

SHORT COMMUNICATION



Greco-Persian Ancient Knowledge of Nervous System

Abstract

In almost all fields of knowledge, whatever advancement is seen today is not entirely new. In fact, present advancement is based on ancillary knowledge. Even the idea of computer is also conceived from the ancillary knowledge. The same is the case with medical knowledge. Today a vast advancement in neuroscience and neurotechnology is seen. It is thought that present form of neurology resulted from day and night efforts of neuroscientists of present day. But the case is little different. The efforts of the present-day neuroscientists are appreciable but efforts made by the predecessor neuroscientists should not be ignored. As a matter of fact, a treasure of knowledge descended from early Greek, Persian, Roman, Arab and Indian scientists, especially in the field of medical science. In the present paper, an effort is made to present the ancillary knowledge of external senses as it was described by the Greek, Persian, Roman and Arab scholars. Simultaneously, comparative notes are also incorporated. This paper would help the reader to know about how much was known and how much is added to the knowledge of the external sense. By this, one can realize between the accuracy of logical imagination and of technological information.

Key words: Nervous System, Unani Medicine (Greco-Persian Medicine), External Sense, Neurosciences, Information Technology

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Introduction

Among the ancient systems of medicine, one and the most prevalent one is Unani system of medicine (Greco-Persian Medicine). Its origin dates back to 320 BC, when Hippocrates was born in Cos of Greece. Since then, this system is flourishing and there has been some time when this pathy was the only option for cure. Curriculum-based teaching first started in this system. The first curriculum was based on certain number of books; they were taught year wise. Most books, selected for the teaching purpose, were written by Galen. In these books' stalwart of that time, including Galen, organized the subjects and topics systematically from fundamental to advance, and from preclinical to clinical, to practical. The first medical college which adopted this curriculum was established in Rome and its name was college of Alexandria. *Kitabul Quwa* of Galen is one of the books used in the curriculum of Alexandria medical college. This book encompasses the description of faculties. All knowledge of predecessors was compiled in this book, along with Galenic addition on the topic. One of the books in this curriculum was on faculties, and was written by Galen. In this book, vegetative, cardiovascular and nervous faculties and their functions are described. Almost all predecessor physicians relied on this book, using and advising the same material for the description of the nervous faculty. Arab physicians added some commentary and explanatory notes wherever was required. Whatever knowledge of nervous system is present today, in its broadest form, has been descended from the Galenic Knowledge.

1- Avicenna, 2006: 83.



Concept of the Nervous Faculty

The Galenic description of the nervous system is present in Unani system (Greco-Persian Medicine). In this system, faculties are classified, in ascending order of importance and evolution, into three parts, i.e. vegetative, vital and nervous faculties¹. Among these three, the most important and most advanced one is the nervous faculty. On the basis of certain nervous functions, human beings are distinguished from animals and animals are different from plants. The vegetative faculty is present in both animals and plants. Whatever knowledge is present in literature of Unani medicine has been descended from Hippocrates, Galen, Persian and Arab scholars. It seems that the description of nervous system or faculty in Unani medicine was the most advanced one for its time. Later on, European scientists added a lot to physiology and anatomy of the nervous system and brought it in its existing form. Today no other system is as vast as the nervous

system and no other system is as much known. No doubt, the present system is built on the foundation laid down by ancients Greek, Persian, Roman and Arab scholars. Nervous faculties are those faculties, which are furnished to an individual for the intellectual, sensory and motor functions of the body. It means that they perform all the functions of nervous system. The organs that possess these faculties are called *Aza-e- Nafsaniyya* (nervous organs), including the brain, spinal cord, nerves and sense organs. The brain is the primary source of this faculty and hence regarded as principal organ of this system.

Basically, the nervous faculty is divided into two types²:

- 1- The Locomotor faculty
- 2- The Perceptive faculty

1- The Locomotor faculty

Almost all sensory and even the abstract experiences of the mind are eventually expressed in some types of motor activity, such as actual muscular movements of direct nature, contraction and relaxation of muscles, attainment of posture, crying and laughing, etc. Thus, the motor faculty is that power which becomes the underlying cause for all the body movements. Perceptive faculty travels through the nerves which are connected with the muscles. Thus, these two functions may be accomplished by these faculties directly at their own level or these faculties can help accomplishing these two functions i.e. perception and locomotion. In order of description, the locomotive faculty comes first, because sensory information is needed for motion and motion is the primary aim. The locomotive faculty is further divided into two types, the first being the faculty which is causative of motion, called *Shawqiyya* (motive power/ desiring faculty)³. This motion results from the perception of beneficial thing. These perceptions then evoke a desire or instinct to obtain the thing and eventually animals decide to obtain the beneficial thing and for this purpose animal moves towards beneficial thing or away from harmful thing. Shehwania and Ghazbia are two sub types of the *Shawqiyya* faculty (Desiring faculty)⁴.

According to Unani physicians, any movement is accomplished by four faculties. These four faculties work in a sequence to accomplish and initiate phobic or phobic movements. First of all, a thing comes in thought or *weham*. If it is beneficial, then the *Shawqiyya* faculty (Desiring faculty) evoke the *Shawq* (Desire) to obtain the thing. Then, the determinative faculty firmly decides to obtain the thing, and in the last *Quwwat fa'ilah* (active/operational faculty) causes contraction and relaxation in the muscles, necessary for the

2- Nafis, 1954: 123.

3- Ibid.

4- Kabiruddin, 2001: 206.



movement. Desiring and determinative faculties decide the nature of movement, as it may be toward (philic) or away (phobic)⁵.

2- The Perceptive faculty

Unani physicians believe that real perceiver / sensor is psych (*Nafs*). Sensory receptors perceive the things to put them in front of psych, and because of this fact, sensory receptors are called sensory tools. Sensory faculties are divided into two broad categories⁶:

- External sensory faculties
- Internal sensory faculties

External sensory faculties are five in number:

1. Faculty of vision / sight
2. Faculty of hearing
3. Faculty of smell
4. Faculty of taste
5. Faculty of tactile sensation

There are a few physicians who have described them as eight⁷. These external senses work like the informer of internal sensory faculties. Whenever any information is delivered to internal sensory faculties, then the resulting oriented processes are initiated in them.

The Faculty of vision / sight - The first and the finest faculty is of vision. Sight is the faculty, located in the optic nerve which discerns images projected on the crystalline humour, whether figures of solid bodies, variously coloured, or through the medium of a translucent substance which extends from this to the surfaces of reflecting bodies. The eye is the organ of vision. Unani physicians stated that eyes are supplied by nerves having canal in them. Reciprocal nerve supply is also described in respect of side. The meeting point of two nerves is called "*Taqatu Salibi*"⁸. In modern physiology "*Taqatu Salibi*" is named the optic chiasma. This site is considered as the seat of the vision faculty, image related information from both eyes fuse here to prevent the duplicity of the image. Modern science advocates that fusion of field of vision is responsible for the perception of a single image from two eyes. Basically, eyes perceive the sense of colour, light and of shape. Some physicians believe that a conical body of light is ejected from eyes which help in vision⁹. Some Unani philosophers are of the opinion that image is printed at *Jalidia* (vitreous body). This makes chiasma ready to accept the image, the imprinting at chiasma makes integration area ready to accept the image and here it is interpreted by *Nafs* (Psych)¹⁰.

- 5- Ahmed, 1980: 170.
- 6- Ibn Rushd, 1987: 40.
- 7- Nafis, 1954: 126.
- 8- Ahmed, 1980: 190-192.
- 9- Kabiruddin, 2001: 229-233.
- 10- Ibn Rushd, 1987: 61.



The Faculty of hearing - Ear is the organ of hearing. Faculty of hearing is considered as the superior sense of all sensation because the ear is the only source of education and wisdom in humans. Therefore, the persons who are congenitally deaf are also dumb, because if speech is not heard, nothing can be pronounced. Hence, the deaf man remains dumb. Acoustic function is performed by the nerve, spread in middle ear cavity. This cavity is filled with stationary air. Hearing faculty senses the sound. The mechanism of perception of sound is described as when sound is produced in the external air; the effective sound waves vibrate and strike at tympanic membrane. This set the tympanic membrane into vibration and this is transmitted to the stationary air, present in the middle ear cavity. From here, these vibrations are perceived by the acoustic nerve and are sent to the integration area of brain¹¹. In respect of acoustic perception, Unani philosophers did not describe the mechanism of conduction through ossicles. In fact, in classical texts of Unani, there is no mention of ossicles. They believe that the middle ear cavity is full of stationary air, which is set in vibration due to the vibration of tympanic membrane. Like modern physiology, Unani medicine has not described the hair cell and mechanism of generation of action potential in hair cells. Unani philosophers simply described the perception of vibration from the middle ear cavity. Besides, Unani philosophers were not familiar with equilibrium or balance related functions of the ear. In the Unani literature, there is no mention of the internal ear cavity, of bony, or membranous labyrinth. Balance related functions are attributed to the movements of *Ruh-e-Nafsani* (psychic pneuma). The present status of knowledge regarding the state of the acoustic function are precise because of the related gadgets available and also because of the magnifying techniques which were not available to the Unani scholars; whatever knowledge they compiled and presented was merely based on their naked eyes observation and more on their logical imagination. Apart from these, the description of the cerebellum is also absent, in the Unani literature, and the description of the cerebellum like structure couldn't be traced. Because of this, functional knowledge about cerebellum cannot be imagined. Unani philosophers attributed the cerebellar functions to psychic pneuma and *Nafs*.

The Faculty of smell - The nose is the organ of this faculty. The faculty of smell performs the function of the perception of odour through the air which is inhaled. The nasal mucosa is the first organ of smell in which the branches of olfactory nerve are spread out. Galen says smell is the faculty located

11- Majoosi, 2010: 194.



in the protuberance situated in the fore part of the brain, resembling the nipple of the breast, which apprehends what is in the inhaled air, and brings to it of odours mingled with the vapours wafted by the air^{12, 13}. Olfactory function is performed by two nerves originated from forebrain whose thin sprouts spread in olfactory (nasal) cavity. Olfactory faculty senses the smell. Smelling things enter the nose along with the inhaled air. Olfactory receptors are of chemical nature. This sense is also relayed to the integration area¹⁴.

The Faculty of taste - Tongue is the organ of this faculty. Gustatory sense is present in the nerve which is distributed in the tongue, and saliva works as mediator in perception of this sense. Taste producing thing reaches the nerve after being dissolved in saliva. The second postulate regarding the mechanism of perception of taste is that saliva acquires the quality of taste first and then the taste is imparted to the nerve directly. Besides taste, tongue can also sense other modalities of sense, like temperature and touch. For these a separate nerve supplies the tongue¹⁵.

The Faculty of tactile sensation - The sense of touch is distributed throughout the skin and flesh. The nerves, thereby, perceive and discern anything which comes in contact with them, such as the four primary qualities; heat, cold, dryness and moisture; and the secondary qualities of roughness, smoothness, hardness and softness. Senses of touch, pressure and temperature are perceived by the skin and the underlying muscles. Unani philosophers differ in respect of the number of tactile faculties. Some are of opinion that tactile, temperature and texture receptor are separate while others believe that these different modalities of sensation are perceived by the same receptors, but there are four different faculties for the perception of four modalities of sensation i.e. temperature, texture, touch and surface qualities. Because of its sensory property, the skin can protect the body from external harmful things that may come in contact of the skin¹⁶. The skin is also a site for the disposal of wastes and accepting the wastes; sometimes, it loses its sensory faculty. That is why, at certain places muscles can perceive the sensation. In Unani texts, there is no description of proprioceptors and nociceptors although the perception of pain and its importance are described¹⁷. Unani philosophers have not described the presence of sensory receptors in ligaments, though ligaments are described. The mechanism of perception is based on the interaction between the receptor and the things to be perceived. According to Unani philosophers, tools of tactile faculties

- 12- Ibn Rushd, 1987: 40, 63.
- 13- Majoosi, 2010: 195.
- 14- Shah, 2007: 59, 60.
- 15- Guyton et al, 2013: 713-716.
- 16- Nafis, 1954: 126.
- 17- Jurjani, 2010: 95, 96.



are affected by the things that come in their contact¹⁸. Here, faculties are passive while the things to be sensed are active. After perception, these sensory modalities are transmitted to the integration area of the brain for interpretation. In Unani literature, five external senses (vision, hearing, smell, taste and touch) are described in order of their media of perception from the finest to the thickest sensation. In modern physiology these are described as special senses, excluding tactile sensation. The mechanism of perception of Telesense in respect of vision is explored extensively in modern physiology. Rod and cone cells excitation and generation of electric potential in them is the basis of vision¹⁹. Unani philosophers could not imagine the retina and they thought that light rays between eyes and object are responsible for the image²⁰. Modern physiology has disclosed that the retinal image is interpreted at the level of visual cortex. Here the impulses reach through lateral geniculate body. Magnocellular and parvocellular pathways start from the layers of lateral geniculate body, projecting the image to visual cortex in occipital lobe²¹. Unani philosophers have the opinion that visual images are projected to the forebrain, and they have recognized this frontal area as the area of integration. According to this viewpoint, all external sensory receptors relay their sensation or perceptions to this integration area, where partial interpretation occurs²².

Regarding the gustatory sense, the present-day knowledge is a little advance. In Unani literature, the role of saliva in the perception of taste is highlighted well and sprouts of nerve in tongue for the perception is described. It is not known why Unani philosophers could not see the glossal papilla? There is no mention about papilla on the tongue and their functions in Unani classical texts. The same is added to the anatomical description in modern books of Unani. Furthermore, unlike modern physiology, there is no precise description of the cerebral area for the interpretation of taste. Actually, Unani philosophers did not describe somatosensory cortex. Neither there is taste-specific distribution of the tongue. In modern physiology, different parts of the tongue are attributed to different tastes²³. Like modern physiology, Unani philosophers described different nerve supply for the tactile and temperature sensation in tongue. Briefly, Unani philosophers described the effects of taste on limbic functions (emotions).

The description of olfactory sense in Unani classical texts is not much different from that in modern physiology. Like modern physiologist, Unani philosophers have described the sprouting of the olfactory nerve in the nasal cavity. Cribriform plate of ethmoid bone is described²⁴. However, the dif-

18- Ibid.

19- Guyton et al, 2013: 446-448.

20- Ahmed, 1980: 191, 192.

21- Sembulingam et al, 2012: 989-993.

22- Avicenna, n.d.: 88.

23- Sembulingam et al, 2012:1024-1026.

24- Chaurasia, 2004: 228.



ference in the final pathway is great. In Unani literature, there is no mention of the olfactory bulb and synapsing of the olfactory nerve with nuclei of the limbic area. Effects of different smell on the heart and the brain are documented well and in details in Unani literature. Because of these effects, various aromatic fumes are recommended for therapeutic purposes and recognition of these aromatic effects may be considered as the beginning of aromatic therapy. For example, aroma of musk is recommended in various cerebral and cardiac diseases²⁵.

Like modern physiologists, Unani philosophers have described various cutaneous tools for the perception of touch, texture and temperature. Mention of specific receptors, like Pacinian corpuscle, Merkel disc for the perception of the tactile sensation, is not found. Nociceptors and proprioceptors are not described in Unani literature. The interaction between the skin and objects to be perceived is considered mandatory²⁶. Unani philosophers are of opinion that certain qualities of object are perceived and, in this mechanism, object works as active. Somatosensory cortex and homunculus are not described. Functions of interpretation of the perceived modality of sense are attributed to *Nafs*. Sensation based protective functions of the skin are described in details. Unani philosophers believe that some muscles at certain part of the body have the sensory ability. The skin is also considered as a receptacle for body wastes²⁷. Like modern physiology, the receptor potential, action potential and its transmission to specific areas of the brain are not described.

Conclusion

In Unani literature, five external senses are described in order of their media of perception from the finest to the thickest sensation. In modern physiology, these are described as special senses, excluding tactile sensation. The mechanism of perception of Telesense in respect of vision is explored extensively in modern physiology. Rod and cone cells excitation and the generation of electric potential in them is the basis of vision²⁸. Unani philosophers could not imagine the retina and they thought that light rays between eyes and the object were responsible for the formation of the image²⁹. Modern physiology has disclosed that the retinal image is interpreted at the level of visual cortex. Here, the impulses reach through the lateral geniculate body. Magnocellular and parvocellular pathways start from the layers of lateral geniculate body, and these project to visual cortex in occipital lobe³⁰. Having recognized the frontal area of the forebrain as the area of integration, Unani philosophers were of the

- 25- Baghdadi, 2005: 106, 107.
- 26- Goldsmith et al, 2012: 1112.
- 27- Bijlani, 2004: 240, 241.
- 28- Guyton et al, 2013: 586-588.
- 29- Ahmed, 1980: 191, 192.
- 30- Sembulingam et al, 2012: 989-993.



opinion that visual images were projected to the forebrain. According to them, all external sensory receptors relay their sensation or perceptions to this integration area, where partial interpretation occurs³¹. As the final analysis, it can be concluded that despite the limited knowledge of Unani physicians on the nervous system, what was presented by Unani physician about 2000 years ago, was at times very precise. From the description and knowledge of external senses, it seems that Unani literature was a good source for the advancement of the knowledge concerning the nervous system. Apart from the functional description various diseases of the external sensory organs and their treatment were also described comprehensively. This formal knowledge of Unani system of medicine paved the way for the present advanced form of the nervous system.

31- Avicenna, n.d.: 88.

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Conflict of Interest

Authors have no conflicts of interest.

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