

# WE ARE OUR BRAIN

Brains, consciousness and faith: neurobiological aspects

Everything we think and do is determined and carried out by our brain. The unheard evolutionary success of mankind and the many restrictions of the individual human being are determined by this organ. The build of this incredible machine determines our possibilities, our restrictions and our character; we are our brain. The rest of our body is merely here to feed our brain, to move and to make new brains by reproduction.

Brain research isn't just a search for handicaps, but is evolving more and more into a search with the central question why we are the way we are, a quest to find ourselves.



The building stones of our brain are nerve cells or neurons. They specialise in (i) the gathering of information from other nerve cells and hormones from the rest of our body and, through our sense organs, from our environment; (ii) the integration and processing of this information, taking decisions about these matters and (iii) the execution of decisions in the form of movement, hormones, regulating the body processes, and the production of an endless stream of thoughts. I am not impressed by the evidential value that comes with the anecdotes of heart transplant patients who experience a change of character in which the distinct characteristics of the donor come forth (Pearsal et al., *J. of Near-Death studies* 20, 191, 2002). If we want to take these cases seriously we have to have a good controlled study. There must be a certainty that the recipient doesn't get any information about the donor. There can't be unwanted manipulations of the interviews and the effect of medicines which are taken after the transplant must be taken into account.

### The computer metaphore

If we consider the brain to be an information processing machine, the computer metaphor isn't that bad. Also, when we look how the building stones of our brain work, this metaphor comes to mind. The brain weighs 1,500 grams and consists of 100 billion (10x10<sup>10</sup>) neurons (about 20 times more than there are people in the world), twice as much glia cells (the glia is a support tissue in the central nervous system) and at least 1000 times as much places here nerve cells make contact or, as Cajal put it, holding each others hand, the synapses. The nerve cells are bound by over 100.000 km of nerve fiber. These dazzling amounts of cells and contacts work so efficiently that our brain has the energy consumption of just a 15 Watts light bulb. This means that the entire energy costs of one person during his entire life, considering the current prices, are less than 1000 euro, as Michel Hofman calculated. You can't get a decent computer for that kind of money. An incredible machine with parallel switches, better equipped for image processing and associating than any computer. The nucleus suprachiasmaticus, the clock of our brain, is just ½ mm<sup>3</sup> in size. This is enough to control all of our day and night rhythm (wake/sleep, eat, drink, reproducing, hormone mirrors, etc.). With 1500 cm<sup>3</sup> of brain (3 million times as many) we can do a lot. The product of the functioning and interaction of all those billions of nerve cells is our 'mind'. In this materialistic view, the spirit isn't replaced by matter but the spirit is the product of matter, of our brain cells.

Disorders in the build up of this efficient information processing machine during the development or later in life result in psychiatric or neurological illness or sickness in the hormone production by nerve cells. Not long ago psychiatrists healed about fifty percent of their patients with psychoanalytic therapy, the rest of the patients on the waiting list healed themselves. Now these disease patterns can be treated in a better way by influencing the chemical messengers with psycho pharmaceuticals. With the help of a microscope you can see that the normal brain development of a patient suffering from schizophrenia is disrupted halfway during pregnancy; because of this schizophrenia became a brain disorder, which is now easier to treat with medicine. To quote the awarded poet Kees Winkler: 'If I don't take my pills, I become more schizo than phrenic'. Anti-

depressants are so successful that there is a lot of abuse. With cancer, terminal pain can be treated by stimulating a brain electrode, which is implanted in the central grey area of the brain, by your self. This way opium-like substances are set free in the brain and the pain will become bearable. Stimulation using such deep electrodes is now also used to treat the shaking which occurs when you have Parkinson disease, clustered headaches and to treat compulsive actions. A gene is discovered which, in a certain family, is responsible for excessive aggression. Somewhere on the x-chromosome there is a gene that could increase the chance of becoming homosexual. There are brain scans that make activated areas in the brain light up that we use to read, do maths, listen to music, hallucinate, to be in love or to display sexual behavior. Damage in the front area of the cerebral cortex (= prefrontal cortex) can lead to dysfunctional social and ethical behavior (Anderson et al., 1999). Pieces of brain tissue from a fetus are transplanted to treat Parkinson's disease. New discoveries are made in rapid succession because of the recent huge technical progression made in neurosciences.

### We transform our own brain into an unique machine

The computer metaphor is only partly applicable. The 'hardware' of our brain isn't just soft, but some systems are also very plastic. Our brain is a living machine, which changes constantly by using it, especially during the development. Everything we do and observe during the development of our brain can result in a permanent change concerning the number of cells, circuits and cell contacts. Our environment and the use of our brain strongly and permanently influence the build and so the function of the brain. That is why our brain becomes permanently uneven in build and function; the brains of identical twins are unique because of this. Genetics are just a small factor when it comes to the development of the brain. The brain development of a child is influenced in the uterus by hormones and the amount of stress that the mother experiences. The development is endangered by medicines, alcohol and nicotine used by the mother during pregnancy. If the mother smokes, the offspring is more likely to become aggressive and criminal. The brain produces massive amounts of cells and connections. The way the brain systems function determines which cells and connections will remain to exist. The brain cells struggle for life is called 'neuronal Darwinism'. Not only the way a child is practising his movements decides the build of the brain, and the later functioning, but the build and functioning of our brain is also permanently organised by everything the child experiences, sees and thinks. Multiple factors influence the brain in the early development stages. They decide, later in life, how we experience ourselves: a man or a woman (gender) and if our gender matches with our sexual organs. With transsexuals we found female brain structure in male brains and vice versa. The characteristics of this structure match the feeling to be a woman or a man, not the genetic gender or the gender of the sexual organs. Our sexual orientation is also determined in the uterus by an interaction between sexual hormones and developing brain cells. The foundation of this behaviour is concealed in the non-plastic structures of our brain, which explains why no doctor has ever 'healed' a transsexual believing he or she is of the opposite sex, or to change a homosexual into a heterosexual. During the first years of our life our environment also determines the build of brain systems related to lan-

guage. That's why we have one permanent native language. In some brain areas, the development of new contacts between nerve cells goes on until after our 65th birthday. Because no one's experiences and thoughts are the same, every brain becomes unique during the development process. This is how character and personality come into being. Our brain creates our culture and our culture shapes the development of our brain. We make our own brain unique – into a person, and sometimes even into a personality.

### Free will?

Our brain is unique and that's why we are able to produce a unique poem or painting, or to create unique experiments. Eccles believes that the evidence of free will is the creativity of the scientist. But this surely doesn't prove the theory of free will. Not coincidentally, in very different parts of the world, the same 'unique' find is made by very creative scientists on a very frequent basis. The 'discovery' of art was made about 35,000 years ago, around the same time in the Ardeche in France, in Australia and in Africa. Apparently, the unique expression of human creativity depends on the development stages of the brain. The brain remains a machine, from which we can theoretically, if we would know the input and build of the brain, know every detail. With reasonable certainty we could predict what will come out under certain circumstances. Because of the complexity of these connections within the human brain we are not (yet) able to do this for one individual, but this doesn't prove the existence of a free will. Groups of people behave so predictably that free will just seems imaginary and suggested by the enormous complexity of our environments and our behaviour. According to Spinoza free will didn't exist and a new argument for its existence isn't given yet. How 'free' are we essentially? From the menu of life we can choose between meat, fish or vegetarian food, but the really important choice, how much and when we eat, is predetermined. The difficult decision to start a war usually will be made during the summer in the northern hemisphere and during the winter in the southern hemisphere. Near the equator this decision will be made depending on the season. This has been the case for centuries.

Not the 'reason' or 'free will', but the amount of daylight or the temperature influence this important decision. When free will doesn't exist, legal and ethical guild don't exist either. This is by no means an argument against legal punishment. For the next time our brain machine takes the punishment into consideration when deciding to do something or not.

The law believes that free will is reserved for humans with a healthy brain. It is true that damaged brain structures could cause arm movements, without the patient having that intention

(alien hand syndrome). Patients with cut connections between the left and right half of the brain or with a damaged medial frontal cortex sometimes are not able to recognise their limbs as their 'own'. These limbs can act independently from the owner. The two hands operate in completely opposite ways (one dresses, the other one undresses). A patient's hand grabbed her own throat and tried to strangle her. Alien hand syndrome could occur also with patients who suffer from corticobasal degeneration, an illness which makes parts of the brain degenerate (Biran and Chatterjee, 2004).

The law suggests that a healthy brain is needed to have free will. Are you someone with a healthy brain? Is that even possible after everything we have been through after our conception? How healthy is our brain with all the mutations and different shapes we are born with, and all the damage in DNA that we have received after that? Doreleijers (1995) found 5 to 7 times more psychopathology with juvenile delinquents who appeared in juvenile court in comparison to the average youngster of the same age. Can we hold them responsible for their actions? How 'free' and 'responsible' were these kids? Child molesters are molested themselves in their childhood. How 'free' is a child molester in deciding not to go down the same path? How 'free' is a youngster whose brain must learn to deal with sexual hormones in a very short amount of time, sexual hormones that change the functioning of almost every part of the brain structure?

Also the predictability of the pattern of the number of aggressive suicides per season does not indicate the involvement of free will when it comes to committing suicide. The brain of RAF-terrorist Ulrike Meinhof proved to be damaged after her suicide in 1976. She had an aneurism (= a bulging of a blood vessel) before that pressed on the amygdale. The prefrontal cortex was damaged during surgery. Both, the aneurism and the damage by neurosurgery could explain her transformation from a critical journalist into a terrorist. How free was her will? A damaged prefrontal cortex in the early life stages results in disrupted social and ethical behaviour (theft, aggressive behavior) when that person reaches adulthood. Many other illnesses of the brain can lead to aggressive / criminal behaviour as well.

Even though some have said that sexual orientation like heterosexuality, homosexuality and bisexuality are 'choices', research shows that sexual orientation is predetermined during the early development, by the influence of genetic and epi- (= later developed) genetic factors (hormones, medicine and stress during pregnancy) on the developing brain structures. Homosexuality was not removed from the ICD-10 (International Classification of Diseases) until 1992. Before that people tried and failed to 'cure' homosexuality with prison sentences, aversion therapy

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with electro shocks, nausea induced by a chemical substance (apomorphine), therapy using female hormones (estrogen), castration and religious counseling (Smitt et al., 2004). According to Antonio Damasio there is a brain area that is the energy source for all our activities, the external (our motion) and the internal (our thoughts and reasoning), this would be the frontal part of the cerebral cortex (namely the gyrus cinguli). Francis Crick (p. 267) said that this is the area where free will comes from, but the argumentation only applies to 'the will' in the sense of taking initiative; Crick himself asks the question: 'Could it not be that our will only appears to be free?' (p. 10, p. 266). The existence of a genetic foundation for addiction, aggression and sexual orientation leads to the understanding that our behaviour is predetermined on some level ('neurocalvinism'). Indeed, it is exceptionally unpleasant if you are ordered to do something that clearly isn't your own free will. But you don't care, as long as it appears you are doing it of free will. If you feel that you have decided on your own that you will go to the cinema, to the museum or to stay in bed it really doesn't matter if you came to that decision through a completely calculated and predictable manner.

### Development causes limitation

During our development our possibilities are limited by the increasing organisation of our brain. This begins in the uterus. We aren't born as a 'tabula rasa' as Locke and Rousseau thought. During insemmination it has already been decided which defects we will carry and how big the chance is to get dementia. The choice of our native language, sexual orientation and gender is decided during the development stage. A transsexual can't be convinced that he or she doesn't live in the body of the wrong gender and that he or she does not need a gender change. There is no other option, because it is almost impossible to change our brain once it has been organised. The last bit of space we have is restricted after birth by the only efficient way of manipulating the brain: a solid Dutch upbringing. Commercials and television take care of the rest. All across the world you will see teenagers wearing the same designer clothes and listening to the same music. Neuronal Darwinism could be the underlying process for these continuous restrictions, causing our brain to function more and more efficiently, but lose more freedom along the way. The paradox comes to mind that the only one who has all the possibilities, and is truly free, is the fetus. But the fetus can't do anything because its nerve system is still too immature. Once we are adults, there not much left to be changed in our brain and our behaviour. We have gotten a certain 'personality' by then.

### Religion and freedom

According to the Oxford World Christian Encyclopedia there are, at this time, about 10,000 different religions and billions of

believers, all of them are convinced that they belong to the true religion. The Christian tradition has, like any religion, always been presented as the religion of freedom and humanity. It is true, reformed and other religious minded people have done outstanding jobs, for example to help Jewish persons hide in World War II. But humanity and courage aren't solely for religious people. These characteristics are also found with socialists, communists and atheists. And religion has had another unfortunate effect as well on a lot of occasions. In the name of God many people have been killed and lost their freedom. The pope has now reluctantly apologised for the crusades and the persecution of the Jews. A lot more apologies are necessary: for the discrimination of women, gays, transsexuals, for forbidding the use anti-contraceptives and condoms. Many Africans are suffering from AIDS because of this. In Holland there are still children who are unnecessarily infected with polio or German measles, because their parents refuse to have them vaccinated 'in the name of the Lord'. There is fundamentalism in every religion. And there old beliefs that are told as modern truths, and are forced upon others, despite the consequences. The whole world is affected by the conflict between Christianity and Islam. 'God's peace' is forced upon others. Opponents are to be killed or tortured. Every group has its own religion, because religion keeps people together. That is the evolutionary benefit of religion. You have to be able to see who belongs to the group. That it is why it is nonsense to forbid signs of recognition like headscarfs, yarmulkes or crosses. The Jews stuck together as a group, despite the Diaspora, inquisition and the holocaust. From the characteristics of DNA we can see that the roots of this group go back about 3000 years. That was around the time of the Exodus from Egypt (Hamer, 2004). One of the universal mechanisms to hold the group together is the strong 'meme' (= self repeating part of culture), which means it is a sin to marry a heathen. The evolutionary benefit of aggression and discrimination is clear. Mankind has developed for millions of years in an environment where there was just enough food for the own group. An 'other' group (discrimination) posed a threat and had to be destroyed (aggression). A few generations with central heating don't smudge years of evolutionary benefits of religion and aggression. Some optimism seems to be in place here. Both religion (to hold the group together) and aggression (to destroy another) will not be able to keep their evolutionary benefits in the global economy and the information community, but will become less important during the next hundreds of thousands of years. This way true 'freedom' and 'humanity' might emerge.

### Spirituality as a biological foundation for religion

*I believe in God, only I spell it Nature*

(Frank Lloyd Wright) quotation D. Hamer, p. 26.

The choice to be religious or not also doesn't seem to be entirely

'free'. Obviously the environment in which one grows up is a decisive factor, but twin studies also show that genetic factors decide about 50% of our religious interest (Saver and Rabin, 1997). The serotonin system (a chemical messenger) could be a biological foundation for spiritual experiences. Also the fact that LSD, mescaline (from the peyote cactus) and psilocybin can give mystical and spiritual experiences points in this direction. This chemical messenger is also the center of attention because of the recent research by Dean Hamer (The God Gene, 2004). Hamer's research isn't about the unanswerable question 'does God exist?', it is about why human beings believe. Religions are found everywhere in the world. And the items given to the dead, found by archeologists prove that believing in the afterworld isn't just universal but also from all ages.

Hamer discerns spirituality from religion. Spirituality is passed on by our genes for 50% as proved by twin research. Religion is the local fulfilment of this. About 95% of the Americans believe in God, 90% pray, 82% say that God can make miracles happen and over 70% believes in the afterlife. Although in England and Holland, only 5% of the people goes to the church on a regular basis, the amount of spirituality would be the same worldwide. The 'God' gene from Dean Hamer is one of the many genes that decide our predisposition for spirituality. The God gene from Hamer codes for VMAT2, a protein that is involved with producing chemical messengers like serotonin. Hamer found a clear association between minor differences in the DNA of VMAT2 and spirituality.

Following the tradition of Francis Galton, a cousin of Darwin, double blind experiments were held to test the effectiveness of praying, most of the time without results for the one who was prayed for (Roberts et al., 1998) or, if there seemed to be a result, it was filled with methodological errors. The one who prays, and is familiar with this ritual, 'distresses', this is shown by the decrease of the stress hormone cortisol in the blood levels.

Another intriguing encounter between religion and science occurs with the often deep religious experiences that patients with epilepsy experience at the part of the brain that is called the temple bone vortex. During the epileptic seizure, patients are often dreamy and experience hallucinations with strong religious images. They can also have the feeling like they are having an 'out of body experience'. They often undergo emotional changes and can become hyper religious. It appeared that a patient who suffered from ecstatic epileptic seizures saw a figure that looked like Jesus, had a brain tumor. The seizures stopped after the tumor was surgically removed. About 23% of the psychoses after an epileptic seizure have a religious theme. Many founders of large religious movements like the prophet Mohammed and religious leaders like the apostle Paul and Jeanne d'Arc suffered from epilepsy. The same is true for Van Gogh and Dostojevsky. Religious illusions occur with 3% of the schizophrenic patients and are also found with other psychiatric illnesses, like mania, and as the first symptom of frontotemporal dementia (related to chromosome 17) (Saver and Rabin, 1997; Muramoto, 2004). However, hyper religiousness as a epileptic psychiatric symptom is presumably rare. Not only the temporal lobe is involved with such processes, also disruptions in other areas of the brain could lead to mystical experiences described in Christianity, Judaism, and Buddhism. If the prefrontal cortex works too strong it can cause amazing ideas and experiences, and hyper religiousness

(Muramoto, 2004).

## Consciousness

Self-consciousness isn't solely reserved for human beings. A monkey can wipe paint from his face in front of a mirror, and a dog recognises the smell of his own urine. The notion 'consciousness' (conscious of the environment and yourself) has a practical meaning when it comes to determining the death of a patient, to continue to go on with transplanting the organs. Before the transplanting era the notion 'dead' was relatively simple, the irreversible end of the heartbeat and breathing.

Neshama, ruach, nefesh. They all mean 'breath of life' in Hebrew and they are also translated with 'soul'. When the time came that a patient with severe brain damage was connected to breathing devices, this definition of death couldn't be used anymore. The beating of the heart and the breathing continued but the patient was 'unconscious' or 'brain dead'. The diagnose 'dead' was redefined to the irreversible absence of all brain functions. However, a quarter of the brains of brain dead patients still produce enough anti diuretic hormone (ADH = vasopressin) not to get diabetes insipidus. This is a function of the basal part of the brain, the hypothalamus.

The large hormone producing nerve cells in that part of the brain are still alive at that moment. Subsequently 'dead' was defined as the irreversible absence of the 'higher brain functions' (cognition, consciousness). Indeed, the thalamus (= the part of the brain where the information from our sense organs arrive) and cortex (= cerebral cortex) are essential for our consciousness, but certainly not the only involved structures. 'Lower' regions of the brain are also involved with 'higher' functions like memory. The alien hand syndrome, which causes a person to be unaware of the actions of one of his limbs (see note 7), can occur when the left-right connection of the brain is cut.

The self-consciousness can partly drop out. After a brain infarct in the right part of the brain, in which the motor cortex (= muscle driver) inside the prefrontal cortex is damaged, it is possible that a person is paralysed on the left side and denies this (neglect). If the premotoric cortex is damaged, the patient can have the feeling 'this left (paralysed) hand isn't mine' (anosognosia). A patient kept believing that her left side was fully functional and that she was physically independent. In her drawings her left side was missing completely ('if it isn't there I can not neglect it'). If she was asked to move her left arm she said: 'yes, I can do that, but it is better if I give it some rest'. If she was asked to walk, she said: 'I can do that but the doctor said it is better for me to rest'. Some patients also act as if the hospital is their home and they bought the furniture (Venneri and Shanks, 2004; Cooney and Gazzaniga, 2003). It happens that Alzheimer patients aren't aware of their decrease in functioning (anosognosia, Venneri and Shanks, 2004). And how sure are we really that someone with severely damaged functions of the cortex (for example Alzheimer patients) are totally unaware?

With the last definition of 'dead' (the absence of higher functions) there are problems with newborn. Children without large brains are used for transplantation of organs. Indeed, they don't have 'higher' functions. But healthy newborn don't have that either. To that last definition we must add the fact that it is not only that there aren't higher functions, it is also that they can't be developed.

# *Pieces of brain tissue from a fetus are transplanted to treat Parkinson disease*



## **We are our material shell**

Are we 'just' a unique, fantastically complex brain machine consisting of living, continuously changing connections without a free will? Are we 'just' conscious machines? Every culture, every religion however has the, as Freud already acknowledged, concept of the continued existence of 'something' immaterial from our personality after we die. That 'something' is called the soul. The common thought is that the soul remains close to the body just after dying and after that find a permanent place elsewhere. A Surinam coroner assistant of the AMC always knocks on the door three times before he enters the morgue to give a sign that he is coming. The Chinese tradition acknowledges two souls inside a human being: a bodily soul, which stays around the body after death, and a soul that is the bearer of the higher spiritual functions. This one ascends after death. According to the Koran human beings have a soul without a doubt. 'Man's spirit is definitely immortal ... In my opinion the matter is so certain that further explanation would be profitless'. Maimonides (1135 – 1204), a well known Jewish scientist, also assumes that the soul is immortal in his writings, which according to Descartes (1662) is localized in the epiphyses. Thomas Willes (1621 – 1675), who build a foundation for neurology, discerns three forms of the soul: a vital, a rational and an immortal soul. Only human beings would have an immortal soul, the other two would also be found in animals. Spinoza described the same idea as: 'The human spirit (soul is better, you will see later on) can't fuse together with the body' (XXIII, Ethica, 1677). Yet he remained to doubt the existence of an immortal soul. In 1906 dying patients were placed on a balance while lying in their beds by McDouglas (USA). If the patient exhaled his last breath, he became 21 grams lighter. Because of this it was concluded that McDouglas had weighed the 'soul'. Other believed that the soul couldn't be weighed and that it concerned the 'life body' that consisted of four 'ethers'. Despite the fact that McDouglas didn't measure a decrease in body weight with animals, prof. Twining (Los Angeles) determined that animals lose a few grams or milligrams when they die and so they must have had a little bit of soul. (Max Heindel, Rozenkruizers Cosmologie, 1913, NV Theosofische Uitgeversmaatschappij Amsteldijk 79, Amsterdam). Near-death experiences are used as evidence to prove that there is an afterlife (Parmi en Fenwick, 2002; Van Lommel et al., 2001). A tunnel is seen, a clear light, deceased family members, a mysterious figure, people see their own life flashing by, has the extraterrestrial experience of going out of their body and seeing their own body as they float above it. In most cases these images are not considered to be frightening, sometimes even as very pleasant. The people who have had this experience often become more interested in spiritual matters, their fear of death decreases, and they believe more in the afterlife. Near-death experiences can occur because of an oxygen

deficiency as a result of heart failure or severe blood loss due to a shock, electrocution, coma due to brain damage or brain infarct, suicide, almost drowning, during a depression or fear of death due to an almost fatal car accident, or isolation, as is the case with a shipwreck. The feeling of going out of body is said to occur in life with 10-20% of the people, without a cause. Patients that have a had a near-death experience in a clinic were dead in the clinical sense of the word, that means unconscious due to the end of the circulation and breathing. Sometimes clinical death is objectified due to an absence of ECG or EEG. Sometimes wide pupils are said to occur which don't react to light. In this case irreversible damage to brain cells will occur within five or ten minutes is the common view. This 'truth' will have to be revised, as we can breed brain cells and keep them in life for months if they are obtained between 2 and 10 hours after dying (Verwer et al., 2002). Because only a part of the patients has near-death experiences (6-18% of clinical dead patients) it is sometimes assumed that this can't be explained by a purely physiological, namely due to a lack of oxygen, reason. This is nonsense of course, because in order to have such an experience it isn't necessary that the brain is stimulated in such a specific way due to a certain lack of oxygen, for this form of hallucination to occur. Besides, the memory has to be in such a good condition that people can remember the experience. There are indeed less cases of near-death experiences if the memory is damaged after a long procedure to get the patient back to life. Besides, you can also trigger near-death experiences by disturbing the brain function in a different way, for example by giving an electric stimulation to the temporal lobe, the hippocampus, or a specific area of the cerebral cortex, the gyrus angularis (Blanke et al., 2002). When stimulating this last area, a patient told that her legs became shorter and that she had the feeling that her body was going to float above the bed. Abnormal activity in this area was also found with six neurological patients (five were epileptic and one had migraine and a small brain infarct), they also had out of body experiences. (Blanke et al., 2004). This occurred together with vestibular (= a part of the ear) sensations like floating, flying, elevation and rotation. These 'experiences' seems to be founded on disruption of the brain mechanisms that are involved in complex somatosentorial, proprioceptive, and vestibular, so all sensory information processing. High Co<sub>2</sub> values which occur when fighter pilots accelerate too fast, hyperventilation, and substances who interfere with the chemical transfer of information in the brain (drugs like ketamine, LSD, pilocarpine and mescaline) can also trigger near-death experiences. The phenomenon seems to founded on changed brain activity in the circuits that normally process sensory information, like also with the hallucinations with schizophrenic patients. You don't need sensory observation, because blind persons also had near-death experiences. Of course it is miraculous that you remember such clear images from a time when your brain cells didn't

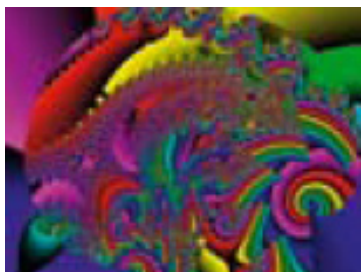
seem to work, but the disappearing of a EEG doesn't say that the function of all brain cells stops. Furthermore the near-death experience could be triggered in the early stage of unconsciousness or in the recovery phase. There is also anecdotic information about detailed memories about the environment from the period of unconsciousness itself. This doesn't say that the brain was not needed for this observation, but it just says that you can also observe and remember if you brain isn't working properly. Patients can sometimes remember whole conversations that the surgeons had while they were under anesthetics. All together there isn't any reason to consider near-death experiences as proof for observation without the brain, or as prove that you have seen the afterlife. In the afterlife, they have never been, these patients. Almost dead isn't the same as dead, just like pregnant isn't the same as almost pregnant. Interesting is the parallel with the before mentioned humorous/religious experiences of patients with temporal lobe epilepsy and the 'Geschwind-syndrome' that consists of hypergraphia, hyposexuality and hyper religiousness (Würfel et al., 2004; Saverre and Sabin, 1997). It is also about a stimulation in the area where new brain cells are made, the hippocampus. Patients with epileptic seizures that have their origin in this area can have intense religious experiences. Apparently the epileptic activity activates circuits that are involved with our experience of religion. The seizures (the 'visits from God') normally last just a few seconds, but can sometimes change the personality forever. Electric stimulation with animals in this area ('kindling') can also have these permanent effects. Although all cultures acknowledge the existence of a 'soul', and there is a academic study of the soul, psychology, the psychologist doesn't studies the soul but the mind or behavior. With this the psychologist represents one of the about 25 disciplines that need to work together to make progress in neurobiology. Descartes, a believing catholic, stated that animals are 'soul-less machines'. The doubts about the existence of a human soul do also for centuries. Spinoza told his fellow students that he doubted the immortality of the soul. If we look at the facts, the idea that we have an immaterial 'soul' still waits for a better argument, other than 'that is just what I believe'. ('If the members of a church really believe in a life after death, why do they not conduct sound experiments to prove it?' – F. Crick, *The Astonishing Hypothesis*, p.258). The churches indeed have enough funds to support such research. A more simple hypothesis (and we must always have that as our goal) clarifies just as much at the moment: the mind is the result of the functioning of the brain and the 'soul' is a misunderstanding in my opinion. The brain-mind problem, which has been discussed for ages, is no problem; the one (the mind) is the result of the functioning

of the other (the brain). Dantzig was right when he said in an interview: 'I presume that the 'soul' exists to fill in the blanks caused by our lack of knowledge about the brain'. Indeed, with such a fantastic machine like our brain and its neurons, we don't need 'extra' immaterial explanations: a 'psychon' doesn't exist, a neuron does. When we die, our brain stops to function and the mind disappears completely. 'Dead, nothing you can do about it' as Johnny the Selfkicker said. And because of the fact that nothing important remains after we die, monks of the Meteora monasteries gave their remains to the vultures. Some modesty fits us. Why would we be so important that some of us must live on? And what is the foundation for the arrogant assumption that we have a soul and animals don't? The concept 'soul' seems to have been founded on the universal fear of death, misplaced self overestimation and of course the hope to see the ones we loved so dearly again. At present brain cells of dead people are being bred. In that way there can be some live after death for some time. The only other way to live on is to write this kind of articles, that will hopefully outlive us, and passing on our genetic information to our children. But that doesn't mean that our 'spirit/soul' lives on. Our children mold their own unique brain and become persons who have remarkably few things in common with us most of the time. From ourselves, not a lot remains. Produced by evolution and became unique by our DNA, environment, functioning and thoughts, are we, that means our brain. Of course we will just turn to dust (Genesis 3.19), because we are, also in life, nothing but our material shell.

## CONCLUSIONS

Everything we think, believe and do is decided, restricted and carried out by our brain. Disruptions in the build up of this efficient information processing machine during the development or later in life lead to psychiatric, neurological or neuro-endocrine illnesses, aggression or criminal behavior. During development the brain produces an exceptional number of cells and connections. By the functioning of the brain systems it is decided which cells and connections remain to exist. This competition of brain cells is also called 'neuronal Darwinism'. The build – and therefore the functioning – of our brain is permanently organises by everything a child experiences, sees and thinks. Genetic information plays just a very small part in the development of the brain.

During this development our possibilities are greatly restricted by the increasing organisation or our brain. The choice of our native language, sexual preference and gender are all decided for us during this development. Once we are adults, there are large restrictions to change our brain, and therefore our behaviour. We have gotten a certain 'personality'. In other words: 'We are our brain'.



*Psychiatrists healed about fifty percent of their patients with psychoanalytic therapy, the rest of the patients on the waiting list healed themselves*

Produced by evolution and compiled by our DNA, environment, functioning and thoughts, our brain has become one of a kind. Of course we will just turn to dust, because we are, also in life, nothing but our material shell. The mind is the product of the functioning of the brain (for distinction: the 'soul' is what remains after you die according to some people). Mind or consciousness produce nothing, but they are products itself from the functioning of our brain, and 'they disappear if the brain stops functioning. The practical meaning of this is showed when it comes to determining the death of a transplant donor. The death of the patient is the same as the irreversible absence of (self) consciousness. Or in other words the absence of all brain activity ('brain dead'). However, a quarter of the brains of brain dead patients still produce a hormone. So there is still neuronal activity present. After that 'absence of higher functions' was taken as the criterion to consider someone to be dead. But with this there are also problems. What are the higher functions exactly, in which parts of the brain do they occur and when are they developed? What you can say against philosophers and theologians who keep on using the concept of 'consciousness' to cover the notion 'free will', is that there is no freedom, not even if you are fully conscious (although we think

we experience freedom). There is a huge restriction, sometimes even determination, by the structure of the brain. We are very complex 'conscious' machines. The structure of the brain is determined by genetics and the competition between the developing brain cells, and they are influenced by neighbor cells, hormones, influences of the mother body and the further environment. Although this contradicts the freedom of brain and 'mind', the uniqueness of brain structures – and the mind that is the product of this – of every individual person still stands. The amount of spirituality is genetically decided for 50%. Minor changes in the DNA of genes that are involved with our chemical messengers, determine the amount of our spirituality. Religion is the local fulfilment of our spirituality. Religion has the evolutionary benefit that it has held the group together. Aggression was there to make an end to the other groups who wanted to steal your rare food. Discrimination has had a clear evolutionary benefit, because every other group was life threatening. My optimistic view on this is that in the long run the discerning of groups and their characteristics (like religions), discrimination and aggression will disappear because they don't have an evolutionary benefit anymore.

**“The crowd has a lot of heads, but no brains”  
- Thomas Fuller-**

Dick Swaab earned his medical and doctoral degrees at the University of Amsterdam, where he became involved in brain research during his third year of medical school. From 1978 until 2005 he has served as director of the Netherlands Institute for Brain Research, and since 1979 as Professor of Neurobiology at the medical faculty of his alma mater. He is leader of the research group on Neuropsychiatric Disorders. Swaab also holds guest professorships in China at the Anhui Medical University at Hefei, the Capital University of Medical Sciences in Beijing, and in Stanford, USA, and is 'Companion in the Order of the Dutch Lion', bestowed by her Royal Majesty Queen Beatrix of the Netherlands.

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