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A review on tissue formation from humors in the light of unani fundamentals

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Abstract

The Unani system of Medicine discusses the anatomy and physiology of the human body under one roof and propounds the theory of seven basic principles (Kulliyat-e-Umur-e-Tabi'yah) for the same. Aa'za (organs) is one of these seven basic principles and belongs to the category of Asbab-e-Maddiyah, which means that they have been considered as one of the materialistic causes for the body; where health or disease resides when acted upon by the Asbab-e-Faila (efficient causes). According to the Greeco-Arab scholars Aa'za, in particular aa'za-e-mufradah have their origin in body fluids, specifically the dense part of the humors; a theory which many of today's physiologists would outright reject based on the fact that cells pour out their secretions into the blood rather vice versa. However, it should not be assumed that our forefathers were absolutely wrong in their theory of organ formation. In this paper, it has been tried to identify the coarse and fine humors with respect to their functions in the body and how they take part in the formation of cells and tissues to substantiate the concept of cell formation from body fluids put forth by the ancient scholars on modern parameters.

Keywords: Aa'za, Aa'za-e-Mufradah, Khilt-e-Kaseef, Khilt-e-Lateef

1. Introduction

Anything and everything that happens to exist in this World is bound to acquire one of the three states of matter, which holds true in case of human body as well. Affirming to the same, J. Tytler while quoting Hippocrates says that the human body is composed of three types of matter; the solid parts are known as Aa'za, which keep in their enclosure the two other parts-liquids and gases^[1] termed as Rutubat-e-Aslia and Rooh respectively. Likewise, Abu Sahel Masihi while briefing about Aa'za states that the entire body consists of three kinds of substances; one of them possess retentivity and hardness and do not, therefore required to be enclosed in vessels to prevent them from flowing^[1].

Aa'za holds the fourth position in sequence amongst the seven Umur-al-Tabi'yah (the Seven principles of Tabiat^[2] and are broadly classified into Aa'za-e-Mufradah and Aa'za-e-Murakkabah. Of these two, Aa'za-e-Mufradah synonymously known as Aa'za-e-Basitah (simple organs) or Aa'za-e-Mutashabihat-ul-Ajza (homogenous organs) means an organ, the smallest part of which exactly resembles the whole both in terms of structure and function^[3,4,5] and therefore, can be understood equivalent to the tissue in Biology^[6]. Thus, Aa'za-e-Mufradah is defined as, "the organs in which the visible and perceptible parts carry the same name and definitions as the whole organ" as opposed to the Aa'za-e-Murakkabah also known as Aa'za-e-Aaliyah; organs in which the comprising parts irrespective of size differ in nature as well as name for the whole organ^[7]. This is equivalent to Organ, in biology, a group of tissues in a living organism that have been adapted to perform a specific function^[8]. Classical literature mentions ten organs or better to say tissues under the heading of Aa'za-e-Mufradah and although most of them are in fact composed of varying structures not so evident macroscopically^[9], regarding which Galen stated that there is no loss if an organ with minimal structure is studied under aa'za-e-mufradah^[1,9,10].

2. Formation of Aa'za-e-Mufradah

With respect to the formation of Aa'za, Ibn-e-Sina stated that the members (organs) of the body are derived primarily from the commingling of the "humors", just as the humors are derived primarily from the commingling of the alimants (nutriments), and the alimants are primarily composed of the commingled elements^[11,12,13]. The point of view of Ali Ibn-e-Abbas Majusi regarding aa'za is that "Akhlāt (humors) are the proximate principles for the human body, but the more proximate are Aa'za-e-Mufradah (tissues), which are composed of Akhlāt; and Aa'za-e-Aaliyah (organs) are composed of Aa'za-e-Mufradah"^[14]. Rabban Tabri in Firdaus-al-Hikmat says, "in fact, man gets nutriment from Arkan-e-Arba (the four elements).

Aliment forms from the Arkan-e-Arba; the four temperaments result from aliments and Aa'za-e-Mutashabihat-ul-Ajza are formed from these temperaments. Aa'za-e-Mutashabihat-ul-Ajza refers to those organs whose part resembles the whole organ e.g., flesh. Aa'za-e-Mutashabihat ul Ajza forms Aa'za-e-Murakkabah.”^[15]

With reference to the formation of aa'za, nearly every classical literature mentions that the Aa'za are formed from the Khilt-e-Kaseef (coarse humors) in the same way as Rooh (Pneuma) is produced from the fine humors. However, nowhere it is being mentioned that what exactly Khilt-e-Kaseef is and what is the exact procedure of the genesis of Aa'za from them? However, in the present scenario, this can be understood in the light of cell formation.

3. Akhlat and their relation to the formation of aa'za-e-mufradah

Amongst various classifications, one of the ways of categorizing humors is in accordance to their quality of being coarse or fine. A coarse and fine humor here refers to the capability of being utilized for cell formation/repair and for energy respectively. Akhlat-e-Latifah (Fine Humors) is the consumable part of the humor that has the property of diffusing into Aa'za-e-Mufradah and after combining with Johar-e-Rooh i.e., Oxygen, it helps in the production of rooh to sustain the Quwa and helps in delivering the functions of various faculties. On the other hand, Akhlat-e-Kaseefah (Coarse humors) is the bulk-forming part of the humor, which helps in takwin (anabolism) and becomes a part of the organ. It replaces what is lost as a part of wear and tear and promotes growth^[3]. Thus, it is this Khilt-e-Kaseef, which is supposed to take part in the formation of cells and tissues. It is generally understood in Unani system of Medicine that Dam is the Khilt-e-Lateef, as it is the carrier of Oxygen in the form of Oxyhaemoglobin, which is critical for aerobic mode of cellular respiration to release energy. Along with this, carbohydrate can also be considered as Khilt-e-Latif and a constituent of Khilt-e-Dam because it is the main nutrient for catabolism. Khilt-e-Balgham (Lipids and Proteins) and Khilt-e-Sauda (Minerals) are mainly considered as Khilt-e-Kaseef. Sauda (Melancholic residues) in the bloodstream thickens the blood, enabling it to clot; it also governs mineral metabolism and bone formation. Vitamins, Enzymes, Hormones and other catalyst can be taken as Khilt-e-Safra without which metabolism, and most of other body functions cannot proceed. However, in the classification of Latif and Kaseef, there can be an intermediate variety also with respect to its dual function, which is being able to serve its function in organogenesis as well as for energy production. In fact, when we analyze the four genus of akhlat (humors) in contemporary view, it is revealed that since, the four humors are not a single entity in themselves, but instead a major class inclusive of components of varied functions; some portion of every humor goes into organ formation, while some of it get utilized for liberating energy so as to keep an individual alive.

To better understand this; let us take an example of macronutrients- carbohydrates, Lipids, Proteins. Since these three are present in blood, they certainly are a part of humor. These three macronutrients can be utilized by the cells of the body for energy production through Krebs cycle and electron transport chain implying that they are Khilt-e-Latif. However, again these three nutrients also take part in cell formation (discussed later), which implies that they are Khilt-e-Kaseef too.

There is another classification of body humors with respect to being Primary or secondary in accordance to their stage of formation. This classification has its importance in the light of organ formation. Of the secondary humors^[10], Rutubat-e-Mahsurah is the interstitial fluid whose fate has not yet been decided that whether it will be converted to Rutubat-e-Talayyah or Rutubat-e-Qareebah ba In'iqad. Rutubat-e-Talayyah permeates the tissues like dew and is capable of being transformed into nutriment as required. It moistens the tissues according to the requirement which active motion entails, and it comes into play if there is anything like to dry up the tissues. It can be taken as Khilt-e-Latif that will be utilized for energy production, whereas, Rutubat-e-Qareebah ba In'iqad is in fact Khilt-e-Kaseef that has acquired the temperament and resemblance of the would be organ except that it still in fluid state and has not condensed yet to be termed as Aa'za.

4. Cell: the unit of Aa'za-e-Mufradah (Tissues)

Though the Unani scholars were not accustomed and well versed with the microscopic structure of the cells, yet they were very well aware of the concept that aa'za-e-mufradah are composed of some minute matter, specific for each tissue. Ibn-e-Nafis said, “there is a specific matter and surat-e-nau'iyah for each uzu-e-mufrad (tissue) by virtue of which it becomes a specific Nau (type) with a specified structure”. This Tabi'at-e-Nau'iyah (nature of the cell) and mahi'at-e-khususiyah (specific structure) is common to the whole organ as well any part of it and owing to this tabi'at, there is no difference between the whole and the part.”^[3, 4] This specific Surat-e-Nau'iyah is nothing but the structural unit of the body i.e., the cell, which together makes up the tissue and its specific proteins encoded by the genes, which determine the specific character of a tissue and become the basis of differentiation and distinction of different tissues.

Cell is the membrane-bound structural and functional unit that contains the fundamental molecules of life and is capable of displaying the attributes associated uniquely with the living state^[15]. In a multicellular organism, cells become specialized as they mature to perform different functions through the process of differentiation. In order to do this, each cell keeps in constant communication with its neighbors. Cooperative assemblies of similar cells form tissues, and aco operation between tissues in turn forms organs, which carry out the functions necessary to sustain the life of an organism.

4.1. Bio-Chemical Composition of the Cell

Although molecules are lifeless, yet, in appropriate complexity and number, molecules compose living things. Cells consist of a collection of such simple and complex organic molecules, inorganic molecules, and ions. Aside from water that constitutes 70 percent of a cell's mass, a cell is composed mostly of macromolecules built from small molecules (Table 1). These precursors also termed as the ‘alphabets of biochemistry’ are twenty amino acids, two purines, three pyrimidines, monosaccharides, palmitate, glycerol and choline, etc. that in combination forms the bio-macromolecules^[16].

Of these biomolecules, carbohydrates are polyhydroxy-aldehydes or ketones with chiral carbons that are used primarily either as an instant source of energy or as a means of storing energy in the form of Glycogen i.e., in the role of khilt-e-lateef. Apart from that carbs are also a component of cellular structure, and helps in cell recognition, which is indicative of their role as khilt-e-kaseef. Lipids on the other

hand are nonpolar hydrophobic molecules that store large amounts of energy over long periods of time in Adipose tissues. Along with that lipids also play a major role in the structure of the cell membranes. Another macromolecule Proteins are polymers of amino acids, which have a chiral carbon bonded to Hydrogen, a carboxyl group, an amino group, and one of the 20 characteristic organic side groups. They are the most abundant substance in plasma by weight and play a part in a variety of roles. They are an important

reserve supply of amino acids for cell function such as synthesis of new proteins, as a building block of many structural components of the cell, and for growth etc. Nucleotides have a purine or pyrimidine ring, ribose or deoxyribose (furanose ring) and a phosphor ester. Nucleic acids on the other hand are linear polymers of ribo- or Deoxyribonucleotide that contain the genetic information of cells and play a vital role in protein synthesis

Table 1: Cell Organelles and their constituent biomolecules

Structural Feature	Molecular Composition
Cell Membrane	Bilayer of proteins (50%) and lipids (50%) and some carbohydrate
Nucleus	Contains genomic DNA, and histone proteins as chromatin; RNA
Cytoplasm	Cytoskeleton made of proteins; contains soluble proteins, enzymes, nutrients, and salts in aqueous solution
Golgi apparatus	Flattened vesicles of lipid, protein, and polysaccharide
Mitochondria	Double-membraned with protein and lipid
Endoplasmic reticulum with ribosomes (RER)	Flat, single-membraned vesicles of lipid and protein; ribosomes consist of RNA and proteins
Peroxisomes	Single-membraned vesicles containing catalase and other oxidative enzymes

(Source: Web.thu.edu.tw/hclu/www/biochem/chap01.pdf)

5. Khilt-e-Kaseef in the structure and composition of cell membrane

A living cell is a self-reproducing system of molecules held inside a container - the plasma membrane, which is a thin barrier of 08 nm that separates the interior of all the cells from the outside environment. It controls the traffic into and out of the cell, since like all biological membranes; the plasma membrane is also selectively permeable to ions and organic molecules, allowing some substances to cross more easily than others. Since, the cell membrane is an integral component of every living cell, it has been taken as an example to demonstrate the role of khilt-e-kaseef in cellular composition and eventually of tissues that will give rise to organs, also known as aa'za-e-murakkabah in classic Unani literature.

Cellular membranes contain a variety of biological molecules (table 2), the relative content of which varies widely from one type of membrane to another, but typically it contains, 40 percent of the dry weight of lipids, about 60 percent proteins and 1 to 10 percent carbohydrates [17]. While lipids help to give membranes their flexibility, proteins monitor and maintain the cell's chemical climate and assist in the transfer of molecules across the membrane. As discussed earlier, lipids and proteins are basically phlegmatic humor that are mainly considered as the khilt-e-kaseef, but here, carbohydrate as a part of sanguinous humor also act as Khilt-e-kaseef. Along with these organic molecules, some minerals, which are taken as a part of the black humor, are also required for formation of some components of cells like phosphorus in combination with lipids, calcium, magnesium are required for the formation of cell membrane.

Table 2: Composition of the Plasma membrane

Component	Location	Humoral component
Phospholipids	Main fabric of the membrane	Balgham-Sauda
Cholesterol	Tucked between the hydrophobic tails of the membrane phospholipids	Balgham
Integral proteins	Embedded in the phospholipid bilayer; may or may not extend through both layers	Balgham
Peripheral proteins	On the inner or outer surface of the phospholipid bilayer, but not embedded in its hydrophobic core	Balgham
Carbohydrate	Attached to proteins or lipids on the extracellular side of the membrane (forming glycoproteins and glycolipids)	Dam

Table modified from OpenStax Biology

6. Conclusion

Aa'za are the solid components of body that have been categorized into simple organs (*Aa'za-e-Mufradah*) and compound organs (*Aa'za-e-Murakkabah*). A simple organ means that the structure is homogenous throughout, so that their name describes them in all parts and it is synonymous to tissues, whereas, Aa'za-e-Murakkabah is synonymous to organs. Humors in general have been classified into fine and coarse with respect to their functions in the body and of these two types, Aa'za-e-Mufradah are considered to be formed of coarse humors (khilt-e-kaseef). However, what we have concluded is that there cannot be a clear cut distinction as to what will be called as the Khilt-e-Kaseef and what will remain as Khilt-e-Latif as humors exhibit duality in function

in accordance to time and requirement. Everything that has been flown with Blood has varied functions in the Body. At one point of time, it might be utilized for energizing the body, whereas the very next moment some portion of it might get utilized by the body for incorporating in the cells either for repair purpose or as a substitute for what is being lost or may be for the formation of a new cell or tissue.

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