first person, experiential, and culturally oriented (Halifax 1979, Harner 1982; Katz 1982; Turner and Turner 1985; Wright 1989; Rasmussen 1992; Heinze 1994; Stark1997). This is especially so for anthropology where the ethnographic literature is exceedingly

rich with indigenous accounts of altered consciousness (e.g. Neihardt [1932]1961; Deren 1953; Turner 1964; Lame Deer and Erdoes 1972; Noll 1985) but offers little in understanding the diverse and discrete characteristics associated with varying altered states of consciousness.

Anthropologists and other social scientists have acknowledged the need for an integrated theory and interdisciplinary approach to consciousness (Anderson 1977; Boals 1978; Walshburn 1978; Bohm 1980; Ader 1981; Walsh 1981; Ingold 1990; Laughlin et al. 1990; Krippner 1991; Berczi and Szeleny 1994; Foss 1995; Shore 1996; Strauss and Quinn 1997; Levinson 1998; Bloch 1998; d'Aquili and Newburg 1999; Rich 2001b; Etzel et al. 2000; Ascoli 2000; Wilbur 2000; Winkleman 1986, 1992, 2000). Winkelman (1994) suggests that only when a neurophenomenological model of consciousness that intentionally addresses neurological systems *and* conscious experiences is constructed, can a unified explanation of consciousness emerge. This need for a unified explanation of consciousness has more recently been echoed by cultural neuroscientists who argue that a comprehensive theory of consciousness must accommodate the role of cultural context with neural activity and genetic systems in shaping consciousness phenomena (Chiao et al. 2008).

Beyond unified models of consciousness is the investigation of how subjective conscious experiences articulate with neurological processes. With regard to brain development, Turner and Whitehead (2008) posit that since the human brain provides a structure for consciousness and the brain is shaped by experience, it stands to reason that culture -- with its constructs of meaning, interpretation and perception -- should have a corresponding influence on the operative anatomy and microstructure of the brain. Using



Durkheim's concept of collective representations with recent imaging research, Turner and Whitehead illustrate that collective representations have defined cortical representations. Combs and Krippner (2008) also discuss supportive neurological and social evidence for collective consciousness where dynamic neuronal activity in individuals and groups give rise to a shared social consciousness. Within the newly emerged field of cultural neuroscience, whose focus is the bidirectional interaction between culture and biology, is a growing literature demonstrating that cultural core values, beliefs (Sui and Han 2007) and practices (Park and Gutchess 2006) play a vital role in shaping neurological representations of self knowledge (Kitayama and Cohen 2007; Chiao and Ambady 2007) and influence genetic processes (Hariri et al. 2006).

Cognitive neuroscience is in fact echoing a position long suggested by anthropologists (e.g. Winkelman, Laughlin, McManus and d'Aquili) and transpersonal psychologists (eg. Wilber and Walsh). The cross-cultural and enduring practice of ritualized altered states of consciousness is an expression of transpersonal traditions that represent the evolution of human cognition and culture (Winkelman 1993; Roberts 2006; Winkelman and Baker 2009). The persistence of ASC cross-culturally throughout history suggests the possibility of advantageous selective factors (Lewis-Williams and Clottes 1998). This is supported by scholars to who take a neurophysiological position on ASC involving ritual (Benson 1975; D'Aquili et. al. 1979; Laughlin et al.1992; D'Aquili and Newburg 1999; McClenon 2002) stating that ritualistic behavior offer biological advantages. For the purpose of this research, human consciousness is defined as a dynamic means of knowing in terms of content and its form of experiencing that is

governed by social, cultural and anatomical factors (Winkelman and Baker 2008) that influence and inform each other.

### States of Consciousness

Several states of consciousness exist that are associated with specific biological characteristics and modes of experience. The human brain generates electrical activity whose pulses form rhythmic wave patterns. Brainwave activity as measured by electroencephalography offers one method for distinguishing states of consciousness. Table 1 illustrates the five major categories of electroencephalograph (EEG) waves that pulse at different frequency cycles per second (cps) from the highest to the lowest (Austin 1999). The categories of EEG waves are broadly associated with discrete conscious states and are usually viewed as a continuum. There are, however, some distinct attributes to brain wave patterns that characterize each state.

Table 1 Brain-wave States and Characteristics

<u>Gamma</u>	<u>Beta</u>	<u>Alpha</u>	<u>Theta</u>	<u>Delta</u>
30-70 cps	14-30cps	8-13cps	4-7cps	0.5-3 cps
Conscious	Conscious	Conscious	Unconscious	Unconscious
Heightened attention	Active	Meditative	Meditative	Deep sleep
Ecstatic	Analytical	Relaxed	Drowsy	Comatose
	Response/reaction		Dreams/ Trance	

(J. Austin, Zen and the Brain 1999)

Gamma waves are present during conscious states and are characterized by rapid wave oscillations associated with a heightened attention and ecstatic states (Jokeit and Makeig 1994). Beta waves occur during normal waking conditions connected with analytical

thinking, problem solving, learning, focused attention to the outside world and adaptation. Alpha waves emerge during conscious awareness with decreased attention to the outside world and its stimuli (Mulholland and Runnals 1962). Alpha waves increase with greater attention to auditory stimuli than to visual stimulation and in the presence of non-visual thinking (Williams 1940; Brown et al. 1977). Theta waves occur at a deep level of inward focus and represent unconscious activity associated with emotions and dreams (Brown 1974). Increased theta activity generates visual images and is linked with the mechanisms in the brain that control and facilitate emotions and unconsciousness memories (Austin 2000). Delta waves appear during periods of deep sleep, comatose states or while a person is under anesthesia. The process of dreaming during sleep accompanied with rapid eye movement (REM) is characterized by mixed brain wave patterns (Winkelman 2000).

The measurement of brain response during meditation rests on the premise that different conscious states produce distinct neurophysiological states. The practice of mediation as a self-regulatory means of reducing stress involves alteration in brain wave frequencies (Bishop 2002). Several studies have investigated behavioral changes in brain activity and function using EEG and autonomic nervous activity. In general, meditation results in higher frequencies of slow alpha and theta waves (Tassi and Muzet 2001), with decreased autonomic sympathetic activity (Young and Taylor 1998) and increased parasympathetic activity. Alpha and theta oscillations are implicated with attention, memory and cognition functioning (Aftanas and Golocheikine 2001; Basar et al. 2001). Shaw (1966) points out that alpha activity is synchronized during internal focus and desynchronized during external attention. Theta power in particular, has been shown to

increase in association with memory and attention (Dietl et al. 1999; Klimesch 1999) and has been regularly reported during meditation (Kubota et al. 2001; Herbert and Lehman 1997). Mikulas (1990) states the manipulation of attentional focus and the expansion in scope and lucidity of mindfulness, are two characteristics that persist despite the many variations of meditation technique. Studies using EEG have found variation in brain wave activity and magnitude between novice and experienced meditators where meditation-induced slowed alpha waves shifted to increased theta wave frequency (Kasamatsu and Hirai 1966; Murata et al.1994). The suggestion that brain wave activity is modulated by meditation experience over time is supported by Cahn and Polich (2006) in a review of EEG and neuroimaging studies where meditation practice was found to alter attentional allocation. Cahn and Polich (2006) point out a distinction between immediate and long-term effects of meditation. The term state is used to refer to changes in sensory and cognitive awareness during meditative practice; the term trait is used in reference to long-term alterations in cognitive and sensory perception persisting beyond the meditation practice (Austin 1998; Shapiro and Walsh 1984; West 1987). While it is clear that the practice of meditation generates both immediate state and long-term trait changes, Takahashi et al. (2005) maintain it is unclear if brain wave activities during meditation represent intrinsic traits or if the effects of meditation practice ultimately become traits. Winkelman (2000) points out that transcendental and mystical experiences distinguished by synchronized alpha and theta brain wave activity are exclusive to humans suggesting that meditation-induced brain activity is essentially intrinsic and refers to this state as an integrative mode of consciousness.

With regard to alpha and theta frequencies, it should be noted that while an integrated model of neural generators for brain wave frequencies has not been determined (Basar et al. 2001) they have been found to possess a diverse sensitivity to various stimuli (Shurmann and Basar 2001). The field of neurophenomenology seeks to correlate neurophysiological aspects of consciousness with internal experience (Jack and Roepstorff 2002; Lutz et al. 2002; Delacour 1997) in the hope of achieving what Varela (1992) states as a methodological remedy for the ‘hard problem’ of understanding modes of consciousness and the challenges of consciousness related research.

While EEG data was not measured during the current study, based on the observable characteristics, reported experiences of study participants and findings from numerous meditation studies (see Aftanas and Golocheikine 2005; Takahasi et al. 2005; Murata et al. 2004; Andresen 2000; Fenwick 1987; Shapiro and Walsh 1984; Kasamatsu and Hirai 1966; Gaylord et al. 1989) it is reasonably assumed that alpha and theta brainwave states were achieved to some extent during the meditative sessions.

### Altered States of Consciousness (ASC)

Anthropologists and other social scientists have sought to classify ASC (Ward 1989).

Tart (1969) defined ASC as:

[a state where one] “clearly feels a qualitative shift in his patterns of mental functioning, that is, he feels not just a quantitative shift (more or less alert, more or less visual imagery, sharper or duller, etc.) but also that some quality or qualities of the mental processes are *different*. Mental functions operate that do not operate at all ordinarily, perceptual qualities appear that have no normal counterparts, and so forth.” (1969:1-2)

This definition is so subjective that difficulty arises in distinguishing one state from another. The term ASC suggests one state is more standard than another state and that ‘altered states’ are departures from ‘normal states’ although the perception of altered and normative is relative (Price-Williams and Hughes 1994). This is addressed by Winkelman and Baker (2008) who put forth the waking mode as the “baseline consciousness” to which all other modes can be compared. “It is also the mode of consciousness in which we are capable of interacting with the other members of our society, developing a consensus about the meanings of our shared experiences and thereby learning our culture. The baseline mode thus has a degree of primacy over all other states of consciousness” (Winkelman and Baker 2008:66).

Earlier attempts to categorize ASC took a descriptive approach. Ludwig (1969) puts forward ten behavioral characteristics linked to ASC that include alterations in thinking, disturbed time sense, loss of control, changes in emotional expression, body-image change, perceptual distortions, change in meaning or significance, sense of the ineffable, feelings of rejuvenation, and hyper-suggestibility. Ludwig (1966) also establishes 5 general methods of ASC induction: 1) increased sensory stimulation produce by auditory driving such as drumming and chanting (Neher 1961; Jilek 1982, Harner and Tryon 1996, Harner 2003) as well as sensory stimulation through dance and exposure to temperature extremes, 2) reduced sensory stimulation generated by isolation, light deprivation, restricted movement and mantra meditation practices (Ludwig 1966, Fischer 1971; Lex 1976; Mandell 1980, Katz 1982), 3) increased alertness through prayer, meditation and focused attention, 4) decreased alertness such as day dreaming, free association and meditative practices that limit focus to an object and, 5) chemical and neurological

changes within the body brought on by fasting, dehydration *and* hallucinogenic substances (Ludwig 1969; Winkelman 1986, Castillo 1995), and observable indicators such as physical changes (Fischer 1971; Lex 1979; Mandell 1980; Winkelman 1986).

ASC induction modes can be placed in two general categories, those that activate the sympathetic nervous system through changes in physical motor activity and those that operate via the parasympathetic system through sensory alteration (Winkelman 2000). While psychological and physiological differences occur between the varied methods of ASC induction, they result in a common physiology that involve parasympathetic dominance with slow brain wave EEG activity (Winkelman 1986, 1992, 2000) and shared neurobiochemical conduits that originate in the hippocampal-septal region (Mandel 1980). These neurobiochemical pathways include dominance of the right hemisphere, cortical synchronization of both hemispheres and an overall state where skeletal muscles are relaxed (Lex 1979). The frontal cortex discharges slower brain waves typically within the theta range of 3-6 cycles per second that originate in the limbic system (Mandel 1980) illustrated in Figure 2. The limbic system is made up of the thalamus which communicates sensory information to the cortex, the hypothalamus that mediates feelings of aggression, fear and sexual drive, the amygdala that is generally responsible for emotion related responses, and the hippocampus that is associated with memory. This older region of the brain is known as the hippocampal-septal system (also referred to as the paleo-mammalian brain) operates as a hub connecting memory, attention and learning (MacLean 1990). A review of positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) studies on meditation by Cahn and Polich (2006)

identifies several neural specific loci that can possibly be associated with meditative activity.

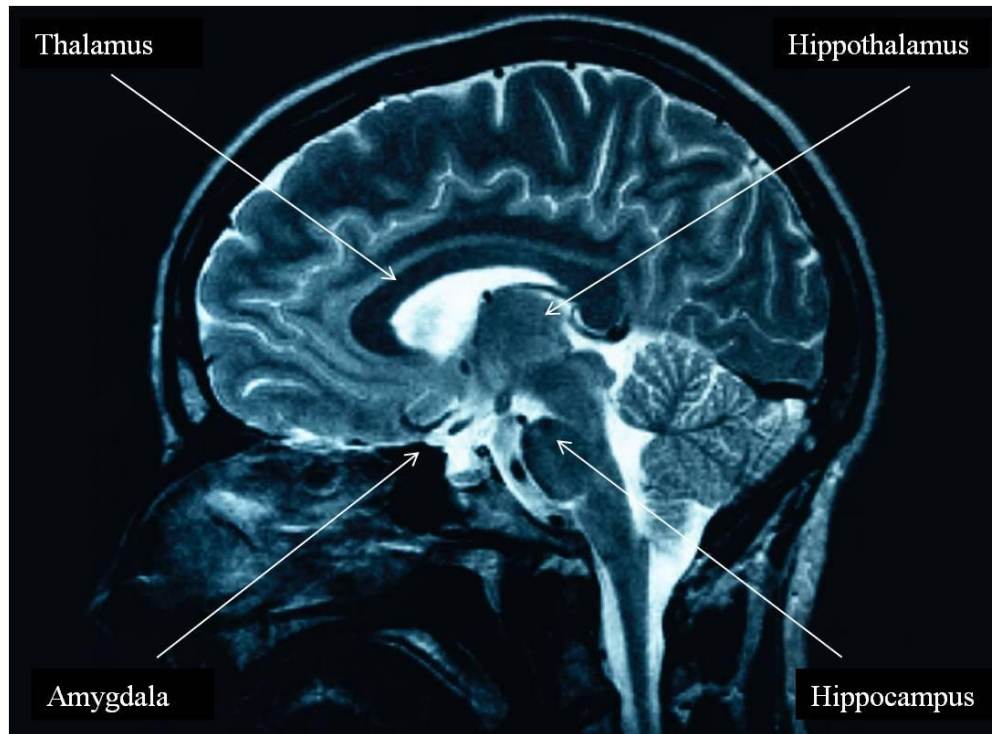


Figure 2 Limbic System / Paleomammalian Brain

Winkelman proposes that different conscious states fall within an overall integrated mode of consciousness. These states are differentiated by features of the self and emotions (Winkelman 2009) are positioned within three basic ASC types: Shamanic, Possession and Meditative. ASC is characterized by changes in the sympathetic and parasympathetic divisions of the autonomic nervous system that drive one's perception of self (Fischer 1971), where arousal of the sympathetic system is in response to external factors and the parasympathetic system focuses on internal operations (Lex 1979). Using Ludwig's (1966) characteristics of ASC in addition to Harner's (1982) delineation



between Ordinary Reality and Non-Ordinary Reality, the current study attempt to determine if a correlation can be made between the activation of the parasympathetic nervous system during meditative ASC and a measurable component of cell-mediated immune response.

### ASC and Anthropology

Ethnographic description of what is often described as “exotic” (i.e., non-Western) ritualized behavior associated with altered states of consciousness (ASC) has always commanded the attention of cultural anthropologists. Skorupski (1976) suggested the anthropological approach to ASC generally fell within two camps: the “intellectualist” and the “symbolist”. The ritual and behavior that accompany possession and trance were considered by early anthropologists such as Tylor (1924) the irrational behavior of a mentally undeveloped culture lacking any actual validity or usefulness (Fraser 1929). Within the unilineal framework of cultural evolutionism, logic is the operating variable in the intellectualist interpretation of ritualistic behavior involving ASC, where non-rational behavior was dismissed as useless and futile although compelling enough to sustain anthropological inquiry. According to White (1959) the effectiveness of ASC ritual behavior is measured by its effectiveness in meeting the needs of a society in terms of its relationship to the environment. In contrast, Durkheim (1961) takes a functional perspective on ritualized activity characteristic of the symbolist approach. Durkheim considers the behavior surrounding ASC as a living metaphor mirroring larger cultural elements in a society. The symbolist interpretation of ritualized ASC sees trance and possession as serving a specific social purpose that establishes order and upholds core

values. In contrast to intellectualist thought, Malinowski (1948) and Norbeck (1961) see ritual behavior as a means of social integration that served to appease individuals in understanding and relating to the world, therefore, ASC rituals are not so much about 'bad rational thought' as about establishing a sacred structure modeled on a society's cultural construct (Evans-Pritchard 1965). Neither the symbolist nor the intellectualist position consider ASC ritual behavior and valid and effective in terms of physical health and healing.

The Boasian tradition of cultural determinism created a vast literature that describes forms of ASC from a functionalist perspective. The function of possession trance as a form of ASC is seen as a response to some outside pressure, be it political, environmental, economic or social (Gussler 1973; Swanson 1973; Turner and Turner 1987; Lyon 1991; Greenfield and Sidney 1991; Shaara 1992; Rasmussen 1992; Heinze 1994; Vitebsky 1995). Eliade (1972) focuses on the functional role of the shaman who is responsible for the overall well-being of the society. Shamanism is a transpersonal method of accessing supernatural power and information which can be brought back through the shaman to his/her society. Eliade's interpretation situates the shaman as a sacred mediator who maintains balance and well-being within their society; however, the shaman's 'methods of ecstasy' - means of inducing ASC and the shamanic journey are not considered to contain validity or efficacy.

Bourguignon's (1973) cross-cultural study of 488 societies showed that 90% display some form of institutionalized ASC. ASC experiences can be positive, such as possession by a benevolent or Holy Spirit or, they can be negative, where malevolent forces are involved. Bourguignon (1976) distinguishes two types of trance that are

correlated with social complexity. A conscious non possession ego-oriented trance state that retains memory and personality is associated with egalitarian societies. Trance possession, on the other hand, is considered to be a condition where the personality is suspended or displaced by an external entity and is associated with more complex stratified societies (Greenbaum 1973). According to Bourgiugnon, complex, stratified societies with strict norms accommodate possession trance because it provides a venue for individuals to act and communicate outside standard cultural parameters. Complex societies are rigid and offer individuals limited opportunity for personal achievement and control over their daily lives. Possession trance provides some relief, if only briefly, from restrictions placed on a section of society where individuals can act outside and beyond standard cultural norms without repercussion. Halifax supports this position stating that shamanism (i.e., ego-oriented possessed state) is a religious complex typically found in hunter-gather societies (see Winkelman 1992). Metraux (1972) and Alexander (1991) concur with Bourgiugnon's position that institutionalized methods of ASC provide a temporary means of balancing out and escaping what is otherwise a condition of inequity. Rasmussen (1992), alternatively, demonstrates the function of possession poems among Taureg women who were dissatisfied with the behavior of their husband. Unable to access formally the authority of the Imam that most often requires travel, dissatisfied women sing poems while in a possessed state. These poems are open displays with coded verbal content that allow wives to disclose their husband's infidelities, abuse and irresponsibility in a public appeal without risk of punishment. These displays motivate elders and relatives to take action towards a resolution. Similarly, Sharpe (1990) observed

that possession provides migrant children in Madagascar a vehicle to express the chaos they experience in their daily lives.

The utility of ritualized ASC is viewed by Hultkrantz (1966) to be associated with ecological factors rather than social complexity. This position is illustrated by Gussler (1973) who demonstrates that, ecological factors in combination with subsistence practices among the Nguni of South Africa have produced certain nutritional deficiencies that in turn create some of the physical, physiological and behavioral changes associated with *ukuthwasa*, possession illness. More recently, Fessler (2002) suggests fasting, pain and sleep deprivation can result in ASC innately occurring during periods of food scarcity, physical trauma and hyper-vigilance, linking socio-political/environmental conditions with ASC episodes and the meaning ascribed to those experiences.

Winkelman (1986a) shows that the relationship between ASC practitioners and socioeconomic conditions is cross-cultural with cultural characteristics such as social complexity, economics and ecological factors contributing to the ways in which ritualized ASC is utilized and expressed. Conversely, Janice Boddy (1994) takes the position that while possession and possession trance are present in many societies, they are manifestly distinct and should not be ascribed to a unitary character. Boddy cautions that interpretations of possession trance which conceptualize an objective framework such as social complexity and ecological factors for analysis are in reality, a reflection of the researcher's own interest. Boddy considers possession as performance. The creation and performance of possession present an image of 'the other' to articulate the self. Possession is not just a form of knowledge; it operates as a means of knowing that literally incorporates the unknown and makes it known. The physical body validates

objective knowledge accessed by the unknown (that which is possessing) and by its embodiment, makes objective knowledge available to other through mimesis.

Anthropologists have explored elements of ASC by looking at shamanistic rituals and narratives of shamanistic flight (Durkheim 1961; Halifax 1979; Katz 1982; Jilek 1982; Noll 1985; Turner and Turner 1987; Winkelman 1986b, 1997) and descriptions of prayer and meditation activities (Lame Deer and Erdoes 1972; Walsh 1977, 1978; Shapiro and Walsh 1984). Halifax (1979) provides a survey of 36 shamanic narratives in the shaman's own words as obtained from direct communication and first person accounts. Likewise, Narby and Huxley (2004) present a collection of narratives from shamans and anthropologists that illustrate ritual practices involving ASC. Collections of narratives have been particularly valuable in illustrating similarities and common elements of shamanic ASC.

First hand experiential descriptions of visions and experiences provide further insights into ASC (Dobkin de Rios 1984). Harner's (1973) first hand and personal accounts of the use of hallucinogens in shamanistic practices suggested that the cultural meaning these hallucinogens have offer insights into our understanding of ASC. Noting that many illiterate societies require direct confrontation with the supernatural for validation and knowledge of the supernatural, Harner's experiential methodology leads him to the conclusion that shamanism is a pan-human phenomenon. Based on earlier cross-cultural research, he asserts the idea of "core shamanism". Harner (1980) suggests there are similarities in shamanism that include intentionally evoking and sustaining an altered state that he refers to as a "shamanic" state of consciousness (SSC). Harner sees benefit in viewing ASC as an innate ability of humans rather than an exclusively cultural

process. This has drawn criticism from indigenous groups who view the idea of innate shamanism as offensive. Native American nations including the Cheyenne and Navajo (Churchill 1996) and other groups (Shaw 1995) have publically lashed out at the suggestion of core shamanism stating that it invites non-natives to explore shamanism using a generic recipe for what most natives consider a long, complex, and sacred process requiring years of commitment (Deloria 1998; Aldred 2000).

Stoller (1984) states once the anthropologist experiences what he refers to as “the inside”, ethnographic realism alone becomes inadequate and incomplete. This methodology, where the anthropologist is directly and personally involved in the ritual activity, is met with opposition that argues scientific objectivity and legitimacy is compromised. An experiential approach offers what Turnbull (1990) refers to as a complementary perspective in comprehending the social process:

“What is needed for this kind of fieldwork is a technique of participation that demands total involvement of our whole being. Indeed it is perhaps only when we truly and fully participate in this way that we find this essentially subjective approach to be in no way incompatible with the more conventional rational, objective, scientific approach. On the contrary, they complement each other and that complementarity is an absolute requirement if we are to come to any full understanding of the social process. It provides a wealth of data that could never be acquired by any other means.”[Turnbull 1990:51]

Cross-cultural studies and analysis by anthropologists have sought to determine which behaviors seem to be ‘culturally constructed and which behaviors appear to be universal (Lex 1976, 1979; Lock 1985; Dow 1986; Winkelman and White 1987; Winkelman 1986a, 1990, 1992, 2000; d’Aquili et al. 1979; Laughlin 1997; McClenon 1997; Ryan 1999; Donald 2001). Yet, for the most part, ethnographic accounts of ASC are general descriptions of the specific method of induction and the cultural relevance of its

associated ritual activity. Lyon (2004) notes that many ethnographies regarding ASC simply report the mode of induction and accompanied ritual activity, thus greatly limiting our understanding.

### ASC and Medical Anthropology

The psychobiological and neurological basis of ASC as an evolutionary process has been a focus of study for several anthropologists (Ryan 1999; Clotts and Lewis-Williams 1998; McClenon 1990, 2000; Winkelman 2000, 2002; Rich 2001a, 2001b). For example, Frescka and Kulcsar (1989) consider ritual healing ceremonies in the context of psycho-biological characteristics associated with attachment. Using ethnographic observations of ritual healing trance, they suggest that healing ceremonies are neurobiologically mediated forms of social bonds and attachment that play a role in trance induction. In healing rituals, treatment modalities can include fasting, physical exertion, isolations, hyper-stress accompanied with fear, pains and extreme temperature, all of which are known to result in ASC. The stress of ceremonial activity can release opioid peptides that produce analgesia, euphoria and amnesia which lessen anxiety. As a result, a sense of deep relaxation or a dramatic emotional release can occur that has a cultural context within the ritual ceremony. Cultural meaning merged with the effects of opioid release, produces a powerful socio-physiological experience that Frescka and Kulcsar suggest is at the root of many healing rituals. Drawing upon neurological research that demonstrates opioid peptides are involved in social activity, particularly symbiotic bonds, they further suggest that the relationship between endogenous opioids and social behavior is first established in infant emotional response which has evolutionary implications.

These findings support the position take by Malinowski (1922) nearly 70 years earlier. In his analysis of ritual magic, Malinowski held that humankind is governed by emotional tendencies that have a far greater influence on custom than logic. Current knowledge of endogenous opioids and their role in human behavior validates the observations of earlier anthropologists like Malinowski by providing new, supportive physiological data.

Winkelman (2000) takes a neuroecological approach to ASC and its role in human evolution and health. He considers the foundations of ASC to reflect innate brain processes and experiences, which underlie the universal manifestations of shamanism. Building upon evidence in neurology regarding brain activity during ASC that involves the older paleo-mammalian part of the brain and its links with learned behavior and memory, Winkelman (2002, 2004) posits that ASC represents psychosociobiological adaptations exhibited in the ritual and cosmology of early modern humans. The suggestion that ASC has played an evolutionary role in human development is compelling and serves as the initial basis for the current research.

### Meditation and Health

The origins of meditation are rooted in shamanism. Shamanism is thought to have emerged as an adaptive response to environmental challenges and favored group dynamics that produced social cooperation and partnerships (Hayden 1987) where ritual activity enhanced emotional bonding and reinforced social alliances. Shamanic rituals involve ASC that provide a communal context for healing within a society's world view that included their relationship with the natural world and unseen forces. Shamans are



found in hunter-gatherer, horticultural and pastoral societies where political hierarchies are generally absent (see Winkelman 1986a, 1990, 1992). The role of the shaman is to facilitate healing, divination and protection through their ability to enter into an ecstatic state or ASC (Eliade 1964). During shamanic ASC, the shaman experiences ‘soul flight’, an ‘out of body’ experience or what is referred to as ‘shamanic flight’ (Eliade 1964; Hultkrantz 1978; Halifax 1979; Harner 1990). Soul flight during ASC is the vehicle through which the shaman enters the into the spirit world to address health and healing concerns. The shift from hunter-gatherer subsistence strategies to sedentary agricultural subsistence with increased population size and stratified social and political structure resulted in the transformation of the shaman into other types of magico-religious healing practitioners (Winkelman 1992). Social complexity also fostered the development of formalized religious paradigms to which many meditation practices are linked. Winkelman and Baker (2009) state that one universal characteristic of shamanistic healing is the utilization of ritual to produce significant changes in emotion. ASC can provoke emotional recall of past experiences that are reassessed, potentially offering relief and healing emotional distress.

Meditation in its varied forms share characteristics with shamanism in that they both involve the deliberate induction of ASC, are linked to some degree with the practitioners belief system, and they are associated either directly or indirectly with an intent toward healing and well-being. This is not to suggest for example, that contemporary practitioners of Zen meditation must adopt a Buddhist belief system however their willingness to engage in Zen meditation suggests an openness to worldviews and cosmologies that may initially be unfamiliar. There are many religion-based meditation

practices that share conceptual qualities with shamanism. As an example, within the Ba’hai tradition, meditation is seen as means through which one’s spirit is informed and strengthened:

“...through [meditation] affairs of which man knew nothing are unfolded before his view. Through it he receives Divine inspiration; through it he receives heavenly food. Meditation is the key for opening the door of mysteries. In that state, man abstracts himself; in that state man withdraws himself from all outside objects; in that subjective mood he is immersed in the ocean of spiritual life and can unfold the secrets of things-in-themselves.” [Abdu’l-Baha 1969:175]

Like shamanic flight, the Ba’hai forms of meditation involve the departure or abstraction of the self, to experience and interact with spiritual realms from which information is revealed or acquired for the well-being of the individual.

Contemporary practices of meditation often bypass the religious traditions associated with meditation and focus more in the health and healing benefits of mindfulness. Many meditation practices and their underlying shamanic characteristics are promoted as health enhancing strategies. According to a study commissioned by the National Center for Complementary and Alternative Medicine (NCCAM) and the National Center for Health Statistics, in the year 2002 alone, 62% of Americans had used some form of complementary and alternative medicine (CAM) and 52% had used mind–body techniques such as meditation (Barnes et al. 2004).

#### Health Implications of Meditation

Studies exploring the physiological and behavioral health related effects of meditation are extensive. Cardiovascular responses to meditation include a general reduction in heart rate (Bagga and Gandhi 1983). A comparison between Transcendental Meditation (TM) and quiet closed eye sitting found greater heart rate reductions during TM (Bono 1984). Similar results were reached by Holmes et al. (1983) where TM produce lowered

heart rates but not lowered arousal when compared against a control resting group. Conversely, Fischer (1971) and Davidson (1976) have reported increased heart rate where the ecstatic reactions can result in elevated heart rates (Gelhorn and Kelly 1972; Lehrer et al. 1980). Variation in heart rates suggests meditation influences blood flow and pressure rates in practitioners. Digital blood flow was found to increase during meditation compared to a resting control (Delmonte 1984). With regard to blood pressure, experienced meditators demonstrated greater blood pressure reductions than novices (Wallace et al. 1983). Hypertension temporarily improves with meditation (Patel 1975, Seer and Raeburn 1980, Hafner 1982) although results vary according to meditation experience, technique and method of measurement. The practice of regular meditation is further associated with decreased serum cholesterol levels (Patel 1976; Cooper and Aygen 1979; Bagga et al. 1981) and may influence absolute lymphocyte counts at rest (Solberg et al. 1995; Solberg et al. 2000).

Ample evidence exists supporting the stress reducing effects of meditation, although initial studies measuring hormonal responses to meditation have been less straightforward (Benson 1983). For example, decreased cortisol levels were reported in inexperienced meditators (Sudsuang et al. 1991) and decreased in both the experimental and control group during TM with no change in aldosterone levels in either group (Michaels et al. 1979). Recent studies show cortisol level reductions as a result of meditation (see Matousek et al. 2009; Carlson et al.; MacLean et al. 1997) and may reflect improvement in design measurement methods. There is also supporting data that relaxation exercises produce favorable physiological results in patients with hypertension, respiratory disease and cancer. In a review of studies on the therapeutic role of qigong exercises combined

with drugs therapy, Sancier (1999) suggests that relaxation exercises allow for dose reduction in drugs required for health maintenance compared to the use of drug therapy alone. Combined relaxation and drug therapies resulted in reduced incidence of stroke and mortality and lowered drug dosage required for blood pressure maintenance. Similar results were found for asthma patients. In cancer patients, the practice of relaxation exercises reduced the side effects of cancer therapy.

The attentional aspects of mindfulness have led researchers to explore how meditation might influence perceptual ability. Brown et al. (1984) tested detection and discrimination thresholds of visual perception in meditators and a control group. The meditation group detected shorter single light flashes and required less time to accurately differentiate consecutive flashes. Comparative findings were achieved by Chan and Woolacott (2007) who found that meditation improves the efficiency of executive processing which monitors for conflict in sensory information and restricts proponent or incorrect responses. Using attentional blinks as a measure of temporal attention characteristics, VanLeeuwan et al. (2009) show that meditation can assist in reducing age-related attentional decline.

While inconsistencies in terms of methods, sample size and measurement tools necessitate increased rigorous investigation of meditation and health, past, current and emerging evidence points to the efficacy of meditation in contributing to positive health outcomes for a variety of illness settings (reviews by Baer 2003; Bishop2000; Bishop et al. 2004; Shigaki et al. 2006; Arthur et al. 2006; Chiesa and Serretti 2009). Given the breath of evidence supporting the physiological and psychological benefits of meditative practice, strong arguments are made for the incorporation of mindfulness-based treatment

interventions in a variety of Western health and healing settings. (see Shapiro and Carlson 2009). The ability of meditation to reduce anxiety makes it a viable tool in the treatment of varied anxiety disorders and depression across age groups (see Baer 2006; Coffman et. al 2006; Smith 2006; Romer et al. 2006).

### The Relaxation Response and Stress Reduction

Stress occurs when an individual experiences and responds to excessive environmental demands (Selye 1956). Walter Cannon (1932) stated the response to stress through the process of homeostasis protects the body against threat and injury. Stress is an external factor that affects an internal physiological response within the individual. When stress becomes extreme and or prolonged defense mechanisms become exhausted leading to potentially maladaptive reactions (Selye 1976). Herbert Benson (1975) coined the term relaxation response to describe the effects of deep rest that alters the physiological and emotional reactions to stress. The relaxation response is counter to the fight-or-flight response. When faced with stress that threatens survival the fight-or-flight response involves the release of adrenaline that increases heart, metabolic and breathing rates and blood pressure equipping the individual with the ability to confront the threat or flee from danger (Cannon 1914). This ability in early humans provided a selective advantage however when the fight-or-flight response is activated habitually in non-life threatening circumstances the long term effects are no longer beneficial.

Benson (1975) found the relaxation response to result in “an inducible, physiological state of quietude” with reduced metabolic, heart and breathing rates and decreased blood pressure. The relaxation response requires 4 elements to be present: 1) quiet environment

absent of external distractions; 2) a point of focus; 3) a passive attitude and 4) a comfortable position.

The relaxation response is often linked with Mindfulness Based Stress Reduction (MBSR) as well as other forms of meditation (Gaylord et al. 1989). MBSR is a term developed and described by Kabat-Zinn (2005) as being aware of what one is doing while they are doing it. MBSR is used as a treatment modality designed to optimize health outcomes of individuals suffering from chronic medical problems (Kabat-Zinn 1990). In medical settings, MBSR programs have successfully improved patient health and overall well-being (Carrington et al. 1980; Miller et al. 1995; Carlson et al. 2001; Carlson et al. 2003). Relaxation associated with mindfulness meditation has been shown to improve stress-related illness such as fibromyalgia (Kaplan et al. 1993; Singh et al. 1998), heart disease (Tacon et al. 2003) and psoriasis (Kabat-Zinn et al. 1998; Goldenberg et al. 1994), anxiety disorders (Kabat-Zinn et al. 1992) as well as the psychological well-being of cancer patients (Matchim and Armer 2007). Cuthbert et al. (1981) reported significant heart rate reductions in meditators practicing a relaxation response technique, particularly where the subject/investigator relationship was supportive. This suggests that support and affect of others may be an influential factor which is reminiscent of communal involvement common in shamanic ritualistic healing activity. Meditation has also produced positive outcomes for physiological arousal (Harmon & Myers 1999), the development of empathy (Wolf and Abell 2003), and increased rate of autonomic recovery from laboratory-induced stressful events (Goleman and Schwartz 1976). Shapiro (1982) however, points out that there are other non-meditative forms of relaxation that produce similar health benefits and that studies may have solely credited

meditation in drawing conclusions when other factors could have influenced the findings (e.g. Perez-De-Albeniz and Holmes 2000). In a review of 15 controlled studies, Toneatto and Nguyen (2007) state that any symptomatic improvements for anxiety are the result of nonspecific variables and conclude MBSR does not have a reliable effect on depression and anxiety. Baer (2003) also posits that MBSR uses mechanisms that are commonly found in psychotherapies and cognitive reprogramming interventions that contribute to its success. In addition, it has also been argued that the term mindfulness has not been defined operationally (Bishop et al. 2004). Furthermore, the key concepts inherent in MBSR such as awareness and compassion are subjective and do not lend themselves easily to empirical investigation (Brown and Ryan 2004). These critiques notwithstanding, a vast multi-disciplinary literature exists documenting the effects of meditation in reducing anxiety and improving positive affect (Ma and Teasdale 2004; Teasdale et al. 2000; Miller et al. 1995; Teasdale et al. 1995; Beauchamp-Turner and Levinson 1992; Kabat-Zinn et al. 1992).

Meditation has been shown to assist cancer patients throughout their span of care by reducing mood disturbance and stress symptoms within a broad range of diagnoses, cancer stages and ages (Specia et al. 2000). Ott et al. (2006) note it is common for cancer patients to feel vulnerable and powerless in confronting their illness. The internal focus of meditation can empower patients “to take a proactive stance by consciously directing their attention to present-moment experiences” (Ott et al. 2006). In a similar study, Carlson et al. (2003) examined the effects of meditation on mood, quality of life, stress, cytokine production and lymphocyte counts among breast and prostate cancer patients. Their findings showed significantly improved quality of life and reduction in stress

symptoms. In addition, results showed a decrease in interferon gamma (IFN- $\gamma$ ) and increase in IL-4 production from T cells indicating that patients improved from a depressive/carcinogenic cytokine immune profile to a more standard profile (Carlson et al. 2003). A one year follow-up study demonstrated that these findings persisted, providing the first initial evidence of cancer-related cytokine production changes linked with participation in a meditative program (Carlson et al. 2007).

The stress-reducing effects of meditation are not limited to MBSR. Increased mental quietness (Gillani and Smith 2001), problem solving ability (Grepmaier et al. 2007) and reduction in performance anxiety among musicians (Lin et al. 2008) have been connected with Zen meditation. Transcendental meditation has been found to reduce lipid peroxide and potentially improve atherosclerosis (Schneider et al. 1995; Kim et al. 2005), decrease systolic blood pressure (Stone and DeLeo 1976; Yen et al. 1996) and diminish insulin resistance components of the metabolic syndrome associated with coronary heart disease (Paul-Labrador et al. 2006).

Advancements in medical imaging have expanded our understanding of the neurological activity associated with meditation. It is well established that meditation practices alter the brain's electric activity as measured by electroencephalography (Anand et al. 1961; Banquet 1973; Benson et al. 1990). Kasamatsu and Hirai (1966) found increased alpha brain wave activity in the frontal regions of the brain during Zen meditation, in addition to the presence of theta brainwave bursts that occur with more experienced practitioners (Murata et al. 1994). More recently, positron emission tomography (PET), single photon emission computed tomography (SPECT) and functional magnetic resonance imaging (fMRI) have been used to measure cerebral



activity during meditation (Herzog et al. 1990; Lou et al. 1999; Lazar et al. 2000; Newberg et al. 2001). Findings from these studies indicate the neurological correlates involved during meditation. The literature on the process of mediation and its impact on neural functioning are modest by comparison (Herzog et al. 1990; Jevning et al. 1996; Austin 1999; Lou et al. 1999; Davidson et al. 2003). Lutz et al. (2004) report that long-term practitioners self-induce sustained gamma brain wave oscillations at baseline and post-meditation baseline indicating that meditation may generate short and long-term neural changes. A related study demonstrated that interaction between central and autonomic nervous systems were altered following a short-term (five-day) integrative body-mind training program involving meditation and mindfulness activity (Tang et al. 2009). Brefczynski-Lewis et al. (2007) found that when compared to novices, experienced meditators had decreased activation in brain regions associated with distracted and digressive thought and emotion and; increased activity in areas linked to response inhibition and attention. These studies imply that meditation practice may have both immediate and enduring neurological impact as well as suggesting that a degree of plasticity exists within neural mechanisms.

#### Immune Function and its Biomarkers

Only a handful of researches have investigated the effects of mindfulness meditation on biological markers such as cortisol or immune function (Carlson et al. 2007). In response to a prolonged physical stress or maximized workload exercise, a reduction in the proliferation of lymphocytes occurs (Landman et al. 1984; Fitzgerald 1988). Solberg et al. (1995) document a decrease in the reduction of specific lymphocytes when

strenuous physical exertion was followed by meditation, suggesting that meditation may have immune-modulation influence. Davidson et al. (2003) measured electrical brain activity of experimental and control subjects before and after an 8-week mindfulness meditation program followed by an influenza vaccine. Meditation produced significant increases in left-sided anterior activation- known to be connected with positive affect, in addition to significantly increasing antibody titers to the influenza vaccine. Furthermore, the magnitude of increased left-sided activation was positively correlated with antibody titer increase to the vaccine suggesting that meditation can effect beneficial changes in brain and immune function (Davidson et al. 2003).

#### Epstein-Barr Virus Antibodies as an Immune Function Biomarker

The Epstein Barr Virus (EBV) is a highly prevalent and latent human herpes virus. Epidemiological research indicates 90-98% of the population is EBV seropositive, having come in contact with the virus at some point. (Roberts 1989; Buchwald et al.1987) Initial infection usually occurs during adolescence (Esterling et al.1993). During initial infection, symptoms can be expressed in the form of mononucleosis or completely absent. In either case, once initial infection has occurred, EBV latently infects the immune system resulting in a lifelong persistent infection (Esterling et al. 1993; Buchwald and Komoroff 1987). EBV infected cells are immortalized requiring the immune system continuously initiate antibodies against the EBV viral capsid antigen (VCA) in order to successfully maintain a homeostatic state (Henle and Henle 1982; Klein et al. 1981). Elevated levels of serum EBV antibodies can signify a new infection originating from an external source, triggering an increased viral load (Rickinson et al. 1981). Increased EBV antibodies can also occur in response to re-infection of latent

lymphocytes requiring a greater volume of antibodies to maintain homeostasis (Esterling et al. 1990; Glaser et al. 1991). The production of EBV antibodies occurs as an acute phase response, which is the first line of defense exercised by the immune system (Baumann and Gauldie 1994). For this reason, EBV antibody levels against EBV capsid antigens offer utility as an indirect measure cell-mediated immune competence and function (McDade et al. 2000; Glaser and Gottleib-Stematsky 1982).

Physiological and psychological stress can activate latently infected cells resulting in the expression of viral antigens. Studies show that academic stress (Herbet et al. 1986), stressful personal relationships (Kiecolt-Glaser et al. 1994), loneliness (Glaser et al. 1985), divorce (Kiecolt-Glaser et al. 1987; Keicolt-Glaser et al. 1988), caring for a family member with Alzheimer's disease (Kiecolt-Glaser et al. 1987), and anticipation of HIV-1 sero status notification (Antoni et al. 1990) have the potential to activate infected cells generating an increased viral antigen load. Glaser and Gottleib-Sematsky (1982) posit that cellular immune competence is a key factor in controlling primary EBV infections and latent reactivation (see Korneva et al. 1997).

Anthropological research has illustrated the effect of specific cultural stressors on blood pressure (Dressler 1995, 1991, 1990; James 1991; McGarvey and Schendel 1986), and stress hormones (Brown 1981, 1982; Flinn and England 1995). More recently, medical and psychological anthropologists have demonstrated significant correlations between socio-cultural factors, increased levels of stress and cell-mediated immune function. (McDade 2002; McDade et al. 2000a; McDade et al. 2000b).

Lowered EBV antibody levels can indicate an enhancement of cellular immune competence in controlling latent reactivation. In a university study, Esterling et al.

(1993) found that students who verbally discussed a traumatic experience had significantly lower EBV antibody titers compared with those who wrote about a stressful experience. Furthermore, both verbal and written disclosure groups had lowered antibody titers compared with a matched control of non-stressful disclosures. Similar results were demonstrated in the verbal disclosures of Holocaust survivors (Pennebaker et al. 1988). These studies suggest that stress reducing interventions can potentially improve cellular immune control over latent EBV. Antibodies against EBV offers proven utility as a dependable biomarker of cell mediated immune function (Herbert and Cohen 1993).

### Salivary Cortisol

Cortisol is a glucocorticoid steroid hormone responsible for the down regulation of immune function as a result of stress. Also known as a stress hormone, cortisol is released from the adrenal glands during episodes of stress as one of the primary hormones associated with the activation of the hypothalamus-pituitary-adrenal cortex (HPA) (Chrousos and Gold 1998). Salivary cortisol is frequently used as a reliable measure of hypothalamus-pituitary-adrenal axis (HPAA) adaptation and a desirable alternative to the invasive method of sampling serum cortisol (Kirschbaum and Hellhammer 1994). Measuring cortisol in saliva is essentially a proportional indication of unbound concentrations (Mendel 1989) of cortisol in serum although (Hellhammer et al. 2009) caution that linear relationships between salivary and serum are not necessarily guaranteed. Interaction between the HPA axis and the central nervous system are regulated by numerous psychological components such as low predictably and control, novelty, expectancy and habituation which can influence salivary cortisol outcomes (see Chrousos and Kino 2007). By the same reasoning, anxiety and discomfort can occur in

anticipation of, or during blood sample collection, potentially modulating serum cortisol outcomes. According to Hellhammer et al. (2008) there is an overall correlation between unbound cortisol in blood and saliva and the advantages of noninvasive, stress free collection and processing justify salivary measurements of free cortisol levels.

Elevated cortisol levels in response to stress have been linked to depressed mood (Sikes and Lasley 1989; Wolkowitz 1994) and alterations in immune function (Antoni et al. 2000; Calabrese et al. 1987). Conversely, cortisol levels have been shown to decrease in response to meditation (Carlson et al. 2004; Rabkin et al. 2000; McCraty 1998; for a review see Matousek et al. 2009). MacLean et al. (1997) found that the practice of transcendental meditation reduced cortisol levels and the effects of chronic stress. In a similar study, guided imagery with music was shown to positively affect mood and lower cortisol levels (McKinney et al. 1997). Positive affect and optimism were correlated with reduced waking cortisol (Lai et al. 2005).

For the purposes of this research salivary cortisol serves as an indirect marker of experience in response to meditative and control sessions.

## CHAPTER 4

### METHODS

#### Research Design

In a series of papers commissioned by the NIH, studies regarding the biological processes that link religiosity/spirituality to health were evaluated and ranked by a working group of scientists (Hill and Pargament 2003; Seeman et al. 2003; Miller and Thoresen 2003; Powel et al. 2003). The result of these evaluations generated a series of recommended research designs, methodologies, and analysis to which this study adhered. A placebo controlled, randomized, cross-over design was used to eliminate many of the potential confounding factors associated with matched control experimental designs. Subjects were voluntarily recruited and placed into one of three groups that engaged in study activities but in a different order; thus, each subject acted as their own control, further maximizing data confidence.

#### Meditative Practices

##### Cellular Theta Breathing.

Cellular theta breathing (CTB) is a double-breathing meditative technique believed to alter consciousness. Therapists have used CTB as part of an overall therapeutic strategy, to help individuals access repressed memories and emotions according to Marriage and Family therapists Cheryl Cornelius and Diane Donovan-Vaughn (personal communication, June 20<sup>th</sup> 1997) both of whom use the CTB method with their clients. The intended purpose of CTB as a meditative technique is to intentionally increase the oxygen level within the body and allow the onset of what is referred to as the ‘theta

state’.

Unlike breathing methods used in yoga or relaxation exercises that can require lengthy periods of alternative breathing patterns, CTB involves a brief ten minute double-breath pattern. CTB uses a sensory reduction method with focused attention on one’s breath. Generally, the practitioner is in a relaxed sitting position or lying down comfortably. Practitioners begin the double breathing pattern and are asked to focus on their breath with their eyes closed. The CTB meditation environment is usually darkened with candles for light. Music without lyrics is played in the background. After ten minutes, practitioners reach a point where they settle into an observably deeper relaxed state and return to a normative breathing rhythm. At this point the practitioner is considered to be in the theta state, identified by decreased breathing rates accompanied by rapid eye movement. Once in this state, specific and non-normative visual, audio and physical sensations are generally reported by practitioners.

Over a decade of participant observation and informal interviews by the author with various meditation groups reveals some meditative techniques generate exceptional ‘non-ordinary’ experiences, such as flying, becoming an animal, and seeing past lives (Hardgrave 2003). CTB produces these non-ordinary experiences with practitioners contributing to reports of dramatic increases in energy, creativity and health. First person accounts report reduction in pain, deep insight to personal problems, extraordinary experiences and improved health and well-being. CTB practitioners often report being swept away by vivid imagery, losing contact with where they are or what they were doing for a period of time. Reported CTB experiences are consistent with the statements of Walsh (1990) where visual images go through a process of appearing and then

disappearing. It is of particular interest that CTB experiences are not necessarily consistent with a practitioner's religion (if they subscribe to one) or belief system. CTB practitioners are often surprised and perplexed by their experience which they often feel are personally meaningful. Accounts of CTB experiences include elements that can be associated with shamanic ASC. Out-of-body experiences or soul flight as well as communication with animals, elements of nature and anthropomorphic beings are common during CTB.

A preliminary study of CTB and its effects on language (Nell-Hardgrave 2003) applied coded linguistic markers to recorded interviews by 9 volunteers taken before and immediately following a CTB session. Statistically significant increases of verbal presentatives (utterances such as “*um*”, “*uh*”, and “*like*” accompanied paused speech) were observed in the post meditation interview. The following is an example from a study subject's post mediation narrative:

“ Uh...I felt that, that I was seeing pictures,...well sort of like, presented to me. And they were all me in these, these portraits but from the past and, and I actually saw, I mean recognized myself. It was very uh...uh...odd. They were flashing and going into space. Yeah, that's it....I was in space, portraits of me were coming in and like fading back. I um...think they were... I can't explain it, it just was so moving to see me as these, these different like ...all past lives...wow. I, I...yeah, this means a lot to me but I can't explain it.”

Content analysis of post CTB interview narratives revealed practitioners were experiencing non-normative visual and audio episodes accompanied with changes in perceived temperature and heightened feelings of emotion. Experiences of non-ordinary reality, as defined by Harner (1982) predominate during the pilot study regardless of level of experience with CTB.



The follow narrative excerpt is from another participant:

“In the beginning I was um...a dolphin...for a while. Uh, and then I started doing really deep in the ocean and I’m thinking to myself dolphins can’t go this deep, they’ll blow up or do something ya know, it can’t be good to go this deep. I felt so cold. And so..then I thought no...it’s all right and I went all the way into like, the center of the earth. And um, I remember seeing some white light, like under a doorway and I opened the door and there was a crystal that they always talk about. You know, right at the center. And I thought well that’s pretty cool and then I bounced out of that place...I really bounced and felt pressure on my skin...my arms. But before that...Oh! I remember right as I was beginning I kept having like this presence...it looked like me and said, “Come on! Follow me, follow me!” And I asked them, I said, “Who are you?” The answer was said with a laugh, “I’m your higher self”. And then I said, “OK.” You know...but I never could keep up and I would kind of like...fade off that was when the bouncing and arm pressure was. And I uh, could never keep up with that presence I followed, but that is what took me to the dolphin thing. I don’t know what to think...um...I think this is important but...I don’t know it was amazing, you know?”

The presence of non-ordinary experience during CTB has the greatest influence on altered language patterns and suggesting that as individuals attempted to express and attribute meaning to their experience, they encountered greater difficulty in verbal expression. Findings from the preliminary study of CTB provided an additional basis for the current research.

#### Guided Meditation

A second form of mediation used in this study, less often associated with ASC is, Guided Meditation (GM). This method which is typically used as relaxation tool, involves a suggestive technique where the practitioner is listening to a narrator who guides them on an imaginary journey up a mountain. The narrative is accompanied with environmental sounds and music that enhance the experience of a journey. The following expert is the guided meditation used in the current research:

“Take several deep breaths...up ahead you see a powerful mountain. This beautiful mountain magically beckons to you. Breathe naturally and feel the cooling of the air as you breathe in and feel its warmth as you exhale. Relax. You feel good here. You sense this is a place of power. You reach the base of the mountain and you see how it towers above you. Feel and sense the mountain’s energy. Create your perfect mountain. You know you will be climbing soon and anticipation surges through your body. Look at the mountain again. This mountain is the mountain of your life. It symbolizes your journey of enlightenment. It symbolizes your mission in life. Now you are ready to begin your journey. First you must prepare for you journey by lightening you load. Sit down in the grass under a tree and ask you self what do I need to leave behind of my physical self, my physical nature or my physical attachments in order to undertake the journey up the mystical journey. Take a moment and perform a sacred ceremony, saying, I now leave this excess weight behind in order to continue my journey into my true nature and be enlightened.” (taken from Finding Your Way Home ,Cornelius and Donovan-Vaughn 1996)

GM is practiced in a darkened room or environment and the practitioner is asked to focus and follow the narration. The narration asks the individual to imagine a mountain before them and to prepare to climb the mountain. During the journey they are given instructions to imagine or envision their mountain, to feel the air, and notice smells and to listen and watch for animals. They are asked to stop at certain points on their journey and leave behind emotions, ideas or thoughts that they wish to release. After reaching the top, they are asked to look around and take in a sense of achievement before returning down the mountain. The narrative keeps the individual cognitively engaged with as many senses as possible. GM does not generate the observable characteristics of rapid eye movement, nor have there been reports of soul flight or out-of-body experience during GM as is often the case with other forms of ASC meditation. Practitioners of both GM and CTB report that while both are relaxing, CTB generates a deeper experience. This form of GM served as a control for the possible Relaxation Response effects of CTB. While a pilot qualitative study has been conducted on CTB (Hardgrave

2003), this study represents the first formal investigation of the GM recording of Finding Your Way Home (Cornelius and Donovan-Vaughn 1996).

### Subject Selection

Subjects were recruited from the UNLV community using campus wide announcements via email. In May 2008 a total of 42 potential subjects volunteered for the study. Potential volunteers were scheduled to meet at the Department of Anthropology Laboratories for a detailed orientation of the study and to answer questions. Signed consent was obtained from volunteers prepared to continue participation. Subjects were assigned an identification code to use for all study questionnaires and asked to complete a self-report questionnaire regarding health practices.

### Exclusion Criteria

The self-report questionnaire was based on methodological recommendations suggested by Kiecolt-Glaser & Glaser (1998) for behavioral immunology research.

Exclusion criteria were:

- 1) use of antibiotics within the past 30 days;
- 2) use of cortisone or other steroid medication within the last 6 months;
- 3) pregnancy;
- 4) childbirth within the past 90 days;
- 5) regular cigarette smoking;
- 6) undergone psychotherapy in the past year;
- 7) report of serious illness within the past 90 days;
- 8) consumption of ten or more alcoholic drinks per week;

- 9) a history of major illness;
- 10) a history of symptoms which might indicate an active immunoregulatory disorder such as allergy; asthma, or eczema;
- 11) the presence of symptoms associated with an active disease process such as fever, drowsiness, sore throat, mouth sores, nasal congestions, in the preceding month.

In addition to the listed exclusion criteria, all subjects were required to be sero-positive for EBV antibodies. The literature states that 90% of populations within developed countries are sero-positive. Rather than delay the project further, the study proceeded under the assumption that 90% of the subjects would be sero-positive. The study protocol called for excluding study data from subjects later found to be sero-negative.

Screening of the self-report questionnaire resulted in 20 subjects being cleared for the project of which seven elected to continue. This number was considerably lower than expected, due to exclusionary criteria and the daily 1 hour commitment during weekdays for a three week period. It was decided to conduct a second run of the study in July 2008. As in May, there was a significant and enthusiastic interest in the study with 24 potential subjects of which 6 met all study criteria and selected to continue. May and July produced a total of 13 subjects. The subject sample (see Table 2) consisted of faculty, staff and students from the UNLV community with 12 females and 1 male aged from 24-56 years.

Table 2 Sample Average Age (SD) and Gender

May	July	Combined
42.6 (10.5)	44.7 (10.7)	44.1(10.2)
6 Females; 1 Male	6 Females; 0 Males	12 Females; 1 Male

### Data Collection

Subjects were randomly placed in to 1 of three groups (A, B or C). Members within each group met at the same time throughout the study and participated in session activities together. Subjects were trained in the meditation method CTB using a script to standardize technique instructions and allowed to ask questions regarding the performance of CTB prior to beginning. Subjects performed a 40 minute practice of CTB, GM and the Reading control each for 5 consecutive days but in a different order over the 3 weeks study period. Material for the reading control consisted of their choice of available magazines (Esquire, Money, Popular Mechanics, People, Spin, Time, Vanity Fair, Men’s Health and Budget Travel). Subjects were free to choose more than one magazine at time but were not permitted to get up once they were sitting. The same choice of magazines was provided for both runs of the study.

Table 3 Data Collection Schedule for May and July

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1 <sup>ST</sup> Week session activity			
	Group A 9:00 am	Group B 11:00 am	Group C 1:00 pm
Monday ^ ~ *	CTB	GM	C
Tuesday ^ ~	CTB	GM	C
Wednesday ^ ~	CTB	GM	C
Thursday ^ ~	CTB	GM	C
Friday ^ ~ *	CTB	GM	C
2 <sup>ND</sup> Week session activity			
	Group A 9:00 am	Group B 11:00 am	Group C 1:00 pm
Monday ^ ~	GM	C	CTB
Tuesday ^ ~	GM	C	CTB
Wednesday ^ ~	GM	C	CTB
Thursday ^ ~	GM	C	CTB
Friday ^ ~ *	GM	C	CTB
3 <sup>RD</sup> Week session activity			
	Group A 9:00 am	Group B 11:00 am	Group C 1:00 pm
Monday ^ ~	C	CTB	GM
Tuesday ^ ~	C	CTB	GM
Wednesday ^ ~	C	CTB	GM
Thursday ^ ~	C	CTB	GM
Friday ^ ~ *	C	CTB	GM

^ STAI & saliva collections before and after session  
 ~ questionnaires & recorded verbal responses  
 \* finger prick blood samples collected  
 CTB: Cellular Theta Breathing  
 GB= guided meditation  
 C= control

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The UNLV Anthropology department photography darkroom was used for all meditation sessions. This area was chosen because of its restricted access and dimmed lighting capability conducive to meditation. The darkroom was modified with carpets, pillows, blankets, yoga chairs and padded mats. Subjects were allowed to seat themselves comfortably prior to session activity. Standard meditation music for CTB and GM audio

was played using an iPod and two stereo speakers. Volume levels remained the same for all meditation sessions and session length was monitored using a stopwatch.

Data collection procedures consisted of subjects arriving at the Medical Anthropology lab where a station was prepared for each individual using a lab bench absorbent surface liner with their identification code clearly written on it. Each station had a clipboard with questionnaire forms, a pen, a labeled and dated plastic vial with a 3 inch straw for saliva collection, and a hand-held mini audio recorder containing a labeled and cued audio tape. Subjects provided saliva samples which were immediately placed in a -40 degree F freezer. The first of two STAI forms were completed and filed. Taking their clipboards, post-session forms and audio recorders, participants proceeded to the photography darkroom where they were allowed to settle comfortably. All efforts were made to reduce external noise from the adjacent rooms and hallways. Once settled, room lights were dimmed and the session began. Subjects were notified when the session ended and given a second plastic vial and straw to collect saliva. Samples were immediately stored. The post session forms were then completed and subjects were given privacy to record their verbal responses to open-ended questions regarding their experience during the session. Subjects returned to the Medical Anthropology lab with their remaining forms and recorders which were collected and filed. Audio recordings were immediately transcribed by either the Investigator or the lab assistant. On the last day of each week, subjects remained in the Medical Anthropology lab to provide finger prick blood spot samples. The collection procedure described above was repeated for each subject group throughout both runs of the study.

## Qualitative Assessments

### Speilberger State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI) is a self-report questionnaire that measures both the transitory subjective perceived feelings of anxiety and tension (state) that can be associated with activation of the autonomic nervous system and stable individual differences in anxiety proneness (trait) regardless of situational stress (Barker et.al. 1977; Speilberger 1983). The State-Trait Anxiety Inventory is a standard tool used in assessing mood in response to variety of circumstances and stimuli. A vast array of studies investigating the effects of meditation on stress exists within the literature that include anxiety levels in response to shamanic drumming (Harner and Tryon 1996), response to reflexology treatments (McVicar et al. 2007), effectiveness of meditation in reducing stress of women with breast cancer (Shapiro et al. 2003) and comparisons of perceived stress following meditation and progressive muscle relaxation (Rausch et.al 2006).

The STAI short-form used in this study is a six item self-report measure that has also demonstrated reliability (Marteau and Bekker 1992). Each item consists of a self-description statement rated on a 4 point Likert-scale ranging from (1) not at all to (4) very much. Three of the six items are reverse scored producing a single anxiety index where the higher the score the greater the anxiety level. The six item STAI short-form was completed by subjects prior to and immediately following all sessions. Forms were filed and stored during the study and analyzed after data collection was completed. Pre and Post session STAI scores were assessed where a positive value represented an increase in



anxiety, a negative value represented a decrease in anxiety and a value zero represented no change.

Within this research, STAI scores are utilized to determine if a relationship exists between CTB and self-reported anxiety and measured salivary cortisol levels. Anxiety scores for CTB are compared against GM and control scored and considered along side corresponding episodes of ASC and perceived session experience.

#### Likert Scaled Session Interview Questionnaire

In order to assess how the subjective experiences of persons engaged in CTB are described and evaluated by practitioners, an eight item Likert-scaled questionnaire was developed by the investigator to identify the presence and scale of attributes associated with an altered state of consciousness. This tool is intended to illustrate the frequency and magnitude of ASC episodes that occur during CTB in comparison to GM and control sessions.

The questionnaire is based on Ludwig's (1966) ten characteristics linked to ASC that include alterations in thinking, disturbed time sense, loss of control, change in emotional expression, body-image change, perceptual distortions, change in meaning or significance, sense of the ineffable, feelings of rejuvenation, and hyper-suggestibility, in addition to noted events of color, movement, emotional and abstract experiences (Winkleman 1986). Each item consists of a self-reported statement of experience regarding temperature, smell, sound, taste, feelings of emotion, physical sensation, time distortion and significance rated on a five point scale ranging from (1) very strongly, (2) Strongly, (3) Somewhat, (4) not at all and (5) not sure (see Appendix 3).

### Audio-taped Open-ended Sessions

Subjects were asked to respond to three open-ended questions regarding their session experience: (1) Describe in detail what you experienced during this session; (2) Were there any aspects of your experience that you felt were important or had meaning?, and (3) How would you describe how you feel after this session? Questions were based on a pilot study where perceived meaning during CTB produced a significant effect on linguistic patterns (Hardgrave 2002). This measurement tool allows subjects to recall and describe specific details, sequence and perceptions providing potentially richer content which can be analyzed. Recorded responses captured verbal intonation and emotion that might otherwise be lost or misinterpreted

Subjects were given a moderate degree of privacy to answer open-ended questions and were not limited in length of response time. Recorded audio tapes were catalogued and immediately transcribed. Transcriptions were then coded to identify episodes of altered consciousness using the same indicators in the scaled interview questionnaire- which were experiences of change in temperature, smell, sound, taste, feelings of emotion, physical sensation, and time distortion. Experienced events that were perceived as meaningful were also coded. A sample transcription is provided below:

“Um. Deep relaxation. I saw um, my breath, coming in and out of my body. I saw it as clouds. It had a V formation and it would lift and then it would go back out 1. Memories that come up or feelings that came up were if my father’s passing and seeing his body but being at peace. Seeing it rise. Having an experience of flying 2. I could feel the core of my body be very stable but my breath and yet having a real floating feeling inside. Uh, at the end I saw smoke as it would circle and go up in the air towards the end of the session **3**. It was rather dark but there were some red tones, some dark burgundy tones but it was mostly dark 4 and it felt like sometimes I was floating in the ocean... a lot of water sensation. I was released and to be free in that environment no tangible sense of gravity 5.”

Underlined sections in the above narrative highlight and count references that can be associated with ASC characteristics. Non-normative visual experiences (1, 3 and 4) and physical sensations of flying (2) and floating (5), illustrate the method with which transcribed data was coded and quantified for frequency analysis.

## Quantitative Assessments

### Epstein-Barr Virus Antibodies: A Biomarker of Immune Response

The Epstein Barr Virus (EBV) is a highly prevalent and latent human herpes virus. Epidemiological research indicates 90-98% of industrialized populations are EBV seropositive, having contracted EBV at some point (Roberts, 1989; Buchwald et al. 1987). The duration time between a given behavioral event (such as meditation) and EBV antibody response is 2-5 days (McDade et al. 2000a), therefore, EBV antibody levels against EBV-VCA offer an indirect measure of proficiency and assessment of cell-mediated immune function (Glaser and Gottleib-Stematsky 1982) making it one of the strongest and dependable immunological markers (Herbert et al. 1993). EBV antibodies were measured from finger-prick dried whole blood drops collected from subjects during the study.

#### Finger-Prick Blood Spot Collection

Each subject's finger was sterilized with isopropyl alcohol and then pricked using a lancet similar to those used by diabetics for measuring blood glucose. The lancets allowed for a consistent puncture that generated a blood flow with minimal discomfort and injury. The first drop of blood was wiped away using a kimwipe and five drops of approximately 50  $\mu$ L each were collected onto filter paper (Whatman #903) labeled with

the subject's identification code, study week number and date. A bandage was placed on the subject's finger. The samples were allowed to dry under a laboratory fume hood for at least 4 hours. Once dry, samples are placed in labeled airtight zip lock plastic bags with a desiccant (VWR Humidity Sponge-indicating # 61161-319) and stored at -40 degrees F. In preparation for shipping, the samples were positioned in a secondary airtight container with cold packs. Samples were then placed in a then final container and shipped overnight as diagnostic specimens in accordance with the Center for Disease Control (CDC) requirements to the Laboratory of Human Biology Research at Northwestern University to be assayed for EBV antibody titers.

#### Salivary Cortisol: A Biomarker of Session Experience

Cortisol is a quick-responding hormone that offers insight into the nature of individual experience occurring during meditative and control activities. Prior to beginning the study, subjects were provided with information regarding the procedure for saliva collection. This included instruction to refrain from eating, drinking, and brushing teeth at least 1 hour prior to study sessions. Upon entering the Medical Anthropology lab, subjects were given a pre-labeled sterile plastic (Wheaton # 985739) vial and a 3 inch straw asked to provide approximately 1.5ml of saliva that was immediately collected and stored at -40 degrees F. At the end of each session, subjects were provided with a second vial for saliva collection that was stored as indicated above. Samples were then transferred to the UNLV Anthropology department's Human Endocrinology Lab for analysis.

## Statistical Analysis

Statistical Package for the Social Sciences (SPSS) version 16.0, Minitab version 15 and Microsoft Excel 2007 were used to conduct the survey analysis. All data results were initially entered into an Excel spreadsheet, which was then imported into SPSS and Minitab for analysis.

### Variables and Statistical Tests

Meditation technique (CTB, GM and Reading control) was the only independent variable analyzed in this study. The data was longitudinal, resulting from repeated measurements taken from each subject for five days for each meditation technique. There are 5 dependant variables: 1) STAI scores, 2) Likert-scaled interview questionnaire, 3) Content analysis of recorded responses to open-ended questions, 4) EBV antibody concentrations and 5) salivary cortisol levels.

Before conducting analysis of each variable, a test was conducted to determine if differences existed between the May and July subjects and if differences existed between groups A, B, and C. This analysis was conducted for each variable and where no differences were found, statistical testing treated the data as one sample set. Statistical testing was conducted using an alpha value of 0.05. EBV antibody concentrations and salivary cortisol levels testing was conducted using a two-tailed test with an alpha value of 0.05.

Analysis for STAI scores, content analysis or recorded verbal responses and Likert-scaled interview data were analyzed using the Generalized Estimation Equations (GEE) module in SPSS 16.0 for ordinal, multinomial data. The EBV antibody concentration percentage difference was analyzed using ANOVA for normal data with equal variances.

Salivary cortisol concentration percentage difference was analyzed using a linear mixed model in SPSS 16.0 after data as shifted by +1 and normalized.

## CHAPTER 5

### STUDY RESULTS

The combined May and July participant cohorts consisted of thirteen subjects, all of whom completed the study. Six subjects missed a single session during the study, with one subject missing two sessions but not within the same week. All but one subject were novices at any form of regular meditation practice.

#### State-Trait Anxiety Inventory (STAI) Results

A separate Kruskal-Wallis test with  $\alpha = 0.05$  using SPSS 16.0 test was conducted for each meditation technique to determine whether there was a difference in distribution between subjects Groups A, B, & C for the May and July studies. In failing to reject the null hypothesis (there is no difference between the groups), it can be concluded that time of day and order in which the groups participated in CTB, GM and the Reading control was not significant in terms of anxiety. All subjects were thus combined into one large data group for further analysis.

Table 4 Kruskal-Wallis Test for Difference in Distribution Between Groups

Technique	p-value	Conclusion
Reading	0.244	No difference
GM	0.150	No difference
CTB	0.180	No difference

The difference between mediation techniques was then analyzed keeping each repeated measure score separate.

Subjects:	13	x
Techniques	3	x
<u>Repeated Measures</u>	<u>5</u>	<u>x</u>
	195	
<u>Missing Data*</u>	<u>10</u>	<u>-</u>
Final Sample Size	185	

\*Missing Data points are sessions where a subject did not complete the pre-, post, or both pre & post during a session, this preventing a difference in pre/post from being calculated.

The Generalized Estimating Equations (GEE) module in SPSS 16.0 was used to account for non-independent data, such as repeated measures, and accounts for missing data (10 data points in this case). The null hypothesis is there is no difference in meditation technique in terms of their influence on anxiety levels in a subject, as perceived by the STAI score. Using  $\alpha = 0.05$ , the p-value for this test was  $p = 0.034$ , therefore the null hypothesis was rejected. There is a difference between meditation techniques and their influence on anxiety levels. Next, a pairwise comparison was conducted to determine how the meditation techniques differed. The results show a significant difference between the reading control and CTB ( $p < 0.05$  means there is a significant difference).



Table 5 Meditation Technique and STAI Scores

Technique	p-value	Conclusion
Reading Control v. GM	0.105	No difference
Reading Control v. CTB	0.013	<i>There is a difference</i>
GM v. CTB	0.322	No difference

The mean and standard error are shown below for Reading and CTB reflecting the mean difference between the pre and post questionnaire scores. A negative number reflects a decreased feeling of anxiety, as reflected by the STAI score; and the below results indicate CTB generates a greater decrease in feeling of anxiety as compared to Reading.

Table 6 Mean STAI Score for CTB and Reading Control

Technique	Mean	Standard Error
CTB	-3.40	0.535
Reading	-1.77	0.380

Analysis was also conducted using a weekly average in STAI score per subject per meditation technique.

Sample size: N = 39

Subjects: 13 x

Techniques 3 x

Final Sample Size 39

The p-value for this test was  $p = 0.058$  just missing significance at 95%. Using  $\alpha = 0.10$ , the null hypothesis was rejected indicating there is a difference between meditation

techniques. Figure 3 reflects the above conclusion when using average weekly score. Subject B3 shows the greatest difference between techniques. The K-W test was run again without subject B3. The p-value was 0.063, which does not change the conclusion.

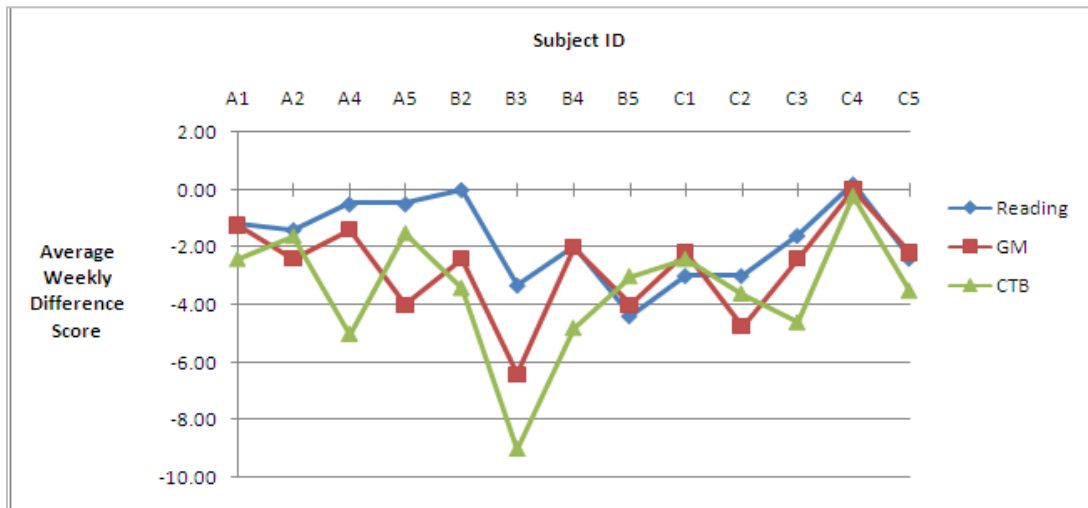


Figure 3 Weekly STAI Score Comparison for CTB, GM and Reading Control by Subject

### Conclusions

CTB produced a greater reduction in STAI anxiety scores when compared to the reading control. No statistical significance was found comparing CTB with GM or between GM and the reading control.

### Likert Scaled Interview Questionnaire Results

Study subjects completed a 5-point Likert-scaled questionnaire consisting of 8 questions after each session. Scaled responses were “Not At All”; “Somewhat”; “Strongly”; “Very Strongly”; and “Not Sure”. The questionnaire was designed to

determine if subjects experienced any of the following 8 characteristics associated with an altered state of consciousness (ASC):

Question 4: Sense of Temperature

Question 5: Sense of Smell

Question 6: Sense of Sound (excluding music and ambient sounds within the session studio)

Question 7: Sense of Taste

Question 8: Experienced Other Physical Sensations

Question 9: Experienced Feelings of Emotion

Question 10: Experienced Distortions in Sense of Time

Question 11: Experience Was Significant /Meaningful To Me

Scaled responses associated with ASC characteristics were measured by technique.

This portion of data analysis tested the following null hypothesis: For each ASC characteristic, there is no difference between the meditation techniques (Control, GM, & CTB). A total of 65 data points were collected for each technique (CTB, GM & Control). This consisted of 13 subjects with 5 repeated measures per subject (representing 5 days per technique).

The Generalized Estimating Equations (GEE) module within SPSS 16.0 was used for this analysis since the distribution is ordinal multinomial with repeated measures and contained missing data points. Missing data points existed where subjects did not respond to a question or responded with “Not Sure.” As a conservative measure, answers of “Not Sure” were excluded, as it was possible that an ASC experience occurred but was

not fully recalled by subjects. Therefore, a 4-point scale was used in scoring and analysis. Responses of “Not Sure” were treated the same as though the subject did not answer the question. The number of missing data points for each characteristic will be presented as “number that did not respond to the question” and “number that responded ‘Not Sure.’” Each interview question was analyzed independently and the null hypothesis was rejected for any results with a p-value less than or equal to 0.05.

This study found the following ASC characteristics to be different between all three techniques, and the null hypothesis was rejected. Further analysis showed GM and CTB generated a significantly greater frequency of the following characteristics, when compared to the control activity.

Question 4: Sense of Temperature

Question 6: Sense of Sounds

Question 8: Experienced Other Physical Sensations

Question 9: Experienced Feelings of Emotion

Question 10: Experienced Distortions in Sense of Time

Question 11: Experience Was Significant /Meaningful To Me

This study failed to reject the null hypothesis for the following ASC characteristics

Question 5: Sense of Smell

Question 7: Sense of Taste

Table 7 ASC Characteristics for meditation Techniques and Reading Control

Question	Total # Data Points	# Included Data Points	# Data Points Excluded		p-value
			“Not Sure”	No Response	
4 Temperature	195	186	0	9	p=0.010*
5 Smell	195	184	2	9	p=0.347
6 Sound	195	187	0	8	p=0.000*
7 Taste	195	186	1	8	p=0.987
8 Physical Sensation	195	187	0	8	p=0.000*
9 Emotion	195	186	1	8	p=0.012*
10 Time distortion	195	181	5	9	p=0.000*
11 Meaning	195	184	3	8	p=0.000*

Pairwise comparisons were not able to be executed in the initial analysis, in order to determine whether there was a difference for each ASC characteristic between GM and CTB. In SPSS, pairwise comparisons are calculated based on estimated marginal means that assumes a normal distribution of data, which does not describe this data set.

Therefore, a second, independent analysis was conducted with only GM and CTB data (Reading Control data was removed with GM as the baseline). The null hypothesis was rejected as the analysis found significant differences between GM and CTB for the following ASC characteristics listed below. Further analysis showed that in all cases where there was a difference, CTB generated a significantly greater frequency of the following characteristics, when compared to GM.

Question 6: Sense of Sounds

Question 8: Experienced Other Physical Sensations

This study failed to reject the null hypothesis for the following ASC:

Question 4: Sense of Temperature

Question 5: Sense of Smell

Question 7: Sense of Tastes

Question 9: Experienced Feelings of Emotion

Question 10: Experienced Distortions in Sense of Time

Question 11: Experience Was Significant /Meaningful To Me

Table 8 ASC Characteristics GM vs. CTB

Question	Total # Data Points	# Included Data Points	# Data Points Excluded		p-value
			“Not Sure”	No Response	
4 Temperature	130	127	0	3	p=0.233
5 Smell	130	124	2	4	p=0.215
6 Sound	130	127	0	3	p=0.032
7 Taste	130	126	1	3	p=0.969*
8 Physical Sensation	130	127	0	3	p=0.000*
9 Emotion	130	126	1	3	p=0.780
10 Time distortion	130	122	5	3	p=0.718
11 Meaning	130	124	3	3	p=0.079

The analysis was repeated using a 3-point scale. Responses of “Very Strongly” and “Strongly” were consolidated as “Strongly.” Results did not differ from those reported above.

### Conclusions

CTB and GM produce a significant number of occurrences in 6 of the 8 measured ASC characteristics when compared to the Reading Control. Significance was found for the ASC characteristics: a sense of sound, smell, physical sensation, feelings of emotion, distortion of time and meaning. CTB was found to be distinct in producing a significant number of occurrences in the ASC characteristics sense of sound and physical sensations

when compared to GM. CTB and GM both produce characteristics associated with ASC, with CTB producing greater of experiences of sound and physical sensations.

### Audio-taped Response Results

Subjects were asked to respond to three open-ended questions regarding their session experience. Responses were audio recorded and transcribed. Transcriptions were coded for Non-ordinary reality, which indicates an experience of altered consciousness using the same indicators listed in the scaled interview questionnaire. Experienced events that were perceived as meaningful were also coded. Coded data was then quantified for frequency and further analysis.

A Mann-Whitney test with  $\alpha=0.05$  was performed for each meditation technique to determine if there was a difference in distribution between the May and July study. The null hypothesis is there is no difference between the May and July studies. In failing to reject the null hypothesis, it was assumed that no significant variation existed and both runs of the study could be combined into one data set.

Table 9 Mann-Whitney Test for Difference in Non-Ordinary Reality /ASC and Meaning Distribution between May and July

	p-value	Conclusion
Non Ordinary Reality	0.119	No difference
Meaning	0.458	No difference

A separate Kruskal-Wallis with  $\alpha = 0.05$  using SPSS 16.0 test using was conducted for each meditation technique to determine whether there was a difference in distribution

between Groups A, B, & C. The null hypothesis is there is no difference between the groups. In failing to reject the null hypothesis, it was concluded that time of day and order in which the groups participated in the three techniques was not significant in terms of non-ordinary experience and meaning. All subjects were thus combined into one large data group for further analysis.

Table 10 Kruskal-Wallis Test for Difference in Non-Ordinary Reality/ASC and Meaning Distribution Between Groups

	p-value	Conclusion
Non Ordinary Reality	0.216	No difference
Meaning	0.326	No difference

The difference between mediation techniques was then analyzed keeping each repeated measure score separate.

Subjects:	13	x
Techniques	3	x
<u>Repeated Measures</u>	<u>5</u>	<u>x</u>
	195	
<u>Missing Data*</u>	<u>7</u>	<u>-</u>
Final Sample Size	188	

\*Missing Data points are sessions where a subject missed a session.

The Generalized Estimating Equations (GEE) module in SPSS 16.0 was used. The null hypothesis is there is no difference between meditation techniques in generating



experiences of non-ordinary reality in a subject. Using  $\alpha = 0.05$ , the p-value for this test was  $p = 0.00$ . Therefore the null hypothesis was rejected. There is a difference between meditation techniques and their influence on experience of non-ordinary reality as reported in responses to open-ended questions. Next, a pairwise comparison was conducted to determine how the meditation techniques differed in terms of non-ordinary reality experiences. The results show a significant difference between all three techniques with CTB and GM showing a greater frequency of experiences compared to the reading control.

Table 11 Average Frequency of Non-Ordinary Reality and Meaningful Experiences

	Non Ordinary Reality	Meaning
CTB	2.84	0.89
GM	1.36	0.81
Reading Control	0.23	0.30
Overall	1.49	0.67

To test differences between CTB and GM, analysis excluded the reading control using GM as the baseline. Results show CTB having a significantly greater frequency of non-ordinary reality compared to GM. The presence of *meaning* ascribed to experiences during meditation was a significant variable in an earlier pilot study. Therefore a pairwise comparison was preformed to determine if meditation techniques differed in terms of ascribed meaning. The results show a significant difference between all three techniques with CTB and GM showing a greater frequency of meaning compared to the reading control. In comparing differences between CTB and GM only, no significance was found. On average, CTB produce 12 times as many Non-Ordinary Reality

experiences (2/84/.23) compared to the Reading Control. GM was found to produce twice as many Non-Ordinary Reality experiences (2.84/2.36) compared to the Reading Control. CTB also generated 3 times as many Meaning experiences (0.89/.30) compared to the Reading Control. No significant differences in Meaning between CTB and GM were found.

Content analysis of non-ordinary reality events displayed an interesting outcome. Reports of flying, floating and departing from their physical body were described by 11 of 13 subjects with a surprising similarity to depictions of shamanic flight found within the ethnographic record. Examples of experience during CTB follow:

#### Subject A

“I was having an experience of flotation. I could feel the core of my body be very stable and yet having a real floating feeling inside with lots and lots of color. First of all light blue in the beginning. Like a light blue you see in the winter sky. Um, it was very bright, but not glaring. Um, then it went to darkness. Black. And you could see purple concentric circles spiraling down, going into different spirals and having tracers. Um, and sometimes they would have a little bit edges, um bubbles I would call them but on top of them like a layer but there were definitely black background with deep purple. I can still see those deep purple circles going in. First they moved counter-clock wise in direction and then going in a clock-wise direction. Um. In the beginning with the blue sky, I felt that I was in the Grand Canyon and not being there physically, but just there floating. But not like a balloon but just kind of travelling through the canyon without uh, feeling the wind and seeing the wind. And seeing nature, uh more connected in that way.”

#### Subject B

“... lying on back, floating in the water and um, the stars up above and all of a sudden they got swirly, and I could actually see the swirling, the stars swirling and I got a little bit dizzy but it was really cool cause I hadn't, hadn't been able to visualize it, anything, this time except, you know, the, um, the life inside the seed so I thought that was really cool and then, um, and then that swirled into this hole in the universe and a big eye and I was looking through the eye and this kind of communion with the universe and like maybe with other, well, species.”

### Subject C

“Um...at the beginning I was um...somehow...standing in a...on the site where the earthquake happened in China. And I was looking down ...all those...um...houses and um... people who died in the earthquake. And then somehow all of a sudden I was...I felt I was sitting on the mat and the mat was...uh...was...starting to um...rise... it started to rise up and then into the sky. And then I was sitting on the mat and actually floating in the air and uh...you know...I was looking down from the top. And um...I was looking...at first I was looking at that area and then gradually the mat was floating away... you know...with the air to other places where I saw beautiful mountains and uh clouds. I was above the clouds and somehow also I experienced raining and storming under the mat...I mean...under...beneath uh...beneath me. And um... then...you know it stopped and I was floating in the air basically”

### Subject D

“I heard the crinkle of plastic um... and it startled me and when I became aware of the room. I was concerned because I opened my eyes and for some reason I thought I was in my own bedroom and I had heard a plastic bag that was...that I know is in my bedroom at the moment. Um...I thought I heard that bag being crinkled and that somebody was in my room. Um... and that was the first reaction I had when I heard the plastic. Um...so... during this point I believed I as actually in my bedroom and not in the meditation lab. Um... so that was...I don't know what I would call that...astral projection...yeah. But...um...so that's what happened”

### Conclusions

CTB and GM generated a significant frequency of non-ordinary reality experiences and ascribed meaning when compared to the reading control. CTB was found to produce a significantly greater number non-ordinary reality experiences when compared to GM.

### Epstein-Barr Virus (EBV) Antibody Results

Study subjects provided a total of four finger-prick blood spot samples over the duration of the study. The first sample was collected at the beginning of the study and served as a baseline. The three collections occurred at the end of each week long session

for a total of 52 samples. EBV antibody titers (the dependant variable) were analyzed against Data Group, Group and Session Activity as defined below.

Data Group	May, July
Group	A, B, C
Session Activity	CTB, GM, Reading

EBV antibody concentrations can vary across individuals, therefore each study subject served as their own control. The first blood-spot collection at the beginning of the study served as the starting baseline BL. At the end of the week, each subject's preceding week measurement served as the baseline to calculate the percentage difference for each subject as shown in the example below:

Example: Subject A1:

Week 1 CTB – BL percentage difference will be their CTB change.  $\frac{CTB-BL}{BL}$

Week 2 GM – CTB percentage difference will be the GM change.  $\frac{GM-CTB}{CTB}$

Week 3 Reading – GM percentage difference will be the reading change.  $\frac{READING -GM}{GM}$

Using  $\alpha = 0.05$ , Figure 4 and Figure 5 show that EBV percentage difference follows a normal distribution ( $p = 0.098$ ) and equal variances ( $p = 0.396$ ) respectfully.

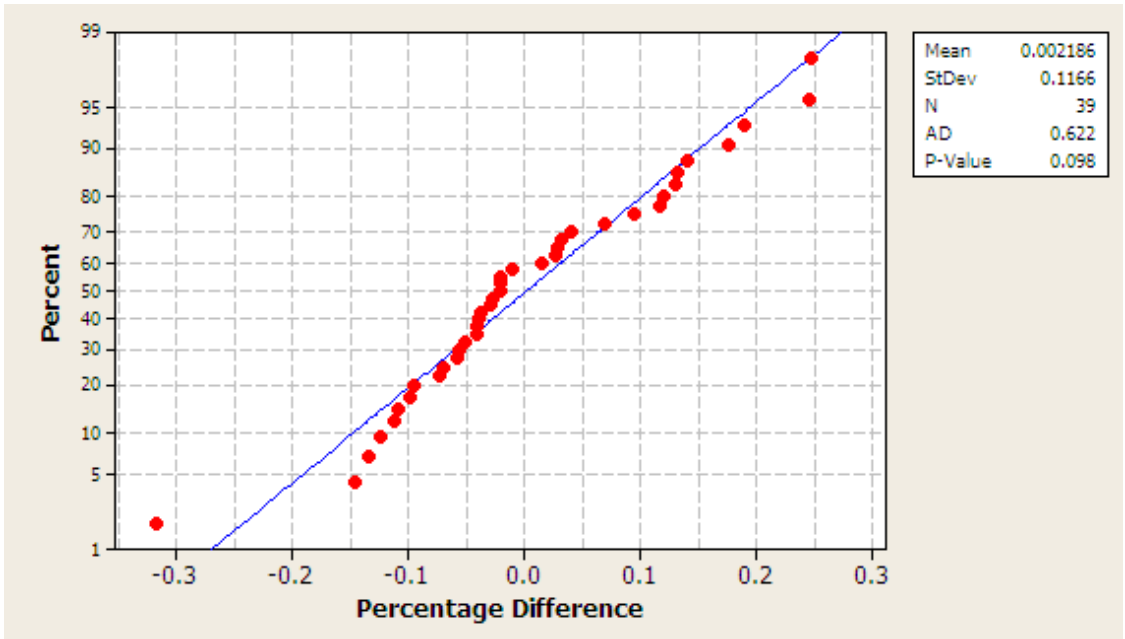


Figure 4 EBV Probability Plot of Percentage Difference

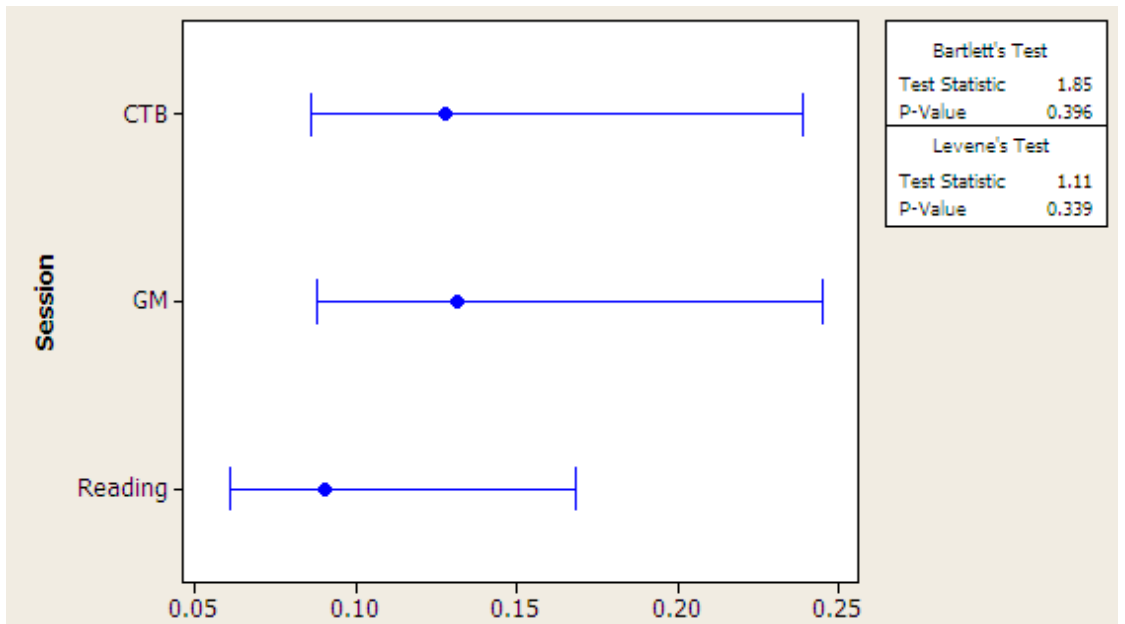


Figure 5 Test of Equal Variance of EBV Percentage Difference

The cross-over design allowed each study subject to act as their own control subject (by activity), therefore a 3-way ANOVA was used to test EBV antibody titer percentage difference for each week.

Table 12 Analysis of Variance for EBV Antibody Titer Percentage difference Between Session Activities

Source	DF	Seq. SS	Adj. SS	Adj. MS	F	P
Data Group	1	0.00969	0.01001	0.01001	0.94	0.334
Group	2	0.01489	0.01082	0.00541	0.51	0.610
Session	2	0.01831	0.06635	0.03317	3.10	<b>0.066†</b>
Data Group * Group	2	0.00562	0.00562	0.0281	0.26	0.771
Data Group * Session	2	0.01597	0.00640	0.00320	0.30	0.744
Group * Session	4	0.08605	0.13082	0.03271	3.06	<b>0.039*</b>
Data Group* Group* Session	4	0.14152	0.14152	0.03538	3.31	<b>0.030*</b>
Error	21	0.22440	0.22440	0.01069		
Total	38	0.51644				

† =  $\alpha$  0.10; \* =  $\alpha$  0.05

Assuming  $\alpha = 0.05$ , Session Activity approaches significance ( $p = 0.06$ ) indicating that a session activity influenced EBV antibody titer levels. In addition a 2-way (Group x Session Activity) and 3-way interaction were also found to be significant. Further analysis using main effects mean plots (Figure 6) was conducted with only session activity is significant at the  $\sigma = 0.10$  level. EBV antibody titer mean percentage differences are decreased for both CTB and Reading control with GM surprisingly increased in comparison. A possible explanation is indicated in Table 13.

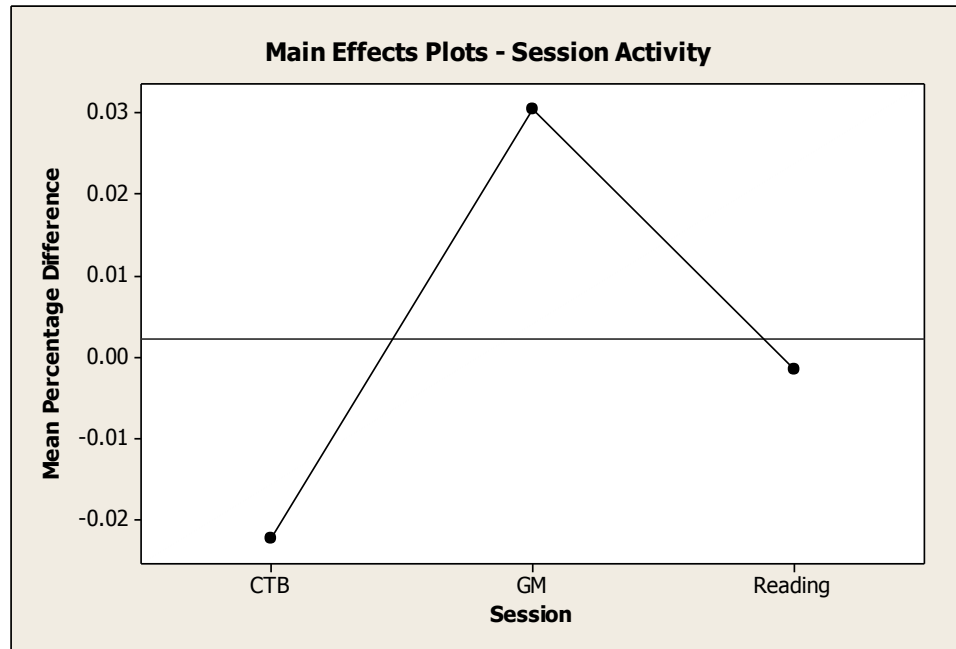


Figure 6 Main Effects Plots - Session Activity

Table 13 shows observations (10-15) are leverage points giving them a disproportionate influence on the dataset.

Table 13 Unusual Observations for EBV Antibody Titer Percentage Difference

Observation	Percentage Difference	Fit	SE Fit	Residual	Standard Residual	
10	-0.317031	-0.317031	0.103372	0.000000	*	X
11	0.248020	0.248020	0.103372	0.000000	*	X
12	-0.010525	-0.010525	0.103372	-0.000000	*	X
13	0.130899	0.130899	0.103372	-0.000000	*	X
14	-0.020481	-0.020481	0.103372	-0.000000	*	X
15	0.014578	0.014578	0.103372	0.000000	*	X
36	0.246452	0.246452	0.073095	0.196055	2.68	R
39	-0.145659	-0.145659	0.073095	-0.196055	-2.68	R

R denotes an observation with a large standardized residual

X denotes an observation whose X value gives it large leverage

Additionally, two data points have large residuals (observations in 36 and 39) suggesting they are outliers. Observations 36 and 39 represent subject #C3 and subject #C5 respectively during GM sessions.

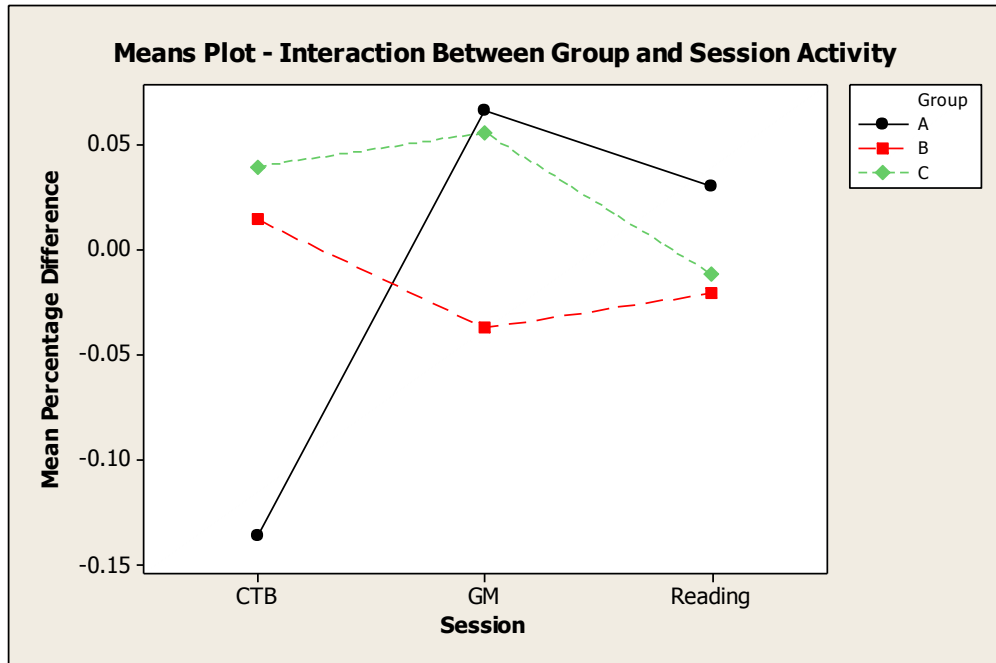


Figure 7 Means Plot Interaction Between Group and Session Activity

A 2-way interaction means plot (see Figure 7) illustrates a significant relationship between Group and Session Activity for EBV. Group A shows the largest negative percentage difference for CTB, Group B shows the largest negative percentage difference for GM. During the first week, Group A practiced CTB, Group B practiced GM and Group C practiced the Reading control suggesting that a benefit as measured by percentage decreases in EBV was derived from study participation regardless of session activity. This could possibly be explained by the fact that subjects were required to



schedule 60 minutes out of their work day (with one exception, subjects were UNLV staff and faculty) to participate in the study and perhaps the break in their routine provided an unforeseen benefit. Furthermore, the large drop in Group A for CTB is influenced largely by one study subject #A1. While analysis could have been conducted excluding subject #A1 the small sample size (only four subjects in Group A) made this option infeasible.

### Conclusions

CTB appears to have a measurable impact on EBV ( $p=0.066$ ) antibody titer levels however this finding should be tempered by the presence of outlier and disproportionate leverage values within a small sample.

### Salivary Cortisol Results

The results were received in an Excel spreadsheet, and represented cortisol from the weekly Monday, Wednesday and Friday sessions. Results were imported into SPSS version 16.0 to conduct the analysis. The data were analyzed as a percentage difference between the pre- and post-cortisol number for each subject for each session. This was calculated as  $(\text{post} - \text{pre}) / \text{pre}$ . A positive percentage reflects an increase in cortisol levels across the session. A negative percentage reflects a decrease in cortisol levels across the session. The presence of negative values and the lack of a normal distribution ruled out linear mixed (hierarchical) models without first transforming the data. After shifting the data by +1, Box-Cox transformation analysis was conducted to determine a lambda value in order to transform the data to a normal distribution (see Figure 8). The

Box-Cox transformation analysis presented a lambda of -0.5 with a 95% confidence interval.

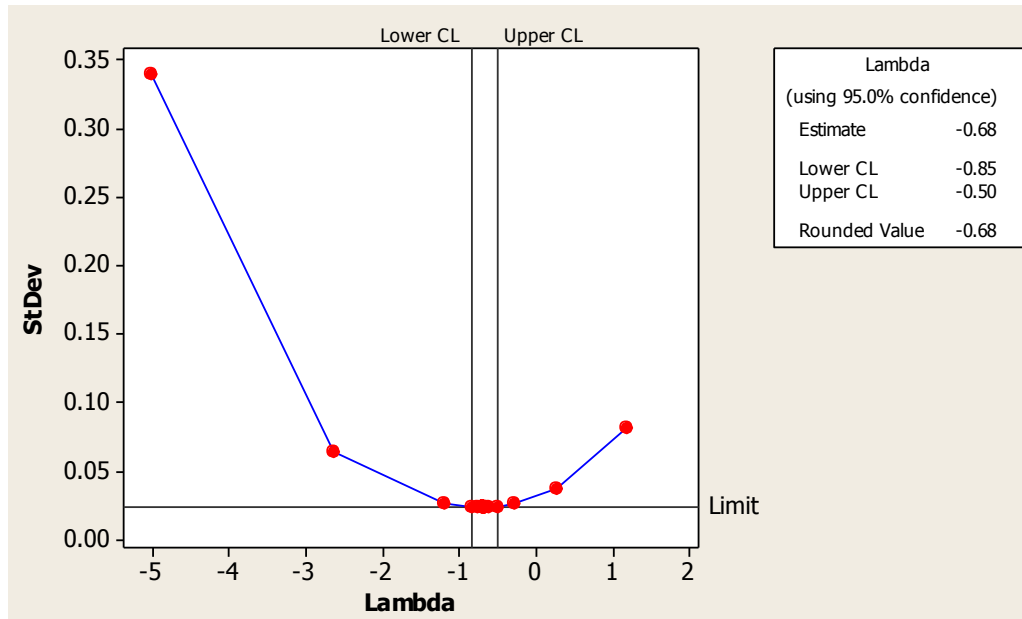


Figure 8 Box-Cox Plot of Shifted Percentage Difference for Salivary Cortisol Values

Figure 9 shows the Normal Probability Plot for the transformed data. Using an alpha value of 0.05, I can fail to reject the null hypothesis ( $p > 0.15$ ) and assume the data now follow a normal distribution.

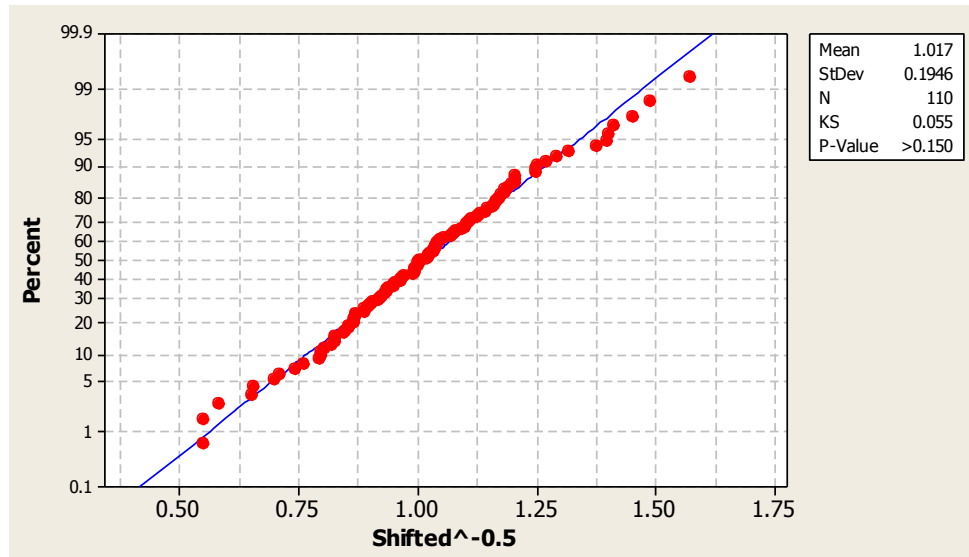


Figure 9 Probability Plot of Shifted<sup>-0.5</sup> Salivary Cortisol Values

The Linear Mixed Models module in SPSS was used for all analysis. Since this data set is continuous and follows a normal distribution, this technique is preferred and more robust when compared to general estimate equation, general linear models, and mixed models ANOVA. The justification for using the Linear Mixed Models module is in its ability to accommodate for missing data points, where Mixed models ANOVA illuminates any subject with missing points. In the case of this data set, six subjects missed one session, using mixed models ANOVA, would have restricted analysis to only seven subjects, effectively reducing and already small sample size by nearly 50%.

Analysis was conducted with all factors included in order to determine whether meditation technique, May/July, Groups A/B/C, Week 1/2/3 and Session M/W/F were a factor. Any factors deemed non significant were excluded in subsequent ANOVA models in order to analyze the data using a simpler model. For all analyses, an alpha value of 0.05 was used to determine whether variables were significant or not.

	<u>p-value</u>	<u>Conclusion</u>
Meditation Technique:	0.214	No difference
May / July:	0.016	There is a difference
Group A/B/C:	0.985	No difference
Week 1/2/3:	0.895	No difference
Session M/W/F:	0.548	No difference

A reduced ANOVA was conducted with only mediation technique and May/July. The reduced model shows the following results.

	<u>p-value</u>	<u>Conclusion</u>
Meditation Technique:	0.190	No difference
May / July:	0.006	There is a difference

A reduced ANOVA was repeated for meditation technique and May/July that included and interaction effect to determine whether the interaction between variables was significant. The below data shows this interaction is not significant and, therefore, will not be included in the final model.

	<u>p-value</u>	<u>Conclusion</u>
Meditation Technique:	0.153	No difference
May / July:	0.007	There is a difference
Interaction	0.413	No difference

Since analysis shows a difference between the May and July groups, they were examined separately to determine whether any variable was significant for one group but not the other. When looking at data only from May, there are no significant factors.

	<u>p-value</u>	<u>Conclusion</u>
Meditation Technique:	0.893	No difference
Group A/B/C:	0.483	No difference
Week 1/2/3:	0.932	No difference
Session M/W/F:	0.959	No difference

When looking at data only from July, meditation technique is significant.

	<u>p-value</u>	<u>Conclusion</u>
Meditation Technique:	0.042	There is a difference
Group A/B/C:	0.635	No difference
Week 1/2/3:	0.701	No difference
Session M/W/F:	0.364	No difference

Further analysis continued since meditation technique is significant in July. The reduced ANOVA with just meditation technique as part of the model shows that meditation technique is no longer significant at the 95% level but is significant at the 90% level.

	<u>p-value</u>	<u>Conclusion</u>
Meditation Technique:	0.086	No difference (at 95% level)

Pair wise comparisons for this reduced model were conducted and discovered that CTB, when compared to GM, is significantly different. There is no difference between CTB and Reading or between GM and Reading.

	<u>p-value</u>	<u>Conclusion</u>
Reading v. GM	0.104	No difference
Reading v. CTB	0.623	No difference
GM v. CTB	0.034	There is a difference

Table 14 shows the median percentage differences for July that indicate GM had a greater percentage increase in salivary cortisol when compared to Reading (24.1% compared to 0.95%).

Table 14 July Median Percentage Differences for Salivary Cortisol

	May	July
Reading	12.67%	0.95%
GM	-7.94%	24.10%
CTB	-0.80%	-1.65%

### Conclusions

From the above analysis, while GM produce significantly higher salivary cortisol levels when compared to Reading, for the July study (n=6), sample size precludes drawing any conclusions. Overall, there does not seem to be significantly correlated with meditation technique.

## CHAPTER 6

### DISCUSSION

The overall aim of this research is to explore the potential health benefits of CTB as a specific form of meditative ASC, and to determine if CTB is distinct from relaxation response characteristics associated with mindfulness-based meditation less often and strongly associated with ASC. Identifiable biomarkers of immune response and experience, measurements of anxiety and coded content analysis of personal accounts were used to capture direct and indirect markers of health related outcomes.

#### ASC Characteristics Produced by CTB and GM

CTB and GM generated six out of the eight ASC characteristics: a sense of sound, smell, physical sensation, feelings of emotion, distortion of time and meaning when compared to the control of quiet reading. GM is a narrated guided imagery process that takes the listener on an imaginary or mental “journey” through nature settings. The narration is accompanied by music and nature sounds that correspond to the journey. Suggestive statements are made during the meditation such as ‘take a moment to see the horizon and feel the coolness of the air’ that is intended to engage as many senses as possible to enrich the experience. As such, the ability of GM to generate ASC characteristics should be tempered by its highly suggestive method. In contrast, the CTB meditation is practiced with music but lacks narration. The only instruction that practitioners are given is in the double breathing technique in which they engage for approximately five minutes before returning to a normal breathing pattern for remainder of the meditation period

Within this study, both CTB, and to a lesser degree, GM yielded a statistically significant number of ASC episodes. CTB-generated ASCs were, however, distinct in several respects. Firstly, all subjects experienced ASC episodes characterized by anomalous physical sensations and sounds during CTB, with the exception of only two individual sessions. The most common physical sensation was described as flying, floating, moving beyond the physical body and travelling to other locations. Sound experiences included nature and animal sounds, being spoken to and receiving messages. An account from a subject after practicing CTB for the first time states, “[I was] having an experience of flotation. I could feel the core of my body be very stable and yet having a real floating feeling inside.” Another subject reported hearing the voice of their grandmother, comforting her. In describing their CTB experience one subject recounted the following:

“Well at one point in time I felt myself leave my body, at least for the most part with conscious awareness; it was a very strange experience though because I was out of body probably everywhere but maybe my belly area and where I was sitting. I clearly heard ‘not my will done but thine’ I felt like I was receiving instruction about certain things to do.”

Secondly, descriptions such as those presented above were common among subjects during CTB throughout the study and strikingly similar to shamanic accounts of soul flight and spirit communication. Winkelman (2009) notes that shamanic soul flight events occur during near-death experiences and among modern practitioners of shamanism neither of which describe the sample population (with the exception of one seasoned meditation practitioner). Hunt (1995) states that soul flight exists cross-culturally because it involves intrinsic physiological and symbolic systems with innate modular structures of the brain and consciousness (also see Winkelman 2009). The



ability of novice meditation practitioners to experience soul flight during CTB, in the absence of suggestibility or instruction to do so, suggests the involvement of innate physiological processes in support of Winkelman, Laughlin and Hunt's position.

### CTB and Stress Reduction

CTB was found to significantly decrease anxiety which is consistent with the literature documenting the stress reducing effects of meditation (see Chapter 3). Unlike the directed format of GM, the practice of CTB requires a short-term alteration of and focus on breathing patterns, leaving subjects open and free to whatever experiences arise. The prevalence of ASC episodes associated with CTB implies activation of the limbic system which modulates the interaction between emotion and memory (MacLean 1990) in tandem with activity in the frontal cortex. Subjects frequently reported experiencing past events in what Mandell (1980) refers to as emotional flooding. An excerpt from a subject's account during CTB exemplifies this point:

“...I was floating on the ocean I was floating on a mat. I was floating with the waves of the ocean. I was just kind of thinking I didn't know why I was there but...somehow I was very calm. I was lying on the mat and the mat was up and down with the waves of the ocean...and pretty much the whole session I was uh...on the ocean...sleeping on the mat. I'm afraid of water, I'm not the kind of person that loves the water. I would be so afraid if I were in the ocean, but somehow it was very calm. I was surprised that I was floating you know. So that is the kind of experience that I started to have right away after the first 5 minutes of breathing. I was surprised that I was so calm on the ocean. I am always afraid of going to the water, even a river. I once was near to drowning, so I've had bad experience with water but um...wow in this session I was floating with the waves of ocean and I was afraid of nothing! That is something I never thought I would see.”

Similar ASC accounts were common during CTB throughout the study and exemplify how affective memories involving the limbic system are presented and potentially transformed with implications for decreased anxiety. Shapiro (1982) has argued that many stress reducing results attributed to meditation are the result of other influences and shared elements from psychotherapy and cognitive reprogramming (Baer 2003). Taking into account that subjects were comprised of UNLV staff, faculty and students (with one exception), who scheduled their participation in the study into their work day, to some degree a reduction in stress would be expected since all session activities (CTB, GM and Reading control) involved sitting or lying comfortably in a relaxed atmosphere during working hours. That CTB produced a significant frequency of ASC and reduction in anxiety in these circumstances further distinguishes the health benefits of this meditative practice.

There were no statistically significant differences in cortisol levels for CTB compared to other study activities. . An interesting finding was an increase in cortisol for GM that approached significance ( $p=.08$ ) compared to Reading for the July run of the study ( $n=6$ ). While speculation as to why cortisol levels increased during GM, should be tempered given the measure's reduced data points (only 60% of obtained samples were assayed) coupled with a further diminished sample size, participant reflections on various portions of the GM may provide some insight. One possible explanation for the cortisol findings above may have to do with some of the subject's reaction to various segments of the GM practice. . One subject expressed agitation with the narrator's voice:

“I still find the woman’s voice to be extremely afflictive um... it doesn’t seem to be as effective as the uh...CTB. I have not been able to actually visualize anything that has been suggested.”

A second subject stated:

I’m afraid what I was doing the whole time was refrain from fighting cynicism, um, the ah, just was kind of hokey the music and the voice and um and I was really trying hard to get into it but by the time I came back down from the mountain and got to the plateau, I was pretty much think, um, trying real hard to go with it. I, I guess these guided imagery things, I mean it seems like it was almost too much

Others experienced frustration with their inability to “match” the narrated environment and events. The following excerpt illustrates this subject’s challenge:

“...when the speaker on the tape indicates, ‘now visualize this...flowers here or trees there’ that you know, I end up having to recreate my mountain. My meadow first of all is mainly in shadow...and the base of my mountain is in shadow. The sun is behind the mountain and um...at the peak of my mountain...it’s a very tall mountain, the peak of my mountain there’s always snow. So when I get to the top of my mountain it’s just rocks there...its just stone. Um, and then the speaker says smell the wild flowers then bend down and touch a pedal and uh, I am thinking...well they are not here... I have to grow them now? So I attempted to quickly create a mountain on the opposite end of the valley.” I consciously tried to construct a new...a different mountain in a different location on the field...the meadow and it was uh...yeah I just...that not my mountain so...uh, I ran back to my mountain.”

These and other individual reactions to aspects of GM may have influenced measured cortisol levels.

### CTB and Cell-Mediated Immune Function

The measurable effect of CTB on cell mediated immune competence as measured by decreased EBV antibody titers approached statistical significance ( $p=0.066$ ). This finding is tempered by the sample size ( $n=13$ ) and the presence of outliers and leverage points which exact a disproportionate influence. Given the high yield of ASC during

CTB and its anxiety reducing effects, it can be argued that CTB has an indirect, secondary effect on immune function, but further research is required to confirm this possible effect. It was observed that all subjects exhibited a decrease in EBV antibody titer concentrations after the first study week, regardless of session activity suggesting that participation in the study provided an unexpected benefit, and potentially modulating subsequent biomarker results.

An interesting pattern did emerge, however, in cases where ASC and ascribed meaning were present with a concomitant reduction in anxiety and EBV antibody titer concentrations. Eight cases (62%) were observed during CTB, four (31%) occurred during GM, along with one instance occurring during the Reading Control (.07%). Sample data points were too small to test for statistical significance, however the pattern suggests a possible synergistic relationship between immune function where ASC, perceived meaning and reduced stress are present. This supports the position taken by several anthropologists regarding the efficacy of healing related rituals involving ASC. For example, Winkelman (2000) states that ASC integrates functional mechanisms of the brain, where the limbic system's modulation of memory attached with emotional affect emerges as a result of relaxation, and is synchronized with the higher processing activity of the frontal cortex. In this interpretation, CTB activates the limbic brain by reducing anxiety and generating ASC experiences. When meaning is ascribed to those experiences through symbolic and psychophysical processes in higher brain systems, an integrated mode of consciousness emerges and sets the stage for personal transformation and healing which, in this case, may also have a direct effect on EBV antibody titers. Similarly, Kirmayer (2003) considers the meaning of events as a factor in a dynamic

relationship between psychological systems and immune function, and indeed, suggests that thoughts, meaning and feelings during ASC and mediated by central nervous system dynamics, can modulate immune response (Kirmayer 2003). It may be that the effect meaning has on immune function in one context (or in one individual for that matter) need not have the same effect in another context. The combined qualitative and quantitative methodologies used in this study have presented clues as to the ways in which meaning associated with context-specific forms of ASC might modulate immune response. While a straightforward and direct cause and effect relationship between ASC and cell-mediated immune response was not found from this study, the data presented here do suggest that the relationship between ASC and immune response deserves a great deal more study.

#### Descriptions of CTB Experience

Accounts of CTB as experienced by subjects in this study are rich with imagery, emotion and an array of physical sensations. A high frequency of physical sensations described as floating, flying and travelling were reported from 11 of the 13 subjects. Subjects practiced CTB for five consecutive days and detailed account of their experiences which in many occurrences revealed a progressive pattern of self realization and introspection. Below is a transcription of one subject's experiences during CTB over five days:

##### Day One

“During the session I had a feeling of longing and [that] somebody was holding me. Um, eyes were closed but yet I had color... of golds, yellows and reds dancing in my eyes.

Um, it was very relaxing and very peaceful. I sensed a calmness that I have not felt in a very long time. Uh, so I think that was very important to me. I had a sense of seeing like trees form and disappear. My husband's face appeared in a pirate's hat and then disappeared. So I don't know what that means but it was very peaceful and relaxing. I feel regenerated, very calm, and very peaceful. There is a sense of peace about me um, yeah it's just kind of really strange."

#### Day Two

"Um, again I had this feeling of floating...suspended but kind of sideways. I just had a feeling of very...peacefulness, calm with random blurred images that repeated over and over again. It's like it was seeing black with these black and white blurred visions. I feel much more relaxed and not tense at all."

#### Day Three

"Um, I felt my arms were extremely heavy today. There were just like dead weight. I had a sense of serenity um...the random thought running through my head was, I am confident and strong and intelligent. The fact that my arms were heavy and I don't know if that means anything but it was, um...it felt like it was something important...like I am finally letting go of something...and that was the last part of it that needs to go. I kept seeing eyes today...random eyes...deep set eyes. During the session today it seemed like the music was lower in the beginning...very peaceful, very...just in the background. And then it sounded like it went rushing to the forefront...it got extremely loud to the point where it was over-powering. I mean it didn't get loud gradually; it went from soft to BOOM BOOM! I feel refreshed. I find this to be very refreshing and I am capable of taking on the rest of my day without feeling sluggish or...I have more energy...which is unusual."

#### Day Four

"My arms were very heavy...I felt like my head was just a fishing bobber, bobbing up and down. Um, I felt like I am slowly becoming clearer. I saw a row of houses along the stretch of the beach today. I had this feeling of, total relaxation...um...again a feeling of floating. It seems like things just seem to become clearer to me. This seems to bring me to a point of mental clarity and I feel rested. I feel energized um...I feel ready to finish my day."

#### Day Five

"I was very emotional in today's session. Um...I could... [weeping] My thought kept going to my daughter. Actually I just had this overwhelming sense that I wanted to make sure she is ok, even though I know that's not possible. Um...just really wanting to know there's something else out there. It was very warm in today's session for me...um I felt like it was extremely hot and I felt like my emotions were...um...uncontrollable. I felt like I was crying even though I wasn't...but...again I still have this sensation of feeling

floating in the air and my upper extremity seems to be semi- heavy...not as heavy as before. I think it was the emotions that I felt that had meaning. I feel like I am getting some sort of peace from this...if that's possible. I just feel she's...things are ok. I feel like I'm getting a handle on what I am suppose to do to get to...um to find a place in life. I feel like I am functioning if that makes any sense. I feel like its helping me define who I am. I feel great. I feel alert, I feel very much relaxed...I feel very much calm and I'm ready to finish my day."

This account of experiences while practicing CTB illustrates how the subject integrated their physical sensations, imagery and emotions with their sense of self and personal development. This subject later disclosed that prior their participation in the study, they had been unable to fully accept the death of their daughter yet, they felt were now able to move on. Although this subject did not indicate they set a specific goal or intention during their meditation sessions, nor are they a shaman, their account of CTB mimics shamanic experience where information accessed through ASC is integrated through psychobiological processes into meaningful concepts of self realization that can affect healing. Other subjects had similar types of realization, so much so that they were compelled share their insights with the investigator beyond the duration of the study. At the end of the study, one subject shared the following in response to her experiences:

"A little sad because its ending...this is the last day...but very thankful. This has been a tremendous and wonderful opportunity...um it has given me a platform to go forward upon...I hope to continue this meditation and self uh...retrospection. It's been an incredible, eye opening, mind opening experience and I am very thankful for this opportunity. I can't believe that I was selected and given this chance to uh...participate and uh...just thank you. Thank you, thank you, thank you. This made an impact on my life that you probably won't even realize...that probably I won't even realize but I know this is something that's changed the course of my life a little bit...and given me some more tranquility and thought so I really appreciate it. I can't tell you how much this has been a good experience. Thank you."

The shamanic journey is traditionally associated with the agenda of accessing information from the spirit world and bringing this information back for the benefit of healing (Eliade 1964). Study subjects did access information through their ASC experience that was ‘brought back’ to their conscious waking state. The presence of shamanic-like features in the narrative descriptions of ASC experience suggests a fundamentally innate process is operating during the practice of CTB.

#### Implications of the Study Results for the Ubiquity of ASC and Healing in the Cross-Cultural Record

The similarity between descriptions of flight and travel during CTB and that of shamanic flight are particularly intriguing. Eliade (1974) defines shamanic flight as a condition where the shaman’s soul leaves the physical body and flies to other realms with an agenda that is associated with healing. A comparison between two narratives illustrates this point. The first narrative is taken from a study subject during CTB:

“...I was floating on the ocean I was floating on a mat. I was floating with the waves of the ocean. I was just kind of thinking I didn’t know why I was there but...somehow I was very calm. I was lying on the mat and the mat was up and down with the waves of the ocean. I was uh...on the ocean...sleeping on the mat. And I saw different kind of weather change, I uh...ya know...saw rainbows and I saw sunshine, I saw clouds...but somehow...and I was not frustrated.”

The following narrative is a song taken from Uvavnuk, a Netsilik Eskimo woman:

“The great sea has set me in motion. Set me Adrift. Moving me as the weed moves in a river. The arch of sky and mightiness of storms have moved the spirit within me, till I am carried away trembling with joy.’ (Rasmussen 1999:34)



Stripped of cultural and religious context, CTB appears to generate experiences parallel to shamanic flight which lends evidence to Harner's (1982) concept of core-shamanism. Core shamanism rests on the premise that shamanism is not culturally bound and the shamanic state of consciousness (SSC) is an innate human capacity. Harner argues that every individual can take the shaman's journey on behalf of themselves or others to affect healing and gain greater awareness (Harner 1982). Along the same lines, Walsh (2007) suggests that the ability of non-shamanic individuals to have spontaneous out-of-body experiences may reflect the origins of shamanic journeying that over time became controlled and culturally contextualized.

Similarly, Hayden (2003) argues that the physiological components associated with ASC have important health consequences, due in part because brain-wave patterns produced during ASC modulate the dissemination of information processes across several brain systems. An example of this occurs when repressed memories (often negative experiences) emerge from the limbic brain. Repressed memories can manipulate behavior and perceptions without conscious awareness. In a parasympathetic state, characterized by slow brain-wave patterns that link limbic brain regions with the frontal cortex, repressed memories emerge as conscious information which can be reevaluated and ascribed new meaning. This reevaluation process can affect tremendous emotional healing and represents one of the processes involved with cognitive reprogramming where the hidden influence of repressed memories is neutralized. Kleinman (1973) refers to this as symbolic healing where physiological responses are mediated by meaning. The findings of the current study are consistent with these observations and assertions. The integration of physical sensations, emotion and extraordinary experience during CTB-

ASC may be linked to symbolic and physiological processes associated with the activation of the limbic brain in tandem with the frontal cortex. The subsequent interpretation of CTB-ASC experiences and the meaning ascribed to them are then reintegrated into the waking state of the individual as new knowledge that can be acted upon. Transcribed responses from the current study's subjects indicate they continued to consider their experiences beyond the session activity suggesting CTB may have an enduring affect. A few subjects have maintained contact with each other and continue to practice some form of meditation, contributing to Hayden's (1987) argument that ASC in group settings foster social alliances.

#### Evolutionary Implications of the Role of ASC in Healing

ASC appears to innately influence health and well-being in its ability to access inner symbolic landscapes that integrate unconscious information into conscious cognitive systems. The biological mechanisms of ASC that result in parasympathetic dominance and limbic-frontal integration provide the hardware from which experience is interpreted, evaluated and given meaning. ASC can thus be viewed as a form of knowledge acquisition where the process of inner realization (via limbic-frontal interaction) loops back in to conscious awareness (through evaluation and ascribed meaning) and becomes part of a 'cognitive toolkit' from which subsequent experiences can be analyzed, assessed and synthesized.

The adaptive potentials of ASC can be considered part of a behavioral inheritance system for societies and social groups that endorse practices which evoke ASC. Jablonka and Lamb (2005) define learning as an adaptive modification in behavior resulting from

experience. The current research suggests that ASC experience offers the practitioner an opportunity for learning through self-realization that can influence behavior, cognitive/emotional states and bio-physiology. As an example, one subject disclosed they had a fear of water resulting from a near-drowning they experienced when they were younger. During CTB this subject experienced being very calm while floating on the open ocean despite changing weather conditions. The sensation of floating up and down with waves lasted for the duration of the meditation. Fear-based emotion associated with a negative experience is within the domain of the limbic brain that under other conditions in a waking conscious state, would initiate a stress response to perceived danger. Under ASC conditions in a parasympathetic state however, the subject was allowed to experience floating on the ocean in a calm and relaxed manner, effectively neutralizing a fear response. Following the mediation session, the subject indicated that they would remember the feeling of calmness on the ocean should they encounter anxiety while in close proximity to large bodies of water in the future. In a sense, ASC provided a ‘trial run’ of an alternative response to an event previously associated with fear. Based on this and other accounts from the study, ASC experience has the potential to influence behavioral, emotional and cognitive processes that can in turn establish and alter conditioned responses.

MacLean (1990) proposes a ‘triune brain’ model for interactions between functional brain systems that offer one explanation for the adaptive potentiality of ASC. The triune brain consists of the reptilian or R-complex brain, the paleomammalian or limbic brain and the neomammalian or neocortex brain structures all of which evolved sequentially (MacLean 1993). The reptilian brain is responsible for digestion, circulation,

reproduction and self preservation. The limbic brain is associated with emotions and their transformation into behavior via neurohormonal and psychosocial systems (Winkelman 2009). Analytical and problem solving skills, along with symbolic representation are connected with neocortex brain structures. MacLean (1993) states the triune brain is modulated on a biological level through hormonal systems and on a symbolic level through ascribed meaning which can affect health and healing outcomes.

Empirical evidence for the relationship between meditation, emotional affect and immune function is presented by Davidson et al. (2003) who report increases in antibody titers to influenza vaccine as well as increased positive affect following an eight week meditation program. Furthermore, the magnitude of increase in positive affect (as measured by left-sided anterior brain activation) predicted the magnitude of increase in antibody titers to the vaccine. This suggests that meditative-ASC is potentially adaptive in its ability to reduce anxiety and enhance immune function. While the present study data are not as conclusive, they are consistent with these findings and underscore the need for continued research (see Davidson 2008, 2010). Other studies provide further evidence regarding the effects of meditative ASC in terms of evolutionary fitness (see Davidson and Lutz 2008). Lutz et al. (2009) found meditation to increase attentional stability which is a vital brain function for controlling the content of concentration. Similarly, Leeuwen et al. (2009) report meditation altered the efficiency with which attentional resources are distributed in addition to assisting in reducing age-related attentional decline.

Given the prevalence of ASC within the ethnographic record, the evolutionary implications are obvious and encourage speculation on the influence of ASC evoked

through ritualistic behavior in early humans in terms of its adaptive features. Increased attentional stability could provide an additional edge among hunter-gather societies who must meet the challenges of their environment to survive. Immune enhancement and increased positive affect through ASC experience might have provided populations an additional advantage reducing their susceptibility to precursory conditions that lead to illness. Along these lines, Winkelman (2000, 2004, 2009) argues that ASC provided the evolutionary prototype for shamanic and ritual behavior that later developed in to religion. Shamanism is considered by Winkelman to be an ecological adaption originally utilized by early humans to foster bonding and therapeutic needs of the society (Winkelman 2000). While shamanic activity varies in its cultural expression, innate physical and psychological ASC features evolved in tandem with changes in subsistence strategies and increased social stratification (Winkelman 1992). Winkelman's theoretical premise regarding the neurological foundations and evolutionary potentiality of ASC is supported by this and other studies, further demanding the need for continued research across disciplines.

## CHAPTER 7

### CONCLUSIONS

This research presents evidence that the meditative practice of CTB is distinct from the mindfulness-based GM practice, through increased ASC episode frequency, ASC characteristics, and subjective description of ASC experience. CTB was also shown to result in a greater reduction in perceived anxiety. Evidence for the effect of CTB and GM on salivary cortisol levels were inconclusive, largely due to sample size. CTB appears to reduce EBV antibody titers, however statistical outliers limit confidence in reaching any definitive conclusions. Study results revealed a trend where EBV antibody titers declined during CTB when in the presence of ASC, reduced anxiety and ascribed meaning. These findings offer sufficient evidence to deduce that the stress-reducing benefits of CTB have an indirect beneficial influence on immune function however; further investigation is called for in the form of longitudinal research with robust sample size.

#### Potential Applications

The persistence of ASC in the ethnographic record and in contemporary society can be explained through its method of weaving inner (somatic, neural, physiological and cognitive) awareness, together with external experience, perception and knowledge that result in clear and demonstrable health benefits (e.g., immune response, stress reduction) identified in this and other studies investigating health-based effects of meditative practices (Davidson et al. 2003; Antoni 2003; Applegate et al. 1997; Beauchamp-Turner and Levinson 1992; Carlson et al. 2003).

Interdisciplinary study of ASC can provide evidence for its biological efficacy in biomedical settings as well as its cultural efficacy in the context of traditional healing systems, and offer promising methods through which these can be integrated into a holistic approach to health and well being.

### Future Research

There is a great deal of future research to be conducted in the area of ASC in terms of its healing and therapeutic potential. A reinvestigation of the ethnographic record in light of the neurobiological aspects involved with ASC provides a context for considering adaptive and behavioral strategies. Contemporary ethnographic research of ASC offers insight into the causal impact of contextual social factors and cultural schemas influencing health. Clinical studies that explore direct and indirect health outcomes of ASC can offer medical practitioners and patients an increased spectrum of treatment strategies and modalities. Collaborative research from biological and social science disciplines is exceptionally valuable in illustrating interactional relationships associated with ASC.

Altered states of consciousness accessed through methods like CTB can contribute to holistic health approaches that integrate mind/body experiences. This study illustrates some of the complexities that must be accounted for when investigating the possible relationship of ASC with immune function and stress responses and provides some additional groundwork for further research. Longitudinal studies may tease out overarching relationships between ASC experience and immune system response over the life course. Methodologies that include measuring several stress-related biomarkers such

as cortisol, DHEA,  $\alpha$ -amylase and chromogranin–A, can further our understanding of how the body responds to ASC experience.

Within the current US health environment there is serious concern regarding the cost and access to health care. Those who can not afford health insurance often seek more affordable options that frequently lead to non-western health and healing systems (i.e. Chinese medicine, Ayurveda, Reiki, etc.). The treatment and prevention of disease and illness within an exclusively biomedical context does not always succeed in meeting intended health outcomes. Research on the health benefits of meditative-ASC and its associated somatic, physiological and psychological characteristics can provide empirically-based evidence of its efficacy as it is practiced in traditional cultures, and justification for its increased utilization in western biomedical healing systems.



APPENDIX 1  
OPRS PROTOCOL APPROVAL



## Biomedical IRB – Expedited Review Approval Notice

### **NOTICE TO ALL RESEARCHERS:**

*Please be aware that a protocol violation (e.g., failure to submit a modification for any change) of an IRB approved protocol may result in mandatory remedial education, additional audits, re-consenting subjects, researcher probation suspension of any research protocol at issue, suspension of additional existing research protocols, invalidation of all research conducted under the research protocol at issue, and further appropriate consequences as determined by the IRB and the Institutional Officer.*

**DATE:** April 9, 2008

**TO:** Dr. Daniel Benyshek, Anthropology

**FROM:** Office for the Protection of Research Subjects

**RE:** Notification of IRB Action by Dr. Charles Rasmussen, Co-Chair  
Protocol Title: The Effects of Cellular Theta Breathing (CTB) Meditation  
on Cell Mediated Immune Response  
Protocol #:0809-2671

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This memorandum is notification that the project referenced above has been reviewed by the UNLV Biomedical Institutional Review Board (IRB) as indicated in regulatory statutes 45 CFR 46. The protocol has been reviewed and approved.

The protocol is approved for a period of one year from the date of IRB approval. The expiration date of this protocol is April 8, 2009. Work on the project may begin as soon as you receive written notification from the Office for the Protection of Research Subjects (OPRS).

### **PLEASE NOTE:**

Attached to this approval notice is the **official Informed Consent/Assent (IC/IA) Form** for this study. The IC/IA contains an official approval stamp. Only copies of this official IC/IA form may be used when obtaining consent. Please keep the original for your records.

Should there be *any* change to the protocol, it will be necessary to submit a **Modification Form** through OPRS. No changes may be made to the existing protocol until modifications have been approved by the IRB.

Should the use of human subjects described in this protocol continue beyond April 8, 2009 it would be necessary to submit a **Continuing Review Request Form** *60 days* before the expiration date.

If you have questions or require any assistance, please contact the Office for the Protection of Research Subjects at [OPRSHumanSubjects@unlv.edu](mailto:OPRSHumanSubjects@unlv.edu) or call 895-2794.

APPENDIX 2

STAIT-TRAIT ANXIETY INVENTORY

**Trait Anxiety Inventory      Self-evaluation Questionnaire**

Group \_\_\_\_\_ Code # \_\_\_\_\_ Session Activity \_\_\_\_\_ Session # \_\_\_\_\_ Date \_\_\_\_\_

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the most appropriate number to the right of the statement to indicate how you feel **right now, at this moment**. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	<u>Not at all</u>	<u>Somewhat</u>	<u>Moderately</u>	<u>Very much</u>
1. I feel calm	1	2	3	4
2. I am tense	1	2	3	4
3. I feel upset	1	2	3	4
4. I am relaxed	1	2	3	4
5. I feel content	1	2	3	4
6. I am worried	1	2	3	4

Please make sure you have answered **all** the questions.      *Thank you!*

PLEASE DO NOT WRITE IN THIS SECTION (STAI)

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APPENDIX 3

LIKERT-SCALED / INTERVIEW QUESTIONNAIRE

Interview Questionnaire

Group \_\_\_ Code # \_\_\_ Session Activity \_\_\_\_\_ Session # \_\_\_ Date \_\_\_\_\_

**Part I: In this section, circle the answer that best applies.**

4. During this session I experienced a sense of temperature?  
(1) Very Strongly (2) Strongly (3) Somewhat (4) Not at all (5) Not sure
5. During this session I experienced a sense of smell?  
(1) Very Strongly (2) Strongly (3) Somewhat (4) Not at all (5) Not sure
6. During this session I experienced a sense of sounds?  
(1) Very Strongly (2) Strongly (3) Somewhat (4) Not at all (5) Not sure
7. During this session I experienced a sense of tastes?  
(1) Very Strongly (2) Strongly (3) Somewhat (4) Not at all (5) Not sure
8. During this session I experienced other physical sensations.  
(1) Very Strongly (2) Strongly (3) Somewhat (4) Not at all (5) Not sure
9. During this session I experienced feelings of emotion.  
(1) Very Strongly (2) Strongly (3) Somewhat (4) Not at all (5) Not sure
10. During this session I experienced distortions in my sense of time.  
(1) Very Strongly (2) Strongly (3) Somewhat (4) Not at all (5) Not sure
11. Overall, this experience was significant for me.  
(1) Very Strongly (2) Strongly (3) Somewhat (4) Not at all (5) Not sure

**Part II: Tape-recorded interview. The interviewer will read each question aloud and ask the participant to answer each question as fully as possible.**

1. Describe in detail what you experienced during this session.
2. Were there any aspects of your experience that you felt were important or had meaning?
3. How would you describe how you feel after this session?

**Thank you!**

PLEASE DO NOT WRITE IN THIS SECTION

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