THE PINEAL GLAND – BIOLOGY AND CONSCIOUSNESS
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Which hormones regulate our consciousness level and enable (or switch off) thinking? The following is an exploration of pineal gland hormones, states of consciousness and brainwaves.

Introduction

Our body uses various hormones for its internal communication. Among these hormones some play a role in our thinking and consciousness. This happens especially in our brain. Besides this, the brain produces many more substances, which influence thinking and consciousness. Examples are the neurotransmitters, which activate or inhibit the activity of our neurons and thus contribute to the communication in our brain. Besides these the brain produces enkephalins, which are short protein molecules, which play a role in different emotions. This article will focus on the hormones, which play a role in the way we think and how we feel.

Hormones are not only produced in the brain but also in other places of the body, for example the sexual glands. The production of hormones in the body is regulated by hormones from the pituitary gland in the brain through feedback mechanisms. Another hormone gland in the brain is the PINEAL GLAND or EPIPHYSIS. The pineal produces a spectrum of hormones, which induce different states of consciousness in the course of a day and night. This article will focus on the pineal gland hormones and their effects on our body and consciousness.

The pineal gland, evolution and light sensitivity.

The pineal gland is situated in the centre of the human brain, in between the left and right brain. It has grown from the brain stem, to which' upper back side it is attached. The pineal is sitting just beneath the back part of the corpus callosum, the nerve bundle, which connects the left and right brain with each other (see Figure 1). The part of the brain stem, to which the pineal is connected, is called "epithalamus" and plays a role in direct survival processes.

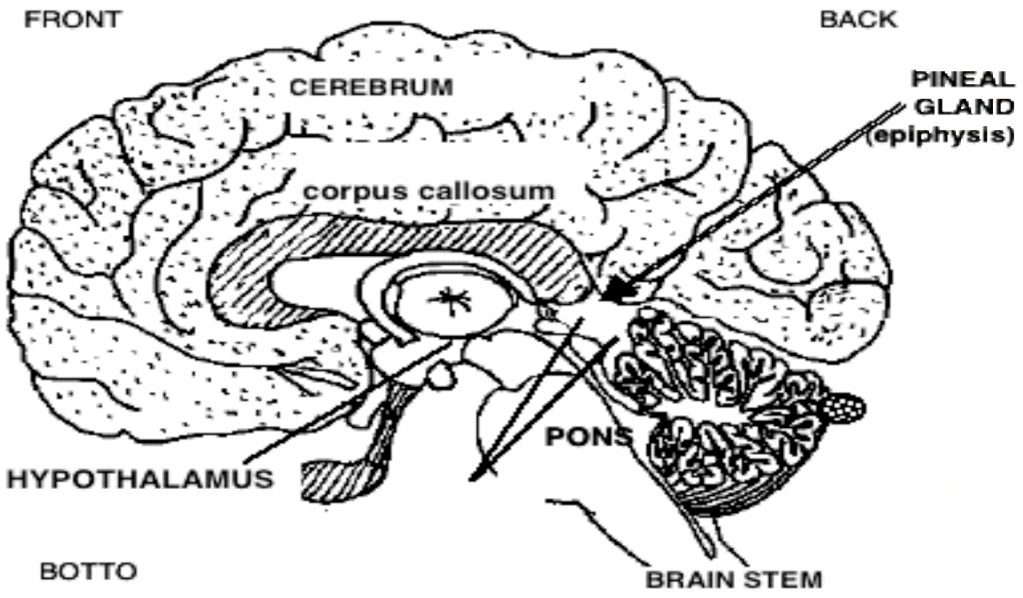

Figure 1 – Location of the pineal gland in the human brain. This is a view on the inside of the right brain.

You can find your pineal gland at the intersection of the following three straight lines: 1) the line connecting the upper attachments of your two ears, 2) the line connecting the point in between your eyebrows and the point about 2 inches (5 cm) above the inion, the point in the centre of the skull ridge at the back of your head, 3) The line connecting your crown and perineum (area of skin in between anus and vagina/scrotum). The pituitary is situated just behind and above the nasal cavity, in between your temples.

The epiphysis is called "**pineal gland**", because it looks like a small pine cone on a stalk. You can also imagine the pineal as a small mushroom, which has not opened yet. Its stalk is connected to the brain stem. The pineal gland has the size of a grain of rice. Figure 2 shows a cross section diagram of the pineal gland.

Figure 2 – Diagram of the pineal gland (cross section), a hollow organ, which is connected to the third brain ventricle and which is surrounded by blood.

According to evolution biology the pineal gland was a third eye, in between the two eyes we know. Some fish, salamanders, crocodiles and

lizards (like the Tuatura in New Zealand) still have a thin part or even a hole in the skull in between their two lateral eyes. Their pineal gland has a part inside the brain from which a thin nerve runs to this point, ending in a structure named "pineal eye", which sits right under the thin part in the skull or under the skin. The pineal eye contains light sensitive cells, may even have a lens and receives information directly about the natural light-dark cycle. In more complex species of animals the pineal is completely inside the brain and indirectly connected to the eyes through nerve pathways. But these pineal glands are still sensitive to the natural light-dark cycle and are informed about it by the eyes. Interesting is that the human embryo in its first weeks still forms a pineal eye, which extends to the forehead and then it is retracted into the brain and integrated into the part of the pineal gland that is here.

The human pineal gland combines hormonal and neuronal functions. The pineal is a special hormone gland, as it sends it hormones into the blood as well as the liquor or cerebrospinal fluid, the clear fluid, which fills the cavities of the brain and the spinal cord. The pineal is a hollow organ, which is connected to the third brain ventricle through its stalk. Thus the pineal is filled with liquor. The outside of the pineal is surrounded by blood, as the pineal is protruding into a blood sinus of the brain.

All hormones of the pineal are derived from one amino acid: tryptophan. Besides being hormone producers the cells of the pineal, the pinealocytes, are also neurons. Just like any other neuron, a pinealocyte exchanges electrical signals with the rest of the brain. An important connection of the pineal is with the eyes. The pineal gland reacts to the light-dark cycle by secreting (i.e. giving off to the blood and liquor) specific hormones. Our biological clock, the suprachiasmatic nucleus just above the optic chiasm, reacts to these hormones. These help it to set its rhythm, which regulates our rhythm of waking and sleeping and thus our daily cycle through different states of consciousness. When we fly through several time zones to the East or West, we may initially have a "jet lag". This is corrected by the biological clock, after it is corrected by the pineal gland, which is informed by the eyes about the shift in light-dark cycle.

Two different nerve connections inform the pineal gland about light and darkness: a fast, sympathetic connection and a slow, central connection. The slow connection informs the pineal about the rhythm of day and night and the changes in the length of the days throughout the seasons. Its nerve connections run from the retinas in the eyes through the optical nerves, hypothalamus, to the upper ganglia on either side of the cervical spine (near the top of the neck) to the pineal.
Through the fast connection the pineal receives information about fast light phenomena, like lightning flashes. From the eyes to the hypothalamus the nerve connection follows the same route as the in the slow system, but then it runs from the back of the corpus callosum to the pineal.

Besides being connected to the eyes, the pineal is also connected to the ears and other senses. The pineal not only reacts to light and darkness,

but also to other stimuli, like sound, smell and other sensory stimuli. Science, however, does not know the function of these connections.

Suggestions have been made in science that the human also perceives electromagnetic signals in the radio range, including changes in the magnetic and electrical fields of the Earth. When a human is isolated from the natural light-dark cycle and just lives with artificial light, the body still keeps to a 24-hour rhythm (Oschman, 2000). The explanation may be a response of the body to an electromagnetic day-night rhythm: variations in the Schumann resonance. The Schumann frequencies shift up and down in the rhythm of day and night with maximally 0.5 Hz. Irregular frequency shifts occur sometimes as a consequence of influences from space, like solar eruptions. The 8 measured frequencies of the Schumann resonance are: 8, 14, 20, 26, 33, 39, 45 and 51 Hz. These frequencies can also be measured in the brain and are within the range of brainwaves. This may be biologically significant. Brainwave measurements have shown synchronization with, but also avoidance of the Schumann resonance frequencies. Because of this, it is presumed that the brain is able to detect and amplify the extremely weak (10 picotesla) signal of the Schumann resonance and to react to it. Some researchers suspect that the reception of the Schumann resonance signal also influences the pineal gland. (Oschman, 2000).

To summarize the above: the pineal gland produces different hormones throughout day and night. These different hormones play a role in our difference in consciousness between waking and sleeping.

The pineal gland and states of consciousness.

We have already seen that the pineal (epiphysis) has a central position in our brain. Does it also have such a central position in our consciousness? To gain more insight in this, one can explore the changes in states of our consciousness in relation to changes in the kind of hormones the pineal produces. Changes in state of consciousness are known to be related to changes in the electrical rhythms of the brain, which can be measured. (van Nieuwenhuijze, 2002, 2003). In the following, first the electrical rhythms the brain will be summarized. Than it will be explored which pineal hormone has which effect on our body and consciousness. Finally another possible electromagnetic relation between our consciousness and biochemistry will be discussed: according to the German engineer Robert Endroes, the hormones emit specific radio waves in the microwave range.

The different states of consciousness can be recognized by what we experience (or don't experience), our electrical brain rhythms and the changes in heartbeat and breathing. Brainwaves are oscillations in electrical potential of 2 to 200 microvolt (millionths of a volt), which can be picked up by electrodes attached to the skin of the head, amplified and registered as the electroencephalogram (EEG), which shows wavy lines. The frequency of these brainwaves is expressed in Hertz (Hz), the number of cycles per second. The different states of consciousness are accompanied by different brainwave patterns and frequency ranges, as illustrated in figure 3. What we measure as brainwaves is caused by the

added electrical activity of many neurons. Each electrode on the head registers the activity of thousands of neurons. The same waves can be registered as magnetic oscillations (MEG, magnetoencephalogram) by sensitive sensors placed close to the head. Important parts of these sensors are the SQUIDs (Super Conducting Quantum Interference Devices), which have to be cooled by liquid helium in order to reach super conduction, which is electrical conduction without any resistance. This is needed to be able to measure the extremely weak magnetic fields of the brain, which are in the order of picotesla to nanotesla, which is a millionth to a thousandth of the strength of the Earth's magnetic field (45 microtesla).

Usually four levels of consciousness are discerned, which are accompanied by 4 different frequency bands in the EEG or MEG of adults. These frequency bands are known as the delta, theta, alpha and beta brainwaves.

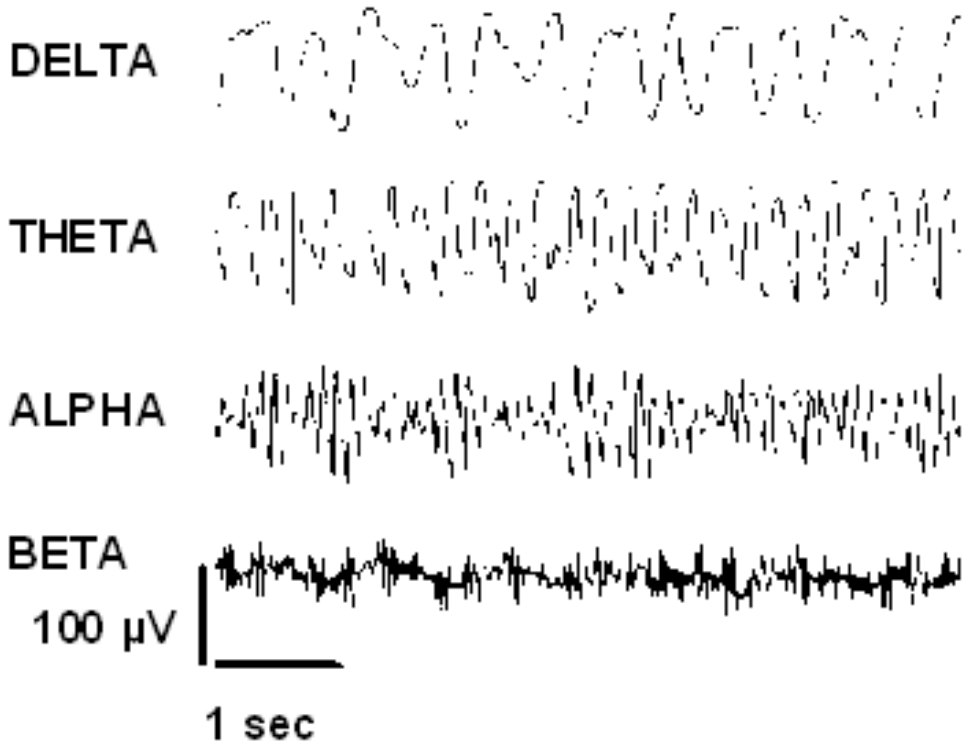

Figure 3 – The four main brainwave frequency bands in the adult human electroencephalogram (EEG). Delta (0.5-4.0 Hz), theta (4-8Hz), alpha (8-12 Hz) and beta (12-60 Hz).

The beta frequency band is further divided in three sub-bands: high, middle and low beta.

High Beta or Gamma (30-60 Hz):
Hyper arousal (hyper-alert state).
40 Hz is important for the integration of all brain functions and possibly also for the intellect and for the experience of meaningfulness.

Mid-Beta (15-30 Hz):
Normal waking, alert state:
Sensory perception
Logical thinking
Decision making
Active visualisation (purposeful imagination)

Low Beta (SMR or Sensory Motor Rhythm, 12-15 Hz):
State of alert relaxation (compare with a cat, waiting for a mouse to appear from a hole).
Important for motor function and body sense (posture, movement, touch).
Important for general organisation of brain functions.
Important for alertness and reaction velocity.

Alpha (7-12 Hz):
Relaxation.
Not thinking, not visualising.
Receptiveness.
Absorption of information.

Theta (4-7 Hz):
Deep meditative state.
Light sleep.
Spontaneous imagery, dreams.
Sleepiness.
States of (dis)comfort.

Delta (0.5-4.0 Hz):
Deepest sleep stage.

Different authors may mention different boundaries between the brainwave frequency bands, as these are not sharp.

The pineal gland as a switch between hormonal and neuronal regulation.

The various hormones, which the pineal sends into the blood and the liquor probably influence the Reticular Activating System (RAS), a bundle of nerve fibres, which run through the brain stem between the pons and the cerebellum (small brain) and from here as a diffuse nerve net to the cerebral cortex (outer layer of the large brain). The activity of the RAS determines the brainwave pattern and thus the level of wakefulness of the

human. It is not known yet which brain centres and nerve connections are important for dreams and visions (the inner experiences). However, the temporal lobes may play a role. But in this area still much has to be clarified. The influence of the different pineal gland hormones (see figure 4) will be discussed below on the basis of an explorative study, which has been performed with people who stayed in a completely dark building for Taoist training (Ackerly, 2002), supplemented with findings from other researchers.

Pineal gland hormones and states of consciousness.

The amino acid tryptophan is the basic substance for all hormones of the pineal gland, which will be discussed below. Tryptophan is not produced by the human body. It is an essential amino acid, which means it needs to be taken in from the food. It can be found especially in pumpkin seeds, lentils, bananas, dates, cottage cheese, eggs, grains, brown rice, sesame seeds, sunflower seeds, peanuts and other nuts. Tryptophan is taken up really well by the brain, when these foods are eaten with something sweet, like a bit of honey. These foods are effective for falling asleep more easily and against depression. (Info from the Dutch website http://www.natuurarts.nl , a website about natural medicine, written by natural medicine practicing MDs). The pineal gland hormones influence neurons in the entire brain.

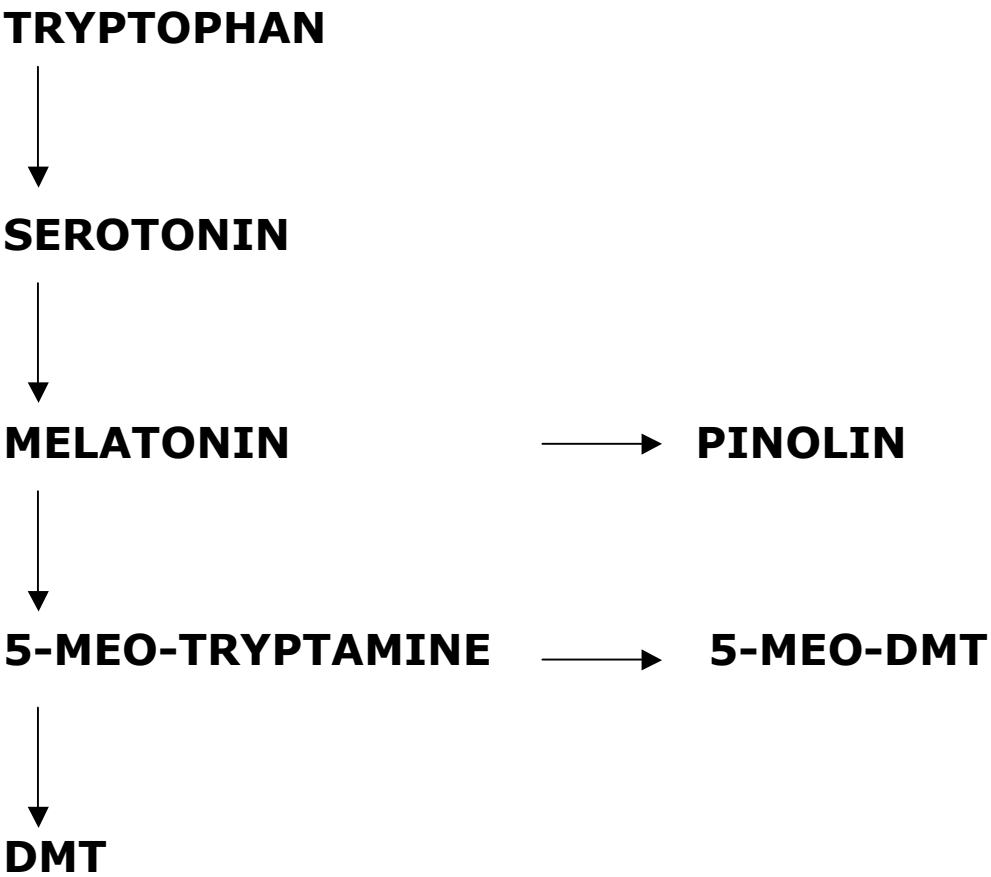

Figure 4 - diagram of the conversion of tryptophan into different pineal gland hormones.
The most important pineal hormones are serotonin, melatonin, pinolin, 5-meo-DMT and DMT. These will be discussed below.

Serotonin - waking

At daytime the pineal gland is stimulated by the daylight to produce serotonin, which keeps us awake and alert: waking consciousness. In waking consciousness one can think clear and rationally and interact consciously with the (social) environment. This state of consciousness is accompanied by beta brainwaves. As soon as one relaxes and stops with thinking or with actively imagining, alpha waves appear in the EEG or MEG. This happens not in everyone. In people who think (almost) exclusively in images, no alpha waves will appear, but theta waves. But, whatever happens, one is still awake and the pineal is sending serotonin into the circulation. Only when one keeps the eyes closed and continues relaxing, like in some forms of meditation, other pineal hormones will appear on the scene. This effect becomes even stronger when one stays in a totally dark space. In the states of consciousness discussed below, our interactions are mainly with our inner world.

Melatonin - sleep

As soon as darkness sets in the pineal converts serotonin into melatonin. This hormone causes our thinking to become less clear: we become sleepy and then we fall asleep. After falling asleep the brainwave pattern quickly goes from alpha through theta to delta (slowest brainwaves), which is accompanied by a slow heartbeat and a slow, deep breathing. Then we move back through the less deep sleep stages and into the Rapid Eye Movements phase (REM). In the REM phase all muscles (except the eyeballs') are paralysed, breathing and heartbeat are irregular and we have lively dreams full of images, actions and emotions. The brainwave pattern looks like beta, but we are still asleep. Because of this, REM sleep is also called "paradoxical sleep" (Shagass, 1972). In a 7 to 8 hour night of sleep we go through 4 to 6 sleep stages and we dream 4 to 6 times. However, we don't dream on melatonin. Just before the REM phase it is converted into other hormones (see next paragraphs).

During a continuous stay in a dark space people are in the so-called melatonin phase during the first 3 days (Ackerly, 2002). The pineal gland produces 2 to 5 milligram of it per day and sends it into the circulation. People sleep a lot during these first 3 days, but also when they are awake the pineal produces melatonin, because the external light stimulus is absent.

In normal life, with light-dark and seasonal cycles, a shortage of daylight can cause too much melatonin in the blood at daytime, which may cause autumn or winter depression. This can lead to pessimistic thoughts and sometimes even thoughts of suicide. This may explain the high number of suicides in Northern areas like Scandinavia. On the other hand, a shortage of darkness thus an overexposure to (artificial) light can lead to a

shortage of melatonin. Melatonin is also important for stimulation of the immune system. Shortage of it may contribute to Chronic Fatigue Syndrome (CFS) and other immune deficiency related diseases. Symptoms of CFS can also be anxiety and depression. Thus a shortage as well as too much melatonin in the body can contribute to these symptoms. Melatonin is also a scavenger of free radicals like highly reactive oxygen in our cells and thus contributes to the prevention of cancer and fast ageing. However, above it has been illustrated that and how we should have a balanced melatonin level. A balanced thus properly functioning pineal may even have a rejuvenating effect on the body.

The visionary hormones

According to James Callaway (1988) melatonin is converted into pinolin, DMT (dimethyltryptamine) and 5-meo-DMT (5-methoxy-dimethyltryptamine) just before REM sleep (the dream phase). Because of their specific psycho-activity these hormones make it possible for us to have spontaneous, inner experiences, thus dreams. Thoughts and emotions can be part of the dreams.

If one of these three hormones is produced in wakefulness, then we will have spontaneous inner experiences like images, as described below. These altered, non-sleeping states of consciousness are accompanied by much theta brainwave activity, especially those at the boundary between theta and alpha, in the small range of 7 to 9 Hz. The small brainwave band is found in the EEG of healers, psychics and meditation practitioners in action. According to James Oschman (2000) these brainwaves exactly follow those of the base frequency of the Schumann resonance (7.8 ± 0.5 Hz), which would only be visible when the EEG rhythm is not driven by the thalamus. This observation still has to be confirmed. The cell in a pacemaker nucleus in the thalamus produce a 6 to 10 Hz rhythm, which is alternating on during 5 to 30 s and off during 5 to 30 s (Oschman, 2000). The 7 to 9 Hz brainwave band can also be measured in people who have been trained to relax deeply, for example by yoga breathing exercises, autogenic training and neurofeedback. This state of consciousness is called "reverie" as it is often accompanied by spontaneously emerging, inner images, while the person stays detached from these. It is known to have a psychologically integrating effect and is used in psychotherapy (Green, 1989). It is also known that some scientists, like August Kékulé von Stradowitz and Albert Einstein, got their brilliant flashes of insight in this state of consciousness. In this way Kékulé found the ring structure of benzene and Einstein his General Theory of Relativity.

Callaway (1988) does not specify the effects of the three different hormones, which originate from melatonin. Ackerly (2002) does, as will be discussed below.

Pinolin – cell repair.

After 3 days of continuous, total darkness, the melatonin concentration in the blood has risen to a level to which the pineal reacts by converting it into pinolin, no matter whether one is awake or not. Pinolin stimulates cell

division (mitosis), which is beneficial for repair (regeneration) processes. Pinolin is able to intercalate with the DNA in the cells, which it enters, which means: it slips in between the base pairs, the genetic code or the rungs of the DNA ladder. This will be discussed later. In the pinolin phase people report lucid dreams (i.e. dreams, in which one is aware that one dreams) and even near-death experiences. During lucid dreams one can consciously interact with one's dream world. Sometimes clairvoyance and clairaudience occur. Sensations in the form of light, images and music may occur. In this state one can gain insights about the cosmos and oneself, which supports psychological integration. These processes continue until the fifth day in darkness (Ackerly, 2002). After this, the following hormone starts to act.

5-meo-DMT – clarified consciousness

From day 6 to 8 in darkness the pineal converts melatonin into 5-methoxy-dimethyltryptamine (5-meo-DMT) through the intermediate form 5-methoxy-tryptamine. The 5-meo-DMT is also called "akashon". It is very luminescent, meaning it emits light. After stimulation by light it is also phosphorescent. This hormone activates 40 % extra of the cerebral cortex. People experience telepathy and even have the sensation of travelling outside the body in a spatial hologram-like reality. In this stage the production of 5-meo-DMT can also be slightly inhibited, which is accompanied by deep, meditative trance states. 5-Meo-DMT intercalates (slips in between the base pairs) of messenger-RNA, which mediates in the gene expression (Ackerly, 2002).

DMT – clarified perception

During day 9 to 12 in darkness the pineal converts melatonin into dimethyltryptamine (DMT) though the intermediate form 5-methoxy-tryptamine. If enough DMT circulates through the body the experience can be very visual. Eyesight expands into the infrared and ultraviolet. A person staying in absolute darkness can see another one in infrared and approach and touch him/her. Also in the DMT phase one experiences oneself in a different reality, complete with images and sound and one can interact with these. With specific exercises, together with a partner, deep love and compassion can be experienced, accompanied with deep orgastic experiences. Ackerly states that then there is an 8 Hz oscillation in the whole body, similar as the base frequency of the Schumann resonance. In the DMT phase one needs very little sleep: just 3 hours a day (Ackerly, 2002).

With training, deep meditation and certain breathing techniques like conscious connected breath may also induce altered states of consciousness (probably mediated by the pineal's production of pinolin, 5-meo-DMT and DMT) without the need to stay in total darkness. Conscious connected breath originates in shamanism and has been rediscovered in the early 70's and applied by Dr. Stanislav Grof as Holotropic Breathwork and by Leonard Orr as Rebirthing. Both are powerful therapeutic techniques.

DMT is not only produced in our body. It can also be found in certain plants. In various cultures such plants are used to induce a state of clarified perception. An example is the herbal mix ayahuasca, which is traditionally used by South-American shamans from the Amazon region. Today DMT is also synthesized and can be ingested, smoked or injected. Within half an hour this leads to inner experiences comparable to those in darkness. However, there is an important difference. DMT produced by our pineal gland is part of a biochemical cycle, in which substances are converted into each other. The DMT metabolites (waste products) inhibit the production of more DMT by the pineal, so that a general balance is maintained. This does not happen when DMT is taken in from outside the body. Also then DMT metabolites arise, which inhibit the pineal production of DMT. However, these metabolites are not in balance with the biochemical reaction chain, thus the biochemical balance becomes disturbed. The pineal stops producing DMT and becomes lazy when ayahuasca or synthetic DMT is used too frequently. Rare, respectful use like in the shamanic tradition may not disturb the balance.

Rick Strassman in the USA has studied the effects of DMT. With healthy, adult subjects he has performed research (not in the dark) on the experiences they had after administration of DMT. He chose to inject DMT, because this would allow a better control of its blood level than ingestion or smoking of DMT would do. The subjects, who were in a bed in a hospital during these experiments, reported an enormous range of experiences. The experience usually started with seeing light, colours and geometrical shapes and hearing high-pitched sounds, followed by seeing and hearing bizarre beings and machines. The experience culminated in the sensation of journeying outside the body into other realities, interacting with these. Some volunteers even described near-death experiences and clairvoyance in space and time (Strassman 2001). Possibly also during dying DMT plays a role in the (near) death experiences that are sometimes described by the transitioning person (McKenna, 1993). Probably a relation between the transitions between life and death/afterlife and between waking and sleeping exists.

Working mechanisms

Only a limited amount of knowledge is available about the working mechanisms of the pineal hormones. It is unknown why the different pineal gland hormones have such different effects. As mentioned, tryptophan is converted into the different psychoactive hormones, which are each active in their own way. These all bind to the same membrane protein, the serotonin (or 5-HT) receptor, which is present in many neurons, spread over the entire brain. Through the receptor the hormone induces biochemical processes inside the cell, leading to depolarisation: reversal of negative and positive charge inside and outside the cell. This leads to complex patterns of action potentials, electrical pulses that move from one neuron to the other. The pineal gland hormones possibly don't always stay connected to the receptor, but sometimes enter the cell and even its nucleus. This has been suggested, because about pinolin, 5-meo-DMT and DMT it is known they can glide in between the base pairs (the genetic code) of DNA, a process called "intercalation". This is possible,

because the pineal hormone molecules have a shape and size very similar to the DNA bases. Intercalation changes the spatial shape (conformation) of DNA. This alters its gene expression, the pattern of genes that can and can not be reached by the enzymes, which copy the genetic codes in the form of messenger RNA, leading to protein synthesis in the cell (McKenna, 1993).

Not only the spatial shape of DNA changes, but also its internal energy distribution. On intercalation, changes are measurable in the numbers of biophotons emitted by the cell, probably by its DNA in combination with proteins. The light called "biophotons" is different from chemiluminescence and phosphorescence. It is emitted in extremely low intensities by organisms and especially by humans. This requires very sensitive equipment and measurements in total darkness. Fritz Albert Popp of the International Institute of Biophysics in Neuss, Germany, suggests that biophotons also play a role in the origin and functioning of our consciousness (Bischof, 1995). One could speculate further, that the psycho-active effects of the pineal hormones can be (partly) explained by this. The McKenna brothers speculate that the electron spin resonance of the intercalation process between the tryptamine molecules and the neuron DNA creates a standing wave in space, which is the hologram of an idea: the inner experience that we have. They presume this electron spin resonance, which' frequency is in the audio range, is somehow translated into the sound, which is often heard in the head by people who use tryptamines (McKenna, 1993).

Electromagnetic influences

Artificially generated electromagnetic fields, especially the 50 Hz magnetic fields of our electricity net (and the 60 Hz in the USA), which fill the air, can cause a decrease in the production of melatonin by the pineal gland, causing a lack of sleep. If people complain about a lack of sleep, it could be wise to find out whether their bedside cabinet is full of equipment connected to the power net, like (radio) alarm clocks, lamps, telephones or telephone chargers. Or, whether they are sleeping under an electrically heated blanket or above an electrical mechanism used for changing the shape of the bed. These devices have a strong 50 Hz magnetic (and electrical) field around them, which can disturb the normal functioning of the pineal gland (Redecke, 1999).

Measuring the pineal gland.

It is possible to measure the activity of the pineal gland in at least three ways.

1) Chemical: The hormones, which are produced by the pineal, can be measured in the blood, cerebrospinal fluid and urine in a clinical-chemical laboratory.

2) Biomagnetic: the pineal is situated too deep in the brain to register its activity in the EEG. MEG in combination with the right spatial-statistical filtering software is able to detect the activity of a small, centrally located

source like the pineal gland. The author and a colleague have been able to detect a response by the human pineal to simple, sound stimuli, using a 180-channel SQUID magnetoencephalography device around the head. As far as we know, nowhere in the world this has been done yet. The pineal is not only connected to the eyes, but also to the ears. However, the biological function of this latter connection is not known yet scientifically.

3) Microwaves: rotations and vibrations of biomolecules lead to the emission of microwaves and infrared light. The emission of microwaves must be especially strong for hormone molecules. Because of this the hormone glands have a strong microwave emission compared to the rest of the body. However, its intensity is extremely low (in the order of microwatts), which requires very sensitive equipment. Robert Endroes, a deceased German engineer, writes in his book "Die Strahlung de Erde" ("The Radiation of the Earth", in German1988) that he has succeeded in doing such measurements, the procedure of which he has patented as a medical diagnostic method. In the 1970-s and 1980-s he detected microwaves with wavelengths of 1 to 20 cm (frequencies 1.5-30 Ghz) from the human hormone glands, up to 2.4 m away from the body, even in non-shielded environments. For these measurements he used a rod antenna, which he could shorten or lengthen in order to measure different wavelengths. He stated he could differentiate among the glands, even glands as close together as the pituitary and the pineal, because the microwave radiation from each gland was polarised in a different direction. The author of this article has been trying, with the help of an electronics engineer, to reproduce such measurements with a variety of microwave detection equipment, but without success yet.

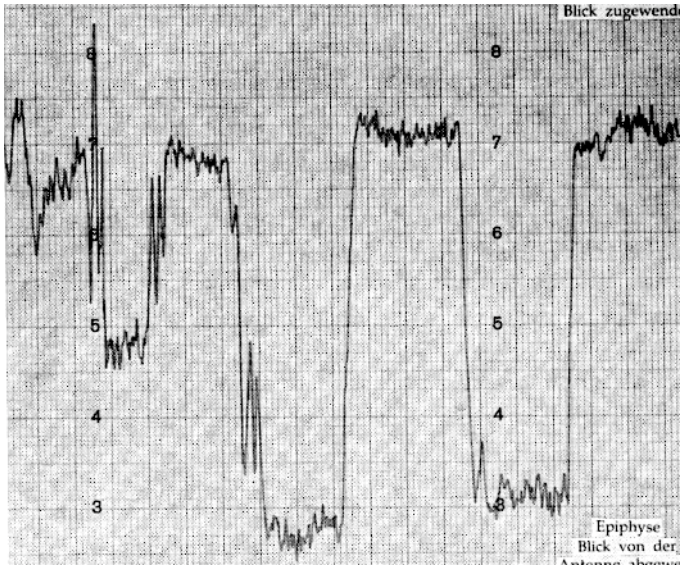

Figure 5 - Intensity of the spontaneous microwave emission of the pineal gland, measured at a distance of 2.4 meter. Recording at 3190 megahertz, while the subject faces the antenna (upper side of the curve) and while the subject looks away from the antenna (looks to his side, bottom side of the curve).

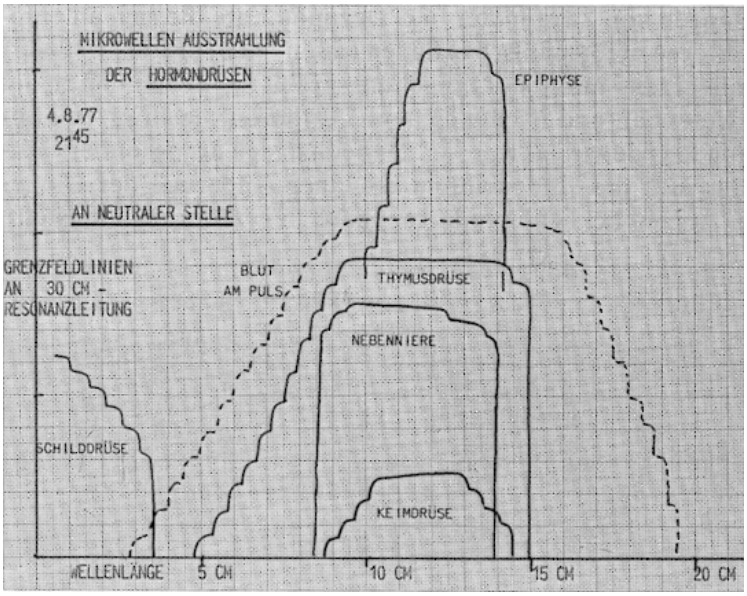

Figure 6 - Intensity spectrum of the microwave emission of the hormone glands.
Epiphyse = epiphysis (pineal gland), Blut am Puls = blood, measured at the wrist (veins). Thymusdrüse = thymus gland, Nebenniere = adrenal gland, Keimdrüse = sexual gland, Schilddrüse = thyroid gland.
Horizontal axis: wavelength in cm, vertical axis: relative units.
Both illustrations are from: Endroes R. (1988), Die Strahlung der Erde, Paffrath-Druck, Remscheid, Germany.

Conclusion

The human pineal gland plays a key role in the brain. Neurons as well as hormones are essential. Not only chemical, but also electromagnetic effects play a role. The gland sends different hormones, all derived from tryptophan, into the blood and cerebrospinal fluid. These influence the neurons of (among other things) the reticular activating system in the brain and thus the human state of consciousness. The different pineal hormones function as a kind of keys for the brain cells, inducing different states of consciousness in the course of the day-and-night cycle. In the waking state (serotonin) we are in contact with the outer world. During sleep, several weeks in darkness and during deep meditation (melatonin, pinolin and (5-meo-)DMT) we are in contact with our inner world. Pinolin and (5-meo-)DMT probably play a role in dreaming and altered states of consciousness , in which one experiences inner, alternative realities and even clairvoyance. The alternating production of serotonin and melatonin make a sleep-waking rhythm possible. The states of consciousness during sleep serve psychological integration processes. Deep sleep serves biological repair processes. Sufficient sleep, inner rest and nutrition rich in tryptophan, optimise the functioning of the pineal gland.

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Summary

States of consciousness, emotions and thinking are influenced and sometimes even induced by various hormones, enkephalins and neurotransmitters. Because certain states of consciousness are a prerequisite for thinking, this article elaborates on the hormones from the pineal gland. Their production varies as a function of diurnal cycles, sleep cycles and deep, meditative trance. The various hormones from the pineal gland give rise to different states of consciousness, which enable humans to experience their inner or outer world and which are accompanied by different brainwave patterns.

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