

*In his "Sceptic" column in Scientific American in March, 2003, Michael Shermer cited a research study published in The Lancet, a leading medical journal, by Pim van Lommel and colleagues. He asserted this study "delivered a blow" to the idea that the mind and the brain could separate. Yet the researchers argued the exact opposite, and showed that conscious experience outside the body took place during a period of clinical death when the brain was flatlined. As Jay Ingram, of the Canadian Discovery Channel, commented: "His use of this study to bolster his point is bogus. He could have said, 'The authors think there's a mystery, but I choose to interpret their findings differently'. But he didn't. I find that very disappointing" (Toronto Star, March 16, 2003). Here, Pim van Lommel sets out the evidence that Shermer misrepresented.*

## Medical Evidence for NDEs ~ A Reply to Shermer

*by Pim van Lommel*

Only recently someone showed me the "Sceptic" article\* by Michael Shermer. From a well respected and, in my opinion, scientific journal like the Scientific American I always expect a well documented and scientific article, and I don't know how thoroughly peer-reviewed the article from Shermer was by the editorial staff before publication. My reaction to this article by Shermer is because I am the main author of the study published in The Lancet, December 2001, entitled: "Near-death experience in survivors of cardiac arrest; a prospective study in the Netherlands". About what he writes about the > conclusions from our study, as well as from the effect of magnetic and electrical "stimulation" of the brain, forces me to write this paper, because I disagree with his theories as well as with his conclusions.

We performed our prospective study in 344 survivors of cardiac arrest to study the frequency, the cause and the content of near-death experience (NDE). A near-death experience is the reported memory of all impressions during a special state of consciousness, including specific elements such as out-of-body experience, pleasant feelings, and seeing a tunnel, a light, deceased relatives, or a life review.

In our study 282 patients (82%) did not have any memory of the period of unconsciousness, 62 patients (18%) however reported a NDE with all the "classical" elements. Between the two groups there was no difference in the duration of cardiac arrest or unconsciousness, intubation, medication, fear of death before cardiac arrest, gender, religion, education or foreknowledge about NDE. More frequent NDE was reported at age younger than 60 years, more than one cardiopulmonary resuscitation (CPR) during hospital stay, and previous NDE. Patients with memory defects after lengthy and complicated CPR reported less frequent NDE.

There are several theories that should explain the cause and content of NDE. The physiologic explanation: the NDE is experienced as a result of anoxia in the brain, possibly also caused by release of endomorphines, or NMDA receptor blockade. In our study all patients had a cardiac arrest; they were clinically dead, unconscious, caused by insufficient blood supply to the brain because of inadequate blood circulation, breathing, or both. If in this situation CPR is not started within 5-10 minutes, irreparable damage is done to the brain and the patient will die. According to this theory, all patients in our study should have had an NDE, they all were clinical dead due to anoxia of the brain caused by inadequate blood circulation to the brain, but only 18% reported NDE.

The psychological explanation: NDE is caused by fear of death. But in our study only a very small percentage of patients said they had been afraid the seconds preceding the cardiac arrest, it happened too suddenly to realise what occurred to them. However, 18% of the patients reported NDE. And also the given medication made no difference. We know that patients with cardiac arrest are unconscious within seconds, but how do we know that the electro-encephalogram (EEG) is Flat-lined in those patients, and how can we study this?

Complete cessation of cerebral circulation is found in cardiac arrest due to ventricular fibrillation (VF) during threshold testing at implantation of internal defibrillators. This complete cerebral ischaemic model

can be used to study the result of anoxia of the brain.

In VF complete cardiac arrest occurs, with complete cessation of cerebral flow, and resulting in acute pancerebral anoxia. The  $M_{ca}$ , the middle cerebral artery blood flow, which is a reliable trend monitor of the cerebral blood flow, decreases to 0 cm/sec immediately after the induction of VF (2). Through many studies in human, as well as in animal models, cerebral function has been shown to be severely compromised during cardiac arrest and electric activity in both cerebral cortex and the deeper structures of the brain has been shown to be absent after a very short period of time. Monitoring of the electric activity of the cortex (EEG) has shown ischaemic changes consisting of a decrease of fast high amplitude waves and an increase of slow delta waves, and sometimes also an increase in amplitude of theta activity, progressively and ultimately declining to isoelectricity. More often initial slowing (attenuation) of the EEG waves is the first sign of cerebral ischaemia. The first ischaemic changes in the EEG are detected an average of 6.5 seconds after circulatory arrest. With prolongation of the cerebral ischaemia always a progress to an isoelectric (flat) line is monitored within 10 to 20 (mean 15) seconds from the onset of the cardiac arrest (3- 6).

In case of a prolonged cardiac arrest of more than 37 seconds the EEG activity may not return for many minutes to hours after cardiac arrest has been restored, depending of the duration of cardiac arrest, in spite of the maintenance of adequate blood pressure during the recovery phase. After defibrillation the middle cerebral artery flow velocity recurred rapidly within 1-5 seconds regardless the arrest duration. However, the EEG recovery takes more time, depending of the duration of cardiac arrest. EEG recovery underestimates metabolic recovery of the brain, and cerebral oxygen uptake may be depressed for a considerable time after restoration of circulation because the initial overshoot on reperfusion (hyperoxia) is followed by a significant decrease in cerebral blood flow. (7)

Anoxia causes loss of function of our cell systems. However, in anoxia of only some minute's duration this loss may be transient, in prolonged anoxia cell death occurs with permanent functional loss. During an embolic event a small clot obstructs the blood flow in a small vessel of the cortex, resulting in anoxia of that part of the brain with loss of electrical activity. This results in a functional loss of the cortex like hemiplegia or aphasia. When the clot is resolved or broken down within several minutes the lost cortical function is restored. This is called a transient ischaemic attack (TIA). However, when the clot obstructs the cerebral vessel for minutes to hours it will result in neuronal cell death with a permanent loss of function of this part of the brain, with persistent hemiplegia or aphasia, and the diagnosis of cerebrovascular accident (CVA) is made. So transient anoxia results in transient loss of functions.

In cardiac arrest global anoxia of the brain occurs within seconds. Timely and adequate CPR reverses this functional loss of the brain because definitive damage of the brain cells, resulting in cell death, has been prevented. Long lasting anoxia, caused by cessation of blood flow to the brain for more than 5-10 minutes, results in irreversible damage and extensive cell death in the brain. This is called brain death, and most patients will ultimately die. In acute myocardial infarction the duration of cardiac arrest (VF) on the CCU is usually 60-120 seconds, on the cardiac ward 2-5 minutes, and in out-of-hospital arrest it usually exceeds 5-10 minutes. Only during threshold testing of internal defibrillators or during electro physiologic stimulation studies will the duration of cardiac arrest hardly exceed 30-60 seconds.

From these studies we know that in our prospective study of patients that have been clinically dead (VF on the ECG) no electric activity of the cortex of the brain (flat EEG) must have been possible, but also the abolition of brain stem activity like the loss of the corneareflex, fixed dilated pupils and the loss of the gag reflex is a clinical finding in those patients. However, patients with an NDE can report a clear consciousness, in which cognitive functioning, emotion, sense of identity, and memory from early childhood was possible, as well as perception from a position out and above their "dead" body. Because of the sometimes reported and verifiable out-of-body experiences, like the case of the dentures reported in our study, we know that the NDE must happen during the period of unconsciousness, and not in the first or last second of this period.

So we have to conclude that NDE in our study was experienced during a transient functional loss of all functions of the cortex and of the brainstem. It is important to mention that there is a well documented report of a patient with constant registration of the EEG during cerebral surgery for an gigantic cerebral aneurysm at the base of the brain, operated with a body temperature between 10 and 15 degrees, she was put on the heart-lung machine, with VF, with all blood drained from her head, with a flat line EEG, with clicking devices in both ears, with eyes taped shut, and this patient experienced an NDE with an out-

of-body experience, and all details she perceived and heard could later be verified. (8)

There is also a theory that consciousness can be experienced independently from the normal body-linked waking consciousness. The current concept in medical science states that consciousness is the product of the brain. This concept, however, has never been scientifically proven. Research on NDE pushes us at the limits of our medical concepts of the range of human consciousness and the relationship between consciousness and memories with the brain.

For decades, extensive research has been done to localise memories inside the brain, so far without success. In connection with the hypothesis that consciousness and memories are stored inside the brain the question also arises how a non-material activity such as concentrated attention or thinking can correspond with a visible (material) reaction in the form of a measurable electrical, magnetic and chemical activity at a certain place in the brain. Different mental activities give rise to changing patterns of activity in different parts of the brain. This has been shown in neurophysiology through EEG, magneto-encephalogram (MEG) and at present also through magnetic resonance imaging (MRI) and positron emission tomography (PET-scan). (9-11) Also an increase in cerebral blood flow is observed during such a non-material activity like thinking (12). It is also not well understood how it is to be explained that in a sensory experiment following a physical sensation the person involved in the test stated that he was aware (conscious) of the sensation a few thousands of a second following the stimulation, while the subject's brain showed that neuronal adequacy wasn't achieved until after a full 500 msec. following the sensation. This experiment has led to the so-called delay-and-antedating hypothesis (13).

Most body cells, and especially all neurons, show an electrical potential across cell membranes, formed by the presence of a metabolic Na/K pump. Transportation of information along neurons happens by means of action potentials, differences in membrane potential caused by synaptic depolarisation (excitatory) and hyperpolarisation (inhibitory). The sum total of changes along neurons causes transient electric fields, and therefore also transient magnetic fields, along the synchronously activated dendrites. Not the number of neurons, the precise shape of the dendrites (dendritic tree), nor the accurate position of synapses, neither the firing of individual neurons is crucial, but the derivative, the fleeting electric and/or magnetic fields generated along the dendrites. These should be shaped as optimally as possible into short-lasting meaningful patterns, constantly changing in four-dimensional shape and intensity (self-organisation), and constantly mutually interacting between all neurons. This process can be considered as a biological quantum coherence phenomenon. The influence of external localised magnetic and electric fields on this constant changing electric and/or magnetic fields during normal function of the brain should now be mentioned.

Neurophysiological research is being performed using transcranial magnetic stimulation (TMS), in the course of which a localised magnetic field (photons) is produced. TMS can excite or inhibit different parts of the brain, depending of the amount of energy given, allowing functional mapping of cortical regions, and creation of transient functional lesions. It allows assessing the function in focal brain regions on a millisecond scale, and it can study the contribution of cortical networks to specific cognitive functions. TMS is a non-invasive research tool to study aspects of human brain physiology including motor function, vision, language, and the pathophysiology of brain disorders as well as mood disorders like depression, and it even may be useful for therapy. In studies TMS can interfere with visual and motion perception, it gives an interruption of cortical processing with an interval of 80-100 milliseconds. Intracortical inhibition and facilitation are obtained by paired-pulse studies with TMS, and reflect the activity of interneurons in the cortex. Also TMS can alter the functioning of the brain beyond the time of stimulation, but it does not appear to leave any lasting effect. (14).

Interrupting the electrical fields of local neuronal networks in parts of the cortex also disturbs the normal function of the brain, because by localised electrical stimulation of the temporal and parietal lobe during surgery for epilepsy the neurosurgeon and Nobel prize winner W. Penfield could sometimes induce flashes of recollection of the past (never a complete life review), experiences of light, sound or music, and rarely a kind of out-of-body experience. These experiences did not produce any transformation. (15- 16)

After many years of research he finally reached the conclusion that it is not possible to localise memories inside the brain. Olaf Blanke also recently described in Nature a patient with induced OBE by inhibition of cortical activity caused by more intense external electrical stimulation of the gyrus angularis in a patient

with epilepsy (17).

The effect of the external magnetic or electrical stimulation is dependent of the amount of energy given. There may be no clinical effect or sometimes stimulation is seen when only a small amount of energy is given, for instance during stimulation of the motoric cortex. But during "stimulation" with higher energy inhibition of local cortical functions occurs by extinction of the electrical and magnetic fields resulting in inhibition of local neuronal networks (personal communication Blanke). Also in the patient described by Blanke in Nature stimulation with higher electric energy was given, resulting in inhibition of the function of the local neuronal networks in the gyrus angularis.

And when for instance the occipital visual cortex is stimulated by TMS, this results not in a better sight, but instead it causes temporary blindness by inhibition of this part of the cortex. We have to conclude that localised artificial stimulation with real photons (electrical or magnetic energy) disturb and also inhibit the constant changing electrical and magnetic fields of our neuronal networks, and so influence and inhibit the normal function of our brain.

In trying to understand this concept of mutual interaction between the "invisible and not measurable" consciousness, with its enormous amount of information, and our visible, material body it seems wise to compare it with modern worldwide communication.

There is a continuous exchange of objective information by means of electromagnetic fields (real photons) for radio, TV, mobile telephone, or laptop computer. We are unaware of the innumerable amounts of electromagnetic fields that constantly, day and night, exist around us and through us as well as through structures like walls and buildings. We only become aware of these electromagnetic informational fields the moment we use our mobile telephone or by switching on our radio, TV or laptop. What we receive is not inside the instrument, nor in the components, but thanks to the receiver the information from the electromagnetic fields becomes observable to our senses and hence perception occurs in our consciousness. The voice we hear in our telephone is not inside the telephone. The concert we hear in our radio is transmitted to our radio. The images and music we hear and see on TV is transmitted to our TV set. The Internet is not located inside our laptop. We can receive at about the same time what is transmitted with the speed of light from a distance of some hundreds or thousands of miles. And if we switch off the TV set, the reception disappears, but the transmission continues. The information transmitted remains present within the electromagnetic fields. The connection has been interrupted, but it has not vanished and can still be received elsewhere by using another TV set. Again, we do not realise us the thousands of telephone calls, the hundreds of radio and TV transmissions, as well as the Internet, coded as electromagnetic fields, that exist around us and through us.

Could our brain be compared with the TV set that electromagnetic waves (photons) receives and transforms into image and sound, as well as with the TV camera that image and sound transforms into electromagnetic waves (photons)? This electromagnetic radiation holds the essence of all information, but is only conceivable to our senses by suited instruments like camera and TV set.

The informational fields of our consciousness and of our memories, both evaluating by our experiences and by the informational input from our sense organs during our lifetime, are present around us as electrical and/or magnetic fields [possible virtual photons? (18)], and these fields only become available to our waking consciousness through our functioning brain and other cells of our body.

So we need a functioning brain to receive our consciousness into our waking consciousness. And as soon as the function of brain has been lost, like in clinical death or in brain death, with iso-electricity on the EEG, memories and consciousness do still exist, but the reception ability is lost. People can experience their consciousness outside their body, with the possibility of perception out and above their body, with identity, and with heightened awareness, attention, well-structured thought processes, memories and emotions. And they also can experience their consciousness in a dimension where past, present and future exist at the same moment, without time and space, and can be experienced as soon as attention has been directed to it (life review and preview), and even sometimes they come in contact with the "fields of consciousness" of deceased relatives. And later they can experience their conscious return into their body.

Michael Shermer states that, in reality, all experience is mediated and produced by the brain, and that

so-called paranormal phenomena like out-of body experiences are nothing more than neuronal events. The study of patients with NDE, however, clearly shows us that consciousness with memories, cognition, with emotion, self-identity, and perception out and above a life-less body is experienced during a period of a non-functioning brain (transient pancerebral anoxia). And focal functional loss by inhibition of local cortical regions happens by "stimulation" of those regions with electricity (photons) or with magnetic fields (photons), resulting sometimes in out-of-body states.

To quote Michael Shermer: it is the job of science to solve those puzzles with natural, rather than supernatural, explanations. But one has to be aware of the progress of science, and to study recent literature, to know what is going on in current science. For me science is asking questions with an open mind, and not being afraid to reconsider widely accepted but scientifically not proven concepts like the concept that consciousness and memories are a product of the brain. But also we should realise that we need a functioning brain to receive our consciousness into our waking consciousness. There are still a lot of mysteries to solve, but one has not to talk about paranormal, supernatural or pseudoscience to look for scientific answers on the intriguing relation between consciousness and memories with the brain.

\* Michael Shermer, 'Demon-Haunted Brain' *Scientific American*, page 25, March 2003.

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