

Where God Lives - Brain Research and Religion

What happens when we pray, meditate, or engage in other religious activities? Neuroscientists are using imaging techniques to shed light on what our grey cells get up to in such cases. Does God exist only in our minds?

'God is dead.' This sentence made the philosopher Friedrich Nietzsche famous, but it did not turn out to be true. Today, more than one hundred years after Nietzsche himself passed away and despite all the prophecies of doom voiced by both materialists and atheists, the religions of the world are enjoying uninterrupted popularity. It makes one feel like standing at the foot of Nietzsche's grave and shouting, 'People live longer when they are expected to die.'

Up until a few years ago, the scientific community paid little attention to belief in a supreme being; religion was considered a purely socio-cultural phenomenon, a construct of the human spirit. Now, however, the scientific community appears no longer willing to give up the field to theologians and sociologists without a fight. A steadily growing throng of brain researchers, psychologists, and radiologists have set about searching for the roots of religious faith.

Armed with state-of-the-art imaging techniques, these so-called 'neurotheologists' are scouring the brain for what a believer would call transcendental reality or the work of God so that they can explain them in terms of neuronal circuits and biochemical processes. And guess what - the quintessence of their efforts is a provocation for all those who believe in the existence of a superior spirit. According to the neurotheologists, religious sensations $\frac{3}{4}$ like all other human feelings $\frac{3}{4}$ are generated by the tangle of one hundred billion nerve cells beneath our skulls. Does this mean that God is nothing more than a figment of our imagination?

'There are many properties that make us human, but none of them is as mysterious as religion,' explains Vilayanur Ramachandran. A respected neurologist from the University of California in San Diego, Ramachandran thinks he is well on his way to unravelling the mystery. Five years ago, he and his colleagues identified a region of the brain that appeared to be closely related to spiritual thoughts. The researchers gave the area in question, which is situated behind the left ear, the catchy name 'the God module'.

Having conducted studies on patients suffering from temporal lobe epilepsy (TLE), Ramachandran concluded that 'there is a neuronal basis for religious experiences'. With this disorder, the nerve cells in and around the temporal lobe, which is closely related to the hippocampus and the amygdala both in terms of function and anatomy, are excited in an uncontrolled, convulsive manner a bit like an electric storm. If the epileptic focus of the seizure is located in an area of the brain behind the left ear, the patients often report having had 'spiritual visions'.

Moreover, what they experience obviously has a lasting impression: a higher-than-average number of people who suffer from TLE also tend to be deeply religious during the long periods between seizures. Many are so taken by the idea of a superior entity that their faith becomes fanatical and the divine an obsession. One of Ramachandran's patients, Paul, has been experiencing such electric storms in his temporal lobe at irregular intervals for several years. Says Ramachandran: 'He sees the universe in a grain of sand and swims in a sea of religious ecstasy.'

The limbic system and the amygdala in particular are causally related to this extreme passion. This part of the brain is responsible for assessing sensory impressions and experiences according to their importance. Key events for human survival, such as sex or the 'adorable' face of an infant, are charged with emotions by the limbic system; this ranking of feelings ensures that significant events are carved on our memories so that we never forget them.

With TLE patients, the rankings are altered. While healthy people have intense emotional reactions to images of close relatives and portrayals of sex and violence, such 'worldly things'

leave TLE patients cold. In their case, it is religious scenes or even the mere mention of the word 'God' that triggers a storm of feelings in them. Interestingly, when this happens, there is a noticeable increase in brain activity in the 'God module'. Ramachandran speculates that the intense electrical excitement experienced during an epileptic seizure leads to an intensification of the neuronal circuitry between the sensory areas in the temporal lobe and the limbic system. This is why his patient Paul considers the whole experience to be the work of a divine power.

Snapshots of nirvana

The neurotheologians are convinced that had Paul been born in an earlier era it is more likely that he would have been revered as a saint or burned as a heretic than treated in a hospital. William Calvin and George Ojemann, neuroscientists at the University of Washington, conclude from contemporary accounts that the miraculous conversion of Saul (not exactly a god-fearing man) to the deeply religious Paul had less to do with revelation than with a seizure caused by TLE. Joan of Arc may also have heard the voice of God calling on her to save France during a temporal lobe epileptic seizure.

This does not mean that regular churchgoers or people who pray in mosques on a regular basis need be concerned about their spiritual health. It is instead the staunch atheists who should give some thought to the matter, because the neurotheologians' findings would appear to suggest that religious thoughts are genetically preprogrammed into everyone's grey cells. To a certain extent, we were 'designed' to believe in God! According to Ramachandran, the depth of the religious feelings experienced depends on the natural electrical activity in the temporal lobe or on the willingness to open oneself to spiritual experiences.

According to Andrew Newberg, all religions make use of the wealth of feelings created by a stimulated limbic system in their rituals. The environment, atmosphere, and stylised procedures of religious ceremonies are so very different from everyday situations that the brain interprets them as being 'particularly important' and ranks them accordingly. Newberg, a radiologist at the University of Pennsylvania in Philadelphia and a pioneer of the scientific search for the divine, is particularly interested in a state of awareness experienced by followers of almost all religions: the feeling of being at one with the universe.

'I felt all borders around me disappear, a connection with some kind of energy, a state of clarity, transparency, and joy. I felt a deep connection with everything; I saw that there had in reality never been a separation in the first place.' This is how Michael Baime describes the moment of transcendence. Baime is one of eight experimentees familiar with the meditation techniques of Tibetan Buddhism who were sent by Newberg on a trip to nirvana at his laboratory of nuclear medicine. At the moment of deepest immersion, the experimentees pulled on a cord. Upon receiving this signal, the researcher, waiting in an adjoining room, injected a radioactive substance into the veins of the meditators by means of an intravenous line. This substance, a so-called 'tracer', quickly attaches itself to brain cells and in particular to those cells to which the supply of blood is strongest. An increased supply of blood to a specific region of the brain indicates that this part of the brain is particularly active at this point in time.

A short time later, Newberg determined the distribution of radioactivity using a special camera. The result was what could be referred to as a snapshot of nirvana. The image produced by the computer using this single photon emission computed tomography procedure (or SPECT for short) shows what happens in the brain at the moment when, as Baime describes it, 'all borders melt away'.

Meditation requires intense concentration. This is why Newberg and his colleagues expected a region in the prefrontal cortex, responsible for regulating attention, to flare up. But it didn't.

Instead a part of the brain located much further back changed in a most surprising way during Baime's spiritual journey: the orientation association area (OAA), which is located in the parietal lobes, was particularly inactive. The purpose of this area is to make sure that we know at all times where our bodies end and the external world begins. The left-hand part of the OAA gives us the sensation of the physical borders of our bodies while the right-hand part processes information about time and space, i.e. the context in which our bodies are working.

Becoming one with God

The OAA needs a steady stream of information from the sensory organs in order to make its calculations. However, as Newberg explains: 'People who meditate shut off their senses from the outside world. This probably means that the temporal lobe does not receive any input at all.' Robbed of this information, the left-hand orientation area can no longer define the point at which the self ends and the world begins. Moreover, the brain has no choice but to perceive that the person to which it is attached is closely linked to everyone and everything.

As a result of the lack of stimulation, the right-hand OAA loses the concept of time and space; for the person meditating, the resulting feeling of eternity and endlessness is entirely real. Newberg assumes that a different part of the brain, the so-called hippocampus, 'regulates the neuronal flow of information between the different parts of the brain, a bit like a sluice gate.' When meditators are in a state of deep concentration focussing on objects, words, or thoughts, the demands made on other areas, such as the centre of concentration, cause the hippocampus to cut off the flow of input to the parietal lobe. Neurotheologians call this phenomenon 'deafferentation'. Despite the fact that it is temporarily blind, the orientation association area continues to function, thereby giving the meditator the impression of merging with something much, much larger.

'I could feel God's presence; I felt His existence permeating my being.' This is Sister Celeste's description of her feelings at the climax of a 45-minute prayer. Interestingly, the SPECT images that Newberg gathered of her and seven other Franciscan nuns were significantly different to those of the meditating Buddhists in one particular respect. Because the nuns reached their spiritual summit by repeating Christian verses, brain activity increased primarily in their language centres. At the moment they 'became one with God', the light in their orientation association area went out. The analogy leads the neurotheologians to assume that the most intensive moments of religious perception transcend $\frac{3}{4}$ neurobiologically speaking $\frac{3}{4}$ the differences in religious denominations.

Those who for lack of personal experience doubt that his or her own grey cells are capable of experiencing such mystic sensations should pay a visit to Michael Persinger at the Laurentian University in Canada. Persinger, a neuropsychologist, claims that almost everyone can 'meet God', as long as he or she is prepared to put on a helmet-like contraption of his design. This contraption generates a weak magnetic field that moves over the brain $\frac{3}{4}$ and in particular over the parietal lobe $\frac{3}{4}$ in a complex pattern in the course of approximately twenty minutes. Four out of five experimentees describe the sensations triggered by the so-called 'transcranial magnetic stimulation' as supernatural or spiritual; the presence of a superior being, God's touch, the impression of having left their bodies.

According to Persinger's theory, the magnetic field induces tiny bursts of electric excitement in the nerve cells of the temporal lobe, a sort of miniature version of the neuron storm in the brains of the epileptics examined by Ramachandran. These tiny discharges, known in the business as temporal lobe transients (TLT), provide the characteristic feeling of the existence of a supernatural power experienced in moments of spiritual awakening. However, trying out Persinger's helmet is not the only way to 'meet God'. Both physiological changes $\frac{3}{4}$ such as a drop in blood sugar or a

lack of oxygen $\frac{3}{4}$ and psychic strain such as fear, depression, or quite simply too little sleep, can cause electrical instability in the temporal lobe. Persinger believes that this is why many people find God at very difficult times in their lives. However, genes would also appear to have an influence on individual tendencies to TLT episodes.

So was it a storm in the temporal lobe that brought Buddha enlightenment beneath the fig tree? Did Moses receive the Ten Commandments not from God, but from a cluster of flaring neurons? As far as Persinger is concerned, there can be no doubt: 'Religion happens in our brains.' He has already received death threats for provocative theories such as this. Nor is the Holy See thrilled by the neurotheologians' efforts to find a biological basis for faith. Bishop Elio Sgreccia, expert for bioethical questions at the Vatican, reacted to a report on Andrew Newberg's work as follows: the idea that God 'lives' only in the brains of believers and nowhere else, is an 'erroneous, materialistic view of human existence'. Newberg is not bothered by such reproaches: 'If there is a God, does it not make absolute sense that he would construct us in such a way that we can experience him and communicate with him?'

In short, these insights into the neurobiology of religious experiences serve to prove that faith is, as it was in Nietzsche's time, just that: a question of faith.

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