

Near-Death Experiences and the Possibility of Disembodied Consciousness

Challenges to Prevailing Neurobiological and Psychosocial Theories

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Abstract

Claims from those having near-death experiences (NDEs), as well as those sympathetic to such claims, challenge the prevailing assumption that consciousness is dependent on a functioning brain. Extant theories, both neurobiological and psychosocial, that attempt to explain NDEs are examined and found unable to adequately account for the full range of NDE reports, especially electromagnetic after-effects and out-of-body experiences with veridical perception. As a result, many leading NDE researchers have proposed that a new model is needed to explain how consciousness could possibly exist independently of the brain, mainly relying on theories from quantum physics. Our paper critically evaluates a range of extant neurobiological and psychosocial theories of NDEs, as well as examines theories that might offer more promise in fully explaining NDEs, especially those using insights derived from quantum physics. We conclude that the “hard problem” of consciousness is not yet solved, but that NDEs provide an important avenue for exploring the relationship between consciousness and brain, as well as possibly understanding a disembodied concept of consciousness.

Key Words: consciousness, near-death experiences, out-of-body experiences, quantum, electromagnetic

NeuroQuantology 2011; 1: 41-53

I. Introduction

Chalmers (1997) labeled the persistent problem of how to relate consciousness to the brain as the “hard problem.” Nevertheless, the continuing *zeitgeist* of scientific consensus seems optimistic that ultimately consciousness will become reducible to a neurobiological basis through somehow solving this hard problem by showing mind is simply an epiphenomenon of matter; in fact, many seem to think it has already been solved by such a reduction (e.g.,

Crick, 1995; Damasio, 1999; Dennett, 1991). We think using neurobiology to shed light on mental processes, including extraordinary ones, is a useful strategy that is promising to explore (e.g., Krippner and Friedman, 2010a), as are psychosocial approaches. But we do not think there is an adequate basis to support reducing the complexity of consciousness to neurobiology, psychosocial causation, or any other material basis. Instead, we think non-materialistic perspectives on consciousness remain just as viable as those emphasizing a neurobiological, psychosocial, or other reductionistic type of approach (Friedman and Pappas, 2006; Tart, 2009). One key leverage point in this longstanding debate involves whether there is credible evidence that consciousness can exist apart from a functioning brain. There are several lines of such evidence, which preliminarily challenge

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Received Jan 10, 2011. Revised Feb 1, 2011. Accepted Feb 6, 2011.

the more accepted notions that consciousness can be reduced to just neurobiology. Lorber's (1980) classic paper, for example, showed that individuals with greatly diminished brains can still function adequately or, in some cases, even superiorly. Perhaps the most promising of these lines of evidence for examining this pivotal question involves near-death experiences (NDEs) in which consciousness appears to persist during the temporary absence of signs of brain functioning or so-called "brain death." Those surviving brain death commonly report being conscious during that period, such as Zingrone and Alvarado's (2009) report of a very high incidence of retention of consciousness during brain death in those with NDEs (NDErs), namely the rates in "retrospective studies combined is 35 percent, whereas that of prospective studies combined is 17 percent" (p. 34). The acceptance of reports from NDErs as valid evidence for a disembodied consciousness - one operating during brain death - is usually dismissed by the scientific community, such as through an ever-growing diversity of neurobiological and psychosocial theories attempting to explain (or perhaps better, "explain away") these reports. However, none of these extant theories appear able to fully account for all NDE phenomena (Greyson, 2010), although many skeptics seem to view NDEs as at best an illusion that may be common but is untrustworthy or, at worst, a delusional confabulation of a diseased brain. Considering that a better understanding of NDEs might offer a potent avenue to challenge the hegemony of materialistic (e.g., neurobiological and psychosocial) understandings of consciousness, we summarize the main theories purporting to explain NDEs, both neurobiological and psychosocial, and examine some of their weaknesses in failing to account for all the findings relevant to explaining causal pathways of NDEs. We then explore how the call for new theories might add to understanding both NDEs and, more broadly, the hard problem. Finally, we mention some of the personal and societal implications that would result if evidence from NDEs were to be accepted as "scientific fact" rather than dismissed as illusory or delusory. Our intent is not to overview the

voluminous literature on NDEs and, for that, we refer the reader to two recent compendia (Holden *et al.*, 2009; Murray, 2009); instead, we focus on the fundamental issues related to the hard problem and the possibility of disembodied consciousness. Last, it is important to note that NDEs are becoming increasingly common, due to improved techniques of resuscitation and other life-enhancing breakthroughs that bring ever more people back from brain death (James, 2004), so this magnifies the importance of NDEs not just for science but for the many people impacted by such experiences.

II. Neurobiological Theories

Many of the extant theories proposed to explain NDEs are based on neurobiology. We discuss some of these under the categories of natural opiates, ketamine, temporal lobe, altered blood gases, REM Intrusion, and ocular theories.

Natural Opiates

Blackmore (1993) and Carr (1982) suggested that natural opiates released under extreme stress account for the feelings of peace and joy reported by many NDErs. According to Blackmore, excessive amounts of released endorphins cause temporal and limbic lobe seizures in areas affecting memory, accounting for phenomena such as a "life review" in which NDErs commonly report re-experiencing their past through vivid memories. As for the commonly reported "tunnel experience," Blackmore and Troscianko (1989) proposed that these are hallucinations that result from a disturbance in the visual cortex, possibly from excessive endorphins that create the illusion of a break-down in time and dissolution of the self (i.e., a mystical experience). One limitation of this theory is that endorphins and other opioids that are naturally released for pain control last for many hours, whereas the pleasant feelings experienced during NDEs are very brief in duration (Fenwick, *et al.*, 2007; Greyson, 2009). As of this date, this theory has also failed to account for out-of-body experiences (OBEs) with reports of veridical perception where NDErs have accurately described resuscitation efforts that have allegedly been verified by medical

staff (Greyson, 2009; 2010; Holden, 2009; Holden *et al.*, 2006).

Ketamine

Rogo (1984) suggested that NDEs may be a chemically-induced experience that occurs when ketamine is administered by clinicians as an anesthetic in emergency situations. This is supported by other studies, such as by Corazza (2010), who found that out of 125 participants using ketamine, 50 met criteria for a NDE using Greyson's (1983) scale as a criterion. In a follow-up study, Corazza and Schifano (2010) compared 36 ketamine-induced NDEs with 36 NDEs reported during cardiac arrest and found them to be similar. Jansen (1997) hypothesized that there may be a ketamine-like endogenous neuroprotective agent that impacts the N-methyl-D-aspartate (NMDA) receptor and that this may be released naturally during times of stress, accounting for transcendent experiences reported during NDEs. Preliminary support for this theory comes from some studies that have used ketamine to replicate NDEs (Kolp *et al.*, 2007).

Interestingly, Kolp and Jansen also reported in this paper that they both personally had NDEs from natural causes and also both had ketamine-induced experiences, concluding there were many similarities between the two (i.e., life review, OBEs, as well as encounters with other beings, visits to non-physical realities, and feelings transcendent of space and time). However, Greyson (2009) pointed out that other studies done with ketamine have reported several characteristics that are not similar to NDEs (e.g., fragmented/distorted thought processes, frightening images, meeting/seeing deceased relatives, full-panoramic life reviews, and a lack of some of the common long-term after-effects generally associated with NDEs). He also pointed out that a hypothesized ketamine-like agent has not been found in the brain as of this date and that many NDEs occur without any drugs being administered, so it is difficult to attribute NDEs to anesthesia effects, something also mentioned by others (e.g., Twemlow and Gabbard, 1997).

Temporal Lobe

Several researchers have suggested that the right temporal lobes may be involved with NDEs, because epileptics who have temporal lobe seizures report many phenomena similar to NDEs (Britton and Bootzin, 2004; Persinger, 1994; Saavedra-Aguilar and Gomez-Jeria, 1989). However, Persinger pointed out that studies that have used transcranial magnetic stimulation of the temporal lobes to induce NDEs only vaguely resembled NDE phenomena and, when replicated, have failed to show consistent results. Likewise, Britton and Bootzin investigated temporal lobe functioning in participants who had NDEs and compared these to those with epilepsy, finding that NDErs had increased temporal lobe activity solely in the left hemisphere, not the right hemisphere (note: temporal lobe activity in the right hemisphere is more common among patients with epilepsy).

Furthermore, in comparison to the control group, the NDErs scored significantly higher in terms of long-term positive coping skills, which suggests the after-effects in NDErs is distinct from those with epilepsy. As of this date, findings are inconclusive and more studies are needed to assess the relationship between the temporal lobes and NDEs, although Greyson (2009) suggested that temporal lobe seizures and reports of NDEs do not appear to be similar in all aspects.

Altered Blood Gases

Several theorists suggested that NDEs are a result of anoxia or hypoxia in the dying brain (Blackmore, 1983; Whinnery, 1997). In brief, hypoxia occurs when the whole body is deprived of oxygen, while anoxia is an extreme form of hypoxia that occurs with oxygen deprivation (van Lommel *et al.*, 2001). In a study with fighter pilots, Whinnery suggested he was able to induce NDE-like experiences by creating brief periods of unconsciousness through rapid acceleration, which created an induced state of hypoxia. A significant number of participants in this study reported seeing fragmented visual images, bright lights, and visions of tunnels, as well as experienced sensations of floating and various other pleasurable sensations, similar to what NDErs report. However, other researchers

pointed out that none of the participants in Whinnery's study reported experiencing a life review, OBEs, seeing non-physical beings, having a conversation with a being of light, along with reporting significant changes in spiritual or life values, which are all commonly reported by NDErs (Greyson, 2009; Parnia *et al.*, 2007; van Lommel *et al.*, 2001).

Critics also noted that this induced experience also led to frightening hallucinations and agitation, which is not commonly reported by NDErs, who instead commonly report feelings of peace (Greyson, 2009). It is interesting to also note that Chawla and colleagues (2009) examined surges of electroencephalogram (EEG) activity in 7 patients during their time of death, and speculated that this spike may be associated with cellular loss of membrane during hypoxemia; subsequently, they suggested that NDErs may be "recalling the aggregate memory of the synaptic activity associated with the terminal but potentially reversible hypoxemia" (2009; p. 1095).

Other theorists suggested NDEs might be a result of hypercarbia, which occurs when levels of carbon dioxide are elevated (Morse *et al.*, 1989). In contrast, Greyson (2009) pointed out that those with hypercarbia rarely report OBEs, a life review, seeing a bright light, or encounters with non-physical beings, and that many NDEs occur without increased carbon dioxide levels, which suggests hypercarbia is not necessary for NDEs to occur. However, a recent study done by Klemenc-Ketis, Kersnik, and Grmec (2010) found significantly higher levels of carbon dioxide and serum levels of potassium in a substantial number of NDErs: out of 52 participants they studied, 11 (21%) met Greyson's NDE Scale criterion for a NDE, and out of this small sample, 41% showed higher levels of carbon dioxide.

REM Intrusion

Nelson and colleagues (2006) suggested those who have NDEs may have a predisposition to REM intrusion, which accounts for the subjective phenomena experienced during NDEs. Nelson and colleagues examined the lifetime prevalence of REM intrusion in 55 NDErs and found that sleep paralysis and sleep-related

auditory and visual hallucinations were common in NDErs, as well as was REM intrusion during wakefulness. They suggested that cardiac arrest can evoke REM intrusion, explaining NDEs. However, Greyson (2009) pointed out it is not known whether REM intrusion contributed to the NDEs or was a result of the NDEs.

Ocular Physiological

Stefansson, Traustason, and Eysteinnsson (2006) suggested that visual sensations in NDEs are associated with different tissue pressures in the eyes and brain as a result of reduced arterial blood pressure during times of trauma or stress. According to this ocular physiological theory, when arterial blood pressure drops, the eyes become ischemic and hypoxic, disturbing the retina and that may result in visual sensations reported by NDErs. This is similar to Bressloff and colleagues' (2002) suggestion that visual hallucinations originate in the visual cortex and, when this becomes unstable, it produces various geometric shapes and hallucinations such as those produced in LSD experiences. However, this model fails to account for OBEs that were reported during the NDE, especially those that included accounts of veridical perception (i.e., when it was reported that NDErs accurately described resuscitation efforts) that have been allegedly corroborated by medical staff (Holden, 2009).

III. Psychosocial Theories

In addition to the neurobiological theories surveyed, there are a number of psychosocial theories used to explain NDEs. These include depersonalization, personality factors, attribution, expectation, and birth (or perinatal) theories.

Depersonalization

Noyes and Kletti (1977) proposed a depersonalization theory of NDEs as a form of detachment that occurs as a psychological defense against the fear of death. However, this theory has been highly criticized since common features of depersonalization outlined in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR; American Psychiatric Association [APA], 2000) include feelings of strangeness, a

sense of decreased reality or loss of reality, and detachment from one's body. In contrast, common reports from NDErs state that NDEs seem more (not less) real than consensual reality (Brumm, 2006; Duffy and Olson, 2007; Holden *et al.*, 2006). Furthermore, while NDErs have been shown to have increased symptoms of distress following a NDE, research has shown that these symptoms do not meet clinical diagnostic criteria for dissociative or post-traumatic stress disorders, as outlined in the DSM-IV-TR (APA, 2000; Brumm, 2006; Duffy and Olson, 2007; Greyson, 1997; 2001; 2003; James, 2004; Simpson, 2001; Wren-Lewis, 2004).

Personality Factors

Gabbard and Twemlow (1984) proposed that NDEs are more likely to occur in individuals who have personality characteristics prone to dissociation, absorption, or fantasy-proneness. According to Gabbard and Twemlow, traits such as absorption allow an individual to screen out the external world and focus on internal characteristics which make it more likely to experience a NDE under states of stress or trauma. Furthermore, this model proposed that individuals who report NDEs are more prone to fantasizing or daydreaming and that the NDE is simply a psychological defense that occurs under a high state of stress or trauma.

However, studies have shown contradictory results and do not reveal significant relationships between the NDE and absorption or fantasy-proneness personality traits (Britton and Bootzin, 2004; Brumm, 2006; Greyson, 2003; Simpson, 2001; Wren-Lewis, 2004). For example, Greyson's (2003) study on 1,583 survivors of cardiac arrest found NDErs to have slightly elevated levels of dissociation, but not high enough to meet DSM-IV-TR (APA, 2000) criteria for a dissociative disorder diagnosis. Furthermore, Greyson (2009) suggested that elevated levels of dissociation in this sample may be a result of the NDE due to feeling different and misunderstood by other individuals who have not had a NDE. Consequently, Greyson suggested studies are inconclusive, since it has not been determined whether dissociation was a trait prior to the NDE or a

result of the NDE or due to any number of other factors, such as lack of social validation or support for the experience.

Attribution

Norton (1995) suggested that how individuals interpret NDEs are a result of how they make sense out of and simplify the experience, as well as resolve ambiguities associated with it. Accordingly, this subjective interpretation of the meaning and cause of their NDEs results in various attributions or descriptions about what the NDE is. However, Greyson (2009) pointed out that this theory fails to take into account why there appears to be universal themes consistently reported by NDErs, although it may be useful in explaining how each individual subjectively interprets and finds meaning in their experience.

Expectation

Rodin (1980; 1989) proposed an expectation theory that NDEs are a psychological response to the fear of death, which culminates from social and cultural expectations. According to Rodin, NDEs are simply products of one's imagination designed to protect oneself from the fear of death and are experienced differently by different cultures. However, subsequent research does not support this hypothesis, since a growing body of research has revealed cross-cultural similarities of NDE reports (Greyson, 2009; McClennon, 2006a; 2006b; 2005; Ring, 1984; 2000). For example, Ring found that a substantial number of NDErs report experiences that contradict their religious beliefs and prior personal expectations regarding the nature of death. Furthermore, several other researchers have found that individuals who have no prior knowledge of NDEs report the same phenomenon as individuals who are familiar with NDEs prior to their NDE experience (Greyson, 2007; Moody, 1975; Ring, 1980; Sabom, 1982; van Lommel *et al.*, 2001).

Of further interest, a growing body of research also suggests that children who presumably have not developed cultural or social expectations about NDEs report the same type of NDE phenomenon that adults report (Atwater, 2003; Morse *et al.*, 1985).

Greyson (2009) suggested that, while NDEs may be interpreted differently cross-culturally, the key features of NDE reports are essentially the same.

Birth

Sagan (1979) suggested that cross-cultural reports of seeing a bright light at the end of the tunnel are universal due to simply remembering of one's birth, which is a universal experience. According to Sagan, during moments of trauma the mind reverts back to memories of being born as a psychological defense mechanism against the fear of death. However, several researchers argued that newborns lack the needed visual and spatial stability, mental alertness, and ability to recall memories due to their immature cortical capacity (Blackmore, 1983; Greyson, 2009). Furthermore, Greyson pointed out this theory does not account for NDErs who were born through a Cesarean section, yet still report seeing a bright light and floating through a dark tunnel.

IV. Gaps in the Extant Theories

It is apparent that the extant neurobiological and psychosocial theories of NDEs have some significant limitations. In particular, there are many extraordinary phenomena that they do not appear to be able to address, two of which we discuss at some length, namely electromagnetic after-effects and OBEs with veridical perception.

Electromagnetic After-Effects

To begin, one commonly cited but underdeveloped area of research involves electromagnetic after-effects of NDEs. These phenomena have been consistently reported in the literature, gleaned mainly from anecdotal reports by NDErs (Atwater, 2007; Nouri, 2008). Probably most profound is Atwater's research with nearly 3,000 adult and 277 children NDErs, the majority of whom reported enhanced electrical sensitivity to various types of equipment (e.g., computers, cell phones, lights, watches, etc.) post-NDE. Additionally, this same cohort reported enhanced psi and/or unusual healing abilities as well. Atwater (2007) stated:

Of the experiencers I interviewed, 73% percent fit this profile and gave numerous reports of electrical snafus such as microphones that "fought" them, recorders that began to "smoke", computers that "crashed", television channels that "flipped", electronic memory systems that "wiped out", or street lights that "popped" as they walked by. None could wear watches anymore without consistently repairing or replacing them. All of them reported a heightened awareness of *electromagnetic fields* in general. Experiencers claim to have a new awareness of invisible energy fields and a sensitivity to electricity and geomagnetic fields. Many claim to "see" sparkles or balls of energy in the air, the aura (or energy) surrounding all things, and to develop a sensitivity to meteorological factors such as temperature, pressure, air movement, and humidity (p. 109).

This is consistent with reports received from many other researchers (e.g., Bonenfant, 2005; Clark-Sharp, 1995; Knittweis, 1997; Nouri, 2008; Ring, 2000). To shed some light on this, Nouri (2008) divided participants into three groups to explore self-reported electromagnetic experiences. Groups consisted of 36 NDErs, 20 participants who had a close brush with death but did not experience a NDE, and 46 participants who had not been close to death. Overall, Nouri found that 70% of the NDErs reported at least one problem with electromagnetic equipment within the past year, while 16-57% reported problems "all the time" (p. 83), compared to very low rates in both of the other groups. Moreover, Nouri found correlations between electromagnetic after-effects and deeper NDE experiences, as reported by higher scores on the Greyson (1983) scale.

As of this date, only one other study could be located in the academic databases that specifically sought to measure electromagnetic after-effects of NDEs using instrumentation (Knittweis, 1997). Knittweis used a "thermistor and electrocope to measure ... heat and electron flow from participants' hands" (p. 223) in 7 NDErs and 10 non-NDErs. Knittweis found no differences between the two groups in measures of heat or electron flow.

Likewise, it should be noted that many NDErs find these experiences of malfunctioning technology very stressful (and costly in leading to having to repair/replace equipment). Due to how common this appears to be, this is an important area of research to be expanded so that efforts can be launched to help NDErs integrate and/or cope with such experiences (Atwater, 2007; Bonenfant, 2004; 2005; Nouri, 2008; Ring, 2000). In trying to understand what could be happening here, and in similar anomalous situations relevant to NDErs, approaches beyond neurobiological and psychosocial theories appear needed.

OBEs with Veridical Perception

Perhaps the most astounding areas related to NDEs are reports of OBEs and veridical perception during so-called brain death. In trying to understand what could be happening during these experiences, neurobiological and psychosocial theories appear most challenged, particularly when these experiences seem to transcend limitations of time and space. In addition, if OBEs with veridical perception could be more adequately substantiated, they would provide one of the strongest lines of evidence to address the “hard problem”, suggesting it is not likely to be amenable to a neurobiological or psychosocial reduction.

NDErs commonly report the occurrence of OBEs with veridical perception both locally (i.e., reporting about the immediate surroundings during brain death, such as resuscitation efforts) and non-locally (i.e., reporting being in another place, such as accurately describing what relatives were doing and/or saying at a physical distance, as in a waiting room). However, this is where great debates ensue: some suggest that these reports are “proof” that consciousness was separate from the brain (Carter, 2010; Greyson, 2010), while others remain skeptical (Laws and Perry, 2010) and argue that more rigorous scientific methods need to be developed (e.g., that there needs to be better ways to establish that the brain was actually dead during the OBE to rule out factors such as so-called “*anesthesia awareness*”).

At the center of these debates is the famous Pam Reynolds case. This case is commonly cited among the NDE community because detailed accounts of Pam’s surgery and medical records were obtained, which confirmed her report of what she encountered during this surgical procedure (Greyson, 2009; 2010; Holden, 2006; 2009; Laws and Perry, 2010; Sabom, 1998). In short, Pam underwent surgery for a brain aneurysm where her body was cooled and cardiac arrest was induced to perform the surgery. Sabom (1998) highlighted the physician’s (Dr. Spetzler) report of Pam Reynold’s surgery. The following are a few excerpts cited and paraphrased by Holden (2009) who summarized Sabom’s findings from his book, pages 38-47. Holden notes the following (note – this is slightly paraphrased - pp. 191-192):

- 1) 7:15am: Pam was brought into the operating room while still conscious. Her eyes were taped shut and small speakers were inserted into both of her ears that emitted a clicking sound so that her brainstem activity could be monitored. Other monitoring devices such as EEG electrodes, etc. were also in place to measure the outer activity of her brain. Next, general anesthesia began.
- 2) 8:40am: Dr. Spetzler made an incision into Pam’s scalp and used a bone saw to remove a section of her skull. At the same time, a female nurse incised Pam’s right groin to prepare the femoral artery and vein for the cardiopulmonary bypass. However, the nurse found that the veins on the left side were too small, so decided to prepare the right side instead.
- 3) 10:50am: The blood and body-cooling process began to prepare her for the cardiopulmonary bypass surgery
- 4) 11:00am: Pam’s core body temperature reached 73 degrees.
- 5) 11:05am: Cardiac arrest was induced and Pam’s EEG of her outer brain went flat. The EEG of her inner “brainstem function weakened as the clicks from her ear speakers produced lower and lower spikes on the monitoring electrogram” (Sabom, 1998; p. 43).
- 6) 11:25am: Pam’s core body temperature reached 60 degrees. The clicks from the speakers in her ears no longer elicited a response and there was zero brain wave activity. Then, “the head of the operating table was tilted up, the cardiopulmonary

bypass machine was turned off, and the blood was drained from Pam's body like oil from a car" (Sabom, 1998; p. 43). Dr. Spetzler then repaired the aneurysm and began heating Pam's body back up.

7) 12:00pm: Pam's heart monitor began showing "disorganized" activity, which required two rounds of defibrillator shocks to get her heart beating normally again.

8) 12:32pm: Pam's body temperature reached 89.6 degrees, monitoring equipment was removed, and surgical assistants finished the closing procedures of the surgery.

9) 2:10pm: Pam was taken to the recovery room in stable condition (cited in Holden, 2009; pp. 191-192).

What is particularly compelling is that Pam stated that she was vividly able to see Dr. Spetzler use the bone saw to make an incision in her scalp, along with overhearing the nurse say that the vein on her left side was too small so she would need to use the vein on the right. One interesting thing about this is that, although technically Pam was not brain dead yet and was only under general anesthesia at this point, her eyes were taped shut and she had speakers in her ears delivering clicking sounds to measure her brainstem activity (Greyson, 2009; 2010; Holden, 2006; Sabom, 1998).

Advocates of the validity of OBEs with veridical perception during NDEs argued that, even though Pam was still registering brain activity, there is no way she could have seen or heard the things she reported; in contrast, counter-advocates argued that Pam still had brain activity at this point and that there could be some other reason she was able to see or hear these things, as sometimes reported in anesthesia awareness. However, Pam's account goes even deeper, as she vividly described several other procedures and conversations in detail, and even recounted hearing the song "Hotel California" by the Eagles playing at one point during the surgery, which again was accurately verified by her physician.

While this is only one account, there are many other similar reports in the literature that are just as compelling (Atwater, 2007; Clark-Sharp, 1995; Greyson, 2009; Holden, 2009). In fact, Holden (2009) analyzed the literature as of 2005 and found

107 reports of such OBEs. Holden separated these into material and "transmaterial" aspects. Those with material aspects are anecdotes reported by NDErs that involve seeing/hearing aspects of the physical world, while transmaterial aspects are reports that involve experiencing a different "realm" (e.g., seeing a light, seeing deceased relatives/loved ones, etc.). Holden (2009) then broke these down even further by discussing apparently nonphysical veridical NDE perception (AVP):

In AVP, NDErs report veridical perception that, considering the positions and/or conditions of their physical bodies during the near-death episodes, apparently could not have been the result of normal sensory processes or logical inference – nor, therefore, brain mediation – either before, during, or after these episodes. Thus, AVP suggests the ability of consciousness to function independent of the physical body. (p. 186)

Out of the 107 cases studied, Holden (2009) identified 89 AVP's as material (i.e., resuscitation efforts and/or rescues were corroborated), while 14 were identified as transmaterial (e.g., reports of seeing someone during the NDE that they did not know was deceased, but was later verified to be deceased), and 4 that included perception of both aspects (i.e., of the physical and "transpersonal" world). Holden then separated these even further, noting that only 6 cases of the material reports contained some error (i.e., reports were not 100% correct when verified by others), and one was completely erroneous (i.e., leaving 82 as accurately verified accounts of AVP). Those separated into the transmaterial aspect of NDEs were just as compelling (i.e., 16 were accurately reported, one reported with some error, and one reported that was completely erroneous).

V. Call for a New Paradigm

A critical analysis of what is firmly established about NDEs (i.e., characteristics, incidence rates, cross-cultural commonalities, after-effects, etc.) has yet to pin down causal pathways explained through extant neurobiological and psychosocial theories that can account for all that is reported. Although each of these

materialistic theories has strengths as well as weaknesses, together they leave large gaps. Before dismissal, however, it is important to note that many theories have not yet been rigorously tested enough to fully exclude them. Notably, having findings replicated with sufficiently large sample sizes or explored prospectively would be necessary steps to explore some theories further.

The ketamine theory, as one example, appears to have inconclusive results across studies, with some studies suggesting ketamine-induced NDEs are similar to naturally occurring NDEs (Corazza, 2010; Corazza and Schifano, 2010; Kolp *et al.*, 2007) and other studies suggesting they are not (Greyson, 2009). Additionally, there are many reports of other psychedelic-induced experiences (e.g., LSD) that are also allegedly similar to NDE reports (Luke, 2008 for an extensive review of the literature on this). Unfortunately, since most of the research with psychedelic substances has been highly regulated until recently, developing this area of research was hindered for many years and had to rely primarily on anecdotal reports; fortunately, this is now changing with several studies using these substances being allowed (Friedman, 2006). Clearly exploration of the effect of psychedelics regarding NDEs is an area of research that needs further investigation.

Furthermore, in order to better understand the relationship between natural occurring NDEs and those induced by ketamine, Kolp *et al.* (2007) suggested future studies might focus on administering ketamine to those who had a natural NDE to compare the similarities between the two. Likewise, more studies are needed in this area by looking at the similarities and differences among phenomena found in NDEs that are also frequently found when the brain is still active, such as via drug-induced means (e.g., ketamine and LSD) or even meditation-like experiences. However, the fundamental question here involves whether these drug-induced experiences are simply an alternate pathway that can invoke NDEs, or whether they are the actual causal pathway that can explain what is going on in NDEs.

As another example, Knittweis' (1997) research using instruments to

measure energy flows in NDErs could perhaps lead to more studies using physiological measures to shed light onto the electromagnetic after-effects of NDEs, since unusual physiological experiences post-NDE are consistently reported in the literature. Likewise, the relationship between carbon dioxide levels, hypercarbia, and NDEs appears to be inconclusive, especially in light of Klemenc-Ketis, Kersnik, and Grmec's (2010) recent findings of higher levels of carbon dioxide in 11 NDErs. Because this is a relatively small sample size, larger sample sizes could possibly ascertain what, if any, relationship carbon dioxide may have with NDEs. This gap could also be explored by more in-depth qualitative studies of NDE reports to discern whether there are different after-effects from NDEs with and without increased carbon dioxide levels (e.g., from reports of OBEs, life reviews, seeing deceased loved ones, etc.).

As perhaps the best example of where such studies based on exploring extant neurobiological and psychosocial theories of NDEs are heading, Parnia and colleagues (2008) announced they would be conducting a 3-year prospective study on 1,500 survivors of cardiac arrest who reported NDEs to examine the "biology of out-of-body experiences" (*US News and World Report*, 2008). As of this date, this is one of the largest studies proposed, which will involve 25 medical centers through the US, Canada, and Europe. In an interview with *Time* (2008), Parnia stated the project is called AWARE (awareness during resuscitation) and will utilize various physiological as well as neurological measures to determine if there are any biological differences in patients who report NDEs compared to survivors of cardiac arrest who do not report NDEs. This study is currently underway, with approximately another year left for the study to be completed.

But what about the more unusual reported aspects of NDEs? In addition to reported electromagnetic after-effects of NDEs and OBEs with veridical perception during NDEs, there are other perplexing reports from NDErs (e.g., of experiencing increased psychic phenomena; Fracasso *et al.*, 2010), which have radical implications to our most basic understanding of the world.

These reports strongly challenge theories that attempt to interpret NDEs as being only due to neurobiological or psychosocial causes. This leads us to speculate as to what other theories might account for such extraordinary phenomena that are commonly reported during NDEs.

Some advocate that a new science is needed, possibly based on quantum physics, to explain NDEs (Carter, 2010; Fenwick, 2010; Greyson, 2010; van Lommel, 2006), but others are not so quick to make this leap (Laws and Perry, 2010; Lynn *et al.*, 2010). Physicist Victor Stegner (1992) raised concerns about a “new myth” arising in modern thinking, which asserts that “quantum physics has ruled invalid the materialistic, reductionistic view of the universe” (Stegner, 1992; p. 13), which is deemed premature if not outright wrong. Similarly, Lynn and colleagues argued that quantum physics may not be the best answer to the challenge NDEs pose to the current scientific models based on material reductionism. They claimed that quantum physics simply does not provide a refuge from the complexities, as follows:

“We agree ... that NDEs are fascinating phenomena, and we further recognize that quantum mechanics undergirds chemistry, and so surely plays some as-yet-undefined role in mental processes. However, we sharply disagree that it is necessary to ‘expand on models of the mind’ on the basis of quantum mechanics before we can progress in our understanding of consciousness and the brain” (Lynn *et al.*, 2010, p. 117).

In this regard, a number of writers have been calling for scientific theories that could possibly better answer the hard problem, which might also help explain how consciousness could exist independently of a functioning brain during NDEs. Most vest their hopes on emerging theories derived from quantum physics (Carter, 2010; Fenwick, 2010; Greyson, 2009; 2010; Van Lommel, 2006). A number of such theories have been proposed (e.g., Hameroff, 2007) and may have promise. However, Chalmers (1997) argued that even these quantum approaches would have the same problems as other materialistic theories (e.g., they still would not fully explain how quantum phenomena lead to consciousness any better than would a more conventional neurobiological explanation). In other

words, just as early theories of a “homunculus” did not solve the mind-body problem, but merely caused an infinite regress of explanations (i.e., to postulating another homunculus within the first homunculus to explain it, *ad infinitum*), so would such quantum approaches just lead to further questions as to how quantum phenomena translate into subjective experience. This is compounded by the recent study conducted by Yu and Eberly (2009), which argued that quantum entanglement cannot exist within the level of the whole brain due to “decoherence,” so it does not seem plausible that it can explain NDEs and other such phenomena.

If quantum physics may not be the answer, perhaps other, even more innovative, models might be on the horizon. For example, Haas (2010) has been exploring an interesting theory by combining fields of chemistry, biology, and physics to account for various synchronistic experiences. He is also currently conducting a study to examine synchronistic telepathic phenomena (personal communication, A. Haas, Dec. 6, 2010), that may potentially shed light on some of the electromagnetic and anomalous after-effects commonly reported by NDErs.

VI. Conclusion

On one hand, advocates of the validity of NDEs assert that the existing findings challenge the prevailing materialistic paradigm and have already been validated numerous times, providing sufficiently credible evidence that a disembodied consciousness can operate separately from a functioning brain (Carter, 2010; Greyson, 2010; van Lommel, 2006). However, counter-advocates argue that the sheer number of reports of these phenomena, which are thought to be in the millions, still do not meet the threshold to be considered scientifically validated (Laws and Perry, 2010; Lynn *et al.*, 2010). These sort of ongoing debates are quite common in many areas of similar controversy, such as are found in the parapsychology literature (Krippner and Friedman, 2010).

While the amount of supportive data about NDEs is overwhelming, quantity does not necessarily equate with quality. Laws and

Perry (2010) argued that more solid proof is needed, based on improvement in methods, such as ways to demonstrate that consciousness was indeed operating outside of a functioning brain during actual times of reported brain death (e.g., did a medical procedure that a patient veridically described actually occur during a period of brain death or was the person just in a deeply sedated state that only approximated death?). This leads to the need for a number of conceptual clarifications, such as better operationalization of what actually constitutes brain death (e.g., as opposed to an anesthesia effect that might mimic it), so how key terms are defined becomes essential in this area. Despite that many have proposed innovative scientific theories to solve the hard problem, (such as electromagnetic, quantum mind, reflexive monism, and space-time theories of consciousness; e.g., Stapp, 1993), it remains unsolved, but we think that NDEs provides one of the most opportune access points to explore it and related important concerns.

If consensually adequate evidence that consciousness could operate separately from a functioning brain during NDEs is obtained, it would support that consciousness can be disembodied. If this were to be the case, it would not necessarily solve the hard problem, but it would revolutionize our concepts of who we are and how our world operates. We conclude that,

if NDEs were to be accepted as legitimate events within mainstream science, not just illusional or delusional experiences, they would undoubtedly profoundly alter the meaning of human lives and social institutions. However, as compelling as we find these numerous accounts of NDEs, which challenge both neurobiological and psychosocial theories, to be, many are simply anecdotal reports that were only “verified” in retrospect, rather than during the exact moment they were happening, and/or have other limitations. Subsequently, some advocates say “yes,” there is sufficient proof already (Carter, 2010), while counter-advocates say “no”, there is not yet adequate proof (Laws and Perry, 2010). At this point, it is our belief that the majority of the evidence does suggest that something profound might be occurring that could challenge some of the most basic assumptions we hold about reality; we also acknowledge that more conventional materialistic explanations cannot yet be definitively ruled out, although they have thus far not explained away these intriguing reports from NDErs. It also remains to be seen whether quantum physics or other newer scientific approaches can eventually offer any better grounds for explaining how a disembodied consciousness could possibly exist separately from a functioning brain during NDEs.

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