

CONCEPTUAL STUDY OF ALOCHAKA PITTA W.S.R. TO RHODOPSIN AND IODOPSIN

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ABSTRACT

Dosha, Dhatu and Mala Vijnana is the foundation of Ayurvedic Science. The three *Dhatu Vata, Pitta* and *Kapha* are the three elementary and fundamental units or principles on which the building and sustenance of the body depend. *Sushruta*, the first person who has classified *Pitta Dosha* in to five types. The *Pitta* which is situated in *Drishti* (retina), is known as *Alochaka Pitta* which is responsible for *Rupa grahana* i.e. perception of vision. *Acharya Bhela* has classified this *Alochaka Pitta* has two kinds: visually or optically (*Chaksus*) differentiative and intellectually (*Buddhi*) name as optically differentiative is that which produces a differentiation by placing a picture. The process by which the world outside is seen is termed as visual process or physiology of vision. The main function of *Alochaka Pitta* is said to be *Rupa Grahana* i.e. responsible for sense of vision. Photoreceptors are specialized cells that begin the process by which light rays are ultimately converted to nerve impulses. There are two types of photoreceptor: rod and cones. There are three phases in this visual process: phase of refraction of light, phase of conversion of light energy into electrical impulse and finally peripheral and central neurophysiology.

Keywords: *Alochaka Pitta, Drishti, Chakshurvaisheshika, Buddhirvaisheshika, optic pathway, neurophysiology*

INTRODUCTION

Alochaka means ‘that which helps to see’ or ‘that which helps to think’. The word *Alochaka* is made up of the term ‘*Lochana*’ which is a synonym of ‘eye’. Thus, *Alochana* means ‘to see’. *Pitta* represent fire or *Agni* in our body. Therefore, *Pitta* and *Agni* are one and the same. All subtypes of *Pitta* carry suffix *Agni*. *Alochaka Pitta* is also known as *Alochaka Agni*. *Drishti* or eyesight is the seat of *Alochaka Pitta*. *Drishti* means vision, that which enable us to see things around us and perceive them in the right sense. This perception happens in eye. Therefore, eye is the

seat of *Alochaka Pitta*. This *Pitta* subtype is not only located in the anatomical eye but also enables physiology of vision.

According to a rule that all the five *Mahabhutas* are represented in the body, the *Tejas Mahabhuta* is represented in the body by *Pitta* though itself *Panchabhautic* in its composition. In its subtle form (*Sukshma*) it is present in every cell. But its gross form (*Sthula*) is also visible in the several parts of the body. *Acharya Sushruta* has described that the *Agni*, as represented by its five types, colors, digests, vital-

izes, illumines, grasps and maintains the temperature and thus favors the body by its *Agni* (enzymatic actions).^[1] This five types of *Pitta* is *Pachaka Pitta*, *Ranjaka Pitta*, *Sadhaka Pitta*, *Alochaka Pitta* and *Bhrajaka Pitta*. *Bhela* has classified *Alochaka Pitta* in to two types first one is *Chakshurvaisheshika* and second one is *Buddhirvaisheshika*.^[2] Above two types of *Alochaka Pitta* explain the activity of optic pathway in i) eye and ii) optic center in the brain respectively.^[3] This *Pitta* brings about the perception of vision after the *Sannikarsa* of *Atma*, *Manas* and *Indriyas*. Name as intellectually differentiative is situated between the two brows in a *Sringataka*. It perceives the minute and extra ordinary matters produced in *Atma*, retains the thoughts thus received in the mind itself.^[4]

The word '*Pitta*' is a group which contains several substances. When *Pitta* goes out of gear it is addressed as *Dosha*, though in many cases it has been referred to as *Dosha*. The five varieties are named as follows:-

1. *Pachaka*- which digests the digested food.
2. *Ranjaka*- which imparts colour to skin.
3. *Sadhaka*- which helps efforts.
4. *Alochaka*- which helps in vision.
5. *Bhrajaka*- which shines the skin.

Alochaka Pitta has been in the eye and it helps the visualization of external objects. *Alochaka Pitta* brings about perception of vision after being associated with soul, mind and sense organs. The change effected by the agency of light which falls upon the retina is a physio-chemical alteration in the protoplasm and this change stimulates the optic nerve endings. Thus, the visual purple (Rhodopsin) has a striking resemblance to the description of the *Alochaka Pitta*.^[5] The *Alochaka Pitta* or vision *Pitta* is responsible to transform and transfer the information of visual perception to intellect. This intellect judges if the information should be accepted or not. When intellect decides to accept the perception, the *Alochaka Pitta* located in the *Chakshurindriya* i.e. the organ of vision will get involved into the act and provides us with distinctive knowledge about the characteristic features, form, structure, shape and color of the seen object. The photo-sensitive chemicals which are present in

eyes are known as *Prakash- Ranjaka Dravya* and the process of photochemistry involve for vision is *Alochaka Pitta*. Although from this represented by Neurotransmitter of visual pathway is kept under *Alochaka Pitta*.^[6] The activated Rhodopsin, following exposure to light, triggers a cascade of complex biochemical reactions which ultimately result in the regeneration of receptor potential in the photoreceptors. In this way, the light energy is converted into electrical energy which is further processed and transmitted via visual pathway. The rods are much more sensitive to low illumination than the cones. Therefore, rods are used more in dim light (scotopic vision) and cones in bright light (photopic vision).

Materials and Methods-

Five types of *Pitta* have described as a *Agni* in *Sushruta Samhita Sutra Sthana* in *Dosa-dhatu-malakashaya-vruddi-vijnaniyam Adhyaya*, and the classification of *Alochaka pitta* is described in *Bhel Samhita Sarira sthana* in *Purusha Nicayam Adhyayam*.

Present work has been done based on critical review of classical information, published research works, modern literature. The possible correlation has been made between collected information and has been presented in systematic way.

DISCUSSION

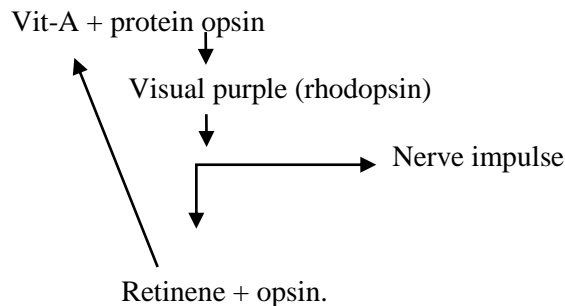
The *Alochaka Pitta* is visualization by the eye and helps with the overall condition of the eye from the color to the translucence of the eye. When the eye transmits through perception to the intelligence in the *Sadhaka Pitta* white film in the mind the mind then turn this information into perceivable truth which is all done by photosynthesis or the meeting of the mind through *Pitta* energy. Just like other parts of the body the eye has enzymes that help with optical imagery. When one does not see reality properly, they start to get disorders within the eye. "The eye that works in conjunction with the *Sadhaka Pitta* and *Buddhi* has the capability to see the truth in depth, dimensional, and through diverse energy levels, "When we look without judgement, without interference of thought and mind, the eyes become the windows of God and we can perceive the Truth. If our thoughts and mind

interfere, then we perceive reality, because reality is a product of our mind. We need sensitive *Alochaka pitta* that can perceive the truth of reality, the truth of actuality". The optical or vision plays a major role in the development of *Buddhi* or Master Intelligence which creates the truth and reality.

Alochaka Pitta renders its functions through its two components. One of its components *Drishhti Vaisheshika Alochaka Pitta* which is confined to eye. It helps in perceiving the seen objects. It helps in identifying and knowing various aspects of objects. The second component of vision *Pitta* located between the eyebrows represents the central control of vision, located in frontal area of brain. This helps in retaining the visual information and later recollecting the saved information through memory, imagination and concentration. It is believed that glutamate is the neurotransmitter substance secreted in the spinal cord at the type A pain nerve fiber endings. This is one of the most widely used excitatory transmitters in the central nervous system, usually having a duration of action lasting for only a few milliseconds. Glutamate is the

neurotransmitter of the neurons of the vertical pathways through the retina. All photoreceptors rods and cones use the excitatory amino acid glutamate to transmit signals to the next order neuron in the chain.

The intricate reactions whereby vitamin A enters the visual process. Retinal is the prosthetic group of photosensitive pigment in both rods (*Rhodopsin*) and cones (*Iodopsin*). All-trans-retinol is oxidized to all-trans-retinal; this compound isomerizes in the dark to the 11-cis form which combined with Opsin to form *Rhodopsin*. Pigments of retina i.e. rhodopsin, iodopsin and melanin can be closely correlated to *Alochaka Pitta* due to similarity in location and functions of these components. Rhodopsin is formed in the layer of rods and is responsible for dark vision. Rods are particularly sensitive to dim light and they serve predominantly in detection of motion. The nerve impulse is caused by decomposition of Rhodopsin into two fractions i.e. opsin and retinene. Retinene is again re-transformed into vitamin A and thus rhodopsin is regenerated.



The innermost and highly developed layer of the eye-ball is known as retina. In fact, the retina is a part of the brain and develops from the optic vesicle, an out-growth from the forebrain. The outer wall of the vesicle forms the retinal pigment epithelium and the inner, the neurosensory retina. Retina consist of ten layers, arranged in two distinct functional components with a potential space between the two. The retina comprises photoreceptor cells, a relay layer of bipolar cells and ganglion cells and their axons that run into the central nervous system. The retina from without inwards is made up of following ten layers-

- 1) Retinal pigments epithelium
- 2) Layers of Rod and cones
- 3) External limiting membrane
- 4) Outer nuclear layer
- 5) Outer plexiform layer
- 6) Inner nuclear layer
- 7) Inner plexiform layer
- 8) Ganglion cell layer
- 9) Nerve fiber layer
- 10) Internal limiting membrane. [7]

The rod and cones are situated in 2nd layer. These are end organs of vision and are also known as photo re-

ceptors. Layers of rod and cones contains only the outer segments of photoreceptor cells. Arranged in a palisade manner. Rods contain a photosensitive substance visual purple (rhodopsin) and subserve the peripheral vision and vision of low illumination (scotopic vision), cones also contain a photosensitive substance and are primarily responsible for highly discriminatory central vision (photopic vision) and color vision.^[8] Approximately 125 million rods and 6 to 7 million cones in the retina subserving the function of photoreception. Cones are densely packed at fovea and have one-to-one correspondence with ganglion cells, thereby having high visual resolution at fovea centralis.^[9] Cones contain iodopsin. Color vision and photopic vision i.e. light vision takes place in layer of cones. The pigment layer of retina contains melanin. This makes the eye a dark chamber and prevents internal reflection of light rays. The light reaches the layer of rods and cones in the retina after passing all the layers in front of it. When it reaches retina the photo-transduction begins. Photo-transduction is the process of conversion of light energy into electrical energy. The rods and cones serve as sensory nerve endings for visual sensation. Light falling upon the retina causes photochemical changes which in turn trigger a cascade of biochemical reactions that result in generation of electrical changes. Photo-transduction comprises of two essential reactions: photo-chemical

and electrical. Rhodopsin is the photo-chemical or chromoprotein having an active chromophore molecule that absorbs light and triggers electrical impulses in the retina. Rhodopsin consists of a protein called as scotopsin and pigment retinal. This retinal is termed as 11-cis-retinal. This cis form of retinal is important because only this form can bind with scotopsin to synthesize rhodopsin. The photochemical changes include: **Rhodopsin bleaching**, under this action Rhodopsin refers to the visual pigment present in the rods- the receptors for night (scotopic) vision. Rhodopsin consist of a colourless protein called opsin coupled with a carotenoid called retinene (Vitamin A aldehyde or 11-cis-retinol). Light falling on the rods converts 11-cis-retinol components of rhodopsin into 11-cis-retinol through various stages. The all-trans-retinal so formed is soon separated from the opsin. This process of separation is called photodecomposition and the rhodopsin is said to be bleached by the action of light. **Rhodopsin regeneration** the 11-cis-retinal is regenerated from the all-trans-retinal separated from the opsin and vitamin-A (retinal) then reunites with opsin in the rod outer segment to form the rhodopsin. This whole process is called rhodopsin regeneration. Thus, the bleaching of the rhodopsin occurs under the influence of light, whereas the regeneration process is independent of light, proceeding equally well in light and darkness.

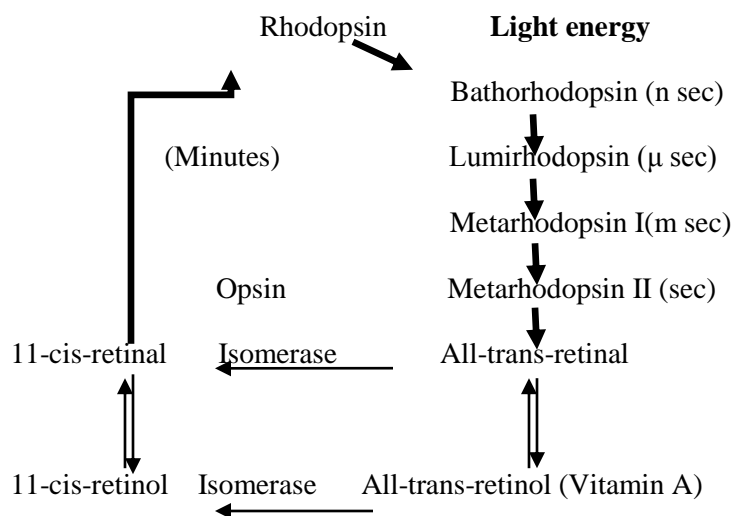


Fig.-Light-induced changes in rhodopsin

Visual cycle In the retina of living animals, under constant light stimulation, a steady state must exist under which the rate at which the photochemical are bleached is equal to the rate at which they are regenerated. This equilibrium between the photodecomposi-

tion and regeneration of visual pigment is in visual cycle.^[10]

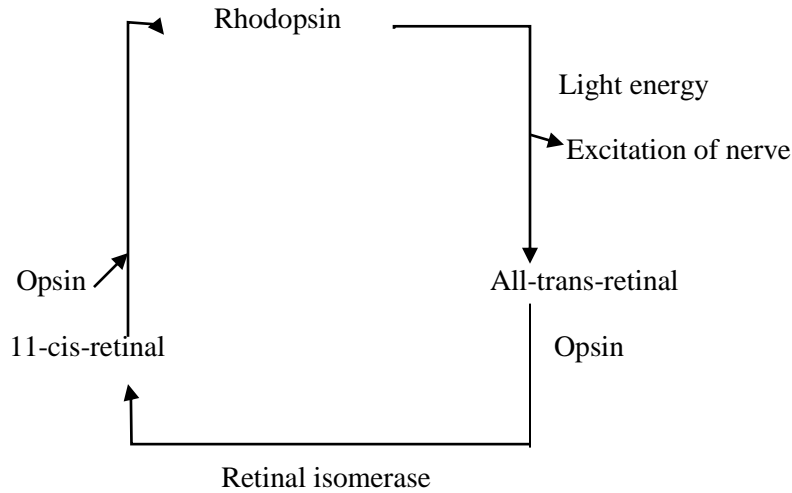


Fig: Visual cycle

The pigment layer adjacent to the photoreceptors stores a large quantity of vit-A and contributes to the generation process in rods. The extent of rhodopsin regeneration decreases drastically if the retina detaches from the pigmented layer. Cone photo pigments regenerated much more quickly than does rhodopsin and are less dependent on the pigmented layer. After complete bleaching, regeneration of half of the rhodopsin takes 5 minutes; whereas half of the cone photo pigments regenerate is only 90 seconds. Full regeneration of bleached rhodopsin takes 30-40 minutes.^[11]

Visual pathway ^[12]- The visual sensations are perceived by the rods and cones and conducted to the brain through three sets of neurons. The conducting nerve cells or neurons of the first order are the bipolar cells of the inner nuclear layer of the retina with their axons in the inner plexiform layer. The neurons of the second order extend from the ganglion cells to the lateral geniculate nucleus. From here, the neurons of the third order transmit the impulse through the optic radiations to the visual center situated in the occipital lobe.

A vertical line is drawn through the macula, it divides the retina into two halves- temporal and nasal. The fibers from the nasal half enter the chiasma, decussate and pass into the opposite optic tract. The fibers from the temporal half enter the chiasma and pass into the optic tract of same side. Both uncrossed and crossed fibers pass to alternating laminae in the lateral geniculate nucleus. The neurons of the third order pass in the optic radiations to reach the occipital lobe.

CONCLUSION

Combination of pigment part (*Ranjaka Pitta*) with protein part (*Rasa Dhatu*) produces photo-chemical reaction. The bond in the photo-chemical reaction can always be broken and rejoined easily by the action of light. Rods are particularly sensitive to dim light and they serve predominantly in the detection of motion. The nerve impulse is caused by the decomposition of Rhodopsin into two fraction opsin and retinene. Retinene is again transformed into vit-A and thus Rhodopsin is generated. From the above it is concluded that the pigments of retina viz. Rhodopsin and Iodopsin are the *Alochaka Pitta*. We can compare the location

of Alochaka Pitta is Chakshurvaishesik Alochaka Pitta and the functions are Buddhirvaishesik Alochaka Pitta. Drishtimandal is rich in Alochaka Pitta and Chakshurindriya itself is originated from Agnibhutta and Sheeta Satmya in nature for which Sheeta Virya Dravya is beneficial to Drishti.

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