

## The evolution of a predisposition for the near-death experience: implications for non-local consciousness

James Lake MD

E-mail: jameslakemd@gmail.com

Submitted: September 29, 2016

### Introduction

Two mutually exclusive perspectives inform current thinking about the near-death experience (NDE). One perspective—the view of current science—assumes that NDEs are artifacts of physiological changes in the brain that take place at moments near death, constitute *epiphenomena* of a dying brain, and have no intrinsic significance. The other perspective—one held by the majority of near-death survivors and increasing numbers of NDE researchers—contends that NDEs are unique and transformative events that cannot be adequately explained by reductionist models of consciousness.

This paper examines the near-death experience in the context of contemporary evolutionary theory. I argue that a model of evolutionary dynamics underlying a NDE predisposition must be contextualized in a “meta-theory” that views body-brain-environment as a system influenced by biological, psychological and symbolic processes as well as postulated non-classical processes. I define a NDE *predisposition* or *latent capacity* as a specialized kind of higher cognitive trait. I argue that the NDE predisposition probably originated from a pre-adaptation that permitted early hominins to experience specialized states of consciousness involving complex mental imagery ensuring flexible adaptive responses to unpredictable or life-threatening situations. I examine NDEs that take place in life-threatening and non-life threatening contexts and comment on evolutionary scenarios that may have led to the origin and persistence of a NDE predisposition in populations through direct or indirect selection involving both biological and non-biological inheritance mechanisms. I examine the evolutionary dynamics of NDEs from the perspectives of multi-factorial fitness landscapes, the neuronal replicator hypothesis, socio-cultural, behavioral and symbolic inheritance systems, and models purporting non-local consciousness. I argue that established inheritance mechanisms including natural selection, mutation and genetic drift cannot adequately explain human evolution much less the origin and persistence of a NDE predisposition or predispositions for other transpersonal or so-called ‘anomalous’ experiences including verified reports of veridical perception (i.e. “extra-sensory perception”) during NDEs. I examine the plausibility of evolutionary scenarios for direct versus indirect selection of a NDE predisposition and conclude that neither scenario alone can adequately explain the origin, persistence and phenomenology of NDEs. I develop an integral

model that expands current understandings of “fitness” to include postulated non-classical processes consistent with verified claims of non-local consciousness that take place during NDEs. Finally, I propose field studies aimed at clarifying the roles of biological, symbolic and postulated non-classical influences on evolutionary dynamics underlying a NDE predisposition.

### **Toward a meta-theory of evolution: entities and processes in the body-brain-environment system**

Disparate paradigms reflect different assumptions about the nature of phenomena that exist or *can have existence* and their inter-relationships. Current Western science and other epistemologies posit the existence of discrete “entities” and dynamic “processes” in both living and non-living systems. Different interpretations of “entity” and “process” from the perspectives of disparate epistemologies result in disparate understandings of the body-brain-environment system, and by extension, disparate models of consciousness. In contrast to the formalisms of current Western science other epistemologies do not assume that all phenomena are secondary manifestations of discrete entities or processes that exist as fundamental kinds of things. Quantum mechanics (QM) and quantum field theory (QFT) for example, posit that *apparent* physical properties of living and non-living systems are manifestations of elemental underlying energetic processes that are misinterpreted on a gross level as having a primary kind of physical existence. This stands in contrast to current Western science which claims that discrete entities have primary existence and physical processes adequately characterize the properties of relationships between entities.

Body-brain-environment can be regarded as a complex system comprised of entities and processes in which attributes of the system are manifestations of interactions that take place at multiple biological, psychological, informational and energetic levels. From the perspective of current Western science the claim that consciousness has non-local attributes is viewed as irrational because constraints on the body-brain-environment systems in “ordinary” 4-dimensional space-time would necessarily and in all cases exclude the possibility of non-local relationships between the entities and processes that comprise the system. In contrast to current Western science emerging paradigms informed by QM, QFT or other postulated non-classical phenomena regard non-local consciousness as not only possible but as an *expected* and *necessary* manifestation of the body-brain-environment system.

In current Western science the assumption that only empirically verifiable entities or processes can affect living systems has led to the corollary assumption that valid models of consciousness must be based solely on biological mechanisms. In spite of this assumption it has been established that, in addition to biological factors, living systems respond to different forms of energy and information. Current Western science subscribes to the materialist view that consciousness is reducible to knowable physiological processes that are congruent with classical Newtonian assumptions about space, time and matter-energy relationships. Proponents of Western science argue that a complete understanding of the body-brain-environment system will be achieved through the application of contemporary theories in biology and physics, which will ultimately provide complete explanations of all attributes of consciousness. I take an opposing viewpoint and argue that biological systems and relationships between living systems and the environment—and by extension the body-brain-environment system—cannot be reduced to formalisms describing discrete biological or physical entities and classically described processes. In other words,

cause-effect relationships between particular functional attributes of consciousness on the one hand, and empirically verifiable entities or processes in living or non-living systems on the other hand, cannot potentially explain all properties of dynamic relationships that comprise brain-body-environment. This is true because living systems and their relationships with the environment behave in complex non-linear ways and are influenced both by classically described biological and physical processes as well as non-classical processes which cannot be completely characterized by the methods and models of current Western science. Scientific models that purport to explain consciousness on the basis of classically described entities and processes *only* are based on naïve materialist assumptions from 18th century physics that do not take into account complex multi-level relationships that take place in the body-brain-environment system as it exists in space-time. As the body-brain-environment system is comprised of multiple biological and non-classical entities and processes it is reasonable to assume that some attributes of consciousness can probably be adequately described in strictly biological terms while other attributes may be more adequately described and explained using the formalisms of QM, QFT or other “non-classical” models.

### **A NDE predisposition in the context of evolutionary theory**

#### *The evolution of higher cognitive traits*

Human beings *create* and continuously *shape* the environment within which they evolve thus *H. sapiens* plays a major role in determining the evolutionary *trajectory* of its gene pool since the species controls many factors in the environment to which it must adapt in order to survive. In other words, *H. sapiens* shapes the context in which selection takes place. The existence of *higher* cognitive traits such as the capacity for abstract reasoning, associative memory and anticipating the future, is the other principle factor that makes human evolutionary dynamics unique. Collectively these traits give *H. sapiens* a degree of independence from the ecological background that is unprecedented among all other known life forms. Through highly evolved cognitive traits *H. sapiens* controls its evolutionary destiny by selecting and differentially conserving those physical, behavioral and cognitive traits that are considered most *useful* or *desirable*.

Contemporary evolutionary theory posits that refinements in the capacity for mental imagery and other so-called *higher* mental traits accrued gradually over millennia through natural selection, enhanced the fitness of small populations of proto-hominids and, following the invention of culture and language, spread rapidly in populations significantly enhancing the fitness of the human gene pool on a global level. In early humans a latent capacity for complex mental imagery, visual memory and abstract reasoning functioned as a pre-adaptation that led to *the possibility* of imagination—the capacity for making inferences about distant or future events based on visual memories or visual images constructed in the brain *de novo*. Through memory, imagination, anticipation of future events and associative reasoning, an almost infinite range of linguistic referents to objects and processes in the world and conceptual constructs representing those objects and processes became possible.

Genetic and non-genetic inheritance mechanisms that made possible the conservation of cognitive abilities or predispositions resulted in superior memory, reasoning, imagination, etc. and were highly favored in human populations since individuals that possessed these mental faculties increased the fitness of their respective reproductive and social groups relative to the gene pools of competing groups. Specialized cognitive capacities that differentially enhanced fitness favored group survival and were thus strongly selected. Over countless generations genetic and epigenetic inheritance, drift, and—in historically recent times—social and cultural factors gradually shaped higher cognitive traits optimizing advantages such traits conferred on different populations.

### *Higher cognitive traits in the context of evolutionary psychology and neural network theory*

Evolutionary psychology posits that the mind is composed of a large number of “adaptive specializations” or modules that are functionally organized to solve complex problems of survival and reproduction and modules are shaped by natural selection (Cosmides and Tooby 2013). This concept is consistent with the view that modularity is a robust feature of living systems as modularity may be associated with enhanced “adaptability” of living systems in general by reducing the number of heritable phenotypes on which natural selection can act (Kirschner and Gerhart 2005). Along the same lines neural network theory regards the brain as a system organized as a hierarchical array of intricately inter-connected structural and functional modules that operate in different temporal and spatial scales permitting the functional integration of neural networks serving perceptual and cognitive tasks that are essential for “adaptability” of organisms to environmental changes (Sporns 2011). In this view a NDE predisposition may be conceptualized as a specialized module strongly conserved in populations to “solve” problems related to biological or psychological “survival” in the context of life-threatening crises. Other transpersonal or so-called ‘anomalous’ experiences such as out-of-body experiences and verified claims of psychic functioning, may represent evolutionarily conserved neuro-cognitive modules that function to solve other kinds of problems.

### *NDE evolutionary models and what they imply about human evolution*

Evolutionary models of a NDE predisposition represent not only disparate assumptions about human evolutionary dynamics but different explanatory modes in that some models fit within mainstream science while other models rest on radical assumptions about human evolutionary dynamics. The evolutionary significance of a NDE predisposition can be interpreted along two distinct lines depending on the *conceptual lens* used to examine it yielding two *non-commensurate* evolutionary models. One model argues that a NDE predisposition is subject to *direct* selection, confers fitness advantages on *H. sapiens* and plays a significant role in human evolution. An alternative model argues that a NDE predisposition is a “spandrel,” i.e. a persisting characteristic that itself is *not directly* selected but is an artifact or *epiphenomenon* resulting from selection of another trait (i.e., which is itself directly selected) to which it is genetically linked. Plausible arguments in support of a NDE predisposition as a specialized cognitive trait subject to *direct* selection would have important implications for human evolutionary dynamics. In that case the connotation of *fitness*—at least with respect to *H. sapiens*—would need to be revised to

include mechanisms that influence natural selection and contribute to “fitness” outside of strictly biological and socio-cultural factors delineated in the modern synthesis of evolutionary theory. Conversely, should arguments for a NDE predisposition as a “spandrel” prove more plausible—this would weaken or negate the argument for fitness contributions of a NDE predisposition which, by definition, would have no intrinsic evolutionary significance.

*Natural selection does not adequately explain a NDE predisposition*

Assuming that a *predisposition* for the near-death experience—and possibly other transpersonal or so-called ‘anomalous’ experiences—is a specialized cognitive trait it is germane to inquire how such a trait could plausibly have *come into existence* in the first place. More specifically, are such traits products of natural selection, mutation, drift, or a combination of biological and socio-cultural inheritance mechanisms. Recent advances in evolutionary theory suggest that strictly biological models cannot *adequately* explain human evolution. For example Pigliucci and Muller (Pigliucci & Muller p. 139) argue it is unlikely that mutation alone can explain the origin or persistence of a predisposition for transpersonal experiences. Arguments have been made for the role of selection, genetic drift, and “neutral” traits in human evolution however these models are also limited. Non-genetic models including epigenetics, as well as socio-cultural, behavioral and symbolic inheritance also encounter limitations when attempting to explain human evolution.

Assuming a NDE predisposition *directly* increases fitness in persons who have such experiences and may *indirectly* increase fitness in populations that have contact with NDE survivors the trait would be expected to correspond to a genetic polymorphism maintained at a stable rate in the species gene pool. However the anthropological evidence does not support this view as the probability of survival following a NDE (i.e. a NDE that takes place in the context of a *life-threatening* event) was negligible until historically recent times thus genes coding for the predisposition would presumably not have been subject to *direct* selection. It follows that NDEs—and possibly other kinds of transpersonal or anomalous experiences (for example out-of-body experiences and confirmed claims of veridical perception during minimally conscious states (Carter 2010; pp. 216-229)—*including those that take place in the context of fatal injury or illness would not be expected to confer* direct fitness benefits on the near-death experiencer or on his or her group. It is important to note that even before the advent and widespread availability of cardio-pulmonary resuscitation technology some persons who had NDEs in the context of fatal trauma or illness may have been able to describe their experiences to others in the moments before dying. It is conceivable that in such instances images and strong emotions associated with transformative experiences could have been *transmitted* to others in the form of memes containing symbolic information conferring fitness benefits to the population including relatives and individuals unrelated to the near-death experiencer.

*The occurrence of NDEs in non-life threatening contexts suggests inheritance of a general predisposition for transpersonal experiences*

In contrast to NDEs associated with life-threatening scenarios humans frequently report experiences that are, for all intents and purposes, *phenomenologically identical* to NDEs but which take place in non-life-threatening contexts including vivid dreams, when using psychedelics, in frightening but *non-life threatening* situations, and in trance. Individuals who have NDEs or other kinds of transpersonal experiences in non-life-threatening situations typically resume their former roles in society and many report changed values, new spiritual beliefs, and loss of fear of death. The occurrence of experiences resembling NDEs during dreams and trance states is consistent with a general predisposition for transpersonal experiences that is expressed in different ways depending on the unique circumstances precipitating each case. Along these lines “anomaly proneness” has been proposed as a trait characterized by a propensity to have uncommon or unusual experiences including paranormal experiences, mystical experiences and transpersonal experiences (Simmonds-Moore p. 174-180). There is evidence that anomaly-proneness may be associated with increased neural and cognitive connectivity, as well as relatively greater creativity and increased vividness of mental imagery both of which would be expected to confer general evolutionary advantages. In this view a NDE predisposition may be *one component* of a more general *predisposition to anomaly proneness*.

Irrespective of whether a NDE predisposition was evolutionarily conserved as an isolated trait or a multifaceted psycho-spiritual predisposition such as anomaly proneness, the invention of language would have provided a mechanism for the dissemination of narratives of transpersonal experiences in the form of potent memes both *horizontally* within a population and *vertically* across generations. Individuals who have transpersonal experiences in non-life-threatening contexts would presumably be able to *more completely* narrate and *more successfully* disseminate their experiences as memes pertaining to spiritual insights potentially influencing beliefs and values in the population. Strengthened social bonds, reduced fear of death and increased altruism are widely reported by near-death experiencers and are also adaptive changes at the population level that could plausibly result from narrative sharing of NDEs and possibly also other transpersonal or anomalous experiences.

#### *The neuronal replicator hypothesis applies natural selection to intra-brain processes*

Biological models proposed in efforts to apply selectionist principles to intra-brain processes include neural selectionism, synaptic replicators and synfire chains. All of these models have converged in a synthetic model called the neuronal replicator hypothesis (Pigliucci & Muller p. 214-229). According to the hypothesis a human predisposition to perform complex cognitive tasks involves natural selection of “neuronal replicators” in the brain (Fernando, Karishma & Szathmary 2008). Variants of the neuronal replicator hypothesis invoke different mechanisms involving neural network dynamics to explain a wide range of behavioral and cognitive functions including executive functioning and the capacity for consciousness in general. A NDE predisposition or a general predisposition for transpersonal experiences broadly may involve analogous intra-brain processes that were strongly selected in early hominid lineages because of their contributions to fitness at the level of neural circuits or brains (see below).

## **A neural model for the evolution of a NDE predisposition as a specialized meme**

Recent advances in evolutionary theory go beyond explanations of strictly genetic inheritance mechanisms of anatomical structures to considerations of complex multi-factorial mechanisms that generate phenotypic plasticity during development permitting organisms to respond rapidly to changing environmental conditions with novel highly adaptive behaviors (Pigliucci & Muller, p. 139).

### *The origin and dissemination of a NDE predisposition through the “founder effect” followed by adaptive radiation*

The “founder effect” may help explain the origin, evolution and spread of a NDE predisposition and a latent capacity for transpersonal experiences in general. In the founder effect random genetic drift in a small group results in a novel combination of genes manifesting as a highly adaptive new trait that significantly increases fitness resulting in rapid growth in population size and rapid dissemination of the new trait (Pigliucci & Muller p. 53-54). Assuming that early hominins existed for the most part in widely separated small population centers, the founder effect may have resulted in rapid growth in size of populations that contained individuals who had highly adaptive *insights* following a NDE, other transpersonal experiences, or experienced so-called “anomalous” or non-local aspects of consciousness. Assuming that genetic drift resulted in a *neural preadaptation* for complex mental imagery in small isolated populations of early hominins it is plausible that fitness advantages conferred on populations containing such *gifted* individuals (i.e. individuals who have a NDE predisposition, predispositions for other transpersonal experiences, or “anomaly proneness” that enhance fitness) would have resulted in differentially higher survival or population growth rates compared to populations with few or no *gifted* individuals.

Adaptive radiation refers to the emergence of ecological and phenotypic diversity in the context of rapid population growth and often takes place following a key innovation which opens new ecological niches or new paths for evolution of a species (Pigliucci & Muller p. 53-54). Adaptive radiation also increases species fitness in new ecological niches resulting in novel evolutionary pathways that permit further evolutionary change (Pigliucci & Muller p. 68). Assuming that a NDE predisposition or a general predisposition for transpersonal experiences or “anomaly proneness” resulted from the founder effect and represented a key innovation in human evolution, it is plausible that such an innovation resulted in rapid adaptive radiation manifesting as novel cognitive capacities and enhanced adaptive functioning in response to unpredictable changes in the environment. This model is consistent with an evolutionary scenario in which a NDE predisposition or a *more general predisposition* for transpersonal experiences originated suddenly in small isolated groups of early hominins which subsequently increased in population size resulting in widespread dissemination of the predisposition. The evolutionary dynamics affecting the transmission of a NDE predisposition probably shifted with the advent of agriculture which led to rapid growth in stable populations permitting large-scale migrations and genetic mixing among previously isolated populations. The evolutionary dynamics associated with a NDE predisposition might have been similar to the dynamics that led to the neural capacity for “intuition” which, following the invention of language, became ritualized and widely incorporated into human culture as shamanism and the early knowledge of *healing*.

*Functional integration of the limbic system and neocortex and the neural basis of self-awareness*

An evolutionary theory about a predisposition for transpersonal experiences is incomplete in the absence of a plausible mechanism for the evolution of a *neural capacity for self-awareness* because highly charged experiences like the NDE (or other transpersonal experiences) could *potentially* have adaptive value *only* in organisms that are self-aware of their emotions and thoughts. This is arguable because a capacity for self-awareness permits an organism to respond adaptively to internal states or perceptions resulting in enhanced fitness thus in the absence of self-awareness adaptive responding to an internal state would serve no purpose and would therefore presumably *not take place*. Since, by definition, organisms that are not self-aware lack the capacity to deliberately respond to internal states or perceptions in adaptive ways a neural mechanism underlying the capacity for internal states would not be expected to be *directly* selected and strongly conserved in species that lack the neural capacity for self-awareness. Following this logic, selection of a neural or psychological predisposition for the NDE, other transpersonal experiences or anomaly proneness may have emerged only after a neural capacity for self-awareness had already been firmly established.

Eccles has argued that the neural basis for a predisposition for complex visual processing in higher mammals was strongly selected because it conferred fitness benefits related to increased speed and accuracy of perceptual tasks required to successfully hunt and evade predators (Eccles p. 175). Continued evolution of the mammalian brain starting with early mammals resulted in higher levels of functional integration of limbic centers and neocortex including sensory, pre-motor and motor areas. This evolutionary process further enhanced perceptual abilities through cross-modal processing eventually conferring on primates what Eccles calls “unified mental experiences,” or a capacity to experience strong affective responses to visual stimuli thus increasing the probability of adaptive responses to environmental cues related to mate selection, predator avoidance and territorial conflicts, significantly increasing fitness and survival probability.

The functional integration of visual cortex and limbic structures was strongly selected in hominid evolution and may have pre-adapted the brain of *H. sapiens* (or early hominins generally) to rapidly evolve a capacity for self-awareness as well as transpersonal experiences characterized by complex visual imagery and strong emotions that may have conferred fitness benefits by strengthening social cohesion in small isolated groups through shared beliefs or values enhancing cooperation in times of resource scarcity (Eccles p. 175). Eccles’ hypothesis is consistent with recent findings from functional brain imaging research showing that mental imagery in awake healthy adults is associated with increased activity in the fronto-temporal network (Kreiman et al., 2002; Zimmer, 2008).

The brain’s microstructure may have provided a necessary “pre-adaptation” for the emergence of consciousness in higher animals including hominids. According to Eccles pre-synaptic vesicular grids, which initially evolved to permit efficient signal transmission at chemical synapses, provided the requisite neural infrastructure for bi-directional information flow between neural circuits called “psychons” that embody a sense of *self* and neural circuits underlying sensory and motor functions (Eccles p. 189-191). In



this model higher order circuits for *self*, i.e. a *capacity for self-reflective awareness*, represent *mind* while neural circuits associated with sensory-motor functions are construed as *brain*. When neural activity originates within a psychon it is a product of *mind*. Conversely, neural activity originating in less complex neural circuits serving sensory-motor functions represents *brain*. In this model there is no need to posit the existence of a non-corporeal mental substance thus avoiding the problem of causal agency encountered in dualistic mind-body theories. By definition, interactions between *mind* and *brain* are bidirectional because neural circuits associated with *mind* and *brain* are tightly coupled by networks of synaptic grids. Eccles' work bears on evolutionary mechanisms associated with a general predisposition for visual imagery and cross-modal relationships between imagery and emotion in humans, other primates and among higher mammals in general.

#### *Analysis of alternative evolutionary scenarios underlying a NDE predisposition*

Depending on the assumptions of a particular evolutionary model for a NDE predisposition or transpersonal experiences broadly, one may embrace either an *adaptationist* or a *neutral* perspective. The adaptationist perspective assumes that a NDE predisposition *directly* or *indirectly* contributes to fitness. In contrast the neutral perspective argues that the vast majority of mutations in animals (including hominins) have *neutral* effects on fitness because fitness-enhancing mutations are extremely unlikely to take place in genes whose contributions to fitness have *already been optimized* over millions of years of evolutionary history. The same kind of neutral effect would be expected with respect to frankly deleterious mutations which are seldom observed in nature because they are rapidly eliminated from the gene pool. Following this logic most mutations would be expected to have either *neutral* or *non-significant beneficial effects* on fitness. Both perspectives may offer plausible explanations of the evolutionary dynamics of cognitive capacities in hominins generally including a capacity for mental imagery or transpersonal experiences however both perspectives also have limitations. It is important to contextualize arguments from both perspectives in a discussion of non-genetic inheritance (i.e., epigenetic, behavioral, symbolic) systems known to play a central role in human evolution.

Poorly characterized biological, social, cultural, psychological, informational and postulated subtle “energetic” factors may influence the *expression of a predisposition* for the NDE, other transpersonal or anomalous experiences in humans, or impact the ability or *willingness* of individuals who have such experiences to accurately recall or successfully convey their experiences to others. These intangible factors could result in significant variation in the rates at which NDEs or other transpersonal or anomalous experiences take place or are reported in different populations.

#### *Evolution of a NDE predisposition in the context of multi-dimensional fitness landscapes*

The theory of multi-dimensional fitness landscapes provides useful tools for understanding traits influenced by multiple interacting factors. In contemporary evolutionary theory a “fitness landscape” specifies fitness components as unique sets of genotypes or phenotypes (Pigliucci & Muller p. 46-49). An organism is conceptualized as a *point* on a fitness landscape and a population is represented as a *cloud of*

*points* which changes its structure and position in response to disparate evolutionary factors such as natural selection, sexual selection, mutation, recombination, drift, and migration. The fitness landscapes of all organisms are shaped by thousands of genes that determine anatomy, physiology and behavior thus fitness landscapes are inherently *highly dynamic* and *multi-dimensional*. In humans fitness landscapes are shaped by biological as well as social and cultural factors. Selection of traits that enhance fitness in a specific environment results in a “high-fitness” landscape.

A NDE predisposition can be conceptualized as a specialized cognitive phenotype that can be described as a multi-dimensional fitness landscape that remains *latent* until it is *released* in response to critical biological, psychological, socio-cultural or environmental factors or *cues* (Pigliucci & Muller, p. 324). Assuming a NDE predisposition represents a trait that was directly selected in human populations the likelihood of a unique individual having a particular NDE is presumably influenced by a combination of physiological, psychological, socio-cultural, environmental and possibly also spiritual or so-called “energetic” factors that trigger the *release* of the predisposition in contexts in which the experience somehow enhances fitness at the level of the experiencer or the population. This evolutionary-developmental (evo-devo) model is based on the assumptions that NDEs *can take place only in those persons (or organisms) in whom a latent capacity for NDEs is present* and that neuro-endocrinological “priming” required for activation of the predisposition takes place during development. An evo-devo model of a predisposition for transpersonal experiences in humans may generalize to other primates, higher mammals broadly, and possibly some species of birds that possess the neural capacity for self-reflective awareness, which as discussed above, is a necessary predisposition for fitness benefits to accrue at the individual or group level.

#### *Evolution of a NDE predisposition as a neutral trait*

There is considerable built-in redundancy in the genotype-to-fitness relationship in most species resulting in different genotypes with similar fitnesses (Pigliucci & Muller p. 55). The modern synthesis of evolutionary theory holds that not all traits are adaptive and may represent special cases of *ordinary variation* (Pigliucci & Muller p. 308). Applying this model to individuals with different cognitive capacities, *gifted* individuals and *non-gifted* individuals would be expected to have similar or identical genotypes and this appears to be the case. Along the same lines inter-individual differences in a NDE predisposition may reflect intrinsic variability in multidimensional fitness landscapes that shape different populations but that do not correspond to permutations of highly adaptive genetic predispositions available in the gene pool. In this scenario variations in fitness landscapes would be expected to be neutral with respect to one another—i.e., they do not correspond to real differences in fitness in different populations. This model is consistent with the hypothesis that a NDE predisposition and perhaps a predisposition for transpersonal experiences broadly, is a neutral cognitive trait. In other words in this evolutionary scenario the existence of a NDE predisposition would presumably have a neutral or negligible impact on fitness. Further, the predisposition would be expected to be variably expressed in relationship to unique multi-dimensional fitness landscapes corresponding to interactions between the environment and the population in which the NDE (or other transpersonal experience) takes place resulting in the *differential expression of the trait in unique populations and individuals*.

It is germane to ask whether a NDE predisposition may represent ordinary variation that is not selected and is thus evolutionarily neutral, or conversely represents a highly conserved phenotypic novelty that is directly selected, persists through genetic, epigenetic, ecological or symbolic inheritance mechanisms, and corresponds to complex neural circuits or *neural memes* that confer fitness benefits at the level of a unique person (or other organism), or the population. In the neutral evolutionary model persons who are predisposed to have NDEs (and possibly transpersonal experiences in general) and persons who are *not* predisposed to have such experiences presumably have similar genotypes and any genetic differences associated with a predisposition for mental imagery may reflect intrinsic variability in multidimensional fitness landscapes that are neutral rather than yielding differentially higher degrees of fitness in different ecological contexts or in different populations. The neutral model is consistent with the view that a NDE predisposition has a neutral impact on fitness and unique NDEs are variably expressed in relationship to differences in multi-dimensional fitness landscapes. Please see the discussion at the end of this paper for more analysis of the merits and shortcomings of arguments for direct, indirect and neutral selection with respect to a NDE predisposition.

#### *Soft inheritance mechanisms and their possible role in the evolution of a NDE predisposition*

“Soft inheritance” refers to a combined mechanism of inheritance that involves both non-DNA variations and developmentally induced variations in genes. In contrast (Pigliucci & Muller p. 144) “epigenetic inheritance” involves the transfer of information between two or more organisms that takes place through developmental interactions and is not mediated by DNA. Epigenetic inheritance is common in the animal kingdom and over one hundred cases of epigenetic inheritance have been documented in 42 species (Jablonka & Raz 2009).

Epigenetic learning occurs when a factor in the environment—the “inducing agent”—elicits a physiological or behavioral response that leaves a persistent epigenetic trace which upon subsequent induction results in a more effective or adaptive response (Ginsburg & Jablonka 2009). Research findings suggest that epigenetically acquired traits are transmitted both within the same generation and across generations in all species including humans (Pigliucci & Muller, p. 163). Epigenetic learning or *induction* of a novel trait and its cross-generational transmission may be a useful concept for examining predispositions for transpersonal experiences which take place in relationship to environmental factors that trigger or *induce* acute physiological or psychological responses. Important unanswered questions are whether neuro-endocrinologic or socio-cultural epigenetic changes that accompany a NDE and possibly other transpersonal or anomalous experiences are somehow *epigenetically transmitted* to other individuals within the same group (i.e., horizontal transmission) or trans-generationally (i.e. vertical transmission). In other words is a NDE predisposition and possibly a predisposition for transpersonal experiences in general mediated in part through epigenetic learning?

Heritable stress-induced changes in brain function originally caused by intense fear associated with actual or anticipated trauma may provide a plausible mechanism for the *non-genetic* transmission of neuroendocrine changes that play a role in activating a NDE predisposition and possibly a predisposition

for other transpersonal experiences. Persisting stress-induced changes in brain function might help explain widespread reports of NDEs in response to environmental, cultural, or symbolic cues. Stress-induced hormonal change is an example of direct induction epigenetic inheritance that may persist in a species across generations (Pigliucci & Muller, p. 154). Behavioral changes in rats have been shown to be caused by stress-induced changes in gene expression that affect the hypothalamic-pituitary-adrenal (HPA) axis (Meaney 2001). Animal studies confirm that the *same epigenetic variation may be induced in multiple organisms at the same time* who subsequently *independently inherit* a capacity to exhibit the *non-genetically induced change* (Pigliucci & Muller, p. 164).

One or more epigenetic mechanisms may be associated with the evolution and persistence of a NDE predisposition in human populations. For example stress-mediated changes in serum cortisol levels may result in a “persistent epigenetic trace” in the body and brain including changes in CNS levels of certain neurotransmitters or changes in the relative activity of particular neural circuits which on subsequent induction by epigenetic factors could manifest as a burst of affectively charged imagery, perceptual changes, or other features characteristic of NDEs, out-of-body experiences (OBE), or other transpersonal experiences. A recent study found that epigenetically mediated changes in expression of the glucocorticoid receptor gene in humans increase the risk of post-traumatic stress disorder (PTSD). Glucocorticoid receptor signaling is known to be involved in regulation of emotional memory processing. This finding has implications for the role of stress-mediated epigenetic changes in the brain on a predisposition for NDEs, OBEs and other transpersonal experiences *released* in the context of severe stress (Vukojevic 2014). It is plausible that epigenetically induced changes in glucocorticoid receptor signaling may affect neuronal gene expression influencing biosynthetic pathways of norepinephrine or other neurotransmitter systems that mediate visual imagery and emotionally charged responses to severe stress.

Stress-induced epigenetic changes that take place at the same time in many persons (or other organisms) exposed to the same stressful stimulus may be consistent with a neuropsychoneuroendocrinologic *group effect* of life-threatening trauma in isolated populations of early hominins whose members had been collectively *primed* to have NDEs through common stress-mediated changes in neuroendocrinologic function in response to the narrative re-telling of a particular NDE to the kinship group by a fatally injured or psychologically traumatized person. Along these lines it is plausible that shared exposure to a life-threatening event and subsequent exposure to the ritual re-telling of a NDE *induced* in one person could result in similar neuroendocrinologic changes in other persons in the group, in effect priming them for having a multiplicity of unique NDEs—or possibly other transpersonal or anomalous experiences—in the future. In cases where narrative re-telling results in intense empathic union between the near-death experiencer and members of his or her kinship group a *melting of boundaries* between many participants in the shared narrative could take place resulting in rapid, highly adaptive social or spiritual transformation (Walach 2002). Narrative re-telling in the context of neuroendocrinologic priming following shared exposure to trauma is essentially an *evo-devo* model and may be consistent with symbolic inheritance as described by Jablonka and Lamb (Jablonka & Lamb p. 193-231). The role of symbolic transmission mediated through ritual re-telling of potent NDEs adds an important non-biological dimension to the genetic and epigenetic layers of a multi-dimensional inheritance system that may help

explain the persistence of a NDE predisposition and possibly a more general predisposition for transpersonal experiences in humans and possibly other species.

Reports of recurring themes and visual patterns in shamanic imagery during ritually induced altered states may be consistent with a neuropsychological model of stress-induced changes in brain function and perception proposed to explain recurring motifs in rock art across disparate cultures (Lewis-Williams & Dowson 1988). This model may help to explain at least some aspects of imagery and intense emotions reported by NDE survivors. It has been suggested that different *stages* reported in shamanic journeys and NDEs may correspond to recurring patterns of activity in discrete brain regions starting with simple geometric (i.e. “entoptic”) shapes generated in the retina, progressing to affectively charged images and memories generated in the hippocampus and other limbic structures, and continuing on to more complex imagery including fully formed visual or other sensory hallucinations frequently interpreted as a “tunnel” or “vortex” presumably mediated by occipital (visual) cortex. Bokkon and Mallick recently proposed the *biophysical physical representation model* which postulates that the perception of bright light in NDEs, dreams and visual imagery is caused by the transient “overproduction of free radicals and energetically excited molecules” in the retina and visual cortex and the generation of bioluminescent biophotons which the brain interprets as originating in the external world (Bokkon 2012). This model provides a testable neurophysiological hypothesis for both entoptic shapes experienced in Shamanic journeys and *brilliant light* frequently reported in NDEs. Neurophysiological models may help explain some cases of *brilliant light* or other recurring features or patterns of imagery reported in NDEs and other transpersonal experiences however they do not explain reports of lucidity frequently experienced during prolonged NDEs, nor can they explain carefully documented reports of veridical perception or other anomalous experiences that take place in the context of complete loss of consciousness due to transient cessation of cardiac and/or brain function.

*Indirect selection and its possible role in the evolution of a general predisposition for mental imagery and transpersonal experiences*

Evolutionary change takes place when natural selection, mutation or drift act on multiple interconnected components of living systems (Pigliucci & Muller, p. 313). Change in one component necessarily affects other interconnected components of the system resulting in the evolution of novel structures, behaviors or cognitive capacities that were not the original targets of selection, drift or mutation. This concept is useful for understanding the evolutionary origins of traits that *indirectly* result from selection or mutation of a disparate but—*inter-related*—trait that itself is the object of selection or mutation. By analogy such *indirectly selected* traits have been described (Gould & Lewontin, 1979) as “spandrels” (i.e., the spaces that exist between the wall and flying buttresses in medieval cathedrals) in that they are an indirect and *unplanned* novel consequence of the intended design goal of the architect, namely, flying buttresses.

Evolutionary *hitchhiking* of a structural or behavioral trait on another trait is widespread in the animal kingdom (Pigliucci & Muller p. 345). The persistence or extinction of a particular trait is often determined not by its relative contribution to fitness but by its chance association with (i.e., genetic linkage to) another trait that is strongly selected in the population. In contrast to spandrels, exaptations are

features that did not originally arise for their current use but were selected for a different evolutionary purpose and were subsequently co-opted for new adaptive purposes. Gould believed that spandrels and exaptations played a more significant role in the evolution of cognition than did strict adaptations (Buss 1998). Assuming that a NDE predisposition or a general predisposition for transpersonal experiences was *not directly selected* but originated in early hominin populations as an *incidental* but *necessary* consequence of selection targeting other cognitive capacities, it is important to ask whether inferences can be made about cognitive capacities that initially may have been the principle targets of selection. Further, are contemporary evolutionary models consistent with what is known about the occurrence of NDEs in the context of a multi-factorial inheritance system that includes genetic, epigenetic, environmental and symbolic factors? These and other questions are addressed at the end of this paper.

*The transmission of symbolic information and its possible role in the evolution and inheritance of a NDE predisposition*

In genetic inheritance the direction of information transmission is vertical, i.e., from parents to offspring. In epigenetic inheritance information may be transmitted vertically (across generations) or horizontally (between individuals or groups that are contemporaneous). Therefore to the extent that genetic inheritance is involved in the transmission of a novel trait, the origin and spread of the trait will require several generations to occur. In contrast, to the extent that inheritance of a novel trait involves epigenetic factors or socially mediated learning, there may be less or, in some cases, no requirement for genetic mechanisms underlying information transmission required for the dissemination of the trait. In socially mediated learning an individual “knows or does something or has a particular preference, influences another (naïve) individual in a way that makes the latter develop and practice a similar behavior or have a similar preference (Jablonka & Lamb pp. 333-336).” If a NDE predisposition is examined in the framework of social learning theory an evolutionary scenario that may explain its persistence involves the rapid or widespread horizontal transmission of epigenetic or symbolic information required to establish a novel trait in a population bypassing the need for genetic inheritance. Jablonka & Lamb have suggested that an innate human predisposition for language may have emerged from continuous interactions between genetic, epigenetic and cultural systems of inheritance (Jablonka & Lamb p. 340). In the same vein, it is plausible that multiple interacting environmental, biological and symbolic inheritance systems were necessary for the evolution and persistence of a NDE predisposition and by extension, a predisposition for transpersonal experiences broadly.

The emergence of symbolic communication in early hominins accelerated the rate of cultural change. Non-genetic inheritance systems soon began to play a central role in human evolution. The *higher level* inheritance of symbolic communication has been a principle factor shaping evolutionary change in humans for millennia modifying traits established through *lower-level* biological inheritance based on genetic and epigenetic mechanisms (Jablonka & Lamb p. 342). In this scenario a NDE predisposition may have originated as a highly specialized evolutionary consequence of symbolic communication and other higher level inheritance mechanisms. In the symbolic communication inheritance model key innovations in the inheritance of early hominins presumably resulted in a general predisposition for the near-death experience. Assuming that symbolic inheritance also plays a role in the conservation of a predisposition

for transpersonal experiences broadly, this self-reinforcing mechanism may help explain the pervasiveness of NDEs and possibly other transpersonal experiences in humans and possibly in other species. A contemporary neural interpretation of Jungian archetype theory is consistent with the hypothesis that a NDE predisposition is an example of a recurrent universal symbol or *symbol pattern generator* that has its evolutionary roots in the *old mammal* brain (i.e., the limbic system) and remains largely outside of conscious awareness (Panskepp 1998). This model predicts that recurrent imagery associated with *old mammal* brain regions would be highly conserved, automatically *released* in response to stress, and emotionally highly charged (Panskepp 2005).

A meme is a hypothesized *unit of cultural inheritance* analogous to a structural gene in terms of its role as a kind of *information-bearing replicator*. Memes are postulated to provide a mechanism for the transmission of symbolic information between individuals and across generations. (Jablonka & Lamb p. 207). A meme may be phenotypically *expressed* as words, music, visual images or other symbolic manifestations of culture. Assuming that symbolic inheritance plays a central role in human evolution a predisposition for NDEs or other transpersonal experiences can be conceptualized as the phenotypic *effects* of a meme that is conserved in *H. sapiens* because of its contribution to *psycho-spiritual fitness*.

Memes may have played an important role in the evolution of human cognitive capacities as well as the origin and transmission of culture generally. Intra-brain replication of memes followed by brain-to-brain replication of semantic information in the form of interacting memes was probably a principle mechanism for cultural transmission. Because the evolution of memes depends on transmission of symbolic information or *meanings* between individuals and groups change takes place much more rapidly than evolution driven exclusively by genetic or epigenetic change. In this view a human predisposition for NDEs and possibly transpersonal experiences broadly, may represent a complex meme or (more likely) the product of interactions between several memes including spiritual and cultural beliefs and values, genes and environmental factors. Pigliucci & Muller have suggested that the *cognitive explosion phase* of human evolution was driven by intense competition between memes (Gavrilets 2005) resulting in the rapid emergence of different kinds of human cognitive capacities. Individual differences in a NDE predisposition—and possibly a predisposition for transpersonal experiences broadly—may reflect unique inter-individual differences in physiological, psychological or environmental factors that *prime* transpersonal experiences increasing the probability of their *expression* at the level of the individual or group in response to stress. In this view patterns of core features reported in a particular NDE presumably reflect unique interactions between memes, genes, epigenetic and environmental factors both developmentally and in the immediate moments leading up to the *release* or *expression* of the NDE.

#### *A neural model for the evolution of a NDE predisposition as a specialized meme*

Assuming it is valid to conceptualize the core features of NDEs as specialized memes or more accurately, the *manifestations of multiple interacting memes*, brain-to-brain replication of semantic information may have been a pre-adaptation required for the socio-cultural transmission of a NDE predisposition. A neural model of memes posits the existence of neuronal networks linked together in several layers or *pools* in multiple feed-forward loops (Pigliucci & Muller, p. 222). In this model a *syn-fire chain* is a “feed-forward

network of neurons with several layers (or pools).” Synfire chains are believed to function in ways that are consistent with the information-bearing replicators described in mimetic theory.

It is germane to ask whether the neural dynamics of syn-fire chains provide a useful model for recurring patterns of complex imagery and emotions widely reported in NDEs. Very weak neurophysiological or other biological signals can sometimes elicit extremely complex responses (Pigliucci & Muller p. 265). This phenomenon may help explain how complex behavioral predispositions such as fixed action patterns in fishes, birds and insects take place in response to weak signals from other organisms. An analogous mechanism may help explain how complex mental imagery is released in the human brain in response to weak biological or socio-cultural signals. For example, a decrease in cerebral oxygenation below a critical threshold, or a sudden increase in central norepinephrine or another neurotransmitter may constitute a weak signal which in a person whose brain has acquired specific neuronal replicator memes evokes a pre-programmed response in particular syn-fire chains which in turn release a unique pattern of mental imagery and emotions retrospectively interpreted as a NDE. The neural dynamics of syn-fire chains may be consistent with a network model of brain activity in which the unique features of NDEs or other transpersonal experiences are shaped by complex feed-forward and feedback loops between multiple neocortical and limbic circuits associated with visual memory and affect regulation. In this model subtle changes in neural activity presumably result in differential gating of certain syn-fire chain topologies that are *optimally rewarding* with respect to how their modulation results in imagery, emotions, or other cognitive states. For this model to make sense feed forward and feedback loops between discrete neural circuits would presumably be necessary to permit *optimally rewarding* changes in brain states in *real time*. Dynamical neuronal replicators have been described that are capable of orders of magnitude faster evolution than possible with classical Darwinian evolution only (Pigliucci & Muller p. 226). A corollary to this hypothesis is that the rapid acquisition of novel cognitive or behavioral predispositions via neuronal replicators would be consistent with scenarios in which a predisposition for the NDE and possibly other transpersonal experiences emerged suddenly in human evolutionary history.

*Spiritual and psychological changes following NDEs may enhance group fitness through increased social cohesiveness*

From a group selection perspective it is important to ask about potential fitness contributions of enhanced spiritual understandings of death widely reported following NDEs. Evidence that more spiritual understandings of death confer fitness advantages on a particular population or culture would constitute indirect evidence for group-selection benefits of NDEs and possibly other transpersonal or so-called anomalous experiences. Surveys of NDE survivors consistently report permanent and dramatic changes in attitudes, beliefs and values resulting from positive after effects of NDEs including increased spirituality, increased concern for others (i.e. empathy), heightened appreciation of life, heightened sense of purpose, decreases in fear of death, decreases in materialistic values and decreases in competitiveness (Ring, 1980; Van Lommel 2001; Greyson 1983; 1992; Sutherland 1995).

Khanna and Greyson studied the frequency of daily spiritual experiences among 229 persons before and after a close brush with death (Khanna & Greyson 2013). While no correlation was found between



frequency of spiritual experiences before a close brush with death and the likelihood of having a NDE, persons who reported NDEs had frequent spiritual experiences following a close brush with death compared to persons who did not report NDEs and the frequency of spiritual experiences was positively correlated with the depth of a NDE.

Positive changes in values and an increased frequency of spiritual experiences following NDEs would be expected to be associated with increases in positive interactions between NDE survivors and their relatives or social peers. This hypothesis predicts relatively greater social cohesiveness in populations in which NDEs are reported more frequently compared to populations in which NDEs take place less frequently or occur at rates similar to other populations but for socio-cultural reasons are *less often reported*. Following the invention of agriculture and the establishment of large stable population centers it is plausible that changes in values and beliefs resulting from NDEs (and possibly other transpersonal experiences) would be disseminated as memes both *horizontally* across different populations at a given time, and *vertically* over generations in the same population. The cultural transmission of positive values would constitute a non-biological inheritance mechanism resulting in the spreading of transformative insights about non-material or spiritual aspects of dying and death that might not otherwise take place or might occur less frequently in populations where NDEs are less often reported.

Evidence that a spiritual understanding of death increases the cohesiveness of tribes is available from field studies of traditional societies showing beneficial social effects of death rituals and beliefs on measures of social cohesiveness (Durkheim 1995). However, a putative role of NDEs with respect to group social cohesiveness may not be straight-forward. While most surveys of NDE survivors from different cultures report widely shared features and positive changes in personality and values (Carter 2010; p.136-149; Kellehear 1993) some surveys report negative social consequences of NDEs. For example some NDE survivors report difficulties integrating their experience into their day to day life, have relationship problems, become depressed, or don't share their experiences for fear of being ostracized by family members or society at large (Ring & Valerino 1998). Other NDE survivors who experience changes in spiritual beliefs or values fail to integrate these changes into their day to day social life resulting in social isolation. In such cases NDEs would likely have neutral or negative effects on group social cohesiveness (Greyson 1997).

It is significant that patients who experience cardiac arrest and report NDEs are more than twice as likely to die compared to patients who do not report NDEs (Kelly & Kelly, 2007, p. 414). This observation may be consistent with the idea that NDEs result in a degree of psycho-spiritual preparation that makes dying easier.

#### *Out-of-body experiences (OBE) and implications for the evolution of a capacity for non-local consciousness*

Out-of-body experiences (OBE) are frequently reported features of NDEs and other altered states characterized by an alteration in the ordinary experience of the self in relation to the body and the external environment (Kelly & Kelly, 2007, p. 395). It is estimated that 10% of the general population

have experienced one or more OBEs (Alvarado 2000, p. 184-186), a prevalence rate that may be consistent with an evolutionary mechanism or mechanisms that conserve the *capacity for OBEs* as a trait in the general population. Roughly one half of NDE survivors examined by one research group reported seeing their physical bodies from a different visual perspective or witnessing events taking place in the environment when unconscious (Kelly & Kelly 2007, p. 387). In another series NDE survivors were significantly more likely to accurately describe events that took place during cardiac arrest (i.e. when they were unconscious) compared to matched patients who had undergone cardiac arrest but did not report having NDEs (Sabom 1982; pp. 87-115). Kelly & Kelly comment that while claims of apparent veridical perception during NDEs are highly subjective and inherently unverifiable, such claims provide intriguing evidence for non-local consciousness at near death and warrant further study (Kelly & Kelly, 2007, pp. 387-390). The authors describe remarkable documented cases in which veridical perception and other anomalous phenomena take place in the context of OBEs, including reports of OBEs that were induced at will (Kelly & Kelly, 2007, pp. 387-390). Confirmed reports of veridical perception during OBEs, support that non-local consciousness takes place during at least some OBEs. There is evidence that people who report OBEs are more likely to have lucid dreams, and some people report being able to induce OBEs during a lucid dream (Alvarado, 2000, p. 195). Similarities between mystical experiences across disparate populations and cultures such as enhanced mental functioning, heightened perception, encounters with light, overwhelming feelings of joy and peace, and feelings of being disconnected from the body suggest a common underlying mechanism or mechanisms (Carter 2010, pp. 216-229; James, 1902/1958, pp. 157, 204-205).

From an evolutionary point of view a predisposition for spontaneous OBEs or mystical experiences may be a latent capacity that is *activated* in moments of acute stress and contributes to fitness by resulting in a *shift* to non-local consciousness permitting access to information about threats in the environment or other useful information. In other words, OBEs (including OBEs that take place in the context of NDEs) may be manifestations of changes in consciousness that *permit the possibility of* extra-sensory perception. It is plausible that individuals who possess a latent capacity for non-local consciousness would confer differential fitness benefits to their respective populations by virtue of providing information about potential threats that would otherwise be unavailable, resulting in increased survival probability of genetic relatives or social peers who would then engage in protective or other kinds of adaptive responses. The finding that some individuals have the ability to induce OBEs during normal awake states or in lucid dreams suggests that a predisposition for OBEs may be activated during many different states of consciousness and is potentially available to humans when shifting to this kind of experience. This latent capacity to experience non-local consciousness may contribute to group fitness by helping populations of humans—and possibly other species—respond to a crisis in highly adaptive ways by providing useful information that is not available through normal sensory channels.

#### *Some comments on the evolutionary dynamics of a capacity for non-local consciousness*

NDEs in which anomalous cognition (e.g. telepathy or precognition) takes place may represent a special case of a general predisposition for transpersonal experiences. 85% of individuals in one study of NDE survivors reported an increased incidence of anomalous experiences ranging from an ability to heal

others, out-of-body experiences (OBE), precognition, telepathy and enhanced intuition (Sutherland 1995, p. 112-135). This is consistent with the finding that individuals who are prone to dissociate in ways that are adaptive may have a heightened capacity to experience altered states including NDEs and possibly other transpersonal experiences (Greyson, 2001). Lovelock and Thomas (Lovelock & Thomas 1990) have remarked that “a human being when confronted with a situation of high risk or lethal danger will draw from his unconscious all the possible knowledge and latent mental and psi capacities that could help him solve the crisis.” Among such latent capacities are specific Psi abilities such as telepathy and clairvoyance—a sensitivity to fellow beings and to the state of the environment that is not bound by distance. Along the same lines Hardy has argued that extra-sensory perception is a form of communication that is instinctive in humans, dolphins and many other species and is rooted in a social instinct and a *coupling* between animals and their environment. Hardy’s hypothesis is consistent with the view that the cognitive system itself emerges in the context of a continuous coupling between perception, behavior and the environment (Varela 1991). This view is essentially a systems theory of evolution that takes into account mind, body and environment. VonLucadou (VonLucadou 1983, p. 224) has postulated that mind influences systems at a macro level and that under certain circumstances individuals and physical systems form a meta-system which functions as a more inclusive whole having its own individuality or *organizational closure*. According to Von Lucadou’s model of pragmatic information (MPI) “Psi is distributed among all the minds connected within an organizational closure” and non-local correlations link each person’s mental state with the external system in some cases resulting in temporary *mind-over-matter* effects (VonLucadou 1983, p. 226). Von Lucadou’s model may provide a useful conceptual framework for an evolutionary model of Psi (including NDE or OBEs as special cases) in that it considers the dynamics of ecological systems comprised of both mind and environment within which selection, co-evolution and adaptive radiation may take place resulting in conservation of *favoured* Psi traits over many generations. This model is consistent with the meta-theory of evolution introduced at the start of this chapter. It posits that body, brain and environment co-evolve resulting in selection of various Psi capabilities or *predispositions* depending on their relative fitness contributions with respect to the ecosystem (i.e. body-brain-environment system) within which evolutionary change takes place. Different body-brain-environment systems would be more or less selected in different populations resulting in greater or lesser rates of conservation of a predisposition for non-local consciousness within discrete populations depending on the relative fitness contributions of a particular Psi predisposition in the context of the unique body-brain-environment system in which evolution takes place.

Assuming that temporary non-local correlations postulated by Von Lucadou result in relatively enhanced adaptive responses to local stressors (e.g., more accurate anticipation of a future threat), transient coupling between mind, body and the environment permitting non-local consciousness could favor selection of a predisposition for Psi including the special case of extrasensory perception during NDEs, OBEs or other transpersonal experiences. In cases where a predisposition for non-local consciousness does not confer relative fitness benefits on a population—and thus is *not* subject to direct selection—the trait may nevertheless persist in populations as a neutral trait or *spandrel* if it represents normal variation within a population or is linked to another trait that itself confers fitness benefits and is subject to direct selection (see above discussion of indirect selection). Cognitive capacities such as complex visual imagery, imagination and intuition are examples of the latter kind.

## Discussion

### *Important unanswered questions*

What inferences can be made about plausible evolutionary mechanisms that led to the origin and persistence of a NDE predisposition or a general predisposition for transpersonal experiences? What can be claimed about potential fitness benefits conferred by the NDE and other transpersonal or anomalous experiences? *Assuming a NDE predisposition is directly selected and highly conserved* under what circumstances *does it make evolutionary sense* for a NDE predisposition to persist in *H. sapiens* in cases where the trait confers no *apparent* fitness advantages? Is it *plausible* that a similar predisposition occurs in other primate species or other classes of animals? If so, what adaptive advantages could *experiences like NDEs*—including verified reports of veridical perception—provide for non-human primates or other species and how might any such advantages compare to fitness benefits accrued from a NDE predisposition in humans or a predisposition for transpersonal experiences broadly? If a similar predisposition occurs in non-human primates, higher mammals, or other classes of animals what would this imply about evolutionary dynamics that shape *higher cognitive traits* in general? Further, what would this finding suggest about a plausible adaptive role in other species of a NDE predisposition or a predisposition for other experiences in which consciousness has apparent *non-local* characteristics? What do gaps in our understanding of a NDE predisposition imply about the limitations of current concepts in the biological sciences including *organism, evolution, and fitness*?

*Assuming a NDE predisposition is a neutral trait* what evolutionary processes might operate to conserve the genetic infrastructure, biomass and metabolic energy required for persistence of the trait in human populations and lead to its *expression* during critical moments in the lives of unique human beings (or other species)? In what—*if any*—evolutionary scenarios would it make sense for the *H. sapiens* gene pool to *waste* genetic information and metabolic energy to sustain the neural capacity required for the expression of a predisposition that may turn out to confer no fitness benefits at the level of the individual or group? From a related point of view, is it *conceivable* and *plausible* that a NDE predisposition or a capacity for transpersonal experiences broadly emerged *in parallel* with a more general *latent capacity* for mental imagery underlying memory, imagination and dreaming? The absence of answers to these questions suggests that current scientific understandings of the mechanisms and role of evolution in human consciousness are incomplete.

### *Evaluating the plausibility of disparate evolutionary models*

It is impossible to estimate when a NDE predisposition originated in phylogeny. By the same token we *cannot know* whether the predisposition is unique to *H. sapiens*, occurs in other primates, in higher mammals or may be widely distributed throughout the animal kingdom. Speculation on the evolutionary dynamics of a NDE predisposition risks inviting a multiplicity of *unverifiable* hypotheses. In this section I evaluate the plausibility of arguments for the 2 principle evolutionary scenarios examined in this chapter:

- Conservation of a NDE predisposition results from direct selection (i.e. a NDE predisposition confers fitness benefits on the population)
- Conservation of a NDE predisposition results from indirect selection (i.e. NDE predisposition is a *spandrel* which does not confer fitness benefits on the population but is linked to another trait (or traits) that does)

#### *Arguments for direct selection of a NDE predisposition*

The inheritance of a NDE predisposition through direct selection assumes that either a NDE predisposition or the *expression* of a unique NDE in a particular individual somehow confers fitness benefits on a population. I have argued that the evolutionary origins of a NDE predisposition—and possibly a general predisposition for transpersonal experiences—*probably* occurred following the evolution of a capacity for *self-reflective awareness* which required functional integration of limbic and neocortical brain regions. A neural capacity for self-reflective awareness was a critical pre-adaptation *for an evolutionary scenario* in which a NDE predisposition *became possible* assuming a NDE predisposition *could not enhance fitness* in the absence of a more general cognitive capacity for awareness of a subjective *self*. Stated differently, it is implausible that a predisposition for a subjective experience that enhances survival probability would be *directly* selected and strongly conserved in populations in the *absence* of the cognitive capacity for an internalized sense of self which in turn rests on a more basic capacity for self-reflective awareness. The argument suggests that it is conceivable that a similar predisposition could have evolved in other primates, higher mammals and birds which possess at least a rudimentary capacity for self-awareness.

The fact that NDEs are frequently reported across disparate cultures and demographic groups and are associated with positive changes in values and beliefs that would be expected to enhance social cohesiveness is consistent with direct selection of a NDE predisposition. Assuming a NDE predisposition is *directly* selected and strongly conserved it follows that the predisposition confers fitness benefits on the experiencer, the population or both. On this point I have argued that for all intents and purposes the chances of survival following a NDE (i.e., in the context of life-threatening trauma) were negligible until historically recent times ruling out an evolutionary scenario in which potential fitness benefits (i.e. in the conventional Darwinian sense of fitness) accrued to either the near-death experiencer or the population.

The conservative interpretation uses this framework and posits that NDEs *could not conceivably have* enhanced fitness over evolutionary time frames because in the overwhelming majority of cases NDEs take place in contexts where death is inevitable or imminent i.e., in the absence of recently available life-saving medical interventions that could not have influenced evolution. Whereas the above may be true for the majority of NDEs associated with trauma when there is a very real risk of imminent death it does *not necessarily* apply to cases in which a NDE is psychologically *induced*, (e.g. as in response to intense fear) and clearly does not apply when experiences *phenomenologically similar* to NDEs occur in dreams, during trance or other altered states of consciousness when there is no threat of imminent death.

Reports of enhanced cognitive functioning in the moments before death when NDEs are likely to occur may permit the experiencer to share a narrative of positive emotional and spiritual values among relatives and loved ones that is subsequently conserved as a meme in the population resulting in increased group fitness by reducing fear of dying and death. Many NDE survivors (Kelly & Kelly, 2007, p. 386) who were cognitively intact prior to a medical crisis after which they report having a NDE, experience normal or heightened cognition that apparently takes place during a medical crisis when brain function is grossly impaired and normal or heightened cognitive functioning would not be expected. Such case reports are rare and it is difficult to interpret their significance since in the vast majority of NDEs it is impossible to confirm the exact timing of a NDE. Thus, in the absence of confirmed *time anchors* hypotheses about normal or enhanced cognition when brain function is grossly impaired cannot be empirically tested (for more on this point. Recent findings of highly coherent brain activity in animals and humans at near-death as measured by EEG may help explain dramatic improvements in cognitive functioning in the final moments of life (Lake 2017). Case reports of apparent return of normal or even heightened mental functioning in demented or severely mentally ill persons at near death are consistent with a general mechanism that operates in the final moments of life resulting in a dramatic shift in the quality and type of cognition (Kelly & Kelly, 2007, p. 410).

A latent capacity or predisposition to experience non-local consciousness (i.e. extra-sensory perception) would be expected to confer significant fitness benefits on a population in which individuals possess this predisposition. A predisposition to have spontaneous OBEs or mystical experiences may be a latent capacity *activated* in moments of acute stress that result in a shift from ordinary waking consciousness to non-local consciousness permitting access to accurate information about threats in the environment or other useful information. Individuals in whom this predisposition is expressed at times of stress (e.g. during a NDE or OBE triggered by a medical crisis or intense fear) could significantly increase the survival probability of relatives or social peers, i.e. assuming they share their experiences with others. Von Lucadou's model of pragmatic information may provide the basis for an evolutionary model of non-local consciousness (i.e., "Psi") in which a predisposition for non-local consciousness is directly selected because of fitness benefits conferred on a population that includes individuals who have this predisposition.

#### *Arguments for indirect or neutral selection of a NDE predisposition*

Evolutionary mechanisms reviewed in this paper provide alternative explanations for persistence of a NDE predisposition in populations in the *absence* of direct selection. Indirect selection of a NDE predisposition through genetic linkage to a trait that is itself *directly* selected is a plausible *alternative* genetic explanation to inheritance through direct selection. In this scenario, genes coding for a NDE predisposition would persist in a population even when the predisposition itself functions as a *spandrel*, i.e. a trait that confers no fitness benefits. The association between a NDE predisposition and an innate capacity for vivid mental imagery suggests that a general predisposition for mental imagery or *imagination* in humans—and possibly in other primates, higher mammals and some bird species—may explain *at least some* reports of NDEs as epiphenomena of a more general predisposition for complex mental imagery that itself is directly selected because it confers fitness benefits on a population (Greyson

2000). Indirect inheritance may help explain high prevalence rates of experiences phenomenologically similar to NDEs that take place in different contexts including life-threatening physical trauma, severe psychological stress, during dreams or day-dreams, in trance or other so-called altered states of consciousness.

Frequent reports of NDEs in individuals who are prone to dissociate may provide further evidence for indirect selection of a NDE predisposition. Greyson has observed that NDEs are more likely to be reported by persons who react to stress with dissociative responses that are *adaptive* rather than *pathological* (Greyson 2001). Kelly and Kelly have argued that a predisposition to dissociate may be related to a heightened capacity to experience altered states including NDEs and possibly other transpersonal experiences (Kelly & Kelly 2007, p. 378). Individuals who report having a NDE are more than 3 times as likely to have had a previous NDE (Van Lommel 2001). A correlation between the likelihood of having one or more NDEs and dissociative tendencies is consistent with Hartmann's model of permeable barriers between supraliminal and subliminal levels of consciousness (Hartmann 1989, 1991). According to Hartmann individuals who have more permeable (i.e. *thinner*) barriers are more predisposed to have dissociative or *transliminal* experiences in which the degree of permeability varies with respect to numerous physiological and psychological factors (Hartman 1989). Along similar lines anomaly proneness has been described as a propensity to have "uncommon or unusual experiences including paranormal experiences, mystical experiences and transpersonal experiences (Simmonds-Moore p. 174-180)."

Finally, it is plausible that a NDE predisposition is a *neutral* trait that resulted from genetic drift in one or more small isolated populations and persists at relatively stable but low rates. In this scenario genes or epigenetic factors underlying a NDE predisposition are conserved in small populations in spite of the *apparent absence* of demonstrable fitness benefits as conventionally defined. The above mechanisms of indirect selection or genetic drift may help explain the origin and persistence of a NDE predisposition however in this paper I have argued that neither linkage nor drift can adequately explain the pervasiveness of NDEs or the homogeneity of NDE features in contemporary human populations.

### *Reconciling different evolutionary scenarios—toward an integral model*

From the above discussion we are left with the dilemma of reconciling two apparently disparate evolutionary scenarios namely that a NDE predisposition is *directly* selected and highly conserved in *H. sapiens* and confers fitness benefits on populations that include individuals who have the predisposition, and a competing scenario in which a NDE predisposition persists in populations for reasons that are not clear and *does not* confer fitness benefits—at least not in a conventional Darwinian sense.

I have discussed the roles of both classically described physical and biological processes and postulated non-classical processes in the body-brain-environment system and have suggested their possible roles in human evolutionary dynamics. Evolutionary theory is based on the assumption that classically described processes adequately characterize the structural and functional attributes of living systems and constrain interactions that take place and *are possible* between genes, other biological processes (e.g. epigenetic

factors), culture and the environment at one cross-section of time and over prolonged periods. I have argued that the current scientific orthodoxy is incomplete because it excludes non-classical phenomena resulting in a limited model of evolutionary dynamics that cannot potentially explain certain attributes of body-brain-environment including confirmed claims of veridical perception during NDEs. A more complete evolutionary model must take into account the multiplicity of classical and non-classical processes that shape the body-brain-environment system over time.

If we assume that body-brain-environment is situated in 4-dimensional space-time and can be completely described by contemporary models of biology and classical physics, factors affecting the evolutionary dynamics of consciousness would be expected to be limited to conventional biological and physical processes that determine the direction and rate of natural selection, genetic drift, adaptive radiation, and other well described processes in evolutionary theory. In contrast, if we assume that body-brain-environment is comprised of both classically described and non-classical processes and some functions of consciousness take place in *ordinary* space-time while other functions take place in *higher order* N-dimensional space-times, both classically described processes and postulated non-classical phenomena would be expected to influence evolutionary dynamics. In the proposed integral model the body-brain-environment system is comprised of and influenced by both classical and non-classical processes thus the concept of fitness must be expanded to include postulated non-classical processes that may affect system.

The above evolutionary scenarios, namely direct and indirect or neutral selection, can be further refined into 4 logically possible models depending on assumptions about biological processes and postulated non-classical processes that may influence mechanisms involved in the origin, persistence and spreading of a NDE predisposition. I am assuming that established biological mechanisms always play a role in evolutionary dynamics of the brain-body-environment system. The 4 models follow:

- A NDE predisposition results from direct selection that involves classically described processes only (conventional model)
- A NDE predisposition results from indirect selection that involves classically described processes only (conventional model)
- A NDE predisposition results from direct selection that involves both classically described and postulated non-classical dynamics (integral model)
- A NDE predisposition results from indirect selection that involves both classically described and postulated non-classical dynamics (integral model)

In the following section I discuss the merits, shortcomings and plausibility of the above models in the context of evolutionary theory, NDE phenomenology and disparate models of consciousness. Although this paper is concerned primarily with a NDE predisposition the same analysis can be applied to other transpersonal experiences.

**Exhibit 1: Evolutionary models of a NDE predisposition and implications for human evolution**

Model	Evolutionary dynamics	Implications for human evolution
Direct selection (conventional)	A NDE predisposition is directly selected, highly	A NDE predisposition is the direct result of selection, its evolutionary



mechanisms only)	conserved and confers fitness benefits in a <i>conventional</i> sense that <i>cannot be verified</i> by current science	dynamics can be investigated and explained using conventional scientific methods and theories
Indirect or neutral selection (conventional mechanisms only)	A NDE predisposition is a <i>neutral</i> trait or <i>spandrel</i> resulting from direct selection of another trait which may confer fitness benefits	A NDE predisposition is an artifact or epiphenomenon that has no adaptive significance and plays no role in human evolutionary dynamics
Direct selection (conventional and non-classical mechanisms)	A NDE predisposition is directly selected in the context of a brain-body-environment system influenced by both classical and non-classical processes, is highly conserved, and may confer fitness benefits in both a conventional sense and a non-conventional sense, e.g., <i>energetic or spiritual fitness benefits</i>	A NDE predisposition can be explained using integral models, however its evolutionary role or adaptive significance cannot be verified by current science
Indirect or neutral selection (conventional and non-classical mechanisms)	A NDE predisposition is indirectly selected in the context of a brain-body-environment system influenced by both classical and non-classical processes and does not confer fitness benefits	Some NDE features can be investigated scientifically and explained by conventional or non-conventional models however a NDE predisposition is an epiphenomenon or <i>spandrel</i> and its characteristics and persistence cannot be explained current science alone

The first two variations are consistent with established conventional biological understandings of evolutionary dynamics. In contrast variations 3 and 4 involve both conventional evolutionary dynamics non-classical models take into account anomalous experiences consistent with apparent non-local consciousness. Model 3 postulates that *energetic or spiritual mechanisms* influence selection and conservation of a NDE predisposition and possibly a general predisposition for transpersonal experiences that is directly selected. Model 4, also an integral model, posits that indirect selection operates at the level of both conventionally described biological mechanisms and postulated *energetic or spiritual mechanisms* and that a NDE predisposition does not contribute to the fitness of individuals or populations. In other words in models 2 and 4, selection operates at both a biological and an *energetic or spiritual* level. It is important to comment that the above models are not mutually exclusive as one or more mechanisms may influence the origin, persistence or spreading of a NDE predisposition in a unique population at a particular time or in one or more populations over evolutionarily significant periods. For example, in a

small isolated population it is plausible that either direct or indirect selection involving classical, non-classical or both classical and non-classical mechanisms could result in change in the prevalence rates of NDEs followed by adaptive radiation and spread of a NDE predisposition within and across populations or the persistence of a NDE predisposition as a neutral trait.

As reviewed in this paper NDEs and OBEs are reported by approximately 10% of the general population, consistent with the hypothesis that predispositions for both transpersonal experiences are highly conserved in human populations. Even traits that confer relatively small fitness advantages can spread throughout a population on the time scales over which evolutionary change takes place (Haldane 1927). Thus even if future surveys show that the social, psychological and group effects of NDEs are associated with only small differences in relative fitness (i.e. compared to populations where NDEs either do *not* take place or take place but do not result in changed values or beliefs) (see above discussion) the persistence of a NDE predisposition in populations would nevertheless be consistent with direct or indirect selection. A similar evolutionary argument can be applied to a postulated predisposition for non-local consciousness that would be expected to enhance group fitness even though such a “Psi” predisposition may take place at a very low prevalence rate in the population. Taylor has argued that an evolved capacity or predisposition for Psi would be limited and would probably operate as an environmental scanning mechanism “receptive to any information that may serve the needs of the organism” in a given ecological context (Taylor 2003).

I have propose an integral model that I believe more adequately explains evolutionary dynamics associated with a NDE predisposition—and possibly predispositions for other transpersonal experiences—than conventional evolutionary models based on classically described mechanisms only. I favor the view consistent with the modern synthesis of evolutionary theory (Jablonka & Lamb 2006) that human evolutionary dynamics are influenced by a multiplicity of biological, psychological and social processes as well as postulated non-classical processes. The implication is that while a NDE predisposition may occur over extended periods at the same rate in some populations its prevalence rate may decline or increase in other populations in response to biological, cultural and postulated non-classical processes that influence the body-brain-environment system.

### **Toward testable hypotheses of evolutionary mechanisms underlying a NDE predisposition**

#### *Potential biological inheritance mechanisms: Direct selection*

If a NDE predisposition is inherited by conventional biological mechanisms, directly selected and confers important fitness benefits large stable populations would be expected to have similar NDE prevalence rates reflecting an “average” inheritance rate of the predisposition regardless of differences in values or beliefs about death or dying. Prevalence rates of a NDE predisposition in small or isolated populations might show significant variability depending on whether genes coding for the trait are universally present in all populations; differences in relative fitness benefits are conferred on unique isolated populations, or a NDE predisposition originated in a population through the founder effect and spread through adaptive radiation. Conversely a finding of significantly smaller NDE prevalence rates in isolated or small populations would be consistent with a scenario in which a NDE predisposition originated through

genetic drift and persisted as a neutral trait. In other words, variability in NDE prevalence rates across populations or cultures does not provide evidence in favor of either direct or indirect selection.

#### *Potential biological inheritance mechanisms: Indirect selection*

If a NDE predisposition is inherited through well described biological mechanisms, indirectly selected (i.e. it is a “spandrel”) and is linked to another trait that itself is directly selected, NDE prevalence rates would be expected to be roughly equal in large or homogeneous populations reflecting the fitness benefits of the trait to which genes coding for a NDE predisposition are linked. By definition in indirect selection no fitness benefits are conferred on a population by a NDE predisposition per se. As is true for the case of direct selection relatively smaller or larger NDE prevalence rates would be expected to occur in small or isolated populations depending on whether a NDE predisposition persists as a neutral trait through genetic drift, or is conserved as a highly adaptive trait that originated through the founder effect followed by adaptive radiation and rapid spreading.

#### *Putative non-biological inheritance mechanisms*

If inheritance of a NDE predisposition takes place primarily on a cultural level and its persistence and dissemination in and across populations is mediated largely or exclusively by symbolic inheritance (i.e. through the creation and transmission of memes) and the predisposition confers important fitness benefits on populations in which it takes place, NDE prevalence rates would be expected to vary between populations corresponding to differences in social values or beliefs attributed to NDEs by disparate cultures or populations. A finding of significant variability in NDE prevalence rates between populations that correlate to differences in shared beliefs about death and dying or measures of social cohesiveness would provide evidence that symbolic inheritance plays an important role in the conservation and dissemination of a NDE predisposition. By the same token large populations characterized by widely shared values and beliefs about death, afterlife, etc would be expected to show stable prevalence rates of a NDE predisposition and differences in prevalence rates would be expected to be commensurate with differences in relative fitness benefits of a NDE predisposition in the context of disparate cultures. The finding of a positive correlation between NDE prevalence rates and reports of transpersonal experiences including verified claims of out-of-body experiences or extra-sensory perception would support an evolutionary scenario in which a NDE predisposition and non-local consciousness are directly selected and confer significant fitness benefits.

#### *Research recommendations*

I have argued that the most likely scenario underlying the evolution of a NDE predisposition is multifactorial in that multiple biological, symbolic and—at least in some cases—postulated non-classical

processes influence selection. Different research methods have been developed to gather evidence for evolutionary dynamics underlying different kinds of traits (Simpson & Campbell, 2005; p. 133-139). Sample surveys and formal theoretical studies can be used to maximize the generalizability of research findings across different persons, settings or times. Before findings of surveys or theoretical studies can be generalized to different populations they must first be checked for *external validity* based on relevance and robustness (Simpson & Campbell 2005; p. 131). Relevance refers to the degree to which findings help solve social problems or improve the quality of life. Robustness reflects the degree to which a finding is replicable across different settings, people, and historical contexts. I have argued that a NDE predisposition results in positive changes in values and beliefs that would be expected to increase social cohesiveness fulfilling the criterion of relevance. Findings from numerous surveys of NDE survivors (Carter 2010; pp. 216-229) have been replicated across different populations, socio-cultural settings and historical contexts fulfilling the criterion of robustness. On this basis an evolutionary model for a NDE predisposition has strong *external validity*, and the model can be generalized to different populations.

Another important concept in evolutionary research methods that bears on analysis of a NDE predisposition is *construct validity*. Construct validity asks “does a finding reveal a causal relationship between variable X and variable Y, between variable Z and variable Y, or with some other outcome variable (Simpson & Campbell 2005; p. 131).” I have argued for an integral evolutionary model in which a multiplicity of biological, symbolic and postulated *non-classical* processes (or *variables*), influence inheritance. While some processes that influence evolutionary dynamics are probably correlated with other processes; some processes probably function independently of one another. Because of the multiplicity of correlated and independent variables that affect the body-brain-environment system experimental field studies could yield findings consistent with multiple hypotheses without confirming the role of any particular causative factor (Simpson & Campbell 2005; p. 131). Along these lines Simpson & Campbell have remarked that evolved adaptations might be difficult to substantiate because complex traits often have “mixed designs.” In other words, complex traits are influenced by multiple factors resulting in different adaptive functions over evolutionary timescales (Simpson & Campbell 2005; p. 127). Evolutionary science developed the multi-trait multi-method matrix approach and other multi-method research approaches to obtain different types of evidence for hypotheses purporting special design in complex psychological traits. Multi-method approaches investigate traits at different levels including neural mechanisms, context-specific information processing, emotional reactions and behavioral responses, and subsequently test for correlations between causative levels (Wilson 1998). In order to adequately characterize complex causative inter-relationships between multiple variables that influence inheritance and persistence of a NDE predisposition—or predispositions for other transpersonal experiences—future surveys should test for correlations between the social and psychological dimensions of NDEs at the level of individuals and populations, neural mechanisms, and reports of veridical perception or other experiences consistent with non-local consciousness.

### **Concluding remarks**

A future integral model of evolutionary should be contextualized in a meta-theory that takes into account established biological mechanisms and postulated non-classical processes. While some functions of consciousness can be adequately described in strictly biological terms others may be more adequately

described using the formalisms of quantum mechanics or other non-classical models. Ongoing theoretical work reviewed in this paper is attempting to reconcile conventional biological models of consciousness with postulated non-classical models. Models purporting to explain the origin and evolution of human consciousness rest on assumptions about factors that influence inheritance that cannot be directly empirically tested. It is likely that a capacity for self-reflective awareness preceded and constituted an essential pre-adaptation for the origin of a NDEs predisposition. Inferences about the evolutionary dynamics and potential fitness benefits conferred by a NDE predisposition lead to two alternative scenarios in support of direct versus indirect selection, respectively. An analysis of their respective merits and limitations fails to support one scenario over the other. I conclude that a NDE predisposition most likely originated and persists through multi-factorial inheritance and may be *directly* or *indirectly* selected in different populations in the context of different classically described and non-classical mechanisms. I broaden the conventional definition of fitness from strictly biological and cultural measures of adaptation to include phenomena consistent with postulated non-local consciousness.

Future laboratory and field investigations of the near-death experience will help answer important questions about the nature of human consciousness, the relationship between consciousness and the brain, and postulated non-local attributes of consciousness. Anthropological field studies incorporating multi-method approaches testing for correlations between biological, social, cultural and psychological factors as well as verified claims of veridical perception or other findings consistent with non-local consciousness, will help elucidate processes that shape inheritance of a NDE predisposition, and contribute to current understandings of the evolutionary dynamics underlying a predisposition for transpersonal experiences in general. Surveys should be undertaken of both near-death survivors and individuals who report phenomenologically similar experiences in dreams or altered states. Surveys of large and small populations characterized by different degrees of genetic or cultural isolation will help determine whether NDE prevalence rates are more consistent with arguments for direct versus indirect selection, whether a NDE predisposition increases social cohesiveness, and will elucidate different functions of NDE-like experiences that take place in the context of non-life threatening circumstances including dreams, trance and altered states.

## References

Alvarado, C.S. "Out-of-body experiences." In E. Cardena, S. J. Lynn, & S. Krippner (Eds). *Varieties of Anomalous Experience: Examining the Scientific Evidence*. Washington, DC, American Psychological Association, 2000, pp. 183-218.

Bókkon, I., and Mallick, B. N. "Activation of retinotopic areas is central to REM sleep associated dreams: visual dreams and visual imagery possibly co-emerged in evolution." *Act. Nerv. Super.*, 54, 2012, pp. 10–25.

Buss D.M., Haselton M.G., Shackelford T.K., Bleske A.L., Wakefield J.C., "Adaptations, exaptations, and spandrels." *Am Psychol.*, 53(5), May 1998, pp.533-48.

Carter, C. *Science and the Near-death Experience: How consciousness survives death*. Inner Traditions; Rochester, VT; Toronto, Canada, 2010.

Cosmides L, Tooby J. "Evolutionary psychology: new perspectives on cognition and motivation." *Annu Rev Psychol.*, 64, 2013, pp. 201-29.

Durkheim, E. *The Elementary Forms of Religious Life*, The Free Press, New York, NY, 1995.

Eccles, J.C., *Evolution of the Brain Creation of the Self*, Routledge, London and New York, 1989.

Fernando C Karishma KK, Szathmary E "Copying of neuronal topology by spike-time dependent plasticity and error-correction." *PLoS ONE* 3:33775, 2008.

Gavrilets S, Vose A. "Dynamic patterns of adaptive radiation." *Proc Natl Acad Sci U S A.*, 102(50), Dec 13, 2005, pp. 18040-5.

Ginsburg S, Jablonka E. "Epigenetic learning in non-neural organisms." *Biosciences*, 34(4), October 2009, pp. 633-46.

Gould S.J, Lewontin R.C. "The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme." *Proc R Soc Lond B Biol Sci.*, 205(1161), Sep 21, 1979, pp. 581-98.

Greyson, B. "Dissociation in people who have near-death experiences: out of their bodies or out of their minds?" *Lancet*, 355, 2000, pp. 460-463.

———. "Near-death experiences and attempted suicide." *Suicide and Life-threatening behavior*, 11, 1981, pp. 10-16.

———. "Near-death experiences and personal values." *American Journal of Psychiatry*, 140, 1983, pp. 618-620.

———. "Post-traumatic stress symptoms following near-death experiences." *American Journal of Orthopsychiatry*, 71, 2001, pp. 358-373.

———. "The near-death experience as a focus of clinical attention." *The Journal of Nervous and Mental Diseases*, 185, 1997, pp. 327-334.

Haldane, J.B.S. "A mathematical theory of natural and artificial selection, Part V: Selection and Mutation." *Proc Cambridge Philosophical Society*, 23, 1927, pp. 833-844.

Hartmann, E. "Boundaries of dreams, boundaries of dreamers: thin and thick boundaries as a new personality measure." *Psychiatric Jour of University of Ottawa*, 14, 1989, pp. 557-560.

Hartmann, E. *Boundaries of the Mind: A new psychology of Personality*. New York: Basic Books, 1989b.

Jablonka, E., and Lamb, M. *Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral and Symbolic Variation in the History of Life*. MIT Press, Cambridge, MA and London, 2006.

Jablonka, E, and Raz, G. "Transgenerational epigenetic inheritance: prevalence, mechanisms, and implications for the study of heredity and evolution." *Quarterly Review of Biology*, 84, 2009, pp. 131-176.

James, W. *The Varieties of Religious Experience*. New York: Mentor, 1958 (original work published 1902).

Juste, R., MacClean, J., Smith, J., Lansner, A. "The Cortex as a Central Pattern Generator." *Nature Reviews Neuroscience*, 6, 2005, pp. 477-483.

Kelly, E., Kelly, E.W., Crabtree, A., Gauld, A., Grosso, M., & Greyson, B., *Irreducible Mind: Toward A Psychology for the 21<sup>st</sup> Century*. Rowman & Littlefield Publishers, Inc., 2007.

Khanna, B., Greyson, B. "Daily spiritual experiences before and after near-death experiences." *Psychology of Religion and Spirituality*, 6(4), 2013, pp. 302-309.

Kellehear, A. "Culture, biology and the near-death experience", *The Journal of Nervous and Mental Diseases*, 181(3), 1993, pp. 148-156.

Kirschner, M., Gerhart, J. Evolvability. *Proc Natl Acad Sci USA*, 95, 1998, pp. 8420-8427.

Kreiman, G., Koch, C., Fried, I. "Imagery neurons in the human brain." *Nature*, 408, 2002, pp. 357-361.

Laland, K., Brown G., *Sense and Nonsense: Evolutionary Perspectives on Human Behavior*. Oxford University Press, 2002.

Lake, J., The near-death experience: a testable neural model. *Jour of Psychology of Consciousness: Theory, Research and Practice*, Vol 4(1), 2017, 115-134.

Lewis-Williams, J.D., Dowson, T.A. "The signs of all times: Entoptic phenomena in upper Paleolithic Art." *Current Anthropology*, 29, 1988, pp. 201-245.

Lovelock, J., Thomas, L. *The Ages of Gaia*. New York, Bantam-Doubleday, 1990.

Meaney, MJ. "Maternal care, gene expression, and the transmission of individual differences in stress reactivity across generations." *Annual Review of Neuroscience*, 24, 2001, pp. 1161-1192.

Panskepp, J. "Affective Consciousness: Core emotional feelings in animals and Humans." *Cognition and Consciousness*, 14, 2005, pp. 30-80.

———. "Toward a neuroscience of emotion: the epigenetic foundations of emotional development." In M.F. Mascolo and S. Griffin (eds.) *What Develops in Emotional Development?* Plenum Press, 1998.

Parnia, S, D. G. Waller, R. Yeates, and P. Fenwick. "A qualitative and quantitative study of the incidence, features and aetiology of near death experiences in cardiac arrest survivors." *Resuscitation*, 48, 2001, pp. 149–56.

Pigliucci, M., and Kaplan, J. *Making Sense of Evolution: The Conceptual Foundations of Evolutionary Biology*. The University of Chicago Press, Chicago and London, 2006.

Pugliucci, M. and Muller, G. Eds, *Evolution: The Extended Synthesis*. The MIT Press, Cambridge, MA and London, England, 2010.

Ring, K. *Heading Toward Omega*, New York, William Morrow, 1984.

———. *Life at Death a scientific investigation of the near-death experience*. New York: Coward. McCann & Geoghegan, 1980.

Ring, K. & Valerino, E.E. *Lessons from the light: what we can learn from near-death experiences*. Perseus Books, Covington, MA, 1998.

Simmonds-Moore, C., Ed. *Exceptional Experience and Health: Essays on Mind, Body and Human Potential*. McFarland & Company, Inc., Jefferson, North Carolina, London, England, 2012.

Simpson, J.A., Campbell, L. "Methods of Evolutionary Sciences." (Ch. 4) in Buss, D., Ed., *The Handbook of Evolutionary Psychology*, John Wiley and Sons, Inc., Hoboken, New Jersey, 2005, pp. 119-145.

Sutherland, C. *Reborn in the light: life after near-death experiences*. New York, NY: Bantam, 1995.

Sporns, O. "Economy, Efficiency and Evolution" (Ch. 7). *Networks of the Brain*. The MIT Press, Cambridge, MA, London, England, 2011.

Taylor, R. "Evolutionary theory and Psi: Reviewing and revising some need-serving models in psychic functioning." *Jour of Soc for Psychical Research*, 67, 2003, pp. 1-17.

Van Lommel, P., van Wees, R., Meyers, V., & Elfferich, I. "Near-death experiences in survivors of cardiac arrest: a prospective study in the Netherlands." *Lancet*, 358, 2001, pp. 2039-2045.



Vukojevic V, Kolassa IT, Fastenrath M, Gschwind L, Spalek K, Milnik A, et al. “Epigenetic modification of the glucocorticoid receptor gene is linked to traumatic memory and post-traumatic stress disorder risk in genocide survivors.” *J Neurosci*, 34(31), July 30, 2014, pp.10274-84.

Walach, H., Schmidt, S., Schneider, R., Seiter, C., & Bosch, H. “Melting boundaries: subjectivity and intersubjectivity in the light of parapsychological data.” *European Jour of Parapsychology*, 17, 2002, pp. 72-96.

Wilson, E.O. *Consilience: The Unity of Knowledge*. New York, Knopf, 1998.

Zimmer, H.D. “Visual and spatial working memory: from boxes to networks.” *Neurosci. Behav. Rev.*, 32, 2008, pp. 1373–1395.