THE CONTINUITY OF CONSCIOUSNESS

A concept based on scientific research on near-death experiences during cardiac arrest

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Abstract

In this article the concept of the continuity of consciousness will be described, based mainly on recent scientific research on near-death experiences (NDE), but also on other experiences of enhanced consciousness. Since the publication of several prospective studies on NDE in survivors of cardiac arrest, with strikingly similar results and conclusions, the phenomenon of the NDE can no longer be scientifically ignored. The NDE seems to be an authentic experience which cannot be simply reduced to imagination, fear of death, hallucination, psychosis, the use of drugs, or oxygen deficiency. According to these prospective studies, the current materialistic view of the relationship between consciousness and the brain as held by most physicians, philosophers, and psychologists is too restricted for a proper understanding of this phenomenon. There are now good reasons to assume that our consciousness does not always coincide with the functioning of our brain: enhanced or nonlocal consciousness can sometimes be experienced separately from the body. The general conclusion of scientific research on NDE is indeed that our enhanced consciousness does not reside in our brain and is not limited to our brain. Our consciousness seems to be nonlocal, and our brain facilitates rather than produces the experience of that consciousness. It is evident that these findings are important for our concepts of life and death, because of the almost unavoidable conclusion that at the time of physical death consciousness will continue to be experienced in another realm, one that encompasses past, present, and future. Death is only the end of our physicality. Without a body we can still have conscious experiences, we are still conscious beings. In this article examples will be given of experiences of nonlocal consciousness beyond the brain, for instance during a period when the brain is either non-functioning or malfunctioning. Other experiences of nonlocal consciousness will also be mentioned, including contact with the consciousness of deceased relatives during special states of consciousness, or the effect of consciousness on the brain as witnessed in neuroplasticity. The primacy of consciousness will also be discussed. All these findings make the concept of the continuity of consciousness highly probable. Based on these ideas it seems obvious that death, like birth, may be a mere passing from one state of consciousness into another.

Keywords: near-death experience, cardiac arrest, mind-brain relationship, nonlocal consciousness, continuity of consciousness, primacy of consciousness.

Introduction

A near-death experience (NDE) can be defined as the reported memory of a range of impressions during a special state of consciousness, including several elements such as an out-of-body experience, pleasant feelings, seeing a tunnel, a light, deceased relatives or a life review, or a conscious return into the body. NDEs are reported under many different circumstances, including cardiac arrest (clinical death), shock after loss of blood (complicated childbirth), traumatic brain injury or stroke, near-drowning (children) or asphyxia, but NDE-like experiences are also reported during serious illnesses that are not immediately life-threatening, during isolation, depression, or meditation, or without any obvious reason. Furthermore, so-called "fear-death" experiences are mainly reported after situations in which death seemed unavoidable, like in serious traffic or mountaineering accidents. Experiences similar to near-death can occur during the terminal phase of illness and are called deathbed visions or end-of-life experiences. This suggests that you do not always need a non-functioning brain to report an NDE. The NDE is usually transformational, causing the loss of fear of death, profound changes to one's perspective on life, and enhanced intuitive sensibility [1]. Therefore, they are also referred to as spiritual transformative experiences (STE). The content of an NDE and the effects on patients appear to be similar worldwide, across all cultures and all times [2]. However, the subjective nature and absence of a frame of reference for this experience lead to individual, cultural, and religious factors determining the vocabulary used to describe and interpret this experience: children and adults, believers and atheists, they all use different words from their own religion, culture, and tradition.

Near-death experiences occur with increasing frequency because of improved survival rates resulting from modern techniques of resuscitation and from better treatment of patients with cerebral trauma. According to a recent random poll in the US and in Germany, about 4% of the total population in the western world has experienced an NDE [3,4]. Thus, about 9 million people in the US, about 20 million people in Europe, and about 2 million people in the UK will have had this extraordinary conscious experience. An NDE seems to be a relatively frequent occurrence. However, to many physicians it remains an inexplicable phenomenon and therefore an often-ignored result of survival in a critical medical situation. Physicians hardly ever hear a patient talk about his or her near-death experience, and if they do they are usually unable to listen without any prejudice or scepticism. Patients are reluctant to share their experience with others (doctors, nurses, family members, partner, friends) because of the many negative responses they usually get.

As a cardiologist I had the privilege to meet many patients who were willing to share their NDE with me. The first time this happened was in 1969. In the coronary care unit a patient with an acute myocardial infarction suffered a cardiac arrest. After two electric shocks and a spell of unconsciousness lasting some four minutes, the patient regained consciousness, much to the relief of the nursing staff and attendant doctor. That attendant doctor was me. I had started my cardiology training that year. Following the successful resuscitation everyone was pleased, except the patient. To everyone's surprise he was extremely disappointed. He spoke of a tunnel, of colours, of a light, of a beautiful landscape and of music. He was extremely emotional. The term near-death experience did not yet exist, nor had I ever heard of people having any recollection of the period of their cardiac arrest. Whilst studying for my degree, I had learnt that

such a thing is in fact impossible: being unconscious means not being aware, and that applies to people suffering a cardiac arrest and patients in a coma. In the event of a cardiac arrest, patients are unconscious; they have stopped breathing and have no palpable pulse or blood pressure. This is called ‘clinical death’. I was always told that according to current science it is simply impossible to be conscious or to have memories at such a moment because all brain functions have ceased. I had learned in medical school that consciousness is a product of a functioning brain.

Although I had never forgotten the successfully resuscitated patient from 1969 with his memories of the period of his cardiac arrest, I had never done anything with this experience. This changed in 1986 when I read a book by George Ritchie (1923-2007) about his near-death experience with the title ‘Return from Tomorrow’ [5]. Ritchie suffered double pneumonia as a medical student in 1943. At the time, antibiotics such as penicillin were not yet widely available. Following a period of extremely high fever and tightness of the chest, he passed away: he stopped breathing and his pulse had gone. He was pronounced dead by a doctor and his body was covered with a sheet. But a male nurse was so upset by the death of this medical student that he managed to persuade the attendant doctor to administer an adrenalin injection in the chest, right into his heart – a most unusual procedure in those days. Having been ‘dead’ for about nine minutes, George Ritchie regained consciousness to the immense surprise of the doctor and nurse. It emerged that during his spell of unconsciousness, the period in which he had been clinically dead, he had an incredible and very special conscious experience of which he could recollect a great many details. At first, he was quite unable and afraid to talk about it. Later he wrote a book about what happened to him in those nine minutes. And after graduation, he shared his experiences with medical students in psychiatry lectures. One of the students attending these lectures was Raymond Moody, who was so intrigued by this story that he started looking into experiences that may occur during critical medical situations. In 1975 he wrote the book ‘Life after Life’ [6] in which he used the term near-death experience (NDE) for the first time.

After reading George Ritchie’s book I kept asking myself how someone can possibly experience consciousness during cardiac arrest and indeed whether this is a common occurrence. That is why, in 1986, I started systematically asking all patients at my out-patient clinic who had ever undergone successful resuscitation whether they had any recollection of the period of their cardiac arrest. I was more than a little surprised to hear, within the space of two years, 12 reports of such a near-death experience among just over 50 survivors of cardiac arrest. Since that first time in 1969, I had not heard any other such accounts. I had not enquired after these experiences either. But what I was hearing now roused my scientific curiosity. After all, according to current medical knowledge it is impossible to experience consciousness when one’s heart has stopped beating.

Questions

For me it all started with curiosity. The phenomenon of near-death experience raises several fundamental questions. An NDE is a special state of consciousness that occurs during an imminent or actual period of death, or sometimes without any obvious reason. But how and why does an NDE occur? How does the content of an NDE come about? Why does a person’s life change so radically after an NDE? I was unable to accept some of the answers to these

questions because they seemed incomplete, incorrect, or unfounded. I grew up in an academic environment in which I had been taught that there is a reductionist and materialist explanation for everything. And up until that point, I had always accepted this as indisputably true.

Some scientists do not believe in questions that cannot be answered, but they do believe in wrongly formulated questions. The year 2005 saw the publication of a special anniversary issue of the journal *Science*, featuring 125 questions that scientists have so far failed to solve [7]. The most important unanswered question 'What is the universe made of?' was followed by 'What is the biological basis of consciousness?' I would reformulate this second question as follows: 'Is there a biological basis of consciousness (at all)?' And what about the temporal dimension of our consciousness? Is it possible to speak of a beginning of our consciousness and will our consciousness ever end?

To answer these questions, we need a better understanding of the relationship between brain function and consciousness. I also realize that many aspects of consciousness, including the mind-brain relationship, are still a great mystery, because as the well-known philosopher David Chalmers has said [8]: *'Consciousness, the subjective experience of an Inner self, poses one of the greatest challenges to science. Even a detailed knowledge of the brain's workings and neural correlates of consciousness may fail to explain how or why human beings have self-aware minds.'* To date the origin of consciousness cannot be explained by science. So, the question is: How can scientific research into NDE help us to better understand the mystery of consciousness and the mind-brain relationship? Can it give us any indication of what happens to consciousness when a person is confirmed death? We shall have to start by examining whether there is any suggestion that consciousness can be experienced during general anaesthesia, coma, clinical death, the process of dying and, finally, after confirmed death. If the answers to any of these questions are positive, we must look for scientific explanations and scrutinize the relationship between brain function and consciousness in these different situations. By studying everything that has been thought and written about death throughout history, in all times, cultures and religions, we may be able to form a different or better picture of death. But we may achieve the same with the help of findings from recent scientific research into near-death experiences. It has emerged that most people lose all fear of death after an NDE. Their experience tells them that death is not the end of everything, and that 'life' goes on in one way or another. According to most people with an NDE, death is nothing other than a different way of being with an enhanced consciousness, beyond time and space, which means everywhere at once, because it is no longer tied to a body. This is what someone wrote to me after his NDE [9]: '*It is outside my domain to discuss something that can only be proven by death. However, for me personally this experience was decisive in convincing me that consciousness endures beyond the grave. Death turned out to be not death, but another form of life.'*

The Dutch prospective study on NDE in survivors of cardiac arrest

Until recently there was no prospective and scientifically designed study to explain the cause and content of an NDE; all studies had been retrospective and very selective with respect to patients. Based on these incomplete retrospective studies some believed the experience could be caused by physiological changes in the brain because of lack of oxygen (cerebral anoxia). Other theories propose an effect of neurotransmitters, a psychological reaction to approaching death, hallucinations, dreams, side effects of drugs, or just false memories.

To obtain more reliable data to corroborate or refute the existing theories on the cause and content of an NDE, we needed a scientific study. This was the reason why in 1988 Ruud van Wees and Vincent Meijers, both psychologists who wrote their doctoral theses on NDE, and I, a cardiologist with an interest in the subject, started a prospective study in the Netherlands[10]. This study was carried out under the auspices of the Merkawah Foundation (now called 'Netwerk NDE'), the Dutch branch of the International Association of Near-death Studies, IANDS the Netherlands, which was also founded by us in 1988. At that point, no prospective studies into NDEs had been undertaken anywhere in the world. Our study aimed to include all consecutive patients who had survived a cardiac arrest in one of the 10 participating Dutch hospitals. In other words, this prospective study would only include patients with a proven life-threatening crisis. All these patients would have died of their cardiac arrest had they not been resuscitated within five to ten minutes. A study of this kind also creates a control group of patients who have survived a cardiac arrest but who have no recollection of the period of unconsciousness. The patients are asked, within a few days of their resuscitation, whether they have any recollection of the period of their cardiac arrest, i.e., of the period of their unconsciousness. All patients' medical and other data were carefully recorded before, during and after their resuscitation. The advantage of this prospective study design was that all procedures were defined in advance and no selection bias could occur.

We had a record of the electrocardiogram, or ECG, for all patients included in our study. An ECG displays the electrical activity of the heart. In cardiac arrest patients this ECG record always displays a lethal arrhythmia (ventricular fibrillation) or an asystole (a flat line on the ECG). In the event of resuscitation outside the hospital we were given the ECG done by the ambulance staff. Likewise, we carefully recorded all medical information: what was the duration of the actual cardiac arrest? What was the duration of unconsciousness? How often did the patient require resuscitation and defibrillation? What medication, and in what dosage, was administered to the patient before, during and after resuscitation? Following successful resuscitation, we carefully recorded the demographic data of all patients, including age, sex, education, religion, foreknowledge of NDE and whether they had had an earlier NDE. They were also asked whether they had been afraid just before their cardiac arrest. We also recorded how many days after resuscitation the interview took place, whether the patient was lucid during the interview and whether his or her short-term memory was functioning well. Within four years, between 1988 and 1992, 344 consecutive patients who had undergone a total of 509 successful resuscitations were included in the study. These patients had all been 'clinically dead'. 'Clinical death' is defined as the period of unconsciousness caused by total lack of oxygen in the brain (anoxia) because of the arrest of circulation, breathing, or both, as caused by cardiac arrest in patients with an acute myocardial infarction. If in this situation no resuscitation is initiated within five to ten minutes, the brain cells will be irreversibly damaged, and the patient will always die.

A longitudinal study into life changes was based on taped interviews after two and eight years with all patients who had reported an NDE and who were still alive, as well as with a control group of post-resuscitation patients who were matched for age, sex, and time interval, but who had not reported an NDE. The question was whether the customary changes in attitude to life and death after an NDE were the result of surviving a cardiac arrest or whether these changes were caused by the NDE. This question had never been subject to scientific and

systematic research in a prospective design before. The Dutch study was published in *The Lancet* in December 2001 [11]. It is still the largest prospective study on NDE, the only prospective study with statistical analysis, and the only prospective study about transformation in cardiac arrest survivors.

Results of the prospective study

If patients reported memories from the period of unconsciousness, the experiences were scored according to a certain index, the WCEI, or "weighted core experience index" [12]. The higher the number of elements reported, the higher the score and the deeper the NDE was. This WCEI index is highly correlated with the Greyson Scale [13] with a correlation coefficient of 90. The WCEI seems best for determining the depth of an NDE while the Greyson Scale is especially useful for screening a population to identify NDEs. Our study found that 282 of the 344 patients (82 per cent) had no recollection of the period of their unconsciousness, whereas 62 patients (18 per cent) reported an NDE. Of these 62 patients with memories, 21 (6 per cent) had some recollection; having experienced only some elements, they had a superficial NDE with a low score. We included these patients because of the prospective design of our study, and because they also reported a transformation in the longitudinal study. And 42 patients (12 per cent) reported a core experience: 18 had a moderately deep NDE, 17 reported a deep NDE and 6 a very deep NDE. The following elements were reported: half of the patients with an NDE were aware of being dead and had positive emotions, 30 per cent had a tunnel experience, observed a celestial landscape, or met with deceased persons, approximately a quarter had an out-of-body experience, communication with 'the light' or perception of colours, 13 per cent had a life review and 8 per cent experienced the presence of a border. In other words, all the familiar elements of an NDE were reported in our study, except for a frightening or negative NDE.

Are there any reasons why some people do but most do not recollect the period of their unconsciousness? To answer this question, we compared the recorded data of the 62 patients with an NDE to the data of the 282 patients without one. To our big surprise we did not identify any significant differences in the duration of the cardiac arrest (anywhere between 2 and 8 minutes) or in the duration of unconsciousness (from 5 minutes to three weeks in a coma). Likewise, intubation for artificial respiration in seriously ill patients who remained in a coma for days or weeks after a complicated resuscitation was not a contributing factor. Nor did we find statistical differences in the thirty patients who had a cardiac arrest during electrophysiological stimulation (EPS) in the catheterization laboratory and whose heart rhythms were always re-established via defibrillation (an electric shock) within twenty to thirty seconds. So, we failed to identify any differences between the patients with an exceptionally long or a very brief cardiac arrest. The degree or gravity of the lack of oxygen in the brain (anoxia) appeared to be irrelevant, and so a physiological explanation for NDE like anoxia could be excluded in our prospective study. Likewise, it was established that medication played no role. Most patients suffering a myocardial infarction receive morphine-type painkillers, while people who are put on a respirator following complicated resuscitation are given extremely high doses of sedatives. A psychological cause such as the infrequently noted fear of death did not affect the occurrence of an NDE, although it did affect the depth of the experience. Whether or not patients had heard or read anything about NDE in the past made no difference

either. Any kind of religious belief, or indeed its absence in non-religious people or atheists, was irrelevant and the same was true for the standard of education reached.

Factors that were found to affect the frequency of an NDE were age and the number of resuscitations: if patients were under 60 and if they required several resuscitations during their stay in hospital, the chances of a NDE report were greater. Remarkably, we found that patients who had had an NDE in the past also reported significantly more NDEs in our study. A complicated resuscitation can result in a long coma and most patients who have been unconscious on a respirator for days or weeks are more likely to suffer short-term memory defects because of permanent brain damage. These patients reported significantly fewer NDEs in our study. This suggests that a good short-term memory is essential for remembering an NDE.

We were particularly surprised to find no medical explanation for the occurrence of an NDE. All patients in our study had been clinically dead and only a small percentage reported an enhanced consciousness with lucid thoughts, emotions, memories, and sometimes perception from a position outside and above their lifeless body, while doctors and nursing staff were carrying out cardiopulmonary resuscitation (CPR). If there were a physiological explanation such as a lack of oxygen in the brain (anoxia) for the occurrence of this enhanced consciousness, one might have expected all patients in our study to have reported an NDE. They had all been unconscious following their cardiac arrest, which caused the loss of blood pressure, the cessation of breathing, and the loss of all body and brain stem reflexes. And it is also well established that people without a lack of oxygen in the brain, like in depression, in meditation, in shared-death experience, in mountaineering accidents or in imminent traffic accidents (‘fear of death’), can experience an NDE-like experience. Likewise, the gravity of the medical situation, such as long-term coma after a complicated resuscitation, failed to explain why patients did or did not report an NDE, except in the case of lingering memory defects. The psychological explanation is doubtful because most patients did not experience any fear of death during their cardiac arrest as it occurred so suddenly, and they were therefore unaware of it. In most cases they were left without any recollection of their resuscitation. This is borne out by Greyson’s study [14], which only collected the subjective data of patients after their resuscitation and showed that most patients did not even realise that they had a cardiac arrest. This is similar to fainting. When people regain consciousness after fainting, they have no clear idea of what happened. A pharmacological explanation could be excluded as well, as the medication had no effect on whether patients reported an NDE. We also reached the inevitable conclusion that patients experienced their NDE elements during the period of cardiac arrest, during the total cessation of blood supply to the brain. Nevertheless, the question how this could be possible remained unanswered.

Results of the longitudinal study

The taped interviews in our Dutch longitudinal study were conducted using a standardised inventory featuring 34 life-change questions [15]. Among the 74 patients who consented to be interviewed after two years, 13 of the 34 factors listed in the questionnaire turned out to be significantly different for people with or without an NDE. We then compared these 13 factors in the same patients after eight years. The second taped interviews after eight years showed that in people with an NDE fear of death had significantly decreased while belief in an afterlife had

significantly increased. It struck us that after eight years the people without an NDE were also undergoing unmistakable transformation. Nevertheless, clear differences remained between people with and without an NDE, although by now these differences had become a little less marked. We were also surprised to find that the processes of transformation that had begun in people with an NDE after two years had clearly intensified after eight years. The same was true for the people without an NDE. In summary, we could say that eight years after their cardiac arrest all patients had changed in many respects, showing more interest in nature, the environment and social justice, displaying more love and emotions, and being more supportive and involved in family life. Nevertheless, the people who had experienced an NDE during their cardiac arrest continued to be clearly different. They were less afraid of death and had a stronger belief in an afterlife. We saw in them a greater interest in spirituality and questions about the purpose of life, as well as a greater acceptance of and love for oneself and others. Likewise, they displayed a greater appreciation of ordinary things, whereas their interest in possessions and power had decreased. The conversations also revealed that people had acquired enhanced intuitive feelings after an NDE, along with a strong sense of connectedness with others and with nature. Or, as many of them put it, they had acquired 'paranormal' gifts. The sudden occurrence of this enhanced intuition can be quite problematic, as it gives people a very acute sense of others, which can be extremely intimidating, and they may experience clairvoyance, precognition, and visions. This enhanced intuition is based on interconnectedness with the consciousness of others and is independent of time (an inner knowing of future events or prognostic 'dreams') and of distance (a hunch about an incoming phone call or the perception of pain or illness in others). It can be quite extreme, with people 'sensing' feelings, sadness and even disease in others, or feeling that they know when someone will die, which usually proved to be accurate [16].

The integration and acceptance of an NDE is a process that may take many years because of its far-reaching impact on people's pre-NDE understanding of life and value system. As someone told me: '*I couldn't even talk about it, or I would have been committed to an institution.'* Despite the mostly positive experiences, the NDE is also a traumatic event, a spiritual trauma, because there is little understanding on the part of doctors, nurses, family, and partner, which makes the process of acceptance and integration very difficult. The divorce rate among those who report an NDE is over 70%. In fact, this process will take many, many years, and involves strong feelings of depression, homesickness, and loneliness. However, the longer the interval between NDE and interview, the more positive changes are usually reported. Finally, it is a remarkable and unexpected finding to see a cardiac arrest lasting just a few minutes give rise to such a lifelong process of transformation.

The typical transformation of those patients who reported an NDE is a kind of 'objective' proof for this 'subjective' experience, because patients who did not report an NDE did not show this transformation. And we know that children below the age of four mostly do not remember their NDE, yet still undergo a classical transformation [17]. This makes it highly probable that when patients do not report an NDE it is not because they do not remember it, but because they did not experience one.

Other prospective studies on NDE

1. **USA**: Bruce Greyson published a prospective study in 116 survivors of cardiac arrest [18]. He found that 15.5 per cent of the patients reported an NDE: 9.5 per cent reported a core NDE and 6 per cent a superficial NDE. His conclusion is that 'no one physiological or psychological model by itself could explain all the common features of an NDE. The paradoxical occurrence of a heightened, lucid awareness and logical thought processes during a period of impaired cerebral perfusion raises perplexing questions for our current understanding of consciousness and its relation to brain function. A clear sensorium and complex perceptual processes during a period of apparent clinical death challenge the concept that consciousness is localized exclusively in the brain' [19].

2. UK: The prospective study by Sam Parnia and Peter Fenwick included 63 patients who survived their cardiac arrest [20]. They found that 11 per cent reported an NDE: 6.3 per cent reported a core NDE, and 4.8 per cent a superficial NDE. They write that the reports suggest that the NDE occurs during the period of unconsciousness. This is a surprising conclusion, in their view, because 'when the brain is so dysfunctional that the patient is deeply comatose, those cerebral structures, which underpin subjective experience and memory, must be severely impaired. Complex experiences as reported in the NDE should not arise or be retained in memory. Such patients would be expected to have no subjective experience, as was the case in most patients who survive cardiac arrest, since all centres in the brain that are responsible for generating conscious experiences have stopped functioning because of the lack of oxygen" [21]. Another, frequently cited explanation might be that the observed experiences occur during the last seconds before the cessation of circulation, or during the first seconds after the recovery of consciousness. Parnia and Fenwick, however, claim that "the verifiable elements of an out-of-body experience during unconsciousness, such as patients' reports on their resuscitation, render this extremely unlikely' [22].

3. UK: Over a period of four years Penny Sartori carried out an even smaller study into NDE in 39 survivors of cardiac arrest [23]. She found that 23 per cent reported an NDE: 18 per cent reported a core NDE, and 5 per cent a superficial NDE. She concludes that 'according to mainstream science, it is quite impossible to find a scientific explanation for the NDE as long as we 'believe' that consciousness is only a side effect of a functioning brain." The fact that people report lucid experiences in their consciousness when brain activity has ceased is, in her view, "difficult to reconcile with current medical opinion' [24].

All scientists who performed prospective studies on NDE came to the same conclusion: lack of oxygen by itself cannot explain the cause and content of an NDE [25, 26, 27, 28]. And this view is also supported by the fact that an NDE can be reported by people not during life threatening illnesses but during fear of death, depression, or meditation [29, 30, 31].

The theory of the continuity of consciousness

With our current medical and scientific concepts, it seems impossible to explain all aspects of the subjective experiences as reported by patients with an NDE during a transient loss of all functions of the brain. With lack of evidence for any other theories for NDE, the concept thus

far assumed but never scientifically proven, that consciousness and memories are produced by large groups of neurons and are localized in the brain, should be addressed. Scientific studies into the phenomenon of NDE highlight the limitations of our current medical and neurophysiological ideas about the various aspects of human consciousness and the relationship between consciousness and memories on the one hand and consciousness and the brain on the other. After all, how can an extremely lucid consciousness be experienced outside the body at a time when the brain has a transient loss of all functions during a period of clinical death, with a flat-line EEG? Furthermore, even blind people have described veridical perceptions during out-of-body experiences at the time of their NDE [32].

Based on the theory of the continuity of consciousness, an NDE might be considered a changing state of consciousness, in which memories, identity, and cognition, along with emotion, function independently from the unconscious body, and retain the possibility of extra-sensory perception. Obviously, during NDE enhanced consciousness is experienced independently from the normal body-linked waking consciousness. But we need convincing arguments to underpin the theory of the continuity of consciousness. Can we be sure that there is no brain function left in patients with cardiac arrest? Can we be sure that an NDE occurs during cardiac arrest, and not before or after the period of unconsciousness? Is there any scientific evidence that consciousness can be experienced separately from the body?

Complete loss of brain function during cardiac arrest

So how do we know for sure that all functions of the brain have ceased during cardiac arrest? Many studies into induced cardiac arrest in both human and animal models have shown cerebral function to be severely compromised during cardiac arrest, with complete cessation of cerebral blood flow immediately following ventricular fibrillation as shown by Doppler measurement on the carotid arteries [33;] and with the clinical findings of the sudden loss of consciousness and of all body reflexes, caused by the loss of function of the cortex; the cessation of brainstem activity (all brainstem reflexes); the loss of the gag reflex and the corneal reflex, resulting in fixed and dilated pupils [34]; and finally the function of the respiratory centre, located close to the brainstem, fails, resulting in apnoea (no breathing). But the most important question is of course: do we know exactly what happens in the brain when the heart stops? The brain accounts for only 2 per cent of overall body weight, but it uses 15 to 20 per cent of the body's total energy supply, primarily for maintaining the membrane potential (the electric charge across a cell membrane) of the nerve cells, or neurons. Total loss of oxygen supply (anoxia) causes a functional loss of all cell systems and organs in the body. However, in anoxia of only some minutes' duration (transient anoxia, like in clinical death) this loss may be temporary, but in prolonged anoxia cell death occurs with permanent functional loss. Some cells respond better to anoxia than others. Neurons respond badly because their sole source of energy is glucose. Unlike the muscle cells in our body, our brains do not store glucose in the form of glycogen as a ready supply of cell energy. The parts of the brain that are most susceptible to anoxia are the neurons in the cerebral cortex, and in the hippocampus and the thalamus, which form an important link between the brainstem and cerebral cortex [35, 36]. The total loss of oxygen supply reduces these structures to utter chaos and wipes out their connections. Synapses are the junctions that enable communication between neurons, and when these synapses stop

functioning cooperation and coordination between neuronal networks in the brain is no longer possible.

No blood flow to the brain

If the absence of blood flow to the brain ('no flow') prevents the supply of glucose and oxygen, a neuron's first symptom will be the inability to maintain its membrane potential, resulting in the loss of neuronal function [37]. The acute loss of electrical and synaptic activity in neurons can be seen as the cell's inbuilt defense and energy-saving response and is called a 'pilot light state'. When the electrical functions of neurons cease, the remaining energy sources can be very briefly deployed for the cell's survival. In the case of short-term oxygen deficiency, like in clinical death, dysfunction can be temporary, and recovery is still possible because the neurons will remain viable for a few more minutes. As was mentioned before, during a cardiac arrest the entire brain is deprived of oxygen (anoxia), resulting in the loss of consciousness, of all body and brainstem reflexes, and of respiration. This period of clinical death is usually reversible, i.e. temporary, if cardiopulmonary resuscitation (CPR) is initiated within five to ten minutes. Within seconds, a cardiac arrest will result in a total loss of oxygen supply and a build-up of carbon dioxide (CO_2) in the brain. This situation cannot be remedied during the resuscitation procedure itself, but only after the cardiac rhythm has been reestablished through defibrillation (an electric shock). A delay in starting adequate resuscitation may result in the death of a great many brain cells and thus in brain death, and most patients will ultimately die. A study carried out at a coronary care unit has shown that patients whose resuscitation was started within one minute had a 33 per cent chance of survival, compared to only 14 per cent for those who, due to circumstances, were only resuscitated after more than a minute since the onset of unconsciousness [38].

Low blood flow to the brain in effective CPR prolongs the viability of the brain

Research has shown that external heart massage (chest compression) during CPR cannot pump enough blood to the brain to restore brain function. As far as we know nobody has ever regained consciousness during external resuscitation of the heart. This always requires defibrillation, which alone can reestablish the cardiac rhythm. Without restoration of normal blood pressure and the resumption of cardiac output, which only can be achieved through successful defibrillation, a long duration of CPR is considered an indication of poor outcome and high mortality because CPR alone cannot ultimately prevent the irreversible damage of brain cells [39]. During CPR, blood supply to the brain is 5-10 per cent of its normal value [40], and during external chest compression the systolic pressure will usually reach approximately 50 mmHg, with an average of 20 mmHg because of the low diastolic pressure. The maximum average blood pressure during proper resuscitation is 30 to 40 mmHg [41], which is still far too low for the blood to deliver enough oxygen and glucose to the brain. The administration of certain medication during resuscitation can increase blood pressure a little [42], but it will remain well below normal. Furthermore, in the absence of a normal blood supply, the brain cells are likely to swell (edema), which results in increased pressure in the brain (intracranial pressure), and an increase of cerebral vascular resistance will occur. Indeed, animal studies have found that a higher-than-normal blood pressure is required to maintain adequate cerebral perfusion and to supply the brain with sufficiently oxygenated blood and to enable the removal of carbon

dioxide (CO_2) [43]. During resuscitation, blood gases (O_2 and CO_2) are sometimes measured to determine the severity of the oxygen deficiency in the blood. However, normal, or even high levels of oxygen (O_2) and carbon dioxide (CO_2) in blood samples do not guarantee that enough arterial blood, and thus enough oxygen, will reach the brain during resuscitation due to still inadequate circulation. To summarize: we know that proper CPR, with adequate external chest compression and mouth-to-mouth respiration or respiration via a mask, will produce minimal blood flow ('low flow') to the brain, which increases the chances of recovery of brain function after the cardiac arrest has been successfully treated with defibrillation. By this minimal cerebral blood flow, the no longer functioning neurons will be able to survive for a longer period in the minimal energy state ('pilot light state'), also called 'hibernation' or 'ischemic penumbra' of the brain [44], because it prolongs the period of reversibility (viability) before neuronal cell death and brain death occur.

Flat-line EEG

Of course, that leaves the question: how do we know for sure that the electroencephalogram (EEG), the registration of the electrical activity of the cortex, has become flat in those patients with cardiac arrest, and how can we study this? In normal circumstances no attempts are made to register an EEG during cardiac arrest, because this takes far too much time, and patients need to be successfully resuscitated and defibrillated as soon as possible. But there have been some reports of instances in which the electrical activity of the brain was measured during cardiac arrest, for example during surgery with EEG monitoring. Following the cardiac arrest ('no flow'), the EEG flat-lined after an average of fifteen seconds and remained flat despite external resuscitation ('low flow') [45, 46, 47, 48]. A persistent flat-line EEG during external CPR has also been shown in animal studies [49]. Monitoring of the electrical activity of the cortex (EEG) has shown that the first ischemic changes during induced cardiac arrest in humans are detected an average of 6.5 seconds after circulatory arrest. Usually, initial slowing and attenuation of the EEG waves is the first sign of cerebral ischemia, but sometimes ischemic changes in the EEG show a decrease of power in fast activity and in delta activity, progressively and ultimately declining to iso-electricity. With prolongation of the cerebral ischemia, progression to a flat-line EEG always occurs within 10 to 20 (mean 15) seconds from the onset of cardiac arrest [50, 51, 52, 53], and the EEG remains flat during the cardiac arrest until cardiac output has been restored by defibrillation [54, 55]. Studies of cardiac arrest in animals show that auditory evoked potentials, or measures of brain-stem viability, can no longer be induced, which means that sound stimulation fails to trigger the usual reaction in a fully functioning brainstem [56, 57].

It is extremely rare for the electrical activity of the heart [**red**] (ECG) and of the cortex of the brain [**black**] (EEG) to be registered concurrently during cardiac arrest. But such a simultaneous registration of an ECG and EEG is shown in **Figure 1:**

Figure 1. (A-F) EEG and ECG registration during asystole = cardiac arrest

A patient was referred because of sudden periods of unconsciousness. During this registration (of 60 seconds, each strip is 10 seconds) a spontaneous cardiac arrest (asystole) with loss of consciousness occurred (B). Due to the lack of oxygen in the brain (anoxia) the EEG starts to change after about 8 seconds (C), and after 18 seconds (D) the registration shows a flat-line EEG. About 30 seconds after the onset of cardiac arrest, a short period of ventricular tachycardia (VT) arises for 4 seconds (E), after which normal heart rhythm gradually recovers (F), and

the EEG starts to normalize some seconds later. The patient received a pacemaker, after which he remained symptom-free.

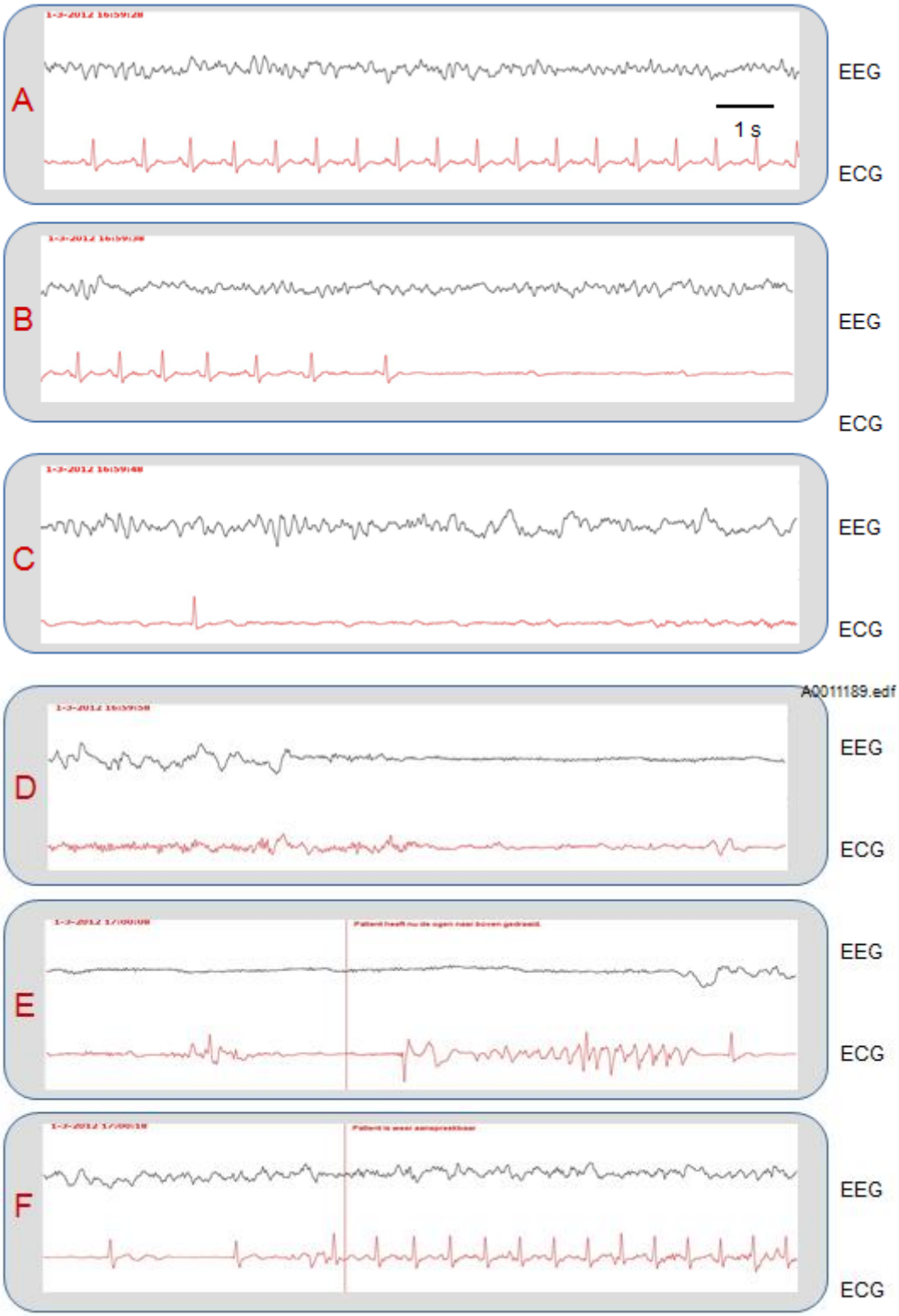

Figure 1. EEG and ECG registration during asystole = cardiac arrest

Reperfusion injury

If the cardiac arrest lasts longer than 37 seconds, the EEG will not normalize immediately after cardiac output has been returned. Despite maintaining normal blood pressure in the period following resuscitation, this normalization ultimately depends on the duration of the cardiac arrest. After a complicated resuscitation with persistent coma, it can take many hours to days for the EEG to get back to normal [58, 59]. The longer the cardiac arrest, the greater the brain damage, the longer the coma and the longer the EEG remains flat or highly irregular. Besides, normalization of the EEG may create an overly positive impression of the recovery of the brain's metabolism. Following restoration of the heartbeat and blood circulation, oxygen uptake in the brain may be reduced for a considerable period, which is caused by this so-called reperfusion injury [60, 61, 62]. Also, in animal studies with induced cardiac arrest the post-arrest cortical hypoperfusion syndrome is prolonged with cortical flow remaining below 20 percent of normal levels up to 18 hours post arrest [63].

Neuronal global workspace

The frequent objection that a flat-line EEG does not rule out any brain activity, because it is mainly a registration of electrical activity of the cerebral cortex, misses the mark. The issue is not whether there is non-measurable brain activity of any kind whatsoever, but whether there is measurable brain activity, in many neural centres, of the specific form regarded by contemporary neuroscience as the necessary condition of conscious experience, the so-called neuronal global workspace [64, 65]. It has been proven in several studies in patients with induced cardiac arrest that there was no such measurable and specific brain activity during cardiac arrest. Additionally, research drawing on magnetic resonance imaging (fMRI) has shown that the joint and simultaneous activity of the cerebral cortex and brainstem with their shared pathways (hippocampus and thalamus) is a prerequisite for conscious experience. As stated before, these parts of the brain, the neurons in the cerebral cortex, the hippocampus and the thalamus, are most susceptible to oxygen deficiency [66, 67]. A flat-line EEG is also one of the major diagnostic tools for the diagnosis of brain death in patients who are eligible for organ donation, and in those cases the objection that there may still be some brain activity is never made.

Moreover, although measurable EEG activity in the brain can be recorded during deep sleep (no-REM phase) or during general anaesthesia, no waking consciousness is experienced because there is no integration of information and no communication between the different neural networks [68, 69, 70]. A functioning system for communication between neural networks with integration of information seems essential for experiencing consciousness, and this does not occur during deep sleep nor during general anaesthesia [71], let alone during cardiac arrest, because, as mentioned before, a complete loss of all brain functions during induced cardiac arrest has been demonstrated in several human and animal studies. To reiterate, during cardiac arrest a non-functioning brain with a flat-line EEG does not mean that the brain is dead, nor that all neuronal networks must have died because they are still viable for a short period of time.

Patients with a myocardial infarction, and who suffer a cardiac arrest, will never be successfully resuscitated within 20 seconds, not even in the coronary care unit: successful CPR usually takes at least 60 to 120 seconds, and usually longer. So it seems rational to assume that all 562 survivors of cardiac arrest in the four prospective studies on NDE must have had a flat-line EEG because no patient had been resuscitated within 20 seconds [72]. Moreover, in a nursing

ward successful CPR will usually take two to five minutes, and in the event of a cardiac arrest in the street (a so-called 'out-of-hospital' arrest) it will take, at best, five to ten minutes for a patient to be successfully resuscitated, but usually longer, resulting in the death of more than 90 per cent of these patients [73, 74].

Materialist-based explanations for the cause and content of an NDE can be excluded

Materialist science starts principally from a reality that is based solely on physical, observable data. This so-called material reality should be provable, measurable, and reproducible, which is impossible for subjective experiences in our consciousness. We should be aware that, besides external and so-called objective observation, there are subjective, not observable, and not demonstrable aspects in our consciousness like thoughts, feelings, inspiration, and intuition. We can only measure neural correlates of consciousness, and these measurements do not explain anything about either the production or the content of consciousness.

But for most scientists, the most common explanation for NDE is still an extremely severe and life-threatening total lack of oxygen in the brain. This should result in the experience of a tunnel by anoxia of the retina, and in the blockage of NMDA receptors in the brain and in the release of endorphins, a kind of morphine produced by the body itself, causing hallucinations and a sense of peace and bliss [75, 76]. A hallucination is an observation that is not rooted in reality, which is not consistent with descriptions of out-of-body experiences during cardiac arrest that are open to verification and corroboration by witnesses. Moreover, an NDE is accompanied by an enhanced and lucid consciousness, and NDE-like experiences can also be experienced under circumstances such as an imminent traffic accident (a 'fear-death' experience), during a severe depression, during an existential crisis, meditation, or isolation, or as a 'shared-death' experience [77], none of which involve oxygen deficiency. As was mentioned before, in the recently published four prospective studies on NDE in survivors of cardiac arrest the lack of oxygen by itself could not explain the cause and content of the NDE [78, 79, 80, 81].

And yet, neurophysiological processes like a transient loss or inhibition of certain neuronal networks could play some part in NDE, because sometimes NDE-like experiences can be induced through electrical "stimulation" (inhibition) of some parts of the cortex in patients with epilepsy [82], or with induced high carbon dioxide levels (hypercarbia) in the brain [83]. Recently it was even suggested that NDEs could be caused by high levels of CO_2 in patients during out-of-hospital cardiac arrest. In a study in 52 survivors of cardiac arrest 21 per cent of them reported an NDE, and a significant correlation was found between higher amounts of CO_2 in the exhalation air (end-tidal CO_2) and higher levels of CO_2 in the arterial blood [84]. However, this study included only patients with an out-of-hospital cardiac arrest, where all arterial blood samples were taken in the first 5 minutes after hospital admission, meaning that most of them already had their cardiac rhythm and blood pressure re-established after successful CPR outside the hospital. Their main conclusion was that high levels of CO_2 in the blood in this study were associated with a slightly higher incidence of NDEs, but this does not explain why most patients with high CO_2 still did not report an NDE.

In the case of oxygen deficiency in the brain (*hypoxia*, or deprivation of adequate oxygen supply), as can be seen in low blood pressure (shock), heart failure or asphyxia, the result is not unconsciousness but confusion and agitation. Brain damage after waking from a coma is also

associated with confusion, fear, agitation, memory defects, and muddled speech. A study of fighter jet pilots is often cited as a possible explanatory model for NDE [85]. Having been placed in a centrifuge, these pilots experienced momentary oxygen deficiency in the brain when the enormous increase in gravity caused their blood to drop to their feet. Fighter jet pilots can indeed lose consciousness, and often experience convulsions, like those seen in epilepsy, or tingling around the mouth and in the arms and legs, as well as confusion upon waking. Sometimes they also experience some elements that are reminiscent of an NDE, such as a kind of tunnel vision, a sensation of light, a peaceful sense of floating without veridical perception, or the observation of brief, fragmented images from the past [86]. These recollections, however, consist of fragmented and random memories unlike the panoramic life-review during NDE. They never meet deceased people, but sometimes see images of living persons. A similar kind of unconsciousness, sometimes accompanied by experiences as reported by pilots, occurs after fainting induced by hyperventilation, followed by a so-called Valsalva maneuver [87]. The latter involves trying to push air from the body with the mouth and nose closed, which slows the heartbeat and lowers blood pressure, and results in a short-lived oxygen deficiency in the brain. The effects of this type of faint have also been wrongly compared to an NDE [88].

NDE-like experiences have also been reported after the use of so-called 'psychoactive' drugs, or 'psychedelics', like ketamine [89], LSD [90] and DMT, or drugs made from mushrooms (psilocybin) or from cactus (mescaline) [91]. All these induced experiences can sometimes result in a period of unconsciousness but can also in rare cases involve a feeling of being out of body, mostly without veridical perception. Also, a perception of sound, light, or flashes of recollections from the past are sometimes mentioned. These recollections, however, consist of fragmented and random memories unlike the aforementioned panoramic life-review during NDE. Furthermore, transformation is rarely reported after induced experiences. Perhaps these drugs influence the threshold of consciousness in the brain to give access to some higher aspects of consciousness, but such experiences induced by psychedelics are usually not identical to NDE [92].

The explanatory gap between brain function and consciousness

In the last decades, many articles and books have been published about consciousness, yet to date there are no uniform scientific views about the relationship between consciousness and the brain [93]. Moreover, extensive research has been done to localize consciousness and memories inside the brain, so far without success. Most of the people who carry out research into consciousness, such as neuroscientists, psychologists, psychiatrists, and philosophers, are still of the opinion that there must be a materialist and reductionist explanation for consciousness. The well-known philosopher Daniel Dennett believes, and many with him, that consciousness is nothing other than matter [94], and that our subjective experience that our consciousness is something purely personal and differs from someone else's consciousness is merely an 'illusion'. According to these scientists, consciousness originates entirely in the matter that constitutes our brain. They believe that everything we experience in our consciousness is nothing but the expression of a machine controlled by classical physics and chemistry, and our behaviour is the inexorable outcome of nerve cell activity in our brain. Most materialist scientists still do not believe it is possible to experience an enhanced consciousness during a

period when our brain is not functioning, and so they try to debunk everything that has been said and written about having an NDE during a cardiac arrest, because according to their current dogma it is obvious that an NDE must be produced by the brain. Unfortunately, it is impossible to have an open-minded discussion with these sceptical scientists because they resolutely cling to their materialist dogma. Here I would like to quote Robert Oppenheimer (1904-1967), the famous American theoretical physicist, who said [95]: *'There is no place for dogma in science. The scientist is free, and must be free to ask any question, to doubt any assertion, to seek for evidence, to correct any errors.'* And it is indeed exceedingly difficult for most scientists to change their scientific worldview, as we know from the quote by Professor Brian Josephson, the Nobel Laureate for Physics at Cambridge University and the head of the Mind-Matter Unification Project, in his interview in *New Scientist* [96]: '*It's hard to change how people think. People have vested interests, and their projects and reputations would be threatened if certain things were shown to be true'*. Materialist scientists only change their mind as soon as they have experienced an NDE themselves, like the neurosurgeon Eben Alexander [97], the orthopaedic surgeon Mary McNeal [98], and many other physicians.

Additionally, the debate about information storage, memory, and retrieval capacity in the brain is complicated by an article in *Science* with the provocative title '*Is* your brain really necessary?'[99]. This article was written in response to English neurologist John Lorber's description of a healthy young man with a university degree in mathematics and an IQ of 126. A brain scan had revealed a severe case of hydrocephalus: 95% of his skull was filled with cerebrospinal fluid and his cerebral cortex was only about 2 millimetres thick, leaving barely any brain tissue. See **figure 2**. The weight of his remaining brain was estimated at one hundred grams (compared to a normal weight of 1,500 grams), and yet his mental function was unimpaired. It seems scarcely possible to reconcile this exceptional case with our current belief that memories and consciousness are produced and stored in the brain.

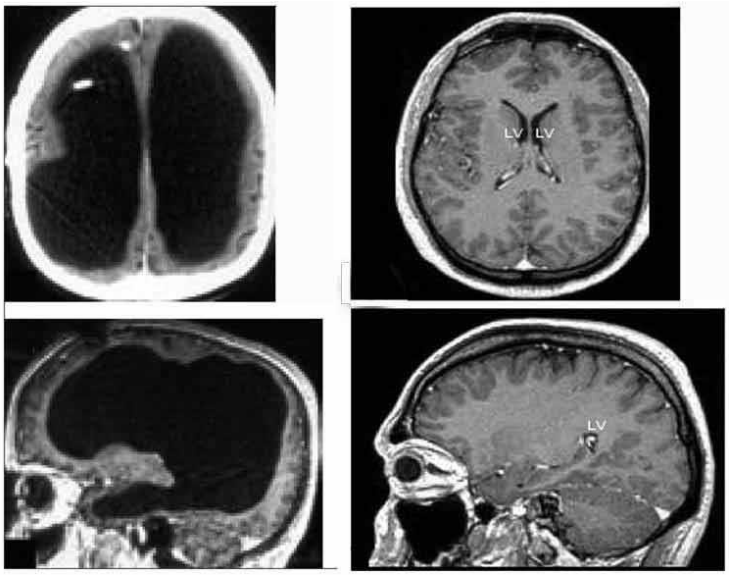

Figure 2 with left a brain with hydrocephalus, and right a normal brain

We should also ask ourselves how a non-material activity such as concentrated attention or thinking can correspond to an observable (material) reaction in the form of measurable electrical, magnetic, and chemical activity at a certain place in the brain by EEG, MEG, and

PET-scan, and in the form of increased blood flow by fMRI. Neuro-imaging studies have shown these aforesaid activities, with specific areas of the brain becoming metabolically active in response to a thought or feeling. However, although they provide evidence for the role of neuronal networks as an intermediary for the manifestation of thoughts (neural correlates), these studies do not necessary imply that those cells also produce the thoughts. A correlation does not elucidate anything about cause or effect. And how should 'unconscious' matter like our brain 'produce' consciousness, while the brain is composed solely of atoms and molecules in cells with a lot of chemical and electrical processes?

As stated before, direct evidence of how neurons or neuronal networks could possibly produce the subjective essence of the mind and thoughts is currently lacking. We cannot measure what we think or feel. There is no proof whatsoever that the brain produces consciousness, nor that consciousness is confined to the brain. There are no known examples of neural-perceptual matches, and hence reasons to doubt the truth of the "matching content" doctrine. Its underlying assumption is that following activation of special neuronal networks, the content of your thoughts or feelings will always be the same. This seems extremely unlikely, because neural activation is simply neural activation; it only reflects the use of structures. This could be compared with a radio: you can activate the radio by turning it on, and you can activate a certain wavelength by tuning in to a specific channel, but you will not have any influence on the content of the program you are going to hear. Activating the radio does not influence the content of the program, and neural activation alone does not explain the content of thoughts, emotions, or sensations. And when you destroy a radio or a TV, the electromagnetic informational fields that are essential to receive a program will still be available, because neither the radio nor the TV produced the program. With another functioning instrument (another radio or TV) you can still receive the program. It seems fair to conclude that current science does not permit us to reduce consciousness only to activities and processes in the brain: the explanatory gap between the brain and consciousness has never been bridged because a certain neuronal state is not the same as a certain state of consciousness.

About concepts in science

When empirical scientific studies discover phenomena or facts that are inconsistent with current scientific theories, so-called anomalies, these new facts must not be denied, suppressed, or even ridiculed, as is still quite common. In the event of new findings, the existing theories ought to be developed or adjusted, and if necessary, rejected and replaced. We need new ways of thinking and to expand science to study consciousness and its relationship with brain function and to acquire a better understanding of the effects of consciousness on body and brain. Some scientists, such as the philosopher David Chalmers, are more receptive and take consciousness seriously [100]: '*Consciousness poses the most baffling problems in the science of the mind. There is nothing that we know more intimately than conscious experience, but there is nothing that is harder to explain.*'

In the past, too, new kinds of science were developed when prevailing scientific concepts could no longer explain certain phenomena. At the start of the previous century, for instance, quantum physics emerged because certain findings could no longer be accounted for with classical physics. Quantum physics upset the established view of our material world. The slow

acceptance of the new insights provided by quantum physics can be attributed to the materialist worldview we have been raised with. According to some quantum physicists, quantum physics assigns to our consciousness a decisive role in creating and experiencing the physical world as we perceive it. This not yet commonly accepted interpretation holds that our picture of reality is based on the information that is received by our consciousness. This view transforms modern science into a subjective science with a fundamental role for consciousness. The quantum physicist Werner Heisenberg (1901-1976) formulates it as follows [101]: *'Science no longer is in the position of observer of nature, but rather recognizes itself as part of the interplay between man and nature. The scientific method ... changes and transforms its object: the procedure can no longer keep its distance from the object.'*

For me science means asking questions with an open mind. Science should be the search for explaining new mysteries, rather than sticking with old concepts. Those who never change their mind, because they don't accept new concepts, will never learn anything. We desperately need a real paradigm shift in science to understand consciousness and its relationship with brain function, and I sincerely hope that quantum physicist Max Planck (1858-1947) was wrong when he said in 1934 [102] : "*A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it".* In my opinion, current science must reconsider its hypotheses about the nature of perceptible reality, because these ideas have led to the neglect or denial of significant areas of consciousness research. Current science usually starts from a reality based solely on objective, physical phenomena. It detests subjectivity and enshrines objectivity, because it wants to depend on objective data rather than on subjective experiences. As stated before, current scientific techniques are incapable of measuring or demonstrating the content of thoughts, feelings, and emotions. A purely materialist analysis of a living being, which focuses only on the structure and the function of the physical brain, will never reveal the content nor the origin of our consciousness.

Nonlocal consciousness

So it is indeed a scientific challenge to discuss new hypotheses that could explain the reported interconnectedness with the consciousness of other persons, including deceased relatives, the possibility of experiencing instantaneously and simultaneously a review and a preview of someone's life in a dimension without our conventional body-linked concept of time and space (nonlocality), where all past, present and future events exist and are available, and the possibility of having a clear and enhanced consciousness with persistent and unaltered 'sense of self', with memories, cognition, emotion, the possibility of perception outside and above the lifeless body, and even with the experience of the conscious return into the body.

In some of my articles [103,104,105] and in my book [106] I have written that based on prospective studies on NDE and recent findings in neurophysiological research, and in analogy with concepts from quantum physics, our consciousness cannot be localised in a certain time or space. This is called nonlocal consciousness, because almost all the reported aspects of consciousness during cardiac arrest seem to behave as quantum-like phenomena, like nonlocal interconnectedness (entanglement), beyond time and space. In this concept our endless or nonlocal consciousness with declarative memories finds its origin and is stored in a nonlocal

realm as wave-fields of information, and the brain only serves as a relay station for parts of these wave-fields of consciousness to be received into or as our waking consciousness. The function of the brain can therefore be compared to a transceiver, a transmitter/receiver, or interface, exactly like a computer. Different neuronal networks function as interface for different aspects of our consciousness, and neuronal networks should be regarded as receivers and conveyors, not as retainers of consciousness and memories. In this concept, nonlocal consciousness is not rooted in the measurable domain of physics, our manifest world. This also means that the wave aspect of our indestructible consciousness in the nonlocal realm is inherently not measurable by physical means. However, the physical aspect of consciousness, which originates from the wave aspect of our consciousness through collapse of the wave function ("objective reduction") can be measured by means of neuro-imaging techniques like EEG, fMRI, and PET scan. One cannot avoid the conclusion that endless or nonlocal consciousness has always existed and will always exist independently from the body, because there is no beginning nor will there ever be an end to our consciousness. Our nonlocal consciousness resides not in our brain and is not limited to our brain. Our brain seems to have a facilitating, and not a producing role in experiencing consciousness. One can even compare the function of our brain with a filter: the brain permits just a small part of the large amount of information from our nonlocal consciousness into our daily waking consciousness. This concept of nonlocal consciousness can explain all reported elements of an NDE during cardiac arrest.

In trying to understand this concept of interaction between nonlocal consciousness and the material body, the analogy with modern worldwide communication may help. There is a continuous exchange of objective information by means of electromagnetic fields for radio, TV, mobile telephone, or laptop computer. At this very moment we are all invaded by hundreds of thousands of telephone calls, by hundreds of radio and TV programs, and by an incredible amount of information from the internet, but we only become aware of these electromagnetic informative fields when we use our mobile telephone or switch on our radio, TV, or laptop. What we receive is neither inside the instrument, nor in the components, but the information from the electromagnetic fields becomes observable to our senses via the receiver and hence perception occurs in our consciousness. The internet with more than a billion websites and videos can be received at roughly the same moment in the USA, Europe and Australia, and is obviously not located inside our laptop nor is it produced by it. Information from the internet is always and everywhere available because it is stored in the 'cloud'. Nonlocal consciousness is a similar concept.

The conclusion that our brain functions as a transceiver and not as a producer of consciousness reflects a view that was expressed about one century ago. As early as 1898 William James (1842-1910) wrote that the brain's role in the experience of consciousness is not a productive, but a permissive or transmissive role; that is, it admits or transmits information [107]. In his view, consciousness does not originate in this physical world, but already exists in another, transcendental sphere; access to higher aspects of consciousness depends on the personal 'threshold of consciousness', which for some people is lower than for others, and which allows them to experience various aspects of enhanced consciousness. James draws on abnormal experiences of consciousness to support his theory [108]: **'***The whole drift of my education goes to persuade me that the world of our present consciousness is only one out of*

many worlds of consciousness that exist, and that those other worlds must contain experiences which have a meaning for our life also'. He also stated: '*The total expression of human experience, as I view it objectively, invincibly urges me beyond the narrow scientific bounds',* and he even refers to '*the continuity of consciousness'*. Other scientists and philosophers a century ago shared the same view, [109, 110] and this idea was also supported by the Australian neurophysiologist, philosopher, and Nobel prize winner Sir John Eccles (1903-1997) [111]: *'The brain is the messenger to consciousness'.* Recently, based on totally different neuro-scientific research, Alva Noë writes in his book [112]: "*All scientific theories rest on assumptions. It is important that these assumptions be true. I will try to convince the reader that this startling assumption of consciousness research that consciousness is a neuroscientific phenomenon and that it happens in the brain is sorely mistaken. Consciousness does not happen in the brain. What determines and controls the character of conscious experience is not the associated neural activity. That is why we have been unable to come up with a good explanation of its neural basis'*.

By making a scientific case for consciousness as a nonlocal and thus ubiquitous phenomenon, we can contribute to new ideas about the relationship between consciousness and the brain. I am aware that this concept can be little more than a stimulus for further study and debate, because at present we still lack definitive answers to the many important questions about how consciousness relates to brain function. I have no doubt that in the future, too, many questions about consciousness and the mystery of life and death will remain unanswered by science. However, faced with extraordinary or anomalous findings we must question a purely materialist paradigm in science. A near-death experience is one such extraordinary finding. Scientific studies on NDE challenge our current concepts about the mind-brain relationship.

Moreover, the findings and conclusions of recent NDE research may fundamentally change one's opinion about death, because of the almost unavoidable conclusion that at the time of physical death consciousness will continue to be experienced in another dimension, in which all past, present, and future is enclosed. As someone with an NDE wrote to me: "*Death is only the end of our physical aspects*". But we should acknowledge that research on NDE cannot give us the irrefutable scientific proof of this conclusion, because even though they were all awfully close to death and had no functioning brain, people with a NDE did not actually die. But, as I have explained before, it has indeed been scientifically proven that during NDE in cardiac arrest enhanced consciousness was experienced independently of brain function. Without a body we can still have conscious experiences. Recently someone with an NDE wrote to me: '*I can live without my body, but apparently my body cannot live without me'*.

The conclusion seems compelling that endless or nonlocal consciousness has and always will exist independently from the body. For this reason, we should seriously consider the possibility that death, like birth, is a transition to another state of consciousness, and that during life the body functions as an interface or place of resonance. As a young doctor my idea was that death is the end of everything we are, including the end of our consciousness, because nothing can survive physical death. But based on the results and conclusions of NDE research in survivors of cardiac arrest my current view on life and death has now fundamentally changed: there are good reasons to assume that our consciousness does not always coincide with the

functioning of our brain: enhanced consciousness can sometimes be experienced separately from the body, and so the death of our body is not the end of our consciousness.

Examples of experiences of nonlocal consciousness beyond the brain

I would like to reconsider some elements of an NDE that are experienced in cardiac arrest during a transient period when the brain is non-functioning: an out of body experience, a holographic life-review, a preview (flash forward), and a conscious return into the body. An NDE, or an experience of an enhanced or nonlocal consciousness during a life-threatening situation like cardiac arrest, makes it extremely unlikely that consciousness is a product of brain function. Based on these experiences it seems inevitable that there is a continuity of consciousness after death. Later in this section, I will also talk about experiences of nonlocal consciousness during a period when the brain is malfunctioning.

A non-functioning brain

1. During cardiac arrest:

1. A. ***Out-of-body experience*** **(OBE).** In this experience people may have veridical perceptions from a position outside and above their lifeless body, with a view of 360 degrees, allowing them to have both an overview and an awareness of details at the same time. Even people who are blind from birth can report an OBE during their NDE [113]. This out-of-body experience is scientifically important because doctors, nurses, and relatives can verify the reported perceptions, and they can also corroborate the precise moment the NDE with OBE occurred during the period of cardiopulmonary resuscitation (CPR). It is important to mention that until now it has been impossible to induce a real out-of-body experience with veridical perception from a position outside and above the body by any method whatsoever [114], despite incorrect suggestions in the medical literature, which merely describe bodily illusions [115, 116, 117, 118]. In two recent reviews, which looked at more than 200 corroborated reports of potentially verifiable out-of-body perceptions, it was found that about 98 percent of the reported OBEs were completely accurate: through verification it was proven that all reported perceptions during coma, cardiac arrest, or general anaesthesia included details that really had happened [119, 120]. This proves that an OBE cannot be a hallucination, i.e. a perception that has no basis in "reality", like in psychosis, neither can it be a delusion, which is an incorrect assessment of a correct perception, nor an illusion, which means a misapprehension or misleading image. Moreover, one needs a functioning brain to experience a hallucination, an illusion, or a delusion. This is the report of a nurse at a coronary care unit [121]: *"During the night shift an ambulance brings a 44-year-old cyanotic, comatose man into the coronary care unit. He was found in a coma in a meadow about 30 minutes earlier. When we go to intubate the patient, he turns out to have dentures in his mouth. I remove these upper dentures and put them onto the 'crash cart.' Only after about an hour and a half does the patient have sufficient heart rhythm and blood pressure, but he is still ventilated and intubated, and he is still comatose. He is transferred to the intensive care unit to continue the necessary artificial respiration for about seven days. After more than a week I meet again with the patient, who is by now back on the cardiac ward. The moment he sees me he says: 'Oh, that nurse knows where my dentures are.' I am incredibly*

surprised. Then the patient elucidates: 'You were there when I was brought into hospital and you took my dentures out of my mouth and put them onto that cart, it had all these bottles on it and there was this sliding drawer underneath, and there you put my teeth.' I was especially amazed because I remembered this happening while the man was in a deep coma and in the process of receiving CPR. It appeared that the man had seen himself lying in bed, that he had perceived from above how nurses and doctors had been busy with his CPR. He was also able to describe correctly and in detail the small room in which he had been resuscitated (where he was admitted in a coma and had left in a coma) as well as the appearance of those present like myself."

For obvious reasons, most scientists are reluctant to accept the possibility of veridical perception from a position outside and above the lifeless body, because this could be the decisive evidence that conscious perception is possible outside the body during a transient period when the brain is non-functioning, and so they dismiss these perceptions as just anecdotes. These scientists want to have more 'objective' proof, and of course most NDE researchers will agree. This is why hidden signs or targets have been put close to the ceiling in resuscitation rooms, in coronary care units, and in intensive care units. These hidden signs, not visible from the bed, can provide objective proof for veridical perception when patients during cardiac arrest are not only able to perceive details of their resuscitation from a position outside and above their lifeless body during their CPR (which can be corroborated by doctors, nurses, and relatives), but can also describe these hidden signs.

But until now there has been no published case where patients during CPR have 'seen' this hidden sign despite perceiving veridical details of their resuscitation previously unknown to them [122]. Could there be a plausible explanation why it is impossible to 'prove' reported perception during OBE with the help of a hidden sign? This lack of 'objective proof' could be caused by so-called 'inattentional blindness', also known as 'perceptual blindness' [123, 124]. This is the phenomenon of not being able to perceive things that are in plain sight. It can be a result of having no internal frame of reference to perceive the unseen object, or of the lack of mental focus or attention caused by distractions. This inattentional blindness is the failure to notice a fully visible, but unexpected object because attention was focused on another task, event, or object, because humans have a limited capacity for attention and intention which thus limits the amount of information processed at any time [125, 126]. Only if we have the intention to decide where to place the attention, will we consciously perceive the event or object we focus upon. Studies of inattentional blindness demonstrate that people fail to report having noticed an unexpected object [127]. Evidence for inattentional blindness comes mostly from relatively simple laboratory tasks [128], but there are probably many everyday examples of this phenomenon. For example, automobile accident reports frequently mention driver claims that they "looked but failed to see" the other vehicle. Recent evidence suggests that talking on a cell phone, for example, dramatically increases the probability of missing an unexpected object [129].

Based on the many corroborated cases of veridical perception from a position outside and above the body during NDE, it seems obvious that perception really can occur during OBE, and that missing a hidden target during OBE must be the result of a lack of intention and attention for this unexpected hidden object, because patients are too surprised by 'seeing' the resuscitation of their own lifeless body from above during their cardiac arrest or surgery.

1. B. ***Life review.*** During a holographic life review subjects feel the presence and have the renewed experience of not only every act but also every thought from their life, and they realize that in some way they have always been intimately connected with others in the past. All that has been done and thought seems to be significant and stored. Aware of the memories, emotions, and consciousness of another person, they experience the consequences of their thoughts, words, and actions for that other person at the very moment in the past when they occurred (interconnectedness or entanglement). They understand now what in some religions and cultures is known as the cosmic law that everything one does to others will ultimately be returned to oneself. Patients survey their whole life at a glance; time and space do not seem to exist during such an experience ('nonlocality'). They are instantaneously taken to where they concentrate, and they can talk for hours about the content of the life review even though the resuscitation only took minutes [130]: *"All of my life up till the present seemed to be placed before me in a kind of panoramic, three-dimensional review, and each event seemed to be accompanied by a consciousness of good or evil or with an insight into cause or effect". "Not only did I perceive everything from my own viewpoint, but I also knew the thoughts of everyone involved in the event, as if I had their thoughts within me. This meant that I perceived not only what I had done or thought, but even in what way it had influenced others, as if I saw things with all-seeing eyes. And so, even your thoughts are apparently not wiped out. And all the time during the review the importance of love was emphasised. Looking back, I cannot say how long this life review and life insight lasted, it may have been long, for every subject came up, but at the same time it seemed just a fraction of a second, because I perceived it all at the same moment. Time and distance seemed not to exist. I was in all places at the same time, and sometimes my attention was drawn to something, and then I would be present there."*

1. C. ***Preview.*** Patients can also experience a preview or flash-forward. People feel like they can see a part of the life that is yet to come, in which both future images from personal life events as well as more general images from the future occur. And again, it seems as if time and space do not exist during this preview ('nonlocality'). The reports of the verifiable future events inevitably raise questions about free will and the extent to which people can determine their own future [131]: '*… and in a flash I saw the rest of my life. I could see a large part of my future life; taking care of my children; my wife's illness; everything that would happen to me, both in and out of the workplace. I could see it all. I foresaw my wife's death and my mother's passing. One day I wrote down all the things I saw back then: over the years I've been able to tick them all off. For instance, I saw my wife on her deathbed, wrapped in a white shawl, just like the one she was given by a friend of hers shortly before she died …'*

1. D. ***Conscious return into the body***. Some patients can describe how they consciously returned into their body, mostly through the top of the head, after they had come to understand that "*it wasn't their time yet*" or that "*they still had a task to fulfil"*. This conscious return into the body is experienced as something very oppressive. They regain consciousness in their body and realize that they are "locked" in their damaged body, which means a return to all the pain and restriction of their disease [132]: "*And when I regained consciousness in my body, it was so terrible, so terrible...that experience was so beautiful, I would have liked to never come back, I wanted to stay there…..and still I came back. And from that moment on it was an exceedingly difficult experience to live my life again in my body, with all the limitations I felt in that period*."

A malfunctioning brain

In the next paragraphs I will refer to experiences of nonlocal consciousness during a period when the brain is malfunctioning, as found in patients in a coma, during general anaesthesia, and in terminal lucidity.

2. During Coma:

While in a coma a patient is unresponsive and cannot wake up, even when stimulated. Coma is a state of apparent unconsciousness due to severe brain injury, such as a cerebral haemorrhage or a cerebral infarction, due to a complicated CPR, a cerebral trauma (traffic accident), a cerebral infection, or intoxication. According to current science conscious experiences should not be possible. However, here follows the account of a conscious experience during a coma (personal communication) [133]: '*While she was thought to be in a deep coma without any apparent brain activity, her specialist and husband were having a conversation by her bedside. The neurologist predicted that his patient would be a "vegetable" for the rest of her life and asked the husband to consider taking her off the equipment (oxygen, medication) that was keeping her alive. The husband was still hopeful of a recovery, so she was kept on the ventilator. Several months later the woman woke up, despite the somber prognosis. It emerged that she had been able to hear throughout most of her coma and had overheard the conversation between her doctor and husband about passive euthanasia! She said how awful this had been and that while she had been trying to shout that she was still there, that she wanted to live, be with her husband and children, they were discussing her possible demise.'*

3. During general anaesthesia:

In studies among patients under general anaesthesia, neurological imaging techniques like functional magnetic resonance imaging (fMRI) or the registration of the electrical activity of the brain (EEG) show a functional loss of nearly all major brain tissue because the connections in the brain have been severed and information between neural centres can no longer be exchanged [134, 135]. So according to these studies conscious experiences should not be possible [136]: *'No, I'd never heard of near-death experiences, and I'd never had any interest in paranormal phenomena or anything of that nature. What happened was that I suddenly became aware of hovering over the foot of the operating table and watching the activity down below around the body of a human being. Soon it dawned on me that this was my own body. So I was hovering over it, above the lamp, which I could see through. I also heard everything that was said: "Hurry up, you bloody bastard" was one of the things I remember them shouting. And even weirder: I didn't just hear them talk, but I could also read the minds of everybody in the room, or so it seemed to me. It was all quite close, I later learned, because it took four and a half minutes to get my heart, which had stopped, going again. As a rule, oxygen deprivation causes brain damage after three or three and a half minutes. I also heard the doctor say that he thought I was dead. Later he confirmed saying this, and he was astonished to learn that I'd heard it. I also told them that they should mind their language during surgery'.*

4. Terminal lucidity:

This is the unexpected return of mental clarity and memory shortly before death in patients suffering from severe neurological disorders, like the end stage of Alzheimer's disease [137]. These patients suddenly become lucid again, recognise family members and children, call them by name, thank them, and die. Terminal (or paradoxical) lucidity cannot be easily explained by normal neurological processes because it has been reported by patients who have had severe Alzheimer's disease for many years, who may be unresponsive or who have been in a coma for days. Brain function must be severely impaired in these patients. In a sample of 49 cases, many with severe dementia, 43 per cent of terminal lucidity episodes occurred within the last day of life, and 41 per cent within two to seven days before death [138] [139]: '*David's head was literally stuffed with lung cancer. Being his orthopedic surgeon, I was called in to take care of his hip and pelvic bones broken by the growing metastases. His seeming nonchalance about the pain and the surgery was clearly out of concern for his beautiful, young family--his wife Carol, a nurse, and his three kids, who were there every night. He couldn't keep up the carefree charade over the next two weeks, though, as his speech slurred, then became incoherent. He stopped speaking, then moving. When his doctors rescanned his head, there was barely any brain left. The cerebral machine was nearly gone, replaced by lumps of haphazardly growing gray stuff. Gone with that machine seemed David as well. No expression, no response to anything we did to him. As far as I could tell, he was just not there. It was particularly bad in the room that Friday when I made evening rounds. The family was there, sad, crying faces on all of them. His respirations had become agonal--the gulping kind of breathing movement that immediately precedes death. I knew Carol had seen this and that she knew what it meant. Next morning the sun poured in as I checked the room. The bed was at chest height, made up and empty, with clean, fresh sheets over the vinyl mattress. As I turned to leave, I was blocked by a nurse, an older Irish lady with a doleful look on her face. She had taken care of David last night."He woke up, you know, doctor--just after you left--and said goodbye to them all. Like I'm talkin' to you right here. Like a miracle. He talked to them and patted them and smiled for about five minutes. Then he went out again, and he passed in the hour." But it wasn't David's brain that woke him up to say goodbye that Friday. His brain had already been destroyed. The metastases actually had replaced most brain tissue.'*

Other experiences of nonlocal consciousness

In the next paragraphs I will discuss other aspects of nonlocal consciousness, like nonlocal information exchange, nonlocal entanglement as reflected in nonlocal perception, genius insight, savants, and nonlocal perturbation, which covers nonlocal healing, neuroplasticity, including placebo, mindfulness and cognitive therapy, meditation, and nonlocal effect on 'dead' matter.

1. Nonlocal information exchange:

Interconnectedness with the informative fields of nonlocal consciousness also explains enhanced intuition, like clairvoyance, clairaudience, prognostic dreams, premonitions, and visions. As mentioned before, following an NDE most people, often to their own amazement and confusion, may experience such an enhanced intuitive sensibility, which means having

access to nonlocal information that is not received by our senses nor by our body. Presumably, the functional receiving capacity of the brain/body is permanently enhanced following an NDE, which can be compared with a radio, receiving not only channel 1, your own personal consciousness, but at the same time channel 2, 3 and 4, the fields of consciousness of others. William James (1842-1910) called this a lower personal 'threshold of consciousness' [140]. This enhanced intuition is based on interconnectedness with the consciousness of others and is independent of time and distance. It can involve an inner knowing of future events, prognostic 'dreams', sensing an incoming phone call, an awareness of other people's pain or illness, or even the sense of knowing when someone will die – which usually proved to be accurate [141]. This nonlocal information exchange could perhaps be explained by a quantum-informational holographic model of brain-consciousness-universe interactions [142].

2. Nonlocal perception:

Nonlocal entanglement seems to be demonstrated in nonlocal perception (***remote viewing)***, which is the ability of an individual to acquire perceptive and nonlocally sourced information that should not be accessible because of shielding from space and time by our sensory organs, and that can be objectively assessed by science [143]. The key to high performance is the ability to attain and sustain intentioned focused awareness, and meditation is the best way for most people to do this. A lot of studies have been done with outstanding and convincing results, for instance at the Stanford Research Institute, in CIA programs, at the Princeton Engineering Anomalies Research Laboratory (PEAR) and by The Alexandria Project [144]. These studies have resulted in the discovery of archaeological sites throughout the world, both terrestrial and marine, as well as the resolution of crimes, historical reconstructions, and the location of natural resources. People have even been able to describe the interior of buildings and the content of locked filing cabinets or state secrets, and one of the most recent remote viewing successes was the discovery of Saddam Hussein's hiding place thanks to detailed descriptions of the suspected location.

3. Genius insight:

Where does sudden scientific insight come from? How do radically new insights enter consciousness? We know that Einstein's theory of relativity came to him in an epiphany. A sudden 'brainwave' inspired Mendeleyev (1834-1907), the Russian chemist, to draw up the periodic table, listing the chemical elements according to atomic mass. What are the origins of inspiration in writers, painters, and other artists? How could someone like Mozart write his beautiful compositions at such a young age? Mozart said, as did Brahms, that he heard the music in his head and that all he had to do was transcribe it, which allowed him to put his brilliant music on paper in near-perfect notation within a noticeably short space of time [145]. Inspiration, creativity, and sudden scientific insight may be explained by (unconscious) contact with aspects of nonlocal consciousness [146].

In the same way, an NDE can give people the feeling of having been in contact with a tremendous source of wisdom and knowledge, like a new insight in quantum physics, or understanding the meaning of life, although they usually have no recollection of this later when they are back in their body. A patient told me the following: "*I felt that I could understand the reason and meaning of everything. It was as if I thought 'Now I see. Now I understand.' But when I woke up, I could not remember the answer."*

4. Savants:

Savants often possess knowledge they could not possibly have acquired through experience or learning. Although savants are often mentally or socially impaired, they frequently possess astonishing creative and intuitive powers of unknown origin in areas such as mathematics, art, or music [147]. Savants are untrained and untrainable, illiterate, and uneducable, yet they appear to have access to a particular field of knowledge. The answers come through them, but they do not know how they know [148, 149]. Many clinicians have reported savants to be capable of nonlocal information exchange, like precognition, telepathy, or clairaudience [150]. To understand the quite amazing capabilities of savants we must reconsider the relationship between consciousness and memories with the brain as an interface with nonlocal consciousness, and not a producer of consciousness. In savants the 'threshold of consciousness' seems to be permanently lowered.

5. Nonlocal perturbation:

This is the effect of nonlocal consciousness on matter. We all know from our daily experience that the mind can have an obvious effect on our body; fear or sexual arousal, for instance, can trigger irrefutable physical reactions. But there are more examples of nonlocal influence on our body and brain.

(5 A) Nonlocal healing, or healing at a distance. Therapeutic intentions studies have found objective changes in fMRI scans, with correlations between distant intentionality and brain function in recipients. Individuals were placed in fMRI instruments, and while they lay there being monitored, healers at a distance would express therapeutic intention at two-minute intervals, selected by random number generators. Only at those times when the therapeutic intention happened did the brains of the recipients show altered behavior. Significant differences between experimental (send) and control (no send) procedures were found. Areas activated during the experimental procedures included the anterior and middle cingulate area, precuneus, and frontal area. It was concluded that instructions to a healer to make an intentional connection with a sensory isolated person can be correlated to changes in the brain function of that individual [151].

To their surprise and dismay many people who have had an NDE often find themselves to be able to heal other people, as Jane Katra and Joyce Hawks describe extensively in their books [152, 153]. They now have, like many others with an NDE, the inner feeling that their body has become a receiver of, and transmitter for, universal (nonlocal) healing energy.

(5 B) Neuroplasticity: the mind can change the brain, which means 'mind over matter'.

Many studies have shown that the human mind can change the function and the structure of the brain: under the influence of mindfulness, emotions, expectations, active thought processes as well as physical activities, the neural networks and electromagnetic activity of the brain undergo constant change. How could this change be scientifically explained if, as is widely assumed, consciousness is only a side effect of a functioning brain, or when consciousness is defined as only an 'illusion'?

Throughout life there is a process of constant adaptation in the cerebral cortex, because our mental, intellectual, and physical activities affect both the number and the location of the synapses, the connections between neurons. This process of ongoing adaptation is called neuroplasticity. At a young age, up to about four, the brain is remarkably plastic. There is evidence that during this period of maximum plasticity, some hundred thousand synapses are

lost and regenerated every second [154]. An extreme example of neuroplasticity is the case of a three-year-old girl whose left brain needed to be surgically removed because of serious chronic encephalitis with symptoms of intractable epilepsy. See **figure 3**. If adults were to undergo this kind of intervention, the consequences would be disastrous: the patients would be unable to speak or understand language, would be left paralyzed on the right side, and lose sight in one eye. But a year after her operation this girl showed almost no more symptoms. The one-sided paralysis was as good as gone and she could think clearly. She is now developing normally, fluent in two languages, running and jumping about, and doing well in school [155, 156].

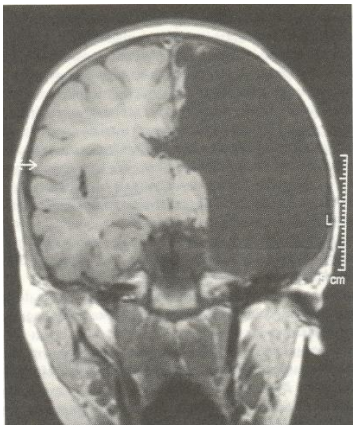

Figure 3: three-year-old girl with half a brain

The only possible explanation for this remarkable adaptability is that the new connections forged by plasticity allowed all brain function to be assumed by the remaining right half of the brain. The girl can do as much with only half a brain as other people with both halves. With practice and the will to get better she was able to completely re-program her brain, because with only half a brain she had regained the same capacities as people with a normal functioning brain.

- **5 B 1: Placebo:**

Several scientific studies have shown that the mind can influence or determine brain function, and even brain structure, to a considerable degree. In a study of cognitive behavioral therapy and placebo treatment for depression, fMRI studies and PET scans found a permanent change in activity distribution in certain regions of the brain [157]. The brain scans of depressed patients receiving placebo treatment showed neurological improvements in certain parts of the brain that were identical to those seen in depressed patients receiving cognitive therapy or antidepressants. The mere thought of receiving proper treatment triggered a clear objective change in brain function among the depressed patients in the placebo group. The placebo effect has not only been studied in patients suffering from depression, but also in patients with Parkinson's disease, during the administration of pain stimuli, and during the measurement of changes in immune response [158, 159]. In all these studies, the changed expectations triggered by the placebo effect produced demonstrably different response patterns in both body and brain. Placebo treatment and positive pain manipulation had a favorable impact on some brain centers thanks to the release of endorphin-like substances, while the fMRI showed increased activity in the prefrontal cortex thanks to the raised expectations and changed attention processes. In Parkinson's patients who received placebo treatment, certain brain centers released more dopamine, which significantly reduced muscular stiffness.

- **5 B 2: Mindfulness and cognitive therapy:**

Cognitive behavioral therapy can have the same effect as a placebo. Extensive neurological research was carried out in patients with obsessive-compulsive disorder, and with the help of PET scans abnormalities were found in some brain circuits. Intensive cognitive behavioral therapy, which taught these patients to harness the positive power of the mind to change abnormal compulsive thoughts, resulted in subjective and objective improvement of clinical symptoms, while a repeat brain scan showed clear neurological improvements [160]. A new practical application is 'mindfulness-based cognitive therapy' (MBCT) for patients with depression, stress, fear (phobia), pain, and physical ailments such as psoriasis. A combination of cognitive therapy and meditation with 'mindfulness', it produces distinct clinical improvements and fMRI registers clear changes, especially in the prefrontal cortex [161]. These cognitive therapeutic changes seem to be the result of neuroplasticity. MBCT also boosted these patients' immune function after an influenza vaccination [162]. Research has also shown that when somebody's expectations are manipulated intentionally (through stimulation or self-regulation) or unintentionally (through placebo), this not only results in a positive impact on their (subjective) sense of well-being and in an (objective) reduction of symptoms, but also brings about an actual biological (structural) change in the brain [163].

- **5 B 3: Meditation:**

During meditation people can experience a transcendent, transpersonal level of awareness, which can be seen as an aspect of nonlocal consciousness, and meditation also produces temporary and permanent changes in brain function. A study showed that the quantitative EEG (or QEEG) of meditating volunteers displayed more gamma waves, while the EEG of meditating Buddhist monks, who have spent tens of thousands of hours engaged in meditation, displayed a much higher gamma activity (25-42 Hz), especially frontoparietal (forehead and sides of the head), which did not disappear after the monks had stopped meditating [164]. The results of these studies are indicative of both an acute change during meditation and a permanent change in brain activity, based on neuroplasticity cultivated during many years of meditation. Consciousness can change the anatomical structure and associated function of the brain.

(5 C) Nonlocal effect on 'dead' matter:

But is there also any scientific evidence that consciousness has an effect on 'dead' matter by nonlocal processes? A quantum-mechanical model has been used to explain many carefully researched and well-documented phenomena of nonlocally connected consciousness, both between people and between consciousness and matter [165]. Likewise, the causal influence of consciousness on matter, based on quantum physical theories, has been extensively described [166]. Both Radin and Goswani use the concept that consciousness is nonlocal, which seems to be essential in explaining these kinds of extraordinary phenomena. A striking example of such a nonlocal effect of consciousness on matter is the global consciousness project, originally created in the Princeton Engineering Anomalies Research Lab at Princeton University, and now directed by Roger Nelson. Data are continuously collected from a global network of physical random number generators (RNGs) located in up to 70 host sites around the world at any given time. When a great event synchronizes the emotions of millions of people, the network of RNGs becomes subtly structured, as seen during the 9/11 terrorist attacks or the death of Diana. They calculate one in a trillion odds that the effect is due to chance [167].

Examples of (mostly unexpected) contact with the consciousness of deceased relatives

Experiences of an enhanced consciousness just before, during, or after death also support the assumption that there must be a continuity of consciousness after the death of the body. But surprisingly, many people nowadays still have never heard of NDEs or after-death communication (ADC), and therefore they still 'believe' that death is the end of our existence and the end of our consciousness. People are afraid that with death everything comes to an end. Remarkably, in a recent representative poll in Europe about 55 per cent of the population, more than 250 million people, believed in personal survival, and in the USA this percentage is even higher [168]. These surprisingly high figures are in sharp contrast with the opinion of most Western scientists, who systematically ignore and ridicule the possibility of personal survival after physical death [169].

In the next paragraphs examples will be given of contact with the consciousness of deceased relatives during NDE, end-of-life experiences, shared death experiences, and peri-mortal experiences, and of the possibility of after-death communication. This will be followed by a discussion of contact with deceased persons by mediums and examples of reincarnation.

1.A. Meeting unknown deceased relatives during an NDE:

If deceased acquaintances or relatives are encountered in an otherworldly dimension, they are usually recognized by their appearance, and communication is possible through what is experienced as thought transfer. Thus, it is also possible to be in contact with fields of consciousness of deceased persons (interconnectedness), even when these persons were unknown, or when it was not known that these people had died. So apparently a kind of personal identity ('Self') is still accessible in the non-physical dimension[170]: *"During my cardiac arrest I had an extensive experience (...) and later I saw, apart from my deceased grandmother, a man who had looked at me lovingly, but whom I did not know. More than 10 years later, at my mother's deathbed, she confessed to me that I had been born out of an extramarital relationship, my father being a Jewish man who had been deported and killed during the second World War, and my mother showed me his picture. The unknown man that I had seen more than 10 years before during my NDE turned out to be my biological father."*

1.B. An experience of meeting people unknown to be dead [171]: '*At the age of sixteen I had a serious motorcycle accident. I was in a coma for nearly three weeks. During that coma I had an extremely powerful experience . . . and then I came to a kind of iron fence. Behind it stood Mr. Van der G., the father of my parents' best friend. He told me that I couldn't go any further. I had to go back because my time hadn't come yet. . . . When I told my parents after waking up, they said to me that Mr. Van der G. had died and had been buried during my coma. I couldn't have known that he was dead.'*

2. End-of-Life Experiences, ELE, or Deathbed Visions: During the terminal phase of illness patients sometimes report encounters with deceased loved ones who welcome them, or the sight of a beautiful, unearthly environment, a bright light, a sense of unconditional love, or sometimes their experiences are only comprised of vague, intuitive images and an inner sense that the moment of transition is near. Like an NDE, such an end-of-life experience takes away the fear of death. Unfortunately, many accounts of ELEs are either not recognized as such or are

interpreted as hallucinations, terminal confusion, or as side effects of medication. It is difficult to find any specific brain mechanism that would underpin these spiritual end-of-life experiences [172]: *'My mother, who was in the hospice, suddenly turned to my daughter and said, "Would you go and pack my bag, because Jan is waiting for me". Jan was her husband, and she could see him. She also saw other deceased members of the family, but not her mother. It was really about her husband, because he died at a relatively young age, he was only 52 years old. My mother was 85. She could see her husband and she knew she was going to be with him. We thought that it was so beautiful. My daughter did indeed pretend to pack her bag. She died about a day and a half later.'*

3. A shared-death experience can be reported by **healthy** people who are present at the bedside of a dying relative, and who share the death experience of this close relative at the moment of their death. They occasionally see an incredibly special light in the room or around the bed of the dying person, with primary qualities of bliss, compassion, and unconditional love. But sometimes they also join the 'death experience' of the person who just died. They may experience a tunnel, a light, a feeling of love, and even sometimes meet deceased relatives or experience the life review of the person who just died. But suddenly they are back in their body again, at the bedside of the person who died some minutes before [173]: *'I was in a relationship with Anne when she suddenly died in a serious traffic accident. Her son, who'd just turned seven, sustained severe head trauma. His brain virtually spilled out of his skull—it looked like a smashed watermelon—and it took him about five days to make the transition. He was the eldest grandson of a couple with nine children. Some sixty relatives had gathered around his hospital bed, and since I'd only been his mother's boyfriend, I was standing somewhere at the back by the window. The moment he died, when his EEG flatlined, I "saw" that his mother came to collect him. You must bear in mind that she'd died five days earlier. There was this incredibly beautiful reunion. And at one point they reached out for me and included me in their embrace. This was an indescribable, ecstatic reunion. Part of me left my body and accompanied them to the light. I know this must sound very strange indeed, but I was fully conscious and with Anne and her son as they went to the light, just as I was fully conscious and in the room where all the relatives were incredibly sad because their nephew and grandson had just died. And I joined them, we were heading toward the light, but at a certain point it was clear that I had to return, so I fell back. I simply fell back into my body. It was such an overwhelming experience, I glowed with happiness, but then I suddenly realized that I had a big smile on my face amid all these people who'd just lost a child dear to them. I quickly covered my face with my hands because I didn't want to be disrespectful toward all these mourning and crying people in the room. And I never said a word about the experience. Talking about it seemed completely inappropriate at the time, and besides I didn't have the words to describe what had happened to me. I used to think that I knew what was what. But my worldview underwent a radical transformation.*'

4. A Peri-Mortal Experience is the contact with the consciousness of a beloved person who just died somewhere else. Sometimes a vision or a strong sense of the dying person from a long distance is perceived, mostly during sleep in a noticeably clear 'so-called' dream, or on sudden awakening from sleep [174]. To understand these experiences, we must step outside the current

materialist scientific framework. (Personal communication): '*At the end of 2000 my eldest son died by suicide. From the police report estimating time of death, I learned it was about the same time a curious thing happened to me. I saw a sphere of light enter my window and then enter my forehead whereupon I was suddenly 'awareness without a body', in a place profoundly lit, with a sense of spacious depth but without any features. I felt profound warmth and love, felt my son was ok, and heard the words, "There is nothing wrong and there has never been anything wrong." Somehow, I knew this to be true with every cell of my body even though he had been suffering with pain for years. The next day I learned of his death.'*

5. After-Death Communication, **ADC**, or a so-called **post-mortal experience,** is the feeling or inner knowing that one is in contact with the consciousness of a deceased loved one in the first days, weeks, or months following his or her death [175, 176, 177, 178]. An ADC is a spontaneous event because our deceased loved ones always choose when, where, how, and if they will contact us. This contact can consist of sensing a presence, feeling touched, or even seeing the deceased person, and is sometimes accompanied by communication, certain fragrances, or unexpected "chance" incidents that are intuitively linked with the dead person [179, 180]. These experiences mostly occur during sleep and are therefore usually dismissed as '*just a dream'*. But people will never forget an ADC, whereas we mostly forget our dreams. An ADC also changes our ideas about life and death, which does not usually happen when we have a dream. People will share these experiences only when they feel a great deal of trust and know that they will not be at the receiving end of prejudices or negative comments ("*It's just wishful thinking"; "It's your grief talking*"). In our Western society it is still a huge taboo to talk about the sensation of being in contact with a deceased loved one, even though about 125 million people in Europe and about 100 million people in the USA are thought to have had an ADC [181]. The fact that contact is possible with the consciousness of a deceased relative is usually very comforting and helpful in the period of mourning, and healthcare workers or family members should not call an ADC just a hallucination. There is no scientific explanation for these evidential ADCs as long as we believe that consciousness is only a side effect of a functioning brain, and that death is the end of our consciousness.

5 A. ADC with information exchange. [182]: '*I have never been an overly religious person. I am reluctant to tell many people this incident but was compelled to write to you after reading this article about NDE. Three years ago my father was murdered. After three weeks the police came to a standstill and put out a call for help in the newspaper. I 'dreamed' of my dad three nights in a row. Each night he told me to look in the files and gave me specific instructions. After the third night I called the head of the ATF who was working on our case. He must have thought I was a real crackpot. But I had looked in my dad's files. In my 'dream' he had given me a date and a name. Sure enough, the name was there. The ATF-agents contacted that person, and he gave the police the names of the people who were involved in my father's murder. I really can't give you any more details on this—we haven't gone to trial yet and there is a gag order issued. I don't claim to be psychic. I don't have any idea why these things have happened to me. But it makes me wonder and curious.'*

5 B. Shared ADC. [183]: *'I would like to tell you about my mother, who had a massive brain hemorrhage three years ago. It left her paralyzed and unable to speak, and she died about six months later. Three days after her funeral, the following happened: I was sleeping when suddenly a strange cold feeling woke me. I was sleeping on my right side, and when I woke up I rolled onto my left, sensing something there. And to my big surprise, I saw my mother! She was dressed in white, surrounded by a radiant white light, and smiling; she was beautiful. She touched me on the shoulder and told me, though not with words: "Everything is all right now, and there is nothing for you to worry about." I wanted to respond, but somehow or other I fell*

back asleep. I didn't wake up again until the following morning, and it wouldn't have been anything other than a strange dream had it not been for the following incident: From the moment I woke up, I kept thinking about what had happened that night, and in the afternoon I went to my father's room to talk to him about it. But to my big surprise, my father said, "You'll never guess what happened last night!" And my father told me: "In the middle of the night, a cold feeling woke me, and when I turned around and sat up I saw your mother at the other end of the bed. She was radiating light, she was dressed in white, she looked happy, and she touched me and said that I shouldn't be worried about her and that she would take good care of us." And after that my father had fallen asleep again! Neither of us had ever experienced anything like it; neither of us had ever heard anything about contact with the dead. My father is a rational doctor and never mentioned it again. I never 'dreamed' about my mother again. But I'm convinced that it wasn't a dream. I'm convinced of this, because my father and I had the same experience, during the same night, without realizing it.'

6. Mediums claim to be in contact with the consciousness of deceased relatives.

Mediumship is still regarded as one of the most controversial areas of consciousness research, but besides several impressive anecdotes about the performances and results of some well-known mediums in the last 150 years, there have been some interesting and meticulous publications about mediumship recently [184]. The results of these studies suggest that certain mediums can anomalously receive accurate information about deceased individuals [185].

It is also possible for those who have experienced an NDE to become well-educated and skilled evidential mediums, even though they were originally successful engineers or applied materialist scientists [186]. As result of experiences of enhanced consciousness during many years of deep meditation, a former US Navy commanding officer and aide to the Chairman of the Joint Chiefs of Staff totally unexpectedly became a highly credible and evidence-based medium [187]. So an NDE or a spiritual experience during meditation can give rise to a permanent change in the receptivity of the brain towards a 'lower threshold of consciousness' and thus facilitate the reception of evidential information about the consciousness of deceased persons.

7. Reincarnation. When I give lectures about NDE and about the continuity of consciousness after physical death, I often receive questions from the audience whether consciousness can return in a new body. The belief in reincarnation, or the transmigration of the 'soul', has been common throughout history and in many cultures and religions [188]. Nowadays fewer people are open to this possibility. But the scientific studies on reincarnation have generally found that small children between the ages of two to four may spontaneously begin to speak about experiences they had in a previous life in many details, and usually with intense emotions and nightmares. The child nearly always describes his mostly violent death in a previous life. There have been many well studied and quite convincing cases of reincarnation, even with birthmarks corresponding to burns, knife wounds, and other violent traumas that caused the death in a previous life [189, 190]. Presumably, these cases of spontaneous reports of reincarnation can be understood as nonlocal information exchange with the consciousness of deceased persons who experienced a violent and unexpected death.

Healthcare

It is now clear to me that research on NDE, ELE, ADC, and other experiences of nonlocal consciousness may be of great help in changing our ideas about death because, based on these experiences, it seems beyond reasonable doubt that there must be a continuity of consciousness after the death of our body. And knowledge about the continuity of consciousness can be of great practical significance to health care practitioners and to dying patients and their families. They all ought to be aware of the extraordinary conscious experiences that may occur during a period of clinical death or coma (NDE), around the deathbed and the dying (ELE, shared death experiences), or even after death (ADC). All these experiences often result in significant life changes, including the loss of the fear of death. By accommodating rather than judging these experiences, patients and their families are given a chance to integrate them into the rest of their lives. In the event of an NDE, ELE, or ADC, the doctor, therapist, or family member should not reject the experience as a pathological or anomalous incident but regard it as an existential and spiritual crisis, with all the disorientation and psychological problems such a crisis entails. Such experiences of enhanced consciousness are much more common than previously assumed, and the personal consequences of such an experience are far more profound than doctors, nurses, and relatives ever imagined. Openness, sympathy, and proper support will help people with an NDE, ELE, or ADC, as well as their family, to accept and integrate their experience. Continuing improvement of the quality of health care is not just contingent on technical and medical advances, but also on compassion for individual patients and their families [191].

A new perspective on death, which conceives of a continuity of consciousness after physical death, will have consequences for the way in which health care providers deal with patients in a coma, with terminally ill or dying patients, and with stories about contact with the consciousness of deceased relatives. Obviously, more knowledge about the possible continuity of consciousness after death also influences our ideas about the removal of organs for transplantation from somebody in the process of dying, with a beating heart in a warm body, but with a diagnosis of brain death [192].

The primacy of consciousness

Based on the scientific research about NDE in survivors of cardiac arrest, with the uniform conclusions about the continuity and the nonlocality of consciousness, and based on conclusions from recent consciousness research [193, 194, 195, 196], today more and more cognitive scientists, neuroscientists, and philosophers are coming to the inevitable conclusion that it is extremely unlikely that consciousness is a product of brain function, and that consciousness must be primary and fundamental. According to Chalmers, consciousness should be regarded as a fundamental property of the universe, and this view acknowledges a clear causal role for consciousness in the physical world [197, 198]. The English physicist, astronomer, and mathematician Sir James Jeans (1877-1946) wrote many years ago [199]: *'I incline to the idealistic theory that consciousness is fundamental, and that the material universe is derivative from consciousness, not consciousness from the material universe'.* Even the famous Nobel Prize winner and originator of quantum theory Max Planck (1858-1947) said [200]: *'I regard consciousness as fundamental. I regard matter as derivative from consciousness. We cannot get behind consciousness. Everything that we talk about, everything that we regard as existing,*

postulates consciousness'. Recently this was confirmed by Donald Hoffman, an American cognitive scientist, who wrote [201]: *'Conscious realism is a non-physicalist monism: Consciousness is ontologically fundamental. Consciousness is first; matter and fields depend on it for their very existence'.* And as quantum physicist Jude Currivan argues [202]: *'We, our consciousness, and all things in the universe, are non-locally connected with each other and with all other things in ways that are unfettered by the hitherto known limitations of space and time".*

Based on recent research about the nonlocality of consciousness I am now convinced that consciousness is fundamental and that everything originates from consciousness. Consciousness creates our subjective reality. There is no beginning nor will there ever be an end to consciousness. Death is only the end of our physical body, but not the end of our consciousness.

We need a new 'post-materialist' approach in science to accept this new insight. However, we should acknowledge that new ideas in science are usually ridiculed, neglected, and only slowly adopted, as the philosopher and psychologist William James (1842-1910) wrote many years ago [203]: '*First, you know, a new theory is attacked as absurd; then it is admitted to be true, but obvious and insignificant; finally it is seen to be so important that its adversaries claim that they themselves discovered it'*. Unfortunately, new ideas in science are nowadays still not easily accepted at all.

In conclusion

Scientific research on NDE in survivors of cardiac arrest appears to provide evidence of a continuity of consciousness after physical death. Consciousness is eternal, and outside of space and time. Interestingly, across all times and in many cultures, people have been convinced that the essence of man, usually known as the soul, lives on after the death of the body. So, an NDE seems to be a personal re-discovery of wisdom and insight that is ages and ages old, but nowadays seem to be forgotten. In the past these experiences were often known under different names, such as visions or mystical, religious, or enlightenment experiences, and in antiquity they were referred to as journeys to the underworld. Nowadays, we would classify most of these cases as near-death experiences. Here I would like to quote Plato (427-347 BC), who wrote more than 2000 years ago about the NDE or 'vision' of the soldier Er, who was thought to be dead for more than 10 days, and he also wrote [204, 205]: *'And what is that which is termed death, but this very separation and release of the soul from the body? Time does not exist in the spiritual world. The ephemeral, material body is the temporary bearer of the soul, which is eternal. [...] The soul, free from the body, comes into contact with the dead. [...] Death is an awakening, a remembering of the soul*'.

To summarize: an NDE is both an existential crisis and an intense lesson in life. People permanently change after an NDE as it gives them a conscious experience of a nonlocal dimension in which time and distance play no role, in which past and future can be glimpsed, where they feel complete and healed, and where they experience unlimited wisdom and unconditional love. Following an NDE most people realize that everything and everyone is always connected, that every thought influences both themselves and the other, and that our consciousness continues beyond physical death.

We should realize that when people still believe that death is the end of everything we are, including our consciousness, they will give their energy only towards the temporary and

material aspects of their life. Their lives will be just about competition and about making more money. In their short-sightedness they will forget how we are interconnected with each other and with nature. They will forget to reflect on the future of our planet, where our children and our grandchildren will have to live and survive. To quote Dag Hammerskjöld (1905-1961) [206]: '*Our ideas about death define how we live our life.'*

It often takes an NDE or another experience of nonlocal consciousness (ELE, ADC) to get people to think about the possibility of experiencing consciousness independently of the body and to realize that our consciousness always has been and always will be, that everything and everybody is connected, that our thoughts and memories will exist forever, and that death as such does not exist. The results and conclusions of scientific studies on NDE in survivors of cardiac arrest may hopefully stimulate the scientific community to ask open questions and to reconsider some assumptions and preconceptions about life and death, and about consciousness and its relationship with brain function.

I hope that in the coming years we will accept nonlocal concepts to understand how we are, and always will be, interconnected with each other, also after physical death, and that we must change our personal consciousness, not only to change the way we live but also to change the way we treat people who are willing and able to share their NDE, ELE, or ADC with us. Their lives changed in ways they were not prepared for, and they all tell us that they fundamentally changed their ideas about life and death, because, and I quote: '*You can be physically dead but your mind lives on'.* Another quote: '*Death was not death, but another form of life'*.

Consciousness seems to be our essence, and once we leave our body, leave our physical world, we exist as pure consciousness, beyond time and space, and we are enfolded in pure, unconditional love. Obviously, this new insight helps us to better understand the inevitable conclusion about the continuity of human consciousness after the death of our body.

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