

**Original article**

## □ **The mind-body problem through the lens of near-death experiences: implications for clinical practice**

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**SUMMARY:** *The mind-body problem is one of the long-standing issues of science. Across the centuries, two main theories have been reported: dualism (the mind and body are two distinct entities) and monism (the mind is the brain). Such a debate can be currently approached by modern neuroscience, especially when considering altered states of consciousness, such as near-death experiences. Indeed, the current scientific discussion on NDEs closely reflects the age-old dualism/monism debate – with those who support reductionist interpretations indirectly supporting monism, while others showing the limitation of the reductionist approach leave open the possibility of a dualist answer to account for these non-ordinary mental expressions. In the present paper we summarize the current state of knowledge on near-death experiences, with particular regard to the scientific explanations of the phenomenon, outlining pros and cons of the reductionist approach. Moreover we suggest the relevance of a broader approach to near-death experiences and other non-ordinary mental expressions with its clinical implications.*

**KEY WORDS:** *Near-death experiences, Non-ordinary mental expression, Scientific reductionism.*

### □ INTRODUCTION

The nature of the human mind has long fascinated a broad range of scholars. Traditionally, philosophies of the mind can be divided into two main categories: dualist and monistic theories. The former - direct descendents of Descartes' radical separation of *res cogitans* and *res extensa* - state that the mind is a non-physical substance that may be dissociated from the body. Such a position leads to a radical distinction between the mind and the body, as if they were two entities whose nature and activities are totally separate,

mutually exclusive, and innumerable. However, it also makes it problematic to explain any sort of reciprocal interrelation between the two.

Descartes proposed that the soul resided in the area of pineal gland (including the cerebellar vermis and choroid plexus), which he thought behaved like a valve regulating the flow of vital spirit through the brain<sup>(54)</sup>. As far as perception is concerned, the brain would receive a pattern of "movements" (what we call a 'stimulation pattern' in modern terminology) transmitted from the retina. This pattern would be then transmitted from the brain to the mind, thus

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Progress in Neuroscience 2015; 3 (1-4): 105-115.

ISSN: 2240-5127

doi: 10.14588/PiN.2015.Facco.105

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**LIST OF ACRONYMS AND ABBREVIATIONS:** ASCs = Altered States of Consciousness; NDEs = Near-Death Experiences.

producing the corresponding sensations in the mind. In contrast, monistic theories state that the mental is not distinct from the physical; in this sense, all mental states and processes would, in principle, be identical with physical states and processes<sup>(31)</sup>. In line with this perspective, Cleeremans (2011) hypothesized that our consciousness is the result of the brain's continuous attempts to predict not only the consequences of its actions, but also the effects of activity in one cerebral region on activity in other regions<sup>(20)</sup>. In this way, the brain would continuously (and unconsciously) learn to describe its own activity to itself. Such learned descriptions, enriched by the emotional value associated with them, would form the basis of conscious experience.

The mind-brain-body problem remains a long-standing issue of science, primarily due to the difficulty in empirically testing the hypotheses provided by these theories, and by the implicit *aporia* yielded by their ostensible incompatibility. In the 20th century, several neuroscientists ignored this debate, instead focusing on other, empirically testable, open questions of neuroscience. This debate is a part of the wider historical-philosophical evolution of science and its progressive separation from philosophy and religion. This process, developed from Galileo's and Descartes' enlightenment mindset, bringing logic and positivism to modern science, was initially curbed somewhat by the Church - in particular the Inquisition - resulting in a political compromise, rather than the fruit of unfettered epistemological reflection. This in turn led to an ever stronger materialist stance and a rejection a priori of anything tainted with a flavour of transcendence. Thus, medical science exclusively focused its attention on Descartes' "Earthern Machine", disregarding the soul (considered the province of theology and philosophy, but taboo for the new science) in its quest for objectivity and neglect of subjectivity (*for a detailed analysis, see Facco, 2014<sup>(26)</sup>; Facco et al., 2015<sup>(29)</sup>*). This stance reached its zenith with logical positivism, in which scientific knowledge is considered superior to any other form of knowledge, being based on logical tools and the empirical observation of reality. From this standpoint, metaphysics is seen as meaningless, redundant.

In this climate, modern psychology stemmed from philosophy following Wundt's seminal 19th-century experiments. Behaviourism, which denied the value

of subjective experience, its narration, and even the relevance of consciousness itself, to psychology, was the next logical step, the focus being the observation of behaviour from a stiff, third-person perspective, an approach very much in line with the mechanistic paradigm of medical science. This, united with the post-Enlightenment rationalistic perspective, led in turn to misinterpretation of relevant subjective phenomena like hypnosis, and other so-called ASCs (e.g., NDEs, shamanic rituals, mystic experiences). Among the ASCs, NDE remains the most intriguing phenomenon, since it bridges the gap between survival and death, physics and metaphysics. The fine line between physical reality (as we perceive it) and the hereafter (whatever that might be, perhaps oblivion) is, by definition, the farthest reaches of the province of science, and the no-man's land in which science, philosophy and religion inevitably converge and clash. The transcendent nature of NDEs has led us in the past to consider them as an odd phenomenon, a psychiatric disorder, or the expression of brain gone awry following acute trauma. Over the past two decades, however, this prejudicial view has been increasingly challenged by modern neuroscientists, fuelling renewed interest in the mind-body debate. NDEs are profound subjective experiences occurring in life-threatening conditions. They often involve the perception of a bright light, tunnels, deceased relatives, entering a new domain, enhanced mental functioning, and a revisitation of their life, as well as 'out-of-body experiences', in which people described a feeling of separation from their bodies and the capacity to watch themselves from a different perspective<sup>(24)</sup>. See Table 1 for a summary of the most common recurring features of NDEs.

The current definition of the term NDE is not yet set in stone by the literature, although it generally refers to an altered states of consciousness that occurs during an episode of unconsciousness in critical medical conditions<sup>(41)</sup>. It is worth noting that the word 'near' is not used here to mean 'almost' dead, more a temporary experience of the early stages of death. Dell'Olio recently proposed an analogy that might help us to understand this difference in meaning, and indeed the importance of studying NDEs, namely the relationship between near-paralysis (temporary paralysis) and paralysis<sup>(22)</sup>. As we can draw conclusions as to the nature of permanent paralysis on the basis of the

Literature descriptions of near-death experiences and examples of their narration	
1	<b>Awareness of being dead</b> <i>"I realized that I was dead..."</i>
2	<b>Feeling of pleasure, euphoria, well-being</b> <i>".. However I wasn't sad or sore, I felt elated and surrounded by a sense of joy..."</i>
3	<b>Out-of-body experience</b> <i>"I could see medical personnel working on me, but I saw it from a new perspective. It was as if I was the director of the scene, not the actor..."</i>
4	<b>Tunnel-like perception</b> <i>"Then I saw a dark tunnel in front of me, I couldn't figure out where to bring and what there was at the end of it..."</i>
5	<b>Perception of a bright light</b> <i>"There was a light in front of me, whose glow I had never seen before..."</i>
6	<b>Perception of heavenly or hellish environment</b> <i>"Everything around it was like I had imagined, I knew I was going to heaven..."</i>
7	<b>Vision of deceased persons, religious figures or undefined entity</b> <i>"... suddenly I saw a human silhouette, an indefinite presence..."</i>
8	<b>Life review</b> <i>"I began to review my whole life, a series of flashbacks that I couldn't control. It was as if I saw them through the window of a train..."</i>
9	<b>Different time perception</b> <i>"I felt in a timeless environment. I could have stayed there one minute or one day, I don't know"</i>
10	<b>Perception of sounds and music</b> <i>"And there were sounds, celestial melodies that I wouldn't easily define..."</i>

**Table 1.** Recurring features reported in the literature descriptions of NDE, with examples of their narration<sup>(2,23)</sup>.

experience of temporary paralysis, so NDEs may help us to understand at least the first stages of a dying body/mind.

Most people who have experienced NDEs have described them as very pleasant. However, some patients also reported unpleasant experiences similar to nightmares (reviewed in Agrillo, 2011<sup>(3)</sup>). Positive experiences that then changed course to become negatively toned have been reported too. Interestingly, research has shown no correlation between apparent life deeds and type of NDE -distressing NDEs are as likely to be experienced by 'good' people as opposed to 'bad' people. More generally, the content of NDEs (positive or negative) seems to be similar worldwide, across cultures and time-spans, suggesting that cultural beliefs do not play a key role in determining this kind of experience<sup>(6)</sup>.

During the last decade, NDEs were documented with increasing frequency due to improvements in resuscitation techniques<sup>(74)</sup>, thereby becoming one of the most important topics in modern neuroscience. It is possible that the incidence of NDEs is even higher

than we envisage, as accounts are not routinely collected by the medical staff. Furthermore, it has been shown that many patients prefer not to report their experiences, or decide to describe them exclusively to doctors who are familiar with the issue, to avoid being dismissed as "crazy", or still highly confused following the injury<sup>(74)</sup>.

Although the majority of modern neuroscientists does not directly refer to the body-mind problem in their studies on NDEs, the two theoretical frameworks reported in this research field<sup>(3)</sup> indirectly reflect monism and dualism. The former suggest that all recurring features of NDEs can be explained by well-known psychobiological factors - perception of bright light, tunnels, and deceased people would be a by-product of a damaged brain. The latter theories do not exclude psychobiological explanations of some recurring features of NDEs, but admit the possibility that other factors may underlie this phenomenon; indirectly, they also leave open the possibility of a partial and temporary dissociation between body and mind.

## □ THE REDUCTIONIST APPROACH

In recent years, several psychobiological interpretations of NDEs have been proposed, all suggesting that they are by-product of a brain under duress and/or the result of a psychological reaction to a life-threatening condition. In short, ‘our mind is our brain’, and any altered perception/cognition is the result of a malfunction in the body-machine. However, the scientific hypotheses advanced to explain the pathophysiology and mechanisms behind NDE still remain mere conjecture, with no physical demonstration forthcoming, and some are clearly ill-founded, being contradicted by already known facts. The available scientific interpretations have been analysed in detail elsewhere<sup>(24,27,29)</sup>, so here we merely summarize them and their limitations and pitfalls:

1. **RETINAL ISCHEMIA AND TUNNEL-LIKE VISION.** It has been suggested that retinal ischemia might explain the tunnel-like vision<sup>(77)</sup> (Figure 1). More recently Bokkon and colleagues argued that the perception of brilliant lights often reported during NDEs is the result of the unregulated production of free radicals and excited biomolecules in the visual system after the traumatic event<sup>(11)</sup>. This release would produce bioluminescent photons and generate phosphenes (the perception of flashing lights in the absence of external visual stimulation), giving the impression of a bright light.
2. **ENDOGENOUS OPIOIDS, GLUTAMATE, REM INTRUSIONS AND TEMPORAL LOBE EPILEPSY.** As endogenous opioids are released in response to stress, they have been postulated as a potential reason for the positive emotional tone of NDEs. Likewise, Jansen pointed to the role of the excitotoxic brain damage yielded by uncontrolled glutamate release in acute brain damage, and proposed ketamine as a pharmacological model of NDEs<sup>(45-48,50)</sup>. Other Authors have stressed the potential role of sleep paralysis associated with hypnagogic, hypnopompic experiences and REM-sleep intrusions<sup>(10,60)</sup>. Britton and Botzin (2004) investigated temporal lobe functioning in individuals who had had NDEs, reporting that they displayed more temporal lobe epileptiform electroencephalographic activity than control subjects, suggesting the role of this district in the pathophysiology of NDEs<sup>(15)</sup>.
3. **EEG ACTIVITY DURING CARDIAC ARREST.** A recent study in rats undergoing experimental cardiac arrest showed that, surprisingly, the rat brain near death can generate neural correlates that resemble those commonly reported in heightened conscious processing<sup>(12)</sup>. According to the Authors, highly lucid experiences reported by near-death survivors could be potentially explained by this highly organized brain activity described in rats.
4. **PSYCHOLOGICAL INTERPRETATIONS.** According to the “expectation hypothesis”, NDEs are the product of altered mental states yielded by life-threatening conditions, which would trigger NDE phenomena as a projection of beliefs and expectancy of the afterlife. As we know, the human brain is constantly trying to make sense of the ambiguous information it receives, in order to formulate a stable and coherent interpretation (Gestalt theory). According to some Authors, in order to deal with the lack of complete sensory information, our brain may recruit the same projection mechanisms observed in several psychological tests (i.e., Rorschach) in a sort of defence mechanism to make the new reality more intelligible and less distressing<sup>(9,32)</sup>. After all, if normal perception itself can be viewed, to some degree, as a stable and successful hallucination, it is a short step to considering NDEs as an extension of this natural process.

*Criticism.* The above-mentioned hypotheses have undoubtedly helped us to form a broader comprehension of NDEs. However, no empirical demonstration has yet been provided for any<sup>(37,74)</sup>. For this reason, it is difficult to swallow the main conclusions they offer and, more generally, the idea that NDEs are a mere by-product of faulty wiring in the brain.

The idea that retinal ischemia might trigger tunnel vision is not sustainable for several reasons<sup>(27)</sup>:

- a) there is no vascular ischemia of the retina in coma due to traumatic events;
- b) in post-anoxic coma (e.g., in cardiac arrest) the loss of consciousness is too sudden to permit patients to develop complex scenarios such as tunnel-like perception;
- c) tunnel vision is not commonly caused by retinal ischemia in hemodynamic syncope;
- d) centripetal ischemia of the retina, such as in military pilots flying at G-force acceleration, can create a circular narrowing of the visual field, but not a tunnel-like perception.

As far as opioids are concerned, they are not hallucinogenic in patients to whom they are administered for analgesia, and their psychotropic effects show a completely different phenomenology than NDEs. Hallucinogens do not seem to produce NDE-



**Figure 1.** Some Authors suggest that NDEs is merely the result of a brain gone awry. For example, as the visual cortex is organized with many cells devoted to the centre of the visual field and few to the periphery, random excitation may produce the effect of a bright light in the centre fading out towards darkness, creating a sort of tunnel effect (a dynamic here briefly represented from left to right) (Images from Agrillo, 2011<sup>(2)</sup>).

like experiences, unless they are used in the context of a clear purpose, such as in the ritual of Iboga in the Bwiti religion<sup>(24,27)</sup>. Even in those cases, participants do not have an ‘other-worldly’ experience, but continue to communicate verbally to those around them throughout the ritual<sup>(38)</sup>. Although acute brain disorders and drugs used in their management can cause delirium, a well-described condition in intensive care, this has a totally different phenomenology with respect to NDEs<sup>(25,33,80)</sup>. Furthermore, ketamine produces both positive and negative effects, similar to those seen in schizophrenia in healthy subjects<sup>(1,14,55,56,654)</sup> that are far from being comparable to the features of NDEs. Indeed, Jansen himself eventually concluded that ketamine is not a cause of NDEs but that, at best, it may be a trigger<sup>(49)</sup>.

Moreover, the involvement of the temporal lobe in the NDE remains speculation with no demonstrable proof. Although Britton and Bootzin reported sub-clinical temporal lobe activation suggestive of seizures in 5 out of 23 near-death experiencers, nearly 80% showed no such unusual EEG activity<sup>(15)</sup>. Above all, as stated by Authors themselves, it was impossible to establish precisely whether the differences between experimental (patients that experienced life-threatening conditions) and control (no life-threatening conditions) group was a generalized result of trauma rather than specifically due to the NDE itself.

Indeed, although electrical stimulation of the temporal lobe can elicit fragmentary bits of music or voices, isolated and repetitive visual scenes, fear or other negatives emotions, or bizarrely distorted dreamlike imagery, these are quite unlike coherent NDEs<sup>(35,64)</sup>. Temporal lobe stimulation can also induce somatic illusions that have been erroneously described as “out-of-body experiences,” but, unlike NDEs, these illusions do not include perception from an ‘out-of-body’ perspective. Neither they include corroborated perceptions of objects not visible from the

physical body, and they disappear when the eyes are closed<sup>(34,44)</sup>. In addition, Greyson et al. compared the reports of out-of-body experiences of patients with EEG evidence of their seizure focus<sup>(39)</sup>. Results showed no differentiating traits associated with patients' reports of their seizures, suggesting that we are far from having grasped the neurophysiological factors underlying this feature of NDEs<sup>(39)</sup>.

What is more, brain imaging with fMRI and EEG of near-death experiencers attempting to visualize and reconnect emotionally with their NDEs showed significant activation of several brain areas, including the right brainstem, right medial prefrontal cortex, right lateral orbitofrontal cortex, right superior parietal lobule, left inferior temporal gyrus, left superior occipital gyrus, left anterior temporal pole, left anterior insula, left parahippocampal gyrus, and left substantia nigra, as well as increased theta power in a wide variety of loci<sup>(4)</sup>. These findings suggest that NDEs might be the results of a complex activity of a large brain network, rather than the simple activation of temporal lobe neurons by an epileptic discharge.

Neither is the hypothesis that NDEs are related to REM intrusion compatible with cardiac arrest, a condition in which brain electrical activity is silent, nor with the typical occurrence of NDEs under conditions that inhibit REM, such as general anaesthesia<sup>(39)</sup>. Also, the discovery that rats' brains show neurophysiological activity 30 seconds after cardiac arrest, though it may shed light on the neural processes underlying mammalian brain death<sup>(12)</sup>, cannot explain NDEs. First of all, there is no way to assess whether rats (or other animals) may have any NDE-like experience associated with specific neural activity. Even if we assume a priori that rats experience a similar phenomenon, other facts speak against the conclusions advanced by Borjigin et al.<sup>(12)</sup>. Despite remarkable similarities in mammals' brain, rat brains are not human brains, and studies of human

brain activity after cardiac arrest show brain activity diminishing and terminating within 6-7 seconds, without any demonstrable surge<sup>(74)</sup>. Furthermore, the neural surges reported in rats are obliterated by anaesthesia, which does not dampen NDEs, and the transient electrical surges seen were a tiny fraction of the power of the cerebral electrical activity in the rats prior to cardiac arrest<sup>(40)</sup>.

Against the “expectation hypothesis”, we must note that patients often report experiences conflicting with their expectations regarding death. Prior knowledge about NDEs does not appear to influence the reported details of the experience. Strictly related to this issue, NDEs reported prior to 1975, when the term “near-death experience” was coined and the phenomenon first described, do not differ substantially from the NDEs reported today. Also, young children, who have fewer cultural and religious beliefs about death, report the same characteristic features of NDEs as adults<sup>(39)</sup>. Against the hypothesis of NDEs as ‘false’ memories, a recent study recorded electroencephalographic activity under hypnosis (which is supposed to increase the amount of details in recollection) in participants who had had an NDE in the past. When required to recall imagined events, the EEG pattern was significantly different to that observed when NDEs were recalled. Specifically, NDE memories were linked with the theta band, a well-known marker of true episodic memory, prompting the Authors to conclude that memories of NDE cannot be considered to be imagined<sup>(61)</sup>.

Several Authors have outlined the limitations of studies assuming a strongly materialistic view of consciousness as a by-product of the brain. Fodor (1981), for example, pointed out that dualist perspectives may even be incompatible with the current practice of experimental psychology, which applies the experimental methods of the physical sciences to the study of human mind<sup>(31)</sup>. If mental processes are different from physical processes, these methods would not work in the mental realm. This may be the reason why many psychologists have sought an alternative to dualism.

Neuroscientists, on the other hand, attempt to provide neurobiological interpretations of mental phenomena - apparently in support of monism - but, paradoxically, fail to provide any support for monism; correlations of mental and biological processes do not necessarily imply that the former derive from the latter, and do not prove any relationship between cause and effect. For instance, when reporting neural correlates of out-

of-body experiences, some researchers may lean towards the reductionist idea, according to which this mental phenomenon is explained by its neural substrates. Similarly, when we demonstrate that factor “X” (e.g., dopamine) is related to outcome “E” (increased attention), one may be tempted to conclude that “E” is caused by “X”. Exactly as our legs constitute the substrate or correlate of walking, neural networks are necessary for mental phenomena. However, this does not imply a 1:1 correspondence between body and mind. As outlined by Bunge<sup>(16)</sup>, some neuroscientists verbally adhere to monism theories even though they “act as dualists” (p. 143) glossing over the fact that, when correlating mental and physical variables, they actually assume these are distinct and may influence each other.

In short, the materialist perspective of science seems to be inescapably axiomatic and, stemming from the classic dualistic separation of body and mind, physics and metaphysics, appears to be endowed with the same limits and implicit aporia. According to Severino<sup>(68)</sup>, the reductionist stance is contradictory in itself, since it is based on an axiomatic negation (a priori) of the spiritual dimension, which, however, must be implicitly admitted in order to reject it. Indeed, as the great 4th-century Taoist philosopher Zhuang-zhou stated, “to adopt what is affirmed is to adopt what is denied”<sup>(81)</sup>. Thus, the idea that NDEs are the mere result of brain dysfunction is based on speculations and axioms rather than on evidence, and these speculations risk denying facts incompatible with the reductionist vision, especially when patients report odd phenomena like the following:

- (a) Witnessed out-of-body-experiences, where the patients report veridical perception during the phase of cardiac arrest. A recent large-scale study documented that a patient had a verifiable period of conscious awareness in a period in which cerebral function was not expected to exist<sup>(62)</sup>, and hospital staff was able to verify their recall of events occurring in the resuscitation room. Although rare, this is not a unique example of a veridical out-of-body experience<sup>(75)</sup>.
- (b) So-called “Peak in Darien” experiences. In these experiences the subject meets a recently deceased person, of whose death he/she had no previous knowledge, like the case of Eddie Cuomo<sup>(37)</sup>. Eddie Cuomo, a 9-year-old child, after recovering consciousness, described his NDE, saying that he had seen heaven, his grandparents, and also his 19-year-old sister Teresa, who told him he had to

go back. When Eddie's parents telephoned the college where Teresa was staying, they learned that she had been killed in an automobile accident just after midnight, and that college officials had been trying unsuccessfully to reach the Cuomos at their home to inform them of the tragic news. Other patients report encounters with unknown but significant persons, whose identity is discovered after recovery, like a patient who met his unknown biological father in such a state<sup>(74)</sup>.

These phenomena, despite their lack of plausibility in the face of our current knowledge, cannot be ignored simply because they are very rare or incompatible with the current view of the physiology of consciousness and mind-body interaction, especially when they are documented, witnessed, recorded and checked in real time by the medical staff. The problem is not in reductionism itself, which can be a powerful investigative tool, but rather in its misuse -like a knife, which can be used for both saving a life or killing a man.

Every undergraduate student will acknowledge that science exists to refute dogmas. On the other hand, dogmas may be inadvertently introduced and held even in science, when undemonstrated axioms lead one to reject facts incompatible with them. We must not forget that facts can be only true or false, never paranormal or transcendental, and cannot be refuted a priori when incompatible with current knowledge; any other stance implies the risk of turning knowledge into dogma, and the adopted paradigm into a sort of theology or methodolatry (for a review of this issue, see Facco and Agrillo, 2012<sup>(27)</sup>, Facco 2010<sup>(24)</sup> e 2014<sup>(26)</sup>). This is the very history of science, made of recurring revolutions and disputes between detractors, pioneers and revolutionaries (like Einstein and quantum physicists).

#### □ TOWARDS A NEW APPROACH TO NEAR-DEATH EXPERIENCES

Despite the ruling materialistic perspective considering mind as an epiphenomenon of brain circuitry, dualist argumentations appear as solid as materialistic ones when facts are observed without any sort of prejudice. Hence it is time to reassess the nature of NDEs within the broader range of spiritual experiences, and reconsider the foundations of this complex topic from an open perspective capable of encompassing all out-of-the-ordinary mental expressions, such

as hallucination, trance, hypnosis, depersonalization and out-of-body experience, together with their still misunderstood physiology.

The definition of NDEs developed from the study of life-threatening conditions, and most of the research on NDEs has been conducted by healthcare professionals. However, rare experiences defined as "NDE-like" have been reported, similar to classical NDEs but in the absence of any physical or psychological disorder. These experiences are relevant for their potential implications on reductionist approaches to NDEs<sup>(28)</sup>. Furthermore, 30 years of research has uncovered no evidence suggesting that NDEs are associated with any dysfunction<sup>(27)</sup>.

Though the transcendent overtones of NDEs and NDE-like experiences differ in some respects from mystical experiences, they are in essence very similar. There is a vast body of literature about the latter phenomena, even though it is primarily confined to the world of psychology, philosophy, and religion<sup>(66)</sup>. However, there is a link between NDE and hypnosis, and between the latter and meditation<sup>(26)</sup>. After all, meditation, which has been considered the essential introspective path to enlightenment in the East and the experience of the divine in Western mysticism for over 2500 years, enables one to evoke visions and vivid mystical experiences. Recent neuropsychological studies on meditation have strongly suggested its capability of enabling one to control unconscious activities and yield both functional and plastic brain changes (see Facco<sup>(26)</sup>, 2014, for a review).

Likewise, hypnosis, erroneously considered for two centuries in terms of loss of control and choice, is in fact an opportunity to enhance control over stress, pain, memories, and shifts in mental states and emotions<sup>(70)</sup>. There is now an increasing evidence that it may intentionally improve control over unconscious functions, paralleled by activation and/or deactivation of several brain areas, for example hypnotic analgesia is the result of a top-down regulation of the pain matrix; it is not mediated by endogenous opioids and may be so powerful to enable surgery to be performed<sup>(26)</sup>.

This indicates that we should be moving away from the classic reductionist stance, in which the mind is considered a mere epiphenomenon of brain circuitry, towards the idea that the mind, through training, may in fact change brain activity. This would legitimate the hypothesis that the mind-brain relationship is bidirectional - bottom-up and top-down at the same time - resembling more the yin-yang relationship of Taoism than a fixed hierarchy from the matter to the "soul".

To explain mystical experiences, some have suggested a link with the physiology and pathology of temporal lobe epilepsy, speculating that St. Paul and St. Teresa of Avila, for example, may have had seizures<sup>(24)</sup>. However, there is considerable evidence contradicting that purported association<sup>(13)</sup>, and in any case the meaning of their thoughts and experiences cannot be reduced to mere brain dysfunction. Indeed, we do not reduce great artists, writers and musicians like Beethoven, Dickens, Donizetti, De Chirico, Dostoevskij, Goya, Gershwin, Mozart, Mussorgsky, Ravel, Shubert, Oscar Wilde and Van Gogh to their likely neurological or psychiatric disorders<sup>(7,18,19,53,57,59,67,69)</sup>. The relationship between genius, madness and the brain is still ill-defined, as the fine line between mental health and pathology (see below), and it would be conceptually misguided to reduce the highest expressions of the mind to mechanistic disorders, whatever neuropsychiatric disorder may be coexistent.

The same can be said for spiritual experiences, which are related to the activation of the fronto-temporo-parietal brain regions; parietal systems also seem to be involved during trance states<sup>(73)</sup>, while religious thinking is often associated with the same brain regions involved in processing emotion and self-representation, but there is no “phrenological” area of faith or atheism (Harris et al., 2009<sup>(43)</sup>; for a comprehensive analysis of the neuropsychology of religious experience see Fabbro, 2010<sup>(23)</sup>).

#### □ IMPLICATINS FOR CLINICAL PRATICE

The multidisciplinary perspective that would encompass NDEs within the wider range of non-ordinary mental expression should help to create a common language for neuroscience, psychology, philosophy, anthropology, and other disciplines. It may also provide a new and promising means of tackling the long-standing debate about the body-mind-world relationship, the dynamic of which, as already mentioned, could be closer to the yin-yang relationship of Taoism rather than a simple, one-way, deterministic, physical machination. It is now clear that brain activity allows the manifestation of mental phenomena, but at the same time the mind shapes our brain, yielding both functional and plastic changes<sup>(26,52)</sup>.

We believe that this new approach may help the advancement of our understanding of subjective phenomena, especially those which have been prejudicially discredited and/or misunderstood, from the

stiff, axiomatic, rationalist perspective of the past century, which considers non-logical mind expression as less valuable than intellectual-logical expression, or even dysfunctional. The fact that mental imagery was considered a feature of children and non-civilized people in the first half of 20th century<sup>(72)</sup>, has little bearing on the cognitive and metacognitive power that we recognize it has today<sup>(63)</sup>. Likewise, emotions were once wrongly considered as more primitive and less valuable than reason, but they now appear essential for cognition and executive control themselves, according to the hypothesis of the somatic marker by Damasio and coworkers<sup>(5,21)</sup>. Indeed, love, especially the Greek *ἀγάπη* (*agape*), empathy and compassion are to be regarded as the highest non-egocentric expressions of humankind.

There is a link between NDEs, mystical experiences, psychedelic experiences, as well as hypnosis, meditation, and existential crises such as role transitions<sup>(28,51)</sup>. NDEs and out-of-the-ordinary mental expressions involve deep epistemological aspects that fuel the need to reappraise the ruling axioms and foundations of scientific medicine, especially when psychiatric, psychosomatic, functional disorders and chronic pain are concerned. It is a huge and complex problem, the main aspects of which can only be schematically listed here:

1. It is far from being clear what the normal state of consciousness is, and, therefore, where its boundaries with so-called ASCs lie. Hence there is a high risk of misinterpretation, taking a meaningful physiological condition for a disorder<sup>(76)</sup>; this can happen in both society and science, with non-conformists, revolutionaries, and anybody failing to fit the “spirit of the age” being classed outsiders.
2. The concept of disorder is at least partially arbitrary, with important theoretical, biological, and sociocultural implications, and the concept becomes even more elusive with psychological disorders<sup>(8)</sup>. In other words, the border between normality and pathology remains uncertain<sup>(71,76)</sup>. Thus, psychiatry faces the huge challenge of delineating the boundaries between disorder and non-disorder, and between physical and mental domains, sometimes metaphorically defined in terms of the ‘hardware’ and ‘software’ of brain function.
3. Conventionally the very concept of disease is broad; Woodruff et al. defined it as “any condition associated with discomfort, pain, disability, death, or an increased liability to these states, regarded

by physicians and the public as properly the responsibility of the medical profession, may be considered a disease<sup>(78)</sup>.

4. In 1948, the WHO's Constitution defined health, in a very wise and forward-looking way, as "a state of complete physical, social and emotional well-being, and not merely the absence of disease or infirmity"<sup>(58,79)</sup>. This definition implies the concept of health as a dynamic, rather than static, condition, due to the interplay of all its components (mind, body and external world); it focuses on living well rather than living long, and may even include spiritual dimensions<sup>(58)</sup>.

The above leads us to conclude that a mechanistic medicine, focusing entirely on Descartes' 'Earthen Machine', and changing the course of diseases with drugs and interventions, by definition, is not enough to ensure health, if patients' subjective experiences are overlooked or ignored. Such reductionism would be akin to looking merely at the chemical composition of the plaster and paints in Michelangelo's frescos in the Sistine Chapel, without thinking to their content and meaning.

Indeed, NDEs and other anomalous mental expressions and experiences do have an impact in clinical practice<sup>(17)</sup>. Both physicians and psychologists may encounter patients reporting NDEs and their relatives, who may need to elaborate the meaning of the experience as part of their recovery, and may, therefore, benefit from psychological support in order to cope with their life. As care-givers we cannot merely dismiss NDEs or chalk them up as the psychiatric symptoms of brain disorders. Instead, it is essential to avoid any a-priori judgement, and to listen to patients respectfully, with an open mind, so that we can properly understand their experiences and help them with the process of integrating them into their lives. In this, as with any other problems posed by life experience, we must take a phenomenological approach from a physiological perspective. Even though some patients might have had psychiatric disorders in the past, a genuine transcendent experience should be distinguished from any delusion or delusional processing of a genuine experience. For example, if a patient shows signs of hyper-religiosity and/or mania, they should be helped to recognize manic symptoms and associated dysfunctional behaviour, improving their insight and awareness<sup>(42)</sup>. Otherwise, the attending physician may risk altering or blocking the meaningful transformational process triggered by the NDE, with all its philosophical components and positive effects on

maturation, well-being, love, empathy and getting over the fear of death.

In short, dealing with NDE experiencers calls for an open, non-judgemental mind, total respect for a patient's experience and tale, and the ability to think outside the box of the reductionist-mechanistic model of conventional medicine. It also entails facing the existential and philosophical problems raised by NDEs, and the doctor/friend/guide must be available to share the unresolved, inescapable mysteries of the human condition, i.e., the nature of consciousness and psyche, inner and outer worlds, space and time, life and death. It is a challenging job - it will ever be - but it is unavoidable.

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