

JEDNAK



KSIĄZKI

GDANSKIE CZASOPISMO HUMANISTYCZNE

2015 nr 4

o Młodej Polsce mniej znanej

ESEJE

A SCIENTIFIC INQUIRY: GALEN'S OPTICS IN DREAMS OF VISION, LIGHT & PRE-NATAL MEMORY

JUDY B. GARDINER

The International Association for the Study of Dreams

The following inquiry is derived from a study in dreaming consciousness commencing in 1994. A series of thirty-eight interlocking dreams revealed Claudius Galen's (c130–201) pneumatic doctrine of vision. His theory of a direct path of light rays to the optic nerve is the focal point. This stimulated my interest in the optic disc. Also known as the optic nerve head, it is the point in the eye where the optic nerve fibers leave the retina. Commonly referred to as the "blind spot," for centuries it has been assumed to have no photoreceptor cells to respond to light stimuli. This assumption requires closer examination.

The principal view assumes the existence of a network in which non-recallable or suppressed memory may be activated in such a way that access of pre-natal memory and mechanisms for its storage are considered.

In this study, I summarize research that I have conducted during the past nineteen years. I will discuss the conclusions, provide an overview of my sources, and share examples of dream associations that have led to the following insights:

- 1) **Pre-natal memory:** The introduction of photons of light in the optic nerve fibers may stimulate electrical signals that rotate the optic disc a.k.a. the blind spot, momentarily opening the visual field where prenatal memories may be activated. Chemical synthesis and synapse potentials may initially occur in the retino-hypothalamic tract, the principal visual pathway in the circadian clock. The study proposes that receptors in the retina stimulate a receptor in the adrenal cortex which communicates with nerve cells in the HPA axis.
- 2) **Sensory Processing:** Receptors in the retina send visual, auditory and other sensory information via the optic chiasm to the brain lighting up the memory matrix in the amygdala, serving all the sense organs through an energy source which carries critical messages between cells.
- 3) **Sixth Sense: Intuition–Instinct–Insight:** The key to intuition may serve as the unified voice of intuition, instinct, and insight residing in the infundibular recess of the third ventricle.

The Eternal Question of Light and Vision: Claudius Galen

The theories of Claudius Galen, the revered second century Greek physician, physiologist, philosopher, and writer, dominated European medicine for 1,500 years. Having recognized, his belief in a divine purpose for all things his teachings were approved by the Christian church. After his death, the fervor of anatomical and physiological inquiry faded until the Renaissance. His work recorded in numerous complex treatises discusses almost every conceivable aspect of man's knowledge. In this author's opinion, Galen's quest to discover the ancient mystery of cerebral or psychic pneuma echoes today's discussions of consciousness among physicists.

The fundamental principle of life in Galenic physiology was *pneuma*, an air like substance circulating in three bodily systems. The *pneuma physicon*, or animal spirit was in the brain. *Pneuma zoticon*, or vital spirit was in the heart and the third, *pneuma physicon* in the liver.

Galen wrote that, in the arteries entering the brain, the vital spirit was transformed into the *cerebral spirit* (*pneuma psychikon*, *animal spirit*) which represented the active principle of the central nervous system. Galen regarded this spirit also as the active agent of all sensory organs. The principal seat of the cerebral *pneuma* was believed to be in the ventricles of the brain.¹

Since Galen regarded either *pneuma* or light separately as insufficient for visual perception, he postulated the fusion of both as indispensable: the cerebral *pneuma*, meeting the sunlight on the surface of the object of vision, was transformed into an activated state.²

Having practiced only animal dissection, Galen thought optical *pneuma* was flowing from the brain to the eyes through hollow optic nerves. Isaac Newton's (1642–1727) mechanical model of nerve action, using the 'vibrating motion' of an aetherial medium, had no need for a hollow nerve. Johann Gottfried Zinn (1727–1759) helped demolish the theory of the hollow optic nerve in his seminal atlas *Descriptio anatomica oculi humani* (1755).³ We've since learned that optic nerves are actually a thick bundle of nerve fibers converting light through electrochemical processes to electrical impulses in the brain thus conducting light traveling from the retina to the brain.

The problem is to discover what Galen was looking at when he decided that the optic nerves really had the lumen he was sure they must have. He gives directions for finding the orifices at the ends of the nerves. "For in dissections of large animals ... it can be seen that a luminous *pneuma* is carried in those [optic] nerves since they have distinct orifices both at their beginning above and at the insertion into the eyes." He notes that "a perceptible groove or "slit could be interpreted as an opening from the optic-nerve-optic-tract system into the descending part of the lateral ventricle."⁴

¹ Siegel, Rudolph E. M.D. 1970. Galen on Sense Perception, Basel: S. Karger. P.4.

² Ibidem, pp.75-76. "The Stoics postulated a combination of light with *pneuma*..."

³ Reeves, Carole, Taylor, D. 2004. "A history of the optic nerve and its diseases". Cambridge Ophthalmological Symposium, Eye 18: 1096–1109. doi:10.1038/sj.eye.6701578

⁴ Galen on the Usefulness of the Parts of the Body vol. 1. 1968. Trans., intro. and comm. Margaret Tallmadge May. Pp. 399-401.

History: Turning a blind eye to the blind spot

The off-axis attachment of the optic nerve was illustrated for the first time in 1619 by the German mathematician and Jesuit priest, Christoph Scheiner.⁵ In 1668, Edme Mariotte, a pioneer of neurophysiology and a Roman Catholic priest, announced his discovery of the blind spot. Known as Mariotte's Spot in visual fields this non-seeing area in the eye corresponds to the head of the optic nerve.

Physiological and philosophical controversy surrounding the imperceptibility or 'filling-in' of the blind spot continued well into the nineteenth century. One obvious explanation had been surprisingly difficult to grasp.⁶

Harry Helson's 1929 research reviews the prominent role of the blind spot in discussions of the seat of vision in the eye, the ability of optic nerve fibers to respond to light, electrical stimulation, etc. His theoretical and concluding remarks on the blind spot recommend possible ways of explaining the results, this in my opinion, being the most relevant:

[T]he optic nerve fibers which are responding directly to light fits in with a rapidly growing belief that all protoplasm is affected by light, that the phenomena of excitation and transmission of nerve impulses are electrical in nature, [...] should receive serious consideration.⁷

194

The foregone conclusion of the scientific establishment is that the blind spot is insensitive to light and therefore, absolutely blind. It is not surprising that little if any research exists that explores a relationship of the memory function in dreaming to the blind spot.

⁵ Reeves, Carole, Taylor, D. 2004. "A history of the optic nerve and its diseases". Cambridge Ophthalmological Symposium, Eye 18: 1096–1109. doi:10.1038/sj.eye.6701578

⁶ Ibidem. "If the blind spot had been situated in the axis, a blank space would have always existed in the centre of the field History of the optic nerve of vision, since the axis of the eyes, in vision, are made to correspond. But ... the blind spots do not correspond when the eyes are directed to the same object, and hence the blank, which one eye would present, is filled up by the opposite one."

⁷ Helson, Harry, "The Effects of Direct Stimulation of the Blind-Spot". 41 (3): 345-397. University of Illinois Press. <http://www.jstor.org/stable/1414679>

Advances in brain and light technology

Front page news of cutting-edge light and brain research revitalized my two decades of dream research to arrive at a re-examination of the effect of light on the brain. Current research would serve as a blueprint to examine functionality of the blind spot.

Brain and light technology in neuroscience is progressing at an astonishing rate. Denmark's one million dollar euro brain research prize was awarded in 2013 to six leading scientists for the development of 'optogenetics,' a revolutionary technique that advances our understanding of the brain and its disorders.⁸ Nine scientific pioneers were awarded in 2014 the Norwegian Kavli Prize for discovery of specialized brain networks for memory and cognition.

A neuroscientific challenge: the blind spot and prenatal memory

Optogenetics introduces light responsive proteins into cultured cells or the brains of live animals allowing for investigation of the structure and function of neural networks. By turning genetically specified populations of neurons on or off with light, the combination of genetics and optics can control well-defined events within specific cells.

Research of the retina using electrical signals as photons of light which control brain activity may have application to a memory function activated by the optic disc. Using light to control neuronal firings in optic nerve fibers introduces the possibility of cracking a neural code to pre-natal memory.

Certain proteins, molecules, a binding mechanism, etc. revealed in my 1997 dream consciousness study⁹ but not explicated here, include the molecule rhodopsin found in the rod cells of the eye. In 2009, Optogenetics in collaboration with labs at MIT published the first use of channelrhodopsin-2 used to turn on mammalian neurons with blue light.

When light strikes the retina, a retinal molecule may absorb a photon, promoting it into an excited electronic state. The rhodopsin has to be reconstituted or the ability to respond to light will be lost completely in a few seconds at most. Might this be consistent with the phenomena of threshold experiences where people see "their entire lives flash before their eyes." Because we are

⁸ Deisseroth, Karl. 2014. "Optogenetics: Controlling the Brain with Light [Extended Version]". *Scientific American* 2010 (October 20).

⁹ Gardiner, Judy B. 1997. "A Dream Odyssey of Visual–Emotional–Cortical Connections..." © Judy B. Gardiner. Unpublished study.

thinking in hyper speed, a similar electronic impulse may be activated by light. Some dreams report seeing all the answers to the universe in a blinding moment.

Research of historical and scientific data connecting to dream material supported a basis for conclusive inquiry. The study utilized associative recognition memory; the ability to learn, remember and recognize the relationship between waking and dreaming consciousness. This faculty was instrumental in validating dream content and clarifying its interconnecting circuitry to arrive at new insights. Explicated is a sampling of relevant dreams.

Dream Referents

Visual, cortical, and cognitive dream referents in the study include, in part:

Visual: lens, optic chiasm, optic disc, optic nerve, neuronal columns, pyramidal cells, retina, saccades, uvea, visual cones, v2;

Cortical: adrenal gland, amygdala, hippocampus, HPA axis, hypothalamus, infundibular recess, mamillary bodies, third ventricle, synapse formations;

Cognitive processing: circadian clock, memory, neural computations, neural networks, neural transmitters.

A firm believer in the diagnostic power of dreams Galen dreamt he committed an outrage by leaving work on vision unexplained and proceeded to write the first great study of optic nerve.¹⁰

I have similar concerns about not communicating the evidence and perceptions that have come through in my own dreams. It is fitting that the first dream I describe below features Claudius Galen's work.

Note: Dream content is italicized.

The Optic Nerve Key Ring

A deceased friend appears in a dream announcing that he is working on a *breakthrough for (hu)mankind; the optic nerve*. The dream image resembling that of the optic nerve, features *a key ring*

¹⁰ Siegel, Rudolph E. M.D. 1970. Galen on Sense Perception. Basel: S. Karger. P. 40.

with the message: "the same key fit all six apartments but no one knows it." There are five keys but six apartments. The keys identified as the five senses echo Galen's theory that one cerebral pneuma acts for each sense organ.¹¹

As the study develops, it suggests a locus where the sixth sense, long assumed to be the pineal gland, may reside. I submit that the sixth unknown apartment represents the key to intuition and non-logical knowing. Galen first wrote of the pineal gland but later refuted the view that it regulates the flow of psychic pneuma in the ventricles because the pineal gland is attached to the outside of the brain.¹²

Richard L. Gregory writes,

There is some residual neural activity reaching the brain even when there is no stimulation of the eye by light. This is known from direct recording from the optic nerve in the fully dark-adapted cat's eye and we have strong reasons for believing that the same is true for human and all other eyes.¹³

Might that residual neural activity manifest in our dreams, in our memory?

Another optic nerve dream placed *a cat named Percival atop a woman's head*. This imagery represented ganglion cells in the cat retina thus transmitting visual information to the brain through the optic nerve.¹⁴ Percival became dream-speak for perceive.

197

A Secret Underground

"Galen described correctly that both optic nerves, on their course to the brain, are [partially] crossed at the chiasma."¹⁵ A subset of dreams centering on the optic chiasm displayed the *letter X* from the Greek letter chi.

A compelling dream journeys through a secret underground lighting the way to the hypothalamus at the base of the brain hinting at something unseen and underneath. An X above a window viewed from below and illuminated by the sun is descriptive of the brain receiving light

¹¹ Ibidem, pp.74-75.

¹² Galen on the Usefulness of the Parts of the Body vol. 1. 1968. Trans., intro. and comm. Margaret Tallmadge May. Pp. 418-19.

¹³ Gregory, Richard L. 1997. *Eye & Brain, The Psychology of Seeing*, 5th ed. Princeton, New Jersey: Princeton University Press, 1997. URL: <http://www.columbia.edu/cu/psychology/terrace/w1001/readings/gregory.pdf>

¹⁴ A. David Milner and Melvyn A. Goodale, *The Visual Brain in Action*, 2nd ed. p .26 (USA, Oxford Psychology Series, 1995)

¹⁵ Siegel, Rudolph E. M.D. 1970. Galen on Sense Perception. Basel: S. Karger. P. 59.

in the optic chiasm. A building designated as a dead-end with a doorway marked X is identified as a secret room. Is the dead-end a hidden part of the optic chiasm that has been buried over time.

I have learned that in the brain there are never any dead ends. Every nucleus or group of neurons receives connections from a multitude of neurons and sends axons to other parts of the central nervous system. Years of research and intuitive examination birthed an assumption that the “secret room” is the “infundibular recess,” a funnel shaped area in the third ventricle. This assertion unfolds as the study progresses.

Again, X symbolized the crossing of retinal fibers in the optic chiasm. Hearing a gong and a clap in a single dream concurred with Galen’s prescient theory that one pneuma acts for each sense organ. This dream suggests an association of two sensory inputs or crossmodal processing: the ability to use one sense—vision—to learn something in another sense—sound.

Speed of Light

The mysterious quest deepened with words by Richard L. Gregory:

Because of the finite velocity of light, and the delay in nervous messages reaching the brain, we always sense the past.

If we could see billions of light years into the distance, observing Galen’s second century would be unremarkable.

Dream images of optical anatomy and function fused faster than thought could travel. A dream illustrating the *speed of light* from eye to brain contained symbols of the *retina, lens, cornea, cerebral cortex, and cerebrospinal fluid*. Learning that the third ventricle provides a pathway for cerebrospinal fluid, I re-associated the third ventricle with the “*Secret Underground* dream.” The relationship of the bending of light, transmission of electrical signals to the brain, and connection to the past was still emerging.

An Ancient Melody

Most revelatory was the dream (8/28/96) instructing the dreamer to play an old, very thin disc, like a CD in blue and yellow. She hears music from a long time ago. Heavy with an old world feeling, it was musty as though it had been kept in a closet for a long time.

Interacting with a cluster of recurring disc dreams related to vision and light, I associated memory storage in a CD with forgotten memory and the optic disc. *The dream song, Eat the Egg* decoded to digesting an embryo of an idea. The eye develops in the embryonic forebrain from which the optic nerve and retina develop. *Eggs contained in soft mesh holders* point to the lamina cribrosa, a soft mesh-like structure at the optic nerve exit and a reminder of Galen's netlike body (the retina). *Directed to eat one of the eggs*, the dreamer chooses an *ostrich egg*, often symbolic of resurrection and immortality, in this case, Galen's doctrine of vision.¹⁶

The compact disc (CD) association to memory storage resounded. The optic disc is the point in the eye where the optic nerve fibers leave the retina. This revived Galen's exploration of orifices at the ends of the nerves. In a normal human eye the optic nerve head carries over a million neurons from the eye towards the brain. Dr. Harry Helson (1898-1977) and others in the twentieth century conceived of the blind-spot in relation to light:

[T]he problem of vision in the blind-spot assumes importance once more if it is true that the optic nerve fibers respond to direct stimulation by light or electricity.¹⁷

A Single Burst of Light

Affirmation of the bending of light relating to the optic disc occurred in November 1997 when I awakened, not from a dream, but with words arriving in the pneuma as from a distant voice:

The refraction of light traveling through the fibers of the optic nerves rotates the optic disc (blind spot) and the prismatic bending of light opens the visual field so that we can see all the facets of our lives in a single

¹⁶ Ibidem, pp. 40, 116.

¹⁷ Helson, Harry, "The Effects of Direct Stimulation of the Blind-Spot". 41 (3): 345-397. University of Illinois Press. <http://www.jstor.org/stable/1414679>

rotation or burst of light. The optic disc acts as the CD storing all the recorded information and is opened by the bending of light flowing through the fibers of the optic nerves.

This startling message analogizes Leonardo da Vinci's (1452–1519) comparison of the eye to a camera obscura based on light passing through a small hole into a “darkened room.”¹⁸ Da Vinci's views were unclear as to whether rays from the visual field were caused to intersect a second time through reflection or refraction. The distant voice acknowledged “refraction.”

Applying optogenetics research using light responsive proteins, the “burst of light” metaphorically describes the sequence of light striking the retina, a retinal molecule absorbing a photon, thus promoting it into an excited electronic state. An electrical impulse or ‘information’ is then sent to the brain for processing. In theory, when the molecule rhodopsin is reconstituted, consider that it opens the visual field to pre-natal memory for mere fractions of a second.

Using different wavelengths of light, delivered via fiber optic cable, scientists can control the activity of the cells that send to and receive information in the brain. Blue light activates targeted neurons; yellow light quiets them.¹⁹ (Reference: *Ancient Melody: CD in blue and yellow.*)

A dream of tubes filled with glowing blue light merged with the concept of seeing light in the dark.

200

8/26/09 Two clear cylindrical tubes are open at the top. Someone fills them with a blue substance and they become candles that glow in the dark. They are lit from within and are glowing blue. They must be carried downstairs immediately.

The immediacy may refer to the few seconds it takes for a retinal molecule to respond to a photon of light.

I briefly depart from the visual system to convey related aspects of the brain evidenced in this dream study.

¹⁸ Lindberg, David C. 1996. *Theories of Vision from Al-Kindi to Kepler*. Chicago: The University of Chicago Press.

¹⁹ Stanford Alumni. 2010. “New Light on the Brain”.

https://alumni.stanford.edu/get/page/magazine/article/?article_id=28287

Hippocampus and amygdala explore memory and light

The *dreamer tries to balance an image of light under an oval shape* representing the amygdala. It has been argued that associative recognition in humans is critically dependent on the hippocampal formation. A dream illustration of *sparkling water* (excitation) arising from the *hypothalamus* under a *crusty oval shape* (amygdala) suggests a synaptic communication between the hypothalamus and the extended amygdala.

Dream imagery infers that application of light to the amygdala may initiate interplay between the amygdala and the hippocampus reinforcing consolidation of old and new memories. Associative memory functions between the amygdala, hippocampus and hypothalamus (including the optic chiasm and infundibulum) may then facilitate activation of the HPA.

These connections led to research of the limbic system and major pathways of the amygdala.

The central nucleus of the amygdala produces autonomic components of emotion [...] primarily through output pathways to the lateral hypothalamus and brain stem. [...] The link between prefrontal cortex, septal area, hypothalamus, and amygdala likely gives us our gut feelings ²⁰

Yip Yip Yaphank: Pre-Natal Consciousness

Consolidation of old and new memories was characterized in a dream entitled *Yip Yip Yaphank*. Unaware that it was a Broadway play in New York (1918), recall of a song my father sang in the 1940s; *Oh How I Hate To Get Up in the Morning* was the lead song in *Yip, Yip, Yaphank*, a play that preceded my birth, a play I had no waking knowledge of.

The dream description and sketch matched a 1918 theatrical review in uncanny detail. Had the illumination of an original memory matrix in the amygdala retrieved a current life memory (the song) and encoded a pre-birth event (the play). Consolidation of the two was curious: the remembered song, the non-recallable play. Images of waking supported the song: an *alarm clock* (circadian clock), a *computer* (neural processing), a *shower cap* (worn when arising).

Neurobiologists have found that the strength of memory is controlled by the number of cells in the auditory cortex that process a sound.²¹

²⁰Department of Neurobiology and Anatomy, University of Texas Medical School at Houston. <http://neuroscience.uth.tmc.edu/s4/chapter06.html>

Joining the amygdala and hippocampus were images of the HPA axis.

The HPA axis: an underlying message

Galen reported fundamental discoveries in the anatomy of the third ventricle, including the pituitary gland which essentially acts after the hypothalamus prompts it.

The complex interaction between hypothalamus, pituitary and adrenal consistently pointed to something “underneath.” Attention to the bottom of the hypothalamus shone light on Galen’s theory that the chambers at the base of the brain supplied animal spirit, the active principle of the central nervous system, to the “optic nerves.”

The Adrenal Gland—the HPA Axis—the Third Ventricle

202

In Galen’s committed search for truth, he wrote:

[I]t is impossible to explain correctly the usefulness of any part without first finding out the action of the whole instrument.²²

Imbued with Galen’s *raison d’être*, I set out to decipher a multifaceted dreamscape and learn what the eye would have in common with the adrenal gland and the HPA axis:

A dream of the adrenal gland pairing vision and birth was characterized by a *kidney-shaped adrenal patch next to the dreamer’s eye*. Two *kidney-shaped images following the word “synapse”* highlight an adrenal component for therapeutic use. Instructions *to check the autonomic and central nervous systems* conclude with repetition of the word *synapse* again suggesting a synaptic function involving both

²¹ Kim, Dongbeom, Pare, Denis, Nair, Satish S. 2013. “Assignment of Model Amygdala Neurons to the Fear Memory Trace Depends on Competitive Synaptic Interactions”. *Journal of Neuroscience* 33 (36): 14354. DOI: 10.1523/JNEUROSCI.2430-13.2013

²² Galen on the Usefulness of the Parts of the Body vol. 1. 1968. Trans., intro. and comm. Margaret Tallmadge May. Pp. 392-93.

systems: the eye, by electrically communicating via retinal projections to the central nervous system, and the adrenal gland, via the HPA axis pathways influenced by autonomic nervous system arousal.

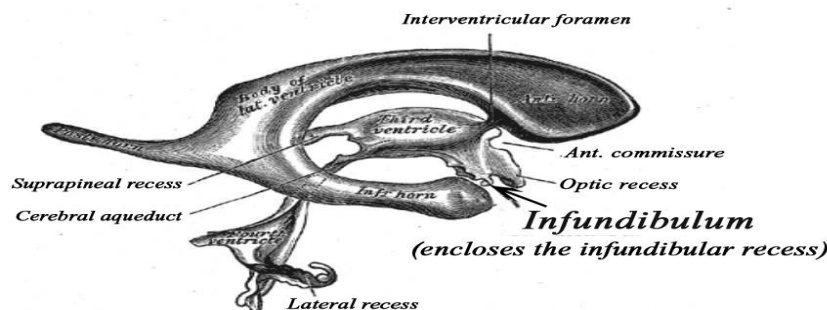
Adrenal images segue to a *dream teacher conducting a course while the dreamer is seated alone behind a column* resembling a vertical neuronal column in the visual cortex.²³ The dreamer senses that electrical connections in this column activate visual memories.

The dream speaks of a *force moving everyone from underneath* illustrated as a *revolving electronic disc in the center of the floor*—or—an electric eye on the floor of the third ventricle.

Dream synopsis:

The *electronic disc* (optic disc) in the *center of the floor* of the third ventricle (bounded by the hypothalamus) relates to the optic chiasm in the center of the brain. I submit that the *revolving disc on the floor* of the third ventricle is the optic disc, powered by light and electrically charged chemicals which open the visual field, thus stimulating visual and electrical signals stored in lost memory.

THIRD VENTRICLE Infundibular recess: extends into infundibulum



"The source of the optic nerves extends to this end of the ventricles (third) and has an orifice that is hard to see." ~ Claudius Galen

²³ Guyton, Hall. 2006. Secondary Visual Areas of the Cortex. In Textbook of Medical Physiology, 11th ed., p. 642. fig. 51-4. <http://malakand1.com/Textbook%20of%20Medical%20Physiology%20Part-2.pdf>

An extension of the hypothalamus, the infundibulum connects the pituitary gland to the base of the brain. This diagram attempts to illustrate the barely visible infundibular recess referred to earlier as the “*secret room*.” (Reference: Secret Underground dream).

Dreams of *funnels, cones* and *recessed lighting* provided significant associative material. An eye-opening dream linking to the infundibular recess consists of *soft, flesh colored, funnel-shaped keys and binoculars*.

Today in casts of the ventricular system, a small ‘hole’ may be seen in the body of the third ventricle, but not seen in all people,²⁴ concurring with Galen’s frustration of an “orifice that was hard to see.”²⁵

Neuronal firings and brain mapping

A dream of a slide machine (neural network computing unit) is surrounded by a mass of coil shaped matter (brain). It mentions a “firing process” and heat that seals (images sealed in memory). The slide machine holds two slides above, two below (pairing visual images with higher and lower states of consciousness or upstream and downstream neurons). Instruction to press down with the thumbs (fingerprinting) to operate the machine infers the recording of impressions in the brain, i.e., memory-printing through brain measuring techniques in memory systems.

In Galen’s cognitive physiology, heat is the cause of the alteration of the pneuma, the substance that triggers thought inside the brain ventricles.

Our Sixth Sense: the Key to Intuition–Instinct–Insight

A dream message, *the key is under the tree*, pivots on the issue of trust while acknowledging the relationship of eye to brain, optical to psychological. The breakthrough Optic Nerve dream advises *there are five keys but six apartments. The same key fit all six apartments but no one knows it*.

²⁴ Project Gutenberg. http://www.self.gutenberg.org/articles/Third_ventricle

²⁵ Galen on the Usefulness of the Parts of the Body vol. 1. 1968. Trans., intro. and comm. Margaret Tallmadge May. Pp. 400-01.

The five keys identified as the five senses echo Galen's theory that one cerebral pneuma (*pneuma psychikon*) acts for each sense organ.²⁶ *Under the tree* symbolizes the hypothalamus at the base of the brain. What of the *sixth apartment*? *What is the one key that fits them all*? Ruling out external senses, remaining is one internal sense prefixed with in, as in inner.

I propose that intuition (inner knowing), instinct (inner feeling), and insight (inner seeing) merge as one unified sense.

The dream introduces instinctive behavior and trust. *Is it a wild or docile animal? Can it be trusted?* This addresses Avicenna's (980 -1037) celebrated example of the sheep's perception of the hostility in the wolf:

Avicenna announces that intention is something not to be perceived by external senses [...] the sheep cannot be said to literally "smell danger" in the scent of the wolf or "see danger" in the wolf's eyes.²⁷

A photographer captures an image of a round recessed opening in the ceiling. A small someone above the opening cannot be seen. The photographer as "the eye" observes a recessed opening in the brain or according to Galen, "an orifice that is hard to see."²⁸

The unseen person above the opening may symbolize a suppressed image, a possible key to understanding the psychology of dreaming/waking memory. The invisible someone, the diminutive, unseen self, explains the inaudible voice of our unified inner sense where the suppression of unknown or non-recallable memory may reside.

The reasons for the suppression of a second image are purely psychological and better understood today than at Galen's time. When the squinting eye receives an optical impression the mind suppresses its conscious perception.²⁹

The dreamer says, *So that we know someone is there, put out an arm or leg*. The straightforward directive contains an evidential clue; an appendage:

²⁶ Siegel, Rudolph E. M.D. 1970. *Galen on Sense Perception*, Basel: S. Karger. Pp. 74-5.

²⁷ Magnani, Lorenzo, Li, Ping, ed. *Philosophy and Cognitive Science. Western & Eastern Studies*: Springer. DOI10.1007/978-3-642-29928-5

²⁸ Galen on the Usefulness of the Parts of the Body vol. 1. 1968. Trans., intro. and comm. Margaret Tallmadge May. Pp. 400-01. Galen says: "But the upper extremity, where it extends toward the middle [third] ventricle, grows broader and a turn is made there laterad, [the ventricles] inclining gradually downward toward the base. They do not reach it, however, but becoming narrower little by little, they come to an end in the shape of a horn, not exactly straight but turned slightly back. The source of the optic nerves extends to this end of the ventricles and has an orifice that is hard to see."

²⁹ Siegel, Rudolph E. M.D. 1970. *Galen on Sense Perception*, Basel: S. Karger. P. 111.

The infundibulum, a funnel-shaped stalk which encloses the infundibular recess symbolizes an appendage in the brain.

I propose that buried in this infundibular recess *under the tree* (hypothalamus) is the key to our integrated sixth sense, “Intuition–Instinct–Insight.”

Vision–Evolution–Memory

This dream tells an evolutionary tale.

The dreamer addresses an audience: *Our dreams encapsulate our past, present and future.*” *She recognizes people from her past.*

An exercise class focuses on jerky moves and tapping around the eyes. Jerky moves or saccadic eye movements occur when the brain suppresses the visual image during rapidly occurring saccades, about three times each second in order to examine the world around us; the still periods between are termed fixations.

One is unconscious of the movements from point to point:³⁰

In researching a relationship of saccadic eye movement to long-term memory, the below theory was instructive.

[T]ranssaccadic memory conceived within the theoretical framework for object perception proposed by Kahneman and Treisman (1984) ... maintains that to explain the perception of objects, one must assume the existence of four levels of representation ... among which is an abstract long-term recognition network.³¹

Consider transsaccadic memory relevant to pre-natal memory.

Tapping around the eyes evokes emotional response and relates to the lacrimal gland thus pointing to sensory cells in Brodmann area 18 or V2 (associated with long-term memory).

³⁰ Guyton, Arthur C., M.D., Hall, John E., Ph.D. 1996. Textbook of Medical Physiology, 9th ed. Pp. 653, 658.

³¹ Irwin, David E. 1996. “Integrating Information across Saccadic Eye”. Current Directions in Psychological Science 5 (3): 94-100. <http://www.jstor.org/stable/20182401>

The dreamer looks at a map folded in half and marked with a small x on the left (past) and large X on the right (future) with more detail but is too far away. “The more distant secondary visual areas are V3, V4, etc.”³²

Dream imagery (ex. x,X: optic chiasm) symbolizing visual areas led to this research:

The secondary visual areas, also called *visual association areas*, lie lateral, anterior, superior, and inferior to the primary visual cortex. Most of these areas also fold outward over the lateral surfaces of the occipital and parietal cortex.³³

Something at the top of the map in the light yellow section needs to be seen; a plausible path to a wavelength of light entering the retina, ultimately projecting to the visual cortex. Yellow, the primary color of wavelength of 571.5-578.5 mu could also point to the yellow spot above the fovea centralis, the area of highest visual acuity.

The dream concludes with:

[T]hree species that had been washed into a metal net. They all wound up looking the same: elongated fish—elephants—the third was forgotten. The fish resemble electric eels. It's something that happened a long time ago which made everyone mad. No one knew what happened.

207

For the first time in 2014 the genome of the electric eel has been sequenced. This discovery has revealed, despite millions of years of evolution, the secret of how fishes with electric organs have evolved to produce electricity outside of their bodies.³⁴ Sense perception in the electric eel may “represent a model for Galen's pneumatic concept of vision, since emitted waves rebound from objects in front of the fish (electric eel) like Galen's pneuma which supposedly returns from the object of vision.”³⁵

This dream presents an evolutionary reminder of our human instincts, our sensory detectors. Like nerve cells in the electric eel, elephant feet and trunk are being tested for an ability to detect vibrations. The elephant, known for its memory, compassion, and ability to express emotion may be reminding us, *the third forgotten species*, of our invisible sense, Galen's psychic pneuma, the “first instrument of the soul.”

³² Guyton, Hall. 2006. Secondary Visual Areas of the Cortex. In Textbook of Medical Physiology, 11th ed., p. 642. fig. 51-4. <http://malakand1.com/Textbook%20of%20Medical%20Physiology%20Part-2.pdf>

³³ Ibidem,

³⁴ “Genomic Basis for the Convergent Evolution of Electric Organs”. 2014. Science 344 (6191.1522-1525).

³⁵ Siegel, Rudolph E. M.D. 1970. Galen on Sense Perception, Basel: S. Karger. Pp. 74-5.

Observations in the preceding dreams were largely guided by a unified sixth sense and validated by concentrated research. The methodology was initialized by deciphering codes and identifying themes which formed a framework composed of vision, light and memory. This sparked realization of convergent vision: merging the invisible with the visible, integrating dreaming with waking, past with future, illustrating how psyche and matter influence each other. Dreams shared in this study and the pathways they lead to unearth the vast knowledge embedded in our psyches.

Was Galen's cerebral pneuma today's Consciousness

When we look to ancient wisdom, the clues are everywhere.

Since the seventeenth century, the philosophy of the visual spirit has been replaced with electricity traveling along nerve fibres much to Galen's credit whose writings clearly foretold the concept of electrical conduction between the brain and the optic nerve. Lacking today's neural imaging techniques and devices to detect electrical activity in the brain, his findings were unparalleled. Energy molecules and hormone receptors were unrecognized in the second century. The term "blind spot" was non-existent but for Galen who insisted that an orifice at the end of the third ventricle was hard to see.

His theory of a luminous pneuma being carried in the optic nerves, though modified over time, endures with new findings and burgeoning technology when fields of consciousness, neuroscience, physics and spirituality are converging.

Galen related visual perception to an active state of the cerebral pneuma present simultaneously in space, in the eye and in the optic nerve remained in agreement with (his) general physiological doctrine which was based on the concept of qualities:

The qualitative change (alloiosis) induced by the incoming picture is transmitted to the central sense organ [i.e. the brain, tes psyches hegemonikon]' [since it contains a perceptive faculty].³⁶

Galen's attempt to reconcile matter and spirit is reflected in his writings:

³⁶ Ibidem, p. 74.

[I]t is impossible to avoid altogether saying something about the substance of the soul if one is explaining the structure of the body that contains it ...³⁷

Yeats' *anima mundi*, the soul of the world reveals the transcendent inner light that Galen struggled to explain physiologically and which continues to challenge scientists.

Had Galen foreseen the 'substance of the soul' as consciousness, an ephemeral, yet enduring quality of the invisible providing a life-giving spirit of light, energy, perception, memory, intuition, empathy, divinity—all that we sense as existence, that we know without reason but presently are unable to quantify.

I posit that this consciousness is actually the vehicle by which the amygdala conveys emotion and memory to the sixth unified sense.

This inquiry rests on the concept that Galen's cerebral *pneuma* is today's basis for consciousness which flows through a collective, universal mind and is the arbiter of all personal and universal energies.

Under the nocturnal cover of dreams and their symbols slept truths that surpass reason and thought. Light appearing as sunlight, yet hidden, illuminated its speed, bending, and refraction. The symbolic *X* (chiasm), the *optic nerve key ring* (sixth sense) the *old disc-CD player* (optic disc), repeating clues pointing to "*something under*" (hypothalamus) plus *funnels, recessed lighting, and cones led to that which is unseen* – the infundibular recess.

It may be helpful to have a renewed look at Galen's pneumatic doctrine of visual perception as well as "other regions of the brain stem supplied with visual signals transmitted in type W optic nerve fibers. These represent the older visual pathway, but their function is unclear."³⁸

³⁷ Galen on the Usefulness of the Parts of the Body vol. 1. 1968. Trans., intro. and comm. Margaret Tallmadge May. P. 418.

³⁸ Guyton, Hall (1996) Textbook of Medical Physiology, 9th ed., p. 658.

SUMMARY

A Scientific Inquiry: Galen's Optics in Dreams of Vision, Light & Pre-Natal Memory

The following inquiry is derived from a 1994 experiential study in dreaming consciousness in which a series of thirty-eight interlocking dreams revealed Claudius Galen's (c130-201) pneumatic doctrine of vision. The research centers on the relationship of light in the brain to vision and memory. The objective is to contribute to the understanding of consciousness by elucidating learning-related patterns of neural activity guided by associative recognition in dream-wake states. Scientific breakthroughs introducing photons of light to control brain activity strengthened the findings.

Premises stemming from neuroscientific and spiritual insights:

*Activation of light in the optic disc may open the visual field to access pre-natal memory.

*A unified sixth sense merging Intuition-Insight-Instinct may have its locus in the infundibular recess of the third ventricle.

*Memory matrix in the amygdala relays information to the sixth sense thereby serving all sense organs.

210

KEYWORDS

Dreaming, Amygdala, Brain, Light, Cognitive/Sensory Processing, Consciousness, Claudius Galen, HPA Axis, Intuition-Instinct-Insight, Memory, Neuroanatomy, Optogenetics, Optic Disc, Optic Nerve, Soul, Synapse, Third Ventricle, Universal Mind, Visual Cortex

BIBLIOGRAPHY

1. Deisseroth, Karl. 2014. "Optogenetics: Controlling the Brain with Light [Extended Version]". *Scientific American* 2010 (October 20).
2. Department of Neurobiology and Anatomy, University of Texas Medical School at Houston. <http://neuroscience.uth.tmc.edu/s4/chapter06.html>
3. Dreher, Bogdan and Robinson, Stephen R. 1991. *Neuroanatomy of the Visual Pathways and their Development*. CRC Press I LLC.
4. Galen on the Usefulness of the Parts of the Body vol. 1. 1968. Trans., intro. and comm. Margaret Tallmadge May. Pp. 392-93, 399-401, 418-19.
5. Gardiner, Judy B. 1997. "A Dream Odyssey of Visual–Emotional–Cortical Connections..." © Judy B. Gardiner. Unpublished study.
6. "Genomic Basis for the Convergent Evolution of Electric Organs". 2014. *Science* 344 (6191.1522-1525).
7. Gregory, Richard L. 1997. *Eye & Brain, The Psychology of Seeing*, 5th ed. Princeton, New Jersey: Princeton University Press, 1997. P. 92.
8. Guyton, Arthur C., M.D., Hall, John E., Ph.D. 1996. *Textbook of Medical Physiology*, 9th ed. Pp. 653, 658.
9. Guyton, Hall. 2006. Secondary Visual Areas of the Cortex. In *Textbook of Medical Physiology*, 11th ed., p. 642. fig. 51-4.
<http://malakand1.com/Textbook%20of%20Medical%20Physiology%20Part-2.pdf>
10. Heimer, Lennart. 1995. *The Human Brain and Spinal Cord*, 2nd ed. Springer-Verlag.
11. Helson, Harry, "The Effects of Direct Stimulation of the Blind-Spot". 41 (3): 345-397. University of Illinois Press. <http://www.jstor.org/stable/1414679>
12. Hobson, J. Allan. 1998. *The Dreaming Brain*, 1st ed. Basic Books.
13. Irwin, David E. 1996. "Integrating Information across Saccadic Eye". *Current Directions in Psychological Science* 5 (3): 94-100.
<http://www.jstor.org/stable/20182401>
14. Kim, Dongbeom, Pare, Denis, Nair. Satish S. 2013. "Assignment of Model Amygdala Neurons to the Fear Memory Trace Depends on Competitive Synaptic Interactions". *Journal of Neuroscience* 33 (36): 14354. DOI: 10.1523/JNEUROSCI.2430-13.2013
15. LeDoux, Joseph. 1994. "Emotion, Memory and the Brain." *Scientific American* 270.
16. Lindberg, David C. 1996. *Theories of Vision from Al-Kindi to Kepler*. Chicago: The University of Chicago Press.
17. Magnani, Lorenzo, Li, Ping, ed. *Philosophy and Cognitive Science*. Western & Eastern

-
- Studies: Springer. DOI10.1007/978-3-642-29928-5
18. Milner, David A., Goodale, Melvyn A. 1995. *The Visual Brain in Action*, 2nd ed. USA: Oxford Psychology Series: 26-7.
 19. Project Gutenberg. http://www.self.gutenberg.org/articles/Third_ventricle
 20. Ptolemy's Theory of Visual Perception. 1996. Trans., with Intro. and Comm. by A. Mark Smith. Philadelphia: American Philosophical Society 86 (2).
 21. Reeves, Carole, Taylor, D. 2004. "A history of the optic nerve and its diseases". *Cambridge Ophthalmological Symposium, Eye* 18: 1096–1109.
 - a. doi:10.1038/sj.eye.6701578
 22. Siegel, Rudolph E. M.D. 1970. *Galen on Sense Perception*, Basel: S. Karger. Pp. 4, 40, 59, 74-76, 111, 116.
 23. Stanford Alumni. 2010. "New Light on the Brain".
 24. https://alumni.stanford.edu/get/page/magazine/article/?article_id=28287.