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Review Article

The Function of the Pineal Gland and its Hormone Melatonin in Demarcating Periods of Time, and in Enhancing Physical and Spiritual Rest - ②

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Summary

The function of the Pineal Gland - a pea-sized portion of tissue situated in the center of the brain, was always a mystery, until relatively recently (in 1958), when it was found to be an Endocrine Gland, synthesizing and releasing a hormone called Melatonin. In a Circadian rhythm, melatonin is secreted in the darkness of night. Together with many other physiological functions, it has a calming or hypnotic effect on the body in readiness for rest and sleep. Apart from circadian rhythms, many living creatures universally exhibit Circaseptan (or seven-day) rhythms, and this fact is firmly established in the literature.

Vollrath, et al. [1] have found in experiments on rats, that there is a Circaseptan (seven-day) rhythm in the output of melatonin, with very significant PEAKS in its concentration on Saturdays. Other research studies on human MOOD, have also shown a Circaseptan pattern, with a “positive affect” or ‘pleasant mood’ accentuated especially on Fridays and Saturdays, with a decrease in “negative affect” or ‘bad mood’ on Saturdays [2]. In these and in other examples cited in the text, it is evident that something SPECIAL or significant occurs on Saturdays.

Recently, Chronobiologists at the Chronobiology Center at the University of Minnesota, found seven-day weekly (Circaseptan) rhythms in the physiological and biochemical behavior of many living creatures. Most significantly, they found repeatedly, that Circaseptan rhythms can be AMPLIFIED and RE-SYNCHRONIZED by a “Single Stimulus”, i.e. in response to a one-time event, such as in (I) Organ Transplantation, (II) Being born (stress of birth), and (III) after balneotherapy [3]. It is most important to note here that a process of ‘GROWTH AND REGENERATION’, with immune system involvement, is common to all three examples.

Bearing these findings in mind, this paper presents HYPOTHESIS #1, namely:- When at Creation in Genesis 2:1-3, God blessed and sanctified the seventh day, (Saturday) the BLESSING and SANCTIFICATION acted as a “Single Stimulus”, which evoked a LITERAL physiological, endocrinological and immunological response in the body, analogous to the University of Minnesota examples. A seven day rhythm was thus initiated, inducing an increased Melatonin output on the initial Seventh Day. An amplification of the seven day rhythm on each subsequent seventh day, manifests itself as renewed “Growth and Regeneration”. The rhythmical Melatonin output, with its calming effect, gives rise to mental tranquility/serenity and conditions our MOOD for worship.

Following on hypothesis # 1, the hypothesis #2 can be enunciated as follows: Because there is physical evidence of a “SPECIAL” seventh day (Saturday) genetically ‘written’ in our bodies, and because this seventh day runs parallel to the ancient written Biblical Seventh Day Sabbath, (Saturday) we can posit that the Saturday (seventh day) demarcated in our DNA, is identical with the Biblical Seventh Day Sabbath, thereby affirming which day of the week is the true Sabbath.

Hopefully, previously confirmed skeptics as it relates to the true Sabbath Day for worship, may be encouraged to re-consider their position, of course with the help of the Holy Spirit.

HISTORICAL BACKGROUND

Throughout ancient history, the pineal gland, situated in the “middle” of the brain, and only the size of a pea, had always been a mysterious organ, even being considered the “Seat of the Soul” by Descartes in the 17th century.

During the 18th century, interest in the gland waned to such an extent that it was only regarded as a “Vestigial Remnant of Evolution.” However, in the late 19th century, the gland’s histological structure

and its photoreceptive role were discovered. This was followed in the early 20th century by the revelation of its endocrine glandular role, which was highlighted during the discovery of the relationship between pineal tumors and precocious puberty [4].

As recent as 1958, Aaron B. Lerner and his team isolated the gland’s hormone - Melatonin. The pineal gland was then credited with the function of being a “neuroendocrine transducer,” responsible for transforming light cues from the retina of the eye into an endocrine response, manifested by the synthesis and release of the Melatonin hormone [4].

We now know that Melatonin, which is the principal hormone of the pineal gland, acts as a powerful neurotransmitter in the brain and the central nervous system. It is involved in circadian rhythms, and also has several other biological functions.

CIRCADIAN RHYTHMS

In 1959, the scientist, Prof. Dr. Franz Halberg, first referred to endogenous biological rhythms occurring “about one day” (i.e. 24 hours) as “circadian”. Other endogenous rhythms have since been divided into “ultradian” for rhythms with periods shorter than 24 hours (< 24 hrs), “infradian” for rhythms longer than 24 hours (> 24 hrs), and “circa-annual” for seasonal rhythms having periods of approximately one year.

We will focus, firstly, on the circadian rhythm which is demonstrated by the pineal gland’s hormone – Melatonin (N-acetyl-5-methoxy-tryptamine), which is secreted under the control of the Central Nervous System (CNS) and the Supra-Chiasmatic Nucleus (SCN) of the hypothalamus.

Melatonin is synthesized by the pineal gland and secreted during the dark phase of the day (i.e. at night). The rhythm is endogenous, i.e. internally generated in man and in most animals.

Melatonin secretion is related to the length of the night; the longer the night, the longer the duration of secretion. Natural light to the eye serves to synchronize the Melatonin rhythm to 24 hours, suppressing its secretion during daylight hours and increasing its production at night in what is known as the “sleep-wake cycle” or “dark-light cycle.” Artificial light at night not only disrupts the circadian rhythm but also suppresses the production of Melatonin by the pineal gland. This “circadian” disruption and nocturnal Melatonin inhibition may have some negative consequences, notably cancerous formation and cancer growth. Night-shift workers who perform their duties in artificially lighted rooms at night and persons with frequent jet lag e.g. pilots and flight attendants are especially at risk [5].

Melatonin rhythmicity is important in several metabolic functions as it acts as an anti-oxidant and as an anti-inflammatory agent. The hormone is successfully used as therapy for certain sleep disorders related to abnormalities of circadian rhythm and is also a mild hypnotic. By this latter action, it prepares the body for rest and sleep. Melatonin in animals has been known to cause sedation,

hypothermia, anxiolysis, muscle hypotonia, decrease in locomotor activity, slight analgesia, slight protection against ECT shock, constriction of cerebral arteries, and calmness in readiness for sleep at night.

CIRCASEPTAN RHYTHMS

Circaseptan literally means “about seven” and refers to a period of about seven days duration.

Approximately weekly rhythms known as “circaseptan rhythms” are some of the most fascinating findings of chronobiology – the science of biological rhythms.

On the surface it would appear that circaseptan rhythms are the result of the seven-day cultural week. However, plants, insects, and animals other than humans also have weekly cycles suggesting that Biology and not Culture, is probably at the source of circaseptan rhythms. Franz Halberg the world’s foremost authority on rhythms and the pioneer of the science of chronobiology proposes that body rhythms of about seven days, far from being passively driven by the social cycle of the calendar week, are innate, autonomous, and perhaps the reason why the calendar week arose in the first place.

We are mostly familiar with the daily rhythms of the sleep/wake cycle, the monthly menstrual cycle and many seasonal cycles. However, the new science of chronobiology has begun to make us aware that we live in a universe replete with circaseptan rhythms. A seven-day cycle has been found in many physiological fluctuations in blood pressure, heart rate, body temperature, and in the concentration of various body chemicals [5]. Many physiological variables are now known to have circaseptan rhythms. Halberg offers this intriguing insight into this new field of study.

“Chronobiology is the eminently interdisciplinary science of interactions in time among metabolic, hormonal, and neuronal networks. It involves anatomy, biochemistry, microbiology, physiology, and pharmacology, at the molecular, intracellular, intercellular, and still higher levels of organization. The compounds coordinating a time structure -- proteins, steroids, and amino-acid derivatives -- provide for the scheduling of interactions among membrane, cytoplasmic, and nuclear events in a network involving rhythmic enzyme reactions and other intracellular mechanisms. The integrated temporal features of the processes of induction, repression, transcription, and translation of gene expression remain to be mapped . . .”:

It does appear that the body has a well developed system for the timing and synchronization of its various metabolic activities. Biological systems are able to reset themselves each day to the twenty-four hour rhythm, thanks to many powerful time cues e.g. the day/night cycle. Chronobiologists call these cues zeitgebers, (German for ‘time-givers’). Some of the cues are internal and others external to the systems. Our internal rhythms also help synchronize each other, for none of the myriad rhythms within our bodies works in isolation. The interrelationships between the rhythms are carefully choreographed.

If all the circaseptan cycles were to vary from a precise 7 day or 168 hour week, in time, the cycles would get intolerably out of sync. One would hypothesize then that there are zeitgebers synchronizing the circaseptan rhythms to the seven-day weekly cycle. In this regard, there are studies which show significant differences in the daily values of the pineal hormone Melatonin, which may be serving as an internal Zeitgeber for the synchronization of the circaseptan rhythms [1].

PHYSIOLOGICAL EFFECTS OF MELATONIN

A seven-day (circaseptan) cycle is the key coordinating rhythm for the body’s many rhythmic interactions which are found in fluctuations of blood pressure, blood acidity, red blood cells, heartbeat, oral temperature, urine chemistry and volume, relationship between norepinephrine and epinephrine, and fluctuations of cortisol which is the stress-coping hormone, which also enhances the immune system. All of these fluctuations are governed by Melatonin, which is a multifunctional molecule and for which there is evidence suggesting the presence of an about 7-day variation. Along with its powerful antioxidant properties, melatonin has beneficial effects in cardiovascular (or heart-related) disorders, body-weight control, energy metabolism, sleep, insulin resistance, obesity and cancers amongst other aspects of body physiology.

Melatonin also acts as an anti-excitatory, anti-inflammatory, immuno-modulatory agent together with important properties as a sedative or hypnotic, thereby inducing nightly rest as it “tones-down” the other endocrine hormonal activities.

By its action as a hypnotic and sedative, the seven-day cycle of melatonin not only gets the body ready for rest but also helps humans to spiritually get in sync with their Creator and to be in harmony with His Divine Nature.

EVIDENCES OF CIRCASEPTAN RHYTHMS

Seven-day rhythms seem to be universal as they are found in algae, rats, mice, guinea-pigs, honeybees and even in primitive one-celled organisms [6]. The following findings are instructive.

- 1) Vollrath, et al. [1] in their research on rats in London, showed that along with a circadian release of melatonin from the pineal gland, there is also a circaseptan variation in its concentration. They found that melatonin concentration peaked significantly on Saturday, when compared with other days of the week.
- 2) Honeybees in remote areas of Brazil have been kept by families for generations away from modern civilization. On the 7th Day Sabbath, those bees stay in their hives and rest. They didn’t go out of their hives to gather nectar nor did they have any other work activities on that day, but on the following day (Sunday) the bees resumed their busy activities. They have since been referred to as “Sabbath-keeping Bees.”
- 3) In the primitive giant alga (*Acetabularia mediterranea*) an innate rhythm of about seven days had been discovered by the famous chronobiologist Franz Halberg. When this alga is removed from alternating 12-hour light and dark spans, this single intact cell is able to translate the light and darkness into the measurement of a seven-day week. Experimentation with rats, face flies, plants and other life forms have also revealed similar circaseptan rhythms by Franz Halberg, et al. [6,7].
- 4) The formation of tooth enamel follows a 7-day (circaseptan) rhythm. In dental enamel in growing human teeth, there are small lines or ridges which exhibit a seven-day weekly rhythm with a dark marker in these ridges indicating a weekly “rest” in the formation. These ridges (called Striae of Retzius) are present even in the teeth of fossil hominids that lived before modern culture existed, - indicating an innate and ancient origin and not just recent “social” or “cultural” ones [8,9].

- 5) At the Halberg Chronobiology Center in the University of Minnesota, it has been repeatedly found that circaseptans can be amplified and re-synchronized by a single stimulus, i.e. in response to one-time event. This has been seen in studies by Dr. G. Hildebrandt in his balneotherapy treatment of patients. The process of organ transplantation (done also in Minnesota and in Italy) evoked a similar response. Also after a single stimulus of "being born" the blood pressure and heart rate of infants in the Neonatal Intensive Care Unit (NICU) in Minnesota displayed a circaseptan pattern [3]. It is important to note here that a process of growth and regeneration with immune system involvement is common to all three examples.
- 6) Research studies on human mood have also shown a weekly circaseptan pattern with a "positive affect" or "pleasant mood" elevated especially on Fridays and Saturdays and a decrease in "negative affect" or "bad mood" on Sabbath [2]. Comparable results have been shown by Areni & Burger [10]. The enhancement of a positive affect on Sabbath facilitates worship.

In summary therefore, a few points must be emphasized.

- 7) (a) The seven-day rhythm seems to be ancient and innate in all living cells and is perhaps the rhythm of life itself. Like circadians, circaseptans are anchored in genomes from bacteria to humans [6] i.e. these biological rhythms are "hard-wired" into the DNA of living organisms, as the work by Halberg, et al. [7] on the endogenicity of circaseptans in twins and neonates shows.
- (b) As mentioned earlier, biological systems can reset themselves each day to the 24-hour rhythm, because of certain powerful time cues e.g. the day/night cycle. Some of these cues are internal and others external to the systems. Our internal rhythms, circadian and circaseptan, help to synchronize each other, thus preventing cycles from getting intolerably out of sync.
- (c) The pineal gland has been found to be remarkably periodic and circaseptans have been demonstrated in the content of its hormone melatonin [11].

THE BASIS FOR HYPOTHESIS #1

The back-drop to hypothesis #1 is related to the findings of researchers at the Chronobiology Center at the University of Minnesota, USA, where it was repeatedly found that seven day (circaseptan) rhythms are amplified and re-synchronized by a single stimulus i.e. in response to a one-time event. Examples of such stimuli (Zeitgebers) are (1) stress of birth (being born), (2) after organ transplantation, (3) after balneotherapy. It is observed that common to all three, are the prominent expressions of growth and regeneration with immune system involvement. It is proposed that a similar "stimulus" (or zeitgeber) occurred at creation on the seventh day.

In Genesis 2: 1-3, KJV. God blessed and sanctified the seventh day of creation. This blessing and sanctification acted as a single stimulus which evoked a LITERAL physiological, endocrinological and immunological response in the body, particularly in the Pineal Gland with an increased melatonin output on that initial seventh day. This was repeated every seventh day thereafter. As a consequence of these, a weekly seventh day (circaseptan) rhythm was induced and

expressed as renewed growth and regeneration. On each subsequent seventh day, there is not only physical regeneration but also amplification and re-synchronization of bodily rhythms, giving rise to mental tranquility/serenity and as stated below, the precipitation of "good mood" on the seventh day.

This hypothesis is supported by the MOOD studies in which there is a marked enhancement of "positive affect" or "pleasant mood" on the seventh-day, accompanied by a decrease in "negative affect" [2,10,12] showed comparable results in their mood studies. Also in support of this is the behavior of the "Sabbath-keeping Bees" which suggests that "something significant" occurs on the Seventh-day. In other words, the biological origin of the week suggests that the seven-day cycle has been programmed into the DNA of living organisms.

These findings of elevated melatonin secretions with its calming and hypnotic effects, along with the increase in "good mood" on Saturday, suggest that God has actually put a biochemical substance in our genetic make-up as in Franz Halberg [13] to empower us and to put us in a mood to rest and worship on the seventh-day. Our physiological and psychological condition on the seventh day, re-energizes and re-synchronizes our body rhythms, making them conducive for us to rest and to "Remember the Sabbath Day" as God has designed in Genesis 2: 2,3 KJV and commanded in Exodus 20:8-11.KJV. The rhythms of nature are, therefore, in sync not only with each other but are also in harmony with the Creator's design.

In general, TIME itself is being measured by the Pineal's reaction to light and darkness, which are cosmic realities, which were introduced at creation week.

SUMMARY OF HYPOTHESIS # 1

As discovered in scientific studies, certain physical/medical procedures having prominent expressions of growth and regeneration common to them, act as single STIMULI for amplification and re-synchronization of seven day (circaseptan) rhythms in humans.

It is proposed that in a similar process, God's blessing and sanctifying the seventh day at Creation as recorded in Genesis 2: 1-3, (KJV) acted as a single stimulus which evoked a LITERAL physiological, endocrinological and immunological response in the Pineal Gland with increased Melatonin output on that initial seventh day and is amplified at each subsequent seventh day.

"TIME MARKER" OF THE SEVENTH-DAY SABBATH

The question may be asked, "Can we find any other evidence of the Origin of the seventh day Sabbath apart from the Bible?" This paper submits that another Origin of the seventh day Sabbath, previously unrecognized, does exist and has been "written" in our genes since Creation Week. Does this physical evidence "written" genetically in our bodies correlate with the seventh day as recorded in the Bible? It would seem so. As outlined in the previous pages of this paper, the Saturday or seventh day which is demarcated physiologically and biochemically in living creatures, is the same seventh day as recorded in the Bible. That is, each line of evidence showing the importance and the uniqueness of the Seventh Day, agrees with, and supports the other.

In his book entitled "The Lost Meaning of the Seventh Day", Sigve K. Tonstad makes the following observation:

"Most remarkable, perhaps is the growing realization that the

seventh day leans on nothing less than the Bible for its origin and meaning. This may be called negative evidence - the silence of the other sources. Numerous attempts have been made to detect some kind of seventh day precursor in the language and ruins of the Near East but to no avail." "On this point," he says, "there is an unusual degree of agreement among the vast majority of scholars" [14].

Tonstad goes on to quote the supporting statements of several of these scholars, including Neils-Erik Andreasen [15,16] who affirmed that "so far, no Sabbath has been found in extra-Biblical sources." These statements act as a backdrop for a second hypothesis.

THE BASIS FOR AND SUMMARY OF HYPOTHESIS #2

Tonstad asserts that there is no written evidence in ancient cultures of the seventh day Sabbath apart from that written in the Bible. However, this paper presents Hypothesis #2, namely that the Seventh Day Sabbath is "written" genetically and inculcated physically within the bodies of all living creatures since the inception of time. Based on what has been postulated in hypothesis #1, this demarcation of Saturday as the Seventh Day, runs parallel to and is identical with the ancient Biblical Seventh Day Sabbath, and is therefore a "kind of seventh day precursor".

The universal seventh day periodicity in nature with the increased activity of the Pineal Gland and that of its hormone melatonin on the seventh day creates a physically and mentally conducive condition and a mood-enhancing atmosphere for the worship of God.

In summary, previously unrecognized physical evidence genetically "written" and embodied in all living creatures, demarcates Saturday as a "special" seventh day which runs parallel to, and is identical with the Sabbath worship day of the Bible. Therefore each line of evidence for a seventh day Sabbath positively reinforces the other.

CONCLUSION

God has created in our bodies, a light-controlled biological clock called the Pineal Gland, which produces a hormone named Melatonin. By creating in us an innate mechanism whereby Melatonin concentration PEAKS on Saturday, our Creator God is emphasizing the importance of THAT day - the same day which the Bible espouses and which we are commanded to Remember (Ex 20:8-11. KJV. . On this day we interact with God, get to know Him better and are in harmony with His whole Creation. He gives us irrefutable evidence (in our actual DNA), that Saturday - the seventh day is SPECIAL, and that it corresponds exactly with the Sabbath Worship Day designed by Him in Genesis 2:1-3 and commanded by Him in Exodus 20:8-11. (KJV).

REFERENCES

1. Vollrath L, Kantarjian A, Howe C. Mammalian pineal gland: 7-day rhythmic activity? *Experientia*. 1975 Apr 15;31(4):458-60. doi: 10.1007/BF02026378. PMID: 1120520.
2. Cornélissen G, Watson D, Mitsutake G, Fišer B, Siegelová J, Dušek J, Vohlídalová, Svaèinová H, Halberg F. MAPPING OF CIRCASEPTAN AND CIRCADIAN CHANGES IN MOOD. *Scr Med (Brno)*. 2005;78(2):89-98. PMID: 18985163; PMCID: PMC2577283.
3. Cornélissen G, Halberg F. The biological week and broader time structures (chronomes): in memory of Gunther Hildebrandt. *Percept Mot Skills*. 2000 Apr;90(2):579-86. doi: 10.2466/pms.2000.90.2.579. PMID: 10833757.
4. López-Muñoz F, Marín F, Alamo C. El devenir histórico de la glándula pineal: II. De sede del alma a órgano neuroendocrino [The historical background of the pineal gland: II. From the seat of the soul to a neuroendocrine organ]. *Rev Neurol*. 2010 Jan 16-31;50(2):117-25. Spanish. PMID: 20112220.
5. Perry S, Dawson J. *The Secrets Our Body Clocks Reveal*. New Year: Rawson Associates; 1988. p.20-21.
6. Greenaway GK. *The Seven-day Rhythms of Life*. 2022. p.60-76. Endnotes 35-94.
7. Greenaway GK. *The Seven-day Rhythms of Life*. 2022. p.13-19.
8. Beynon AD. Circaseptan Rhythm in Enamel Development in Humans and Plio-Pleistocene. 295-307.
9. Lacruz RS, Rozzi FR, Bromage TG. Variation in enamel development of South African fossil hominids. *J Hum Evol*. 2006 Dec;51(6):580-90. doi: 10.1016/j.jhevol.2006.05.007. Epub 2006 Aug 5. PMID: 16999985.
10. Areni CS, Burger M. Memories of "Bad" days are more biased than memories of "Good" days: Past Saturdays vary, but past Mondays are always blue. *J Appl Soc Psychol*. 2008;38:1395-1415.
11. Cornélissen G, Engebretson M, Johnson D, Otsuka K, Burioka N, Posch J, Halberg F. The week, inherited in neonatal human twins, found also in geomagnetic pulsations in isolated Antarctica. *Biomed Pharmacother*. 2001;55 Suppl 1:32s-50s. doi: 10.1016/s0753-3322(01)90004-6. PMID: 11774867.
12. Areni CS. (Tell me why) I don't like Mondays: Does an overvaluation of future discretionary time underlie reported weekly mood cycles? *Cognition and Emotion*. 2008;22(7):1228-1252.
13. Halberg F. The week in phylogeny and ontogeny: opportunities for oncology. *In Vivo*. 1995 Jul-Aug;9(4):269-78. PMID: 8555425.
14. Sigve K Tonstad. *The Lost Meaning of the Seventh Day*. Andrews Univ Press; 2009.
15. Niels-Erik Andreasen. Rest and Redemption, 23; idem, "Recent studies of the Old Testament Sabbath: Some observations," *ZAW86*. 1974;453-469.
16. Cornélissen G, Portela A, Halberg F, Bolliet V, Falcon J. Toward a chronome of superfused pike pineals: about-weekly (circaseptan) modulation of circadian melatonin release. *In Vivo*. 1995 Jul-Aug;9(4):323-9. PMID: 8555431.