

Herman M. Van Praag¹

God and the brain. A Jewish perspective

¹Herman M. van Praag is Professor Emeritus at the Universities of Groningen, Utrecht, Maastricht, The Netherlands and at the Albert Einstein College of Medicine, New York N.Y., USA. Presently he is Scientific Advisor to the Department of Psychiatry and Neuropsychology, Academic Hospital, Maastricht, The Netherlands.

This treatise is partly included in the Dutch book by the writer entitled: *God en Psyche. De redelijkheid van het geloven. Visies van een Jood.* (God and Psyche. The reasonableness of faith. Viewpoints of a Jew.). Boom Amsterdam, 2008. An extended version has appeared in: *Psychiatry and Religion.* P.J. Verhagen, H.M. van Praag, J.J. Lopez Ibor, J. Cox, D. Moussaoui, Wiley, New York, 2010.

Recently research has been initiated into the cerebral substrate of spirituality c.q. religiosity. This endeavour is called neurotheology. There is evidence that such a substrate indeed exists. The relevant findings have been received with great acclaim by atheists. They see it as a triumph of their conviction. Religious faith is nothing but a "brain state". Believers are bewildered: religion and religiousness biological phenomena? That sounds blasphemous. Is the triumphant atheist right or is the believer mistakenly bewildered? That is the theme of this treatise.

SUBJECT MATTER

Is there a connection between religiosity and the functioning of the brain? On the face of it a peculiar question. Religiosity is the foundation of religion. Religion is a philosophy of life, whose essence is the concept of God, being a pure abstraction. The brain, however, is a concrete object; an organ consisting of 10 billion neurons with 1000 times as many contact points (synapses), 200 billion gliacells and 100,000 kilometres of axon (nerve fibres). So a pure piece of matter.

How can there be any connection between these two unequal quantities? This astonishment is not appropriate. Neither mind nor soul float above the waters. Like all phenomena of life, they are solidly anchored in a biological substrate. Many people feel the need to give meaning to their

lives. This can be done in an "earthly" manner, for example by artistic, scientific or social activities or simply by trying to make the most of it, in their family, at work or in social life. To some this is not sufficient. They have a need to add a vertical dimension to life, one that transcends earthly existence. They, or rather, their minds are looking for a concept which undoes the temporal, the arbitrary and the accidental nature of existence. Their minds are looking for a superhuman concept, a God-concept. Without the brain this need would not exist. There would be no mind. This means that I would have been surprised if religiosity/spirituality had existed without the development of neural circuits required for its manifestation.

Mind and soul, constructs dependent on the existence of a functioning brain. These words seem to come from an unadulterated materialist. I am not. I consider myself a moderate dualist. I will make myself clear by means of an analogy which I derive from Oomen.¹

Suppose one has a coin. This is a piece of matter with definable and measurable qualities. It is also a valid means of payment. You can buy something with it. What is actually bought varies from individual to individual. One person will buy ice-cream, the other a book; one person a ticket for a football match, the other a ticket for a concert. Whatever is bought is not enclosed in the material qualities of the coin. In other words, the purchase is dependent on the coin, but the coin does not determine the nature of the purchase.

A comparable relationship exists between mind and soul on the one hand and the brain on the other. Mind and soul are dependent on a functioning brain, but these two quantities do not coincide. Mind and soul are not extrapolatable to the brain. The brain does not determine what soul and mind will be equipped with. That is determined by that enigmatic concept, which is so extremely difficult to define and not localizable in the brain: the self.

So, I am not an orthodox materialist, rather a liberal dualist. On the one hand I consider the soul attached to a material substrate, i.e. the brain, but on the other hand I allot these two domains a considerable degree of autonomy.

CORRESPONDENCE:
Prof. Dr. H.M. van Praag
Loseweg 246, 7315 HD
Apeldoorn, The Netherlands.
E-mail: h.m.van.praag@vanpraag.com

I will first concisely discuss some results of neurotheological research. Subsequently I will go into the theological interpretation of these data. Beforehand I will define the concepts that are central to this treatise.

DEFINITIONS

I interpret the concept of soul as a metaphor for all of the psychological faculties an individual is equipped with. Faculties that give him access to both his own inner world and the outer world, including the inner world of others. Faculties that enable him to orient himself in both worlds, to hold firm there and to enrich them. Psychological faculties (or functions) are measurable, some of them even quantitatively, for example cognitive functions. The concept of soul is, though immaterial, concrete by nature.

Mind and soul are concepts usually used interchangeably. I do not. By mind I mean that domain of the human existence where the "what-for question" arises. What is the sense of my existence? Do I have to live up to someone's expectations and if so, whose? Only mine, or also those of a higher authority? This raises the question of the conceivable existence of a metaphysical space within which the concept of God figures.

Metaphorically speaking, I consider the mind as the "top layer", also the most esoteric layer of the soul. The mind is an immaterial, and in contrast to the psyche, an abstract concept.

By religion I mean a system that has developed around the hypothesis of a supernatural authority, an authority not sensorily perceptible, not accessible to empirical studies, and yet fundamentally influences the individual and the society in which he lives. This authority is called God. It is either experienced in an anthropomorphical way, so as a being with human features, or more as an abstraction, as an impersonal, intangible, inconceivable field of force. "The foundation of all foundations". Out of respect for the God Principle a ritualized worship has developed.

I denote the affinity with the religious root idea as religiosity, or rather religious susceptibility. I prefer this last term. For the first implies that religiousness is an all-or-nothing phenomenon. One is either religious or one is not. Practice learns otherwise. Religiousness is a quality that varies individually, just like for example in the case of aesthetic susceptibility. The term religious susceptibility conveys this the most accurate. For brevity's sake, however, I will often use the term religiosity throughout.

Religiosity includes three components:

- Susceptibility – emotionally *and* cognitively – to the concept of God and the transcendental reality it

represents.

- Affinity with the worship and rituals that have developed around the God Principle.
- Acceptance – at least in broad outline – of the life- and worldview that religion stands for.

Spirituality is a much more loose concept. It refers to a want for the "higher", for the "spiritual", to a discontentment with the here and now and constantly having one's feet firmly on the ground. Some people every now and then have a romantic need to escape from the everyday, commonplace of life; away from worries, ambitions and conflicts to a world in which one can find inner peace and opportunities to "realize oneself".

That spiritual world, however, remains blurred, because it is unstructured. Generally the existence of a transcendent reality is presumed where a higher authority or higher authorities operate, but one hesitates to attach to those the predicate God or the qualification divine. Yet, as is the case with religiosity, that higher authority may assume a quality of sanctity, it might be venerated and the veneration may become ritualized. However, little of no theology is developed, no philosophy of life. Infrastructurally spiritual movements are weak and hence, as far as content goes, variable and often evanescent. Religion has given the spiritual needs of human mind a strong focus: God; a foundation: theology, and a bedding: religious practice.

For the religiously receptive individual God is the symbol of spirituality. All other manifestations of spirituality are for him by definition of a lower order.

SOME DATA

Heredity: twin research

It has been found that spiritual orientation and susceptibility to experiences interpreted as spiritual are partly hereditary and therefore biologically determined. In these studies spirituality was defined as a tendency:

- to reach across the boundaries of the self to a transcendent and thus unattainable reality and
- to experience the world as one coherent whole, the self being part of it.

Cloninger et al.² operationalized this concept of spirituality and developed a questionnaire to assess its various aspects systematically in a standardized manner. He does not speak of spirituality for that matter, but of "self-transcendence". In this concept he distinguishes three components. Firstly, the faculty to become entirely absorbed by a particular activity, experience or perception ("self-forgetfulness"). Secondly, the ability to evoke the feeling of being connected with all aspects of the world as they

manifest themselves to us, with, as it is often called, the "all" ("transpersonal identification"). A third component (and sub-scale) concerns the affinity felt with the supernatural, the miraculous in this world, with a focus on the intuitive and on matters that can only be determined with a "sixth sense" ("spiritual acceptance versus rational materialism").

The evidence that spiritual / religious sensitivity is partly genetically determined was demonstrated by means of twin research. Dizygotic twins are genetically similar to "ordinary" brothers and sisters. They have 50% of their genes in common, in contrast to monozygotic twins who are genetically identical. If a certain feature is completely or partly genetically determined, monozygotic twins will be more alike in this respect than dizygotic twins. Comparable scores on the self-transcendence scale were found twice as frequently in monozygotic than in dizygotic twins.³ The scores in monozygotic twins, however, did not correspond anywhere near 100%. This means that also non-genetic factors – environmental influences during life – play a role in the development of spiritual sensitivity, factors such as upbringing, education and social "climate". Hamer,⁴ following Dawkins,⁵ calls this transmission through "memes, self-replicating units of culture; ideas that are passed on from one individual to another through writing, speech, ritual and imitation". Blackmore⁶ defines the "meme" even pithier: "instructions for carrying out behaviour, stored in brains (or other objects) and passed on by imitation".

The genetic "load" is particularly strong when religiosity is the guiding factor in somebody's life. This is called intrinsic religiosity, or also "religious devotion".^{7,8} It applies to a far smaller extent when

religiosity is assessed in terms of external criteria, such as regularity of church attendance and prayer, or when it appears that religiosity is strongly nurtured for reasons of usefulness, for example the social circle it provides, or the professionally remunerative network (the so-called extrinsic religiosity). The genetic make-up for religiosity is weaker than for spirituality.^{9,10} "Memes" seem to play a larger role in the transmission of religiously tinted spirituality than genes.⁴

Heredity: gene research

Which genes are involved in the transfer of personality traits that determine religious c.q. spiritual sensitivity is still largely unknown. Hamer⁴ lifted a corner of the veil that is covering this issue. He found an association between the degree of self-transcendence, measured with Cloninger's instrument and a variant of a gene called VAMT2, involved in a process called monoaminergic neurotransmission. Let me explain. The brain is our main information processing system. It consists of nerve fibers and cells, amongst others nerve cells (neurons). Those latter cells transport bits of information. They do not, however, form a continuum. Between one

neuron and the next there exists a narrow gap, the synapse. Here information is transmitted through a chemical process. The substances involved are called neurotransmitters. Monoamines act as such in neuronal circuits involved in the regulation of a variety of emotional processes. Monoamines are stored in vesicles located at the end of a nerve fibre. In this way they are protected from degradation and thus inactivation. When an electric current (so the "information") arrives at the end of the nerve fibre, synaptic vesicles release their contents into the synapse. The monoamine binds with certain protein molecules in the cell membrane of the following neuron, the so-called receptors. Due to this fusion the permeability of that membrane changes, and a complicated pattern of ion transport is activated. This again causes an electrical current, which is transmitted by the next neuron. This continues until the final destination of the impulse has been reached (Fig 1).

After it has done its job, the monoamine, must be removed from the synapse. A small part is broken down. The largest part is transported back into the nerve cell and again stored in synaptic vesicles (recycling).

The VAMT2 gene codes for a pump-system involved in this recycling process. The variant mentioned is relatively low-acting. Less of the monoamine is brought back into the storage vesicles. It is broken down and less is available for neurotransmission. The relationship between self-transcendence and this phenomenon is as yet unknown. Hamer⁴ called the VAMT2 gene the "God-gene". For the time being this term sounds somewhat presumptuous and its introduction is certainly premature.

There is an other study demonstrating a relationship between measures of spirituality / religiosity and low functioning of certain neuronal systems that use monoamines as neurotransmitter. Borg et al.¹¹ studied with brain imaging techniques the density of a particular receptor type, being used by a particular monoamine, i.e. serotonin, in particular parts of the brain. He found that a relatively low density of the so-called serotonin-1A receptor correlated with a relatively high degree of "spiritual acceptance", a measure of spirituality / religiosity.

Furthermore, some pharmacological data suggest a role for serotonin in the occurrence of spiritual/religious experiences. We know of hallucinogens which can evoke a state the user describes as "spiritual awakening" or as "consciousness broadening". Experience and perception of the environment alters. All that is perceived gets a different, sometimes "deeper" and "richer" significance. Also the experience of the user's own body changes. For example he may perceive his body as from a distance (out-of-body experiences). He may feel united with the cosmos, more than with his own body. In short, phenomena occur that we also know from the mystical forms of religiosity / spirituality. Consciousness remains intact, so that one remembers very

well what one has experienced after the drug effect has worn off. These effects can be generated by substances such as LSD and psilocybine. They affect the functioning of the serotonergic system drastically. It is unknown whether the 1A-subsystem is particularly involved.

In short then, there is evidence suggesting for a connection between spiritual susceptibility on the one hand and particularly the functioning of (certain parts) of the serotonergic system on the other hand. However, the data are still scarce, need confirmation and are definitely insufficient for a well-founded hypothesis about the biological foundations of spirituality/religiosity.

Brain imaging during spiritual peak experiences

Newberg et al.¹² examined Buddhist monks from Tibet during meditation and Franciscan nuns during prayer. During meditation the monk tries to rid himself of his desires; these are considered the root cause of human misery. Through prayer the nuns try to come closer to and eventually melt with God. When the test subjects indicated they had reached the spiritual peak experience, a brain scan measuring blood flow through the brain was made.

During the meditative peak experience ("There's a sense of timelessness and infinity. It feels like I am part of everyone and everything in existence") and the religious peak experience ("a tangible sense of closeness of God and a mingling with Him") the blood stream in the brain had altered. Generally speaking: an increase in the front parts of the brain and a decrease in the hind parts were found. The former phenomenon, is believed to be related to heightened and focussed attention, the latter one to self-awareness: the ability to experience a boundary between the self and the outer world. Decreased activity in this area would limit this capacity. Reduction of self-awareness and strongly heightened and focussed attention are prerequisites for the above-mentioned peak experiences. A connection between the biological and the psychological phenomena seems therefore plausible.

Temporal epilepsy and religious experiences

Temporal epilepsy is a form of epilepsy, in which the patient suddenly "feels as if he is not really there, like in a dream", and is no longer able to communicate normally. He is in a sort of dreamy state without being asleep. Motor seizures - muscle contractions - do not occur. With an electroencephalogram epileptic zones can be located in the temporal lobes.

During such a seizure the way the world is experienced changes. Colours, sounds, smells change in nature. Distances,

spatial dimensions are experienced as altered. In short, the patient lives in another world. In such a state visual hallucinations (visions), acoustic hallucinations (hearing voices) and delusions can occur. Those phenomena relatively frequently have a religious content.^{13, 14} For example, one sees Biblical scenes, hears heavenly voices, believes to be a figure with religious significance or with a Divine assignment. Apart from the seizures these people are often religious "fundamentalists" with unshakeable beliefs. They can be called hyper-religious.¹³

There are obviously areas in the brain that evoke religious images and ideas during stimulation. Persinger's^{15, 16} observations confirmed that conclusion. On the heads of normal, non-religious test subjects (psychology students) he placed a helmet that can transmit electromagnetic signals to specific parts of the brain. Activation of certain areas in the temporal lobe resulted in the feeling of a "presence", interpreted by the test subject as God, a spirit, or another supernatural being.

According to Persinger, spontaneous discharges in those areas - micro seizures not accompanied by motor phenomena - are the biological basis for spiritual/religious/mystical experiences. Persinger believes he has traced the "God spot".

DOES ATHEISM TRIUMPH?

Spiritual/religious experiences are accompanied by measurable changes in brain activity. Spiritual/religious susceptibility is partly genetically determined and a few possible biological determinants of that feature have been traced. Finally, activation of particular brain zones evokes experiences that can be interpreted as religious/spiritual. Neurobiologists suggested they have found indications for the existence of a "God gene" and a "God spot". These terms are not used as slightly mocking metaphors. They parade as research findings. "Gefundenes fressen" for atheist diehards. They have interpreted these observations as evidence of being right. Religious and related experiences are literally chimeras. I quote some dyed-in-the-wool atheists. Joseph¹⁷ - an American brain researcher - states that:

"... heightened emotional activity within these (limbic) nuclei could result in feelings of fear, foreboding, or religious awe, as well as activation of the neural networks that respond selectively to crosses, such that emotional and spiritual significance is attributed to objects such as crosses.... Indeed, it could be argued that the essence of God, and of our living soul, may be slumbering within the depths of the ancient limbic lobe, which is buried within the belly of the brain".

Janssen¹⁸ - Professor of Psychology of Religion, Nijmegen University - observes: "God is biologically anchored and in our genes."

When Plasterk¹⁹ – Professor of Molecular Biology and currently Minister of Health in the Netherlands – was asked whether advancing scientific knowledge will ultimately result in people abandoning the God-idea, he replied: "That would be possible ... If at a certain point that vague soul is the only aspect that can keep religions alive, this would consequently mean a resounding victory for science. Actually, in that case we can consider the Science versus Religion conflict as ended".

Swaab²⁰ – Director of the Brain Institute in Amsterdam – expresses himself as follows: "I see the spirit as a product of our brain cells. I see the soul, as some believe something immortal that lives on after our death, as a misunderstanding."

So, no transcendence whatsoever; immaterial reality: an illusion; a higher, superhuman Authority: a fable; God, just a mystification; religious experiences: no more than private fantasies. There is no world beyond the perceptible and measurable, no world beyond the horizon. Religious belief is a primitive relic of an infantile past. It arises from and is a product of unusual, possibly pathological activity in certain neuronal networks. "Just that". Basically, the phenomenon can be provoked or suppressed via direct, e.g. pharmacological manipulation of the brain. Religion unmasked. God resides in the brain, not in heaven.

I fundamentally disagree with this line of reasoning, with its premise and with the interpretation of the neurotheological data.

APPARENT VICTORY

An incorrect premise

The premise of these kinds of arguments is twofold. First: science is synonymous with natural sciences and second: the relation between science and religion is an antipodal one.

The first premise is a product of scientific narrow-mindedness. The humanities are no less scientific than the natural sciences. Both try to find truths. Their methods differ fundamentally. However, the insights gained by means of methods used by the humanoria are no less "true" than the ones acquired with empirical-scientific methods. They are truths of an entirely different order. Natural scientists search for truths in the material world. Truths that can be measured in size and number and are generalizable. They refer to the how of existence, to the underlying mechanism.

Scientists labouring in the humanities search for truths in the spiritual world. Generally speaking, they deal with subjects or a subject, with the analysis of its make-up, with the foundations of the world in which it moves, with the products of its creative faculties. Science of this nature

produces subjective truths. Truths that, generally speaking, are not objectivable, measurable in size or number, or generalizable. The degree of truth is based on the feeling of obviousness these truths evoke, to what extent they enhance and enrich our notion of the reality in which we live. Frequently, not everyone will acknowledge these truths as true. This, however, applies just as much to "truths" of the natural sciences. The observation may have been established more or less objectively, an important degree of subjectivity is enclosed in its interpretation. It is not uncommon to be able to draw different conclusions from the same dataset; fairly often it turns out to be multi-interpretable.

Conclusions are fallible. This goes for both types of scientific practice, but, once again, conclusions derived in the humanities are not *qualitate qua* less "true" than those from the natural sciences. Natural sciences are not the only key to knowledge. Subjectivity is not the antithesis of knowledge.

I also object to the second part of the premise. Religion is not the antipode of (natural) sciences. Their basic assumptions of reality are totally different. As mentioned earlier, natural sciences explore matter and try to analyse that material reality and express results in size and number. Religion is a spiritual system that has developed from the human need to imagine a world beyond the material; a world in which one can satisfy one's hunger for meaning, for spirituality. In this respect it is completely irrelevant if that world really exists, in material terms, and if it can (ever) be made perceptible, measurable, or verifiable. It exists for the person who experiences it, for the believer, and for him it is of essential significance. When, theoretically speaking, that transcendent world could be defined materially, its spiritual value would be lost.

By definition, metaphysical concepts are inaccessible for research with methods used in the natural sciences. Objective evidence for their correctness is therefore illusory. As said, the significance and importance of these concepts is based on the measure in which they "enlighten" realities. If that degree is high, the individual experiences the concept as true and real, or at least meaningful. He believes in it. He does not require objective evidence, no more than the satisfied concert-goer will require evidence for having enjoyed himself, or the lover for loving his beloved.

Religion and even more religiosity are subjects to be studied by the humanities. The natural sciences have nothing to offer in this respect. Nevertheless, the atheist demands from the believer: give me evidence that this metaphysical world exists. The believer cannot do this. This is not a fiasco, for the demand is nonsensical. A fish cannot be asked to walk. It simply does not have the tools. If it had been able to walk, it would have lost its fish-nature. Still the atheist believes he has won a knock-out victory. In fact, his demand makes no sense.

Misuse of the neurobiological data

Religious perceptions are accompanied by measurable changes in the functioning of certain brain circuits. This would indicate that religion is a product of the brain. "I believe that, just like one's mother tongue, religion is rooted in certain brain circuits ... that what we call religious faith is a brainstate"...²⁰ The changes in the brain might demonstrate that religious experiences are "real", Newberg¹² noted.

I believe that such reasonings are based on misinterpretation of neurobiological data. It is suggested that "biology drives psychology", whereas the reverse is true: biology in this case is driven by psychology. I will explain this in some detail.

Manifestations of religiosity are accompanied by measurable changes in brain activity. To me that is self-evident. Religiosity is primarily an experiential state, an ability to experience. Experiencing depends on a functioning brain. Without the brain there would be no experiencing.

Basically, activation of those "religious circuits" *could* be the result of biological processes. Due to genetic influences they could be hypersensitive, being activated by very mild, c.q. not easily verifiable stimuli (or the opposite: there could be decreased sensitivity, making the individual concerned immune to religious experiences). A second biological option is that acquired processes, such as brain injury, tumors in or inflammations of the brain have made these circuits oversensitive.

This, however, is rare. In most cases these areas will be activated and the accompanying feelings/experiences generated by psychological processes, not by a primary anomaly in structure or function of the brain. "Psychology drives biology", as good as "biology drives psychology".^{21, 22} This also goes for religious feelings and experiences. They are usually generated by spiritual needs. Generally speaking, the need to provide life with a vertical dimension. Spiritual needs arise at the psychological level, are products of somebody's psychological make-up and living conditions. Gratification of these spiritual needs is effected by induction of religious feelings and expressions. This requires availability and subsequently activation of certain neuronal systems in the brain. Thus, gratification of spiritual needs is effectuated at the biological level.

In other words: the brain is the intermediary between religious needs and gratification of those needs. It is not the origin of those needs.

Let me illustrate this with an example from another domain of the psyche. The locus ceruleus is a cluster of nerve cells in the brainstem and an important centre in anxiety regulation. Its stimulation arouses feelings of anxiety. Direct stimulation of this nucleus by a material process in the brain

is basically possible, but rare. It would present an example of non-psychologically determined anxiety. In most cases anxiety originates from a psychological condition, such as an inner conflict or a threat from the outer world. The tension resulting from this activates the locus ceruleus, arousing feelings of anxiety. The statement "anxiety is a product of locus ceruleus activation", though not incorrect in itself, would be a serious simplification and present a completely distorted picture of the way in which anxiety generally arises.

A second analogy. The observation of a work of art can evoke aesthetic feelings. Without doubt these feelings are based on activation of certain neuronal circuits, even though we do not know them yet. It is true that this activation is essential to trigger these feelings, but it says nothing about the source of these feelings, the work of art, nor about the aesthetic qualities of the individual, who is appreciating this work of art. Research into this requires methods that have nothing to do with neurobiology.

Just as, I presume, one has "aesthetic circuits", nerve cells that evoke aesthetic experiences when stimulated, one similarly has "religious circuits", nerve cells that, when activated, generate religious experiences. These religious circuits are a *conditio sine qua non* for the religious perceptions to arise. However, they do not give any insight into the roots of this phenomenon, nor into the role religiosity plays in the lives of the individual concerned.

DOES THEISM TRIUMPH?

I repeat: neurotheological data provide information about the material substrate of religiosity; the substrate that determines that religious susceptibility can exist at all. Neurotheological data do not provide any insight into the origins of religiosity, nor into the significance religiosity has for a certain individual, a certain group or a certain culture. Religiosity, or rather the need for it, is generated by psychological and social factors. The brain provides the opportunities to satisfy those needs.

From the atheistic point of view it has been argued that the neuro-theological data demonstrate that religious susceptibility is nothing more than the product of an abnormal or at least unusual "brain state". In this viewpoint a transcendental reality, occupying a central place in all monotheistic religions, is a grotesque misinterpretation of the experiential effects of that "brain state". I consider this view a "terrible simplification", which completely denies the significance of religiosity.

I interpret the neurotheological data as a triumph of theism. The brain obviously contains a neuronal network that, when activated, generates religious c.q. spiritual experiences. I assume that this network has developed

because such experiences have come to play an essential and valuable role in human existence. From an evolutionary point of view, the "religious circuits" provided psychological advantages.

The "utility" of religiosity can be understood in a psychological but also in a theological sense. This is most likely the believer's viewpoint. He will presume, better: he believes, that his religious urge does not stem from his own psychic inner world but comes from "above", from a metaphysical space. He does not consider the concept of God a symbol, a symbol of ultimate compassion and ultimate justice – paradoxically phrased: a symbol of superhuman humanity – but a concrete reality. In his line of reasoning God *does* exist; there *is* a superhuman authority who wants to make himself known to man, to communicate with him. God in search of man.²⁴ He will believe that the cerebral circuits developed to make that contact possible.

This, I think, can be called a viewpoint pre-eminently Jewish. The God of the Torah is not a disconnected, detached Being but an Agent with a worldly mission, with a blueprint for world affairs. His creation is unfinished and He realizes for its completion he needs man's assistance. He seeks rapprochement to mankind. God looks for Abraham, not vice versa. It is God who calls on Moses to lead the Jews out of Egypt. Moses himself did not desire that position. The prophets Samuel, Jeremiah, Ezekiel, Hosea and Jonah, are personally selected by God for the prophetic task. It was not their personal calling. It is God who need them to convey His viewpoints to mankind. They are God's hand-picked mouthpieces. Israel's first king's, Saul and David, were God's choice. Certainly Saul accepted the honour willy-nilly. At Sinai it is God who proposes a covenant, it is not a suggestion of the Jewish people. Mutual dependence enforces partnership. Without partnership a covenant gets void. Moreover, without man there would be no one on earth to attest to God's existence. In that sense he would not exist (Isaiah 43: 10,12):

..."And understand that I am He: Before Me no god was formed,
And after Me none shall exist...
And no strange God was among you,
So you are My witnesses
and I am God."

The Hebrew Bible urges to respect the stranger. Riskin²³ remarks:

"God hears the stranger because God – no less than Israel – is the consummate stranger, the One who is wholly other, *kadosh*, forever apart."

God is homeless in this world as long as mankind is not willing or able to provide Him with a shelter in which He can feel at home. God is in search of man. Heschel²⁴ says:

"There is only one way to define Jewish religion. It is the awareness of God's interest in man, the awareness of a covenant, of a responsibility that lies on Him as well as on us Our need of Him is but an echo of His need of us".

God's voice however, is not perceptible with our ears (Psalm 19: 2,4):

"The heavens declare the glory of God ...
There is no utterance,
there are no words,
their sound is not heard"

The Baal Shem said:

God's voice reveals itself not in sounds "but in thoughts, in signs that man must learn to perceive".²⁵

Formulated in more modern biological terms: in the human brain circuits had to come into being to receive and register the signals from "above".

SUMMARY

Religiosity is above all an experiential ability. As such it cannot exist without a biological substrate, without neuronal circuits whose activation evokes religious experiences. Research into the nature of those circuits has already yielded some results. Is religiosity with this reduced to a purely biologically determined phenomenon? Definitely not. Religiosity is not rooted in these cerebral circuits. Its roots are to be found at the psychological level. The brain functions as an intermediary; an intermediary between religious needs and their experiential gratification. In other words, homo sapiens developed hardware that enabled the development of religiosity.

I conclude that the neurotheological data do not support the atheistic viewpoint. Religious susceptibility cannot be seen as a sophisticated complex of chimeras. The neurotheological data, on the contrary, give support to the theistic viewpoint: religiosity is a normal and valuable component of the human psyche. Hence it has been firmly biologically anchored, an anchorage that was in part genetically embedded.

REFERENCES

1. Oomen PMF. On brain, soul, self, and freedom: an essay in bridging neuroscience and faith. *Zygon*. 2003;38:377-92.
2. Cloninger CR, Bayon C, Srvakic DN. Measurement of temperament and character in mood disorders. *Archives General Psychiatry*. 1993;50:975-90.
3. Kirk KM, Eaves LJ, Martin NG. Self-transcendence as a measure of spirituality in a sample of older Australian twins. *Twin Research*. 1999;2:81-7.
4. Hamer D. The God gene. How faith is hardwired into our genes. New York: Doubleday, 2004.

5. Dawkins R. *The selfish gene*. Oxford: Oxford University Press, 1976.
6. Blackmore S. *The meme machine*. Oxford: Oxford University Press, 1999.
7. Kendler KS, Gardner ChO, Prescott CA. Religion, psychopathology, and substance use and abuse: a multimeasure, genetic - epidemiologic study. *American Journal of Psychiatry*. 1997;154:322-9.
8. Waller NG, Kojetin BA, Bouchard ThJ, et al. Genetic and environmental influences on religious interest, attitudes and values. *Psychological Science*. 1990;1:138-42.
9. Bouchard TJ, Lykken DT, McGue M, et al. Sources of human psychological differences: the Minnesota Study of Twins reared apart. *Science*. 1990;250:223-8.
10. Bouchard TJ, Lykken DT, Tellegen A. Intrinsic and extrinsic religiousness: genetic and environmental influences and personal traits. *Twin Research*. 1999;2:88-8.
11. Borg J, Andr e B, Soderstrom H, et al. The serotonin system and spiritual experiences. *American Journal of Psychiatry*. 2003;160:1965-9.
12. Newberg A, D'Aquili E, Ransie V. *Why God won't go away*. New York:Ballantine Books, 2001.
13. Trimble MR. *The psychoses of epilepsy*. New York: Raven Press, 1991.
14. Brewerton TD. Hyperreligiosity in psychotic disorders. *Journal nervous and mental disease*. 1994;182:302-4.
15. Persinger MA. I would kill in God's name: role of sex, weekly church attendance, report of a religious experience and limbic lability. *Perceptual and Motor Skills*. 1997;85:128-30.
16. Persinger MA, Tiller SG, Koren SA. Experimental stimulation of a haunt experience and paroxysmal electroencephalographic activity by transcerebral complex magnetic fields: induction of a synthetic ghost? *Perceptual and Motor Skills*. 2000;90:659-74.
17. Joseph R. The limbic system and the soul. Evolution and the neuroanatomy of religious experience. In: Joseph R, ed. *Neuropsychiatry, neuropsychology, and clinical neuroscience. Emotion, evolutions, cognition, language, memory, brain damage, and abnormal behavior*. Baltimore (Maryland): Williams and Wilkins, 1996.
18. Janssen J. *Religie blijft altijd bestaan*. NRC Handelsblad, 2002.
19. Plasterk R. *Juist onder religieuzen heerst een gebrek aan ethiek*. In: Visser H, ed. *Leven zonder God. Elf interviews over ongelooft*. Amsterdam/Antwerpen: Uitgever L.J. van Veen, 2003.
20. Swaab D. *Evolutionair gezien zijn we weinig meer dan wegwerpartikelen*. In: Visser H, ed. *Leven zonder God. Elf interviews over ongelooft*. Amsterdam/Antwerpen: Uitgeverij L.J. van Veen, 2003.
21. Van Praag HM, De Kloet R, Van Os J. *Stress, the brain and depression*. Cambridge: Cambridge University Press, 2004.
22. Van Praag HM. *God and psyche. The reasonableness of believing. Visions of a Jew*. Amsterdam: Boom, 2008.
23. Riskin S. *Stranger in a strange land*. *International Jerusalem Post*. January 2008;25-31.
24. Heschel J.H. *God in search of man: a philosophy of Judaism*. New York: Farrar, Straus and Giroux, 1955.
25. Heschel J.H. *Between God and man: an interpretation of Judaism*. New York:The Free Press, 1959.