

# Analogical Insight: *Tridosha Karma* at Cellular Level

Author: Navya K<sup>1</sup>

Co Author: Febin Joy<sup>2</sup>

<sup>1</sup>Dept of Samhita and Siddhanta, P.N. Panicker Souhruda Ayurveda Medical College, Kasaragod, Kerala, India

<sup>2</sup>Dept of Dravyaguna, P.N. Panicker Souhruda Ayurveda Medical College, Kasaragod, Kerala, India

## ABSTRACT

Introduction: *Sushruta Samhita* includes *Upamana* as a *Pramana*. Consequently usage of analogies in this revered text is extensive. Exploring the analogies reveals various aspects related to the base and the target domain involved in an analogy. Methodology: The analogy in the quote was critically studied by referring the views of commentators and thereafter collecting information related to cellular energy through internet source and contemporary books. Results: A critical analysis of one of the quote in *Sushruta Samhita* reveals the role of Tridosha in the production, maintenance and distribution of energy in a cell. Macronutrients play the visarjana role of kapha, enzymatic break down of macronutrients and cellular metabolism carry out the *Adana karma* of *Pitta* and rotatory movement of ATP Synthase performs the *Vikshepa karma* of *Vata*. Discussion: Abstract information conveyed by the usage of analogies when explored throws insight on the subtle aspects of the concerned topic as in the example considered here.

**Key Words** *Tridosha, Analogy, Cell*

Received 20<sup>th</sup> October 22 Accepted 08<sup>th</sup> November 22 Published 10<sup>th</sup> November 2022

## INTRODUCTION

The authentic sources of all the information in the field of Ayurveda are *Samhita*. These texts were written by the knowledge acquired by the aid of *Pramana* like *Pratyaksha*, *Anumana*, and *Yukti* etc. *Sushruta Samhita* mentions a *Pramana* termed as *Upamana*<sup>1</sup>. Consequently there is extensive usage of *Upama* in *Sushruta Samhita*. By the usage of these *Upama* or analogy mainly two purposes are served. Firstly vast information is conveyed in a concised form and secondly complex phenomena are conveyed in a simple way. But the other side of the coin is that *Upama*

limits the information to a gross level. Hence there is always a chance of misinterpretation based on the preconception of the individual readers. Hence if these *Upama* are critically studied it will lead to revelation of vast information. It will also connect the missing links between the target and domain involved, thereby resulting in better understanding of the concerned subject<sup>2</sup>.

## MATERIALS AND METHODS

A quote mentioned in *Sushruta Samhita* alongwith its two reknowned Commentaries

## REVIEW ARTICLE

*Nibandha Sangraha* and *Bhanumati Teeka* were referred. It was found that the core idea conveyed through the quote was the production and distribution of energy in body. Physiology textbooks as well as Internet source were referred to get the contemporary view regarding the same and striking similarities were found in both the views.

## LITERARY REVIEW

In *Sushruta Samhita Sutrasthana* 21<sup>st</sup> Chapter an analogy is mentioned with regard to the functions of *Tridosha*<sup>3</sup>.

विसर्गादानविक्षेपैः सोमसूर्यानिला यथा |  
धारयन्ति जगद्देहं कफपित्तानिलास्तथा // सु सू  
२१/८||

The quote compares the function of *Kapha*, *Pitta* and *Vata* with the functions of Moon, Sun and Air. Analogical Mapping can be tabulated as in Table 1.

**Table 1** Analogical Mapping of *Tridosha* based on its karma

<i>Upameya</i>	<i>Upamana</i>	Function Compared
<i>Kapha</i>	Moon	<i>Visarga</i>
<i>Pitta</i>	Sun	<i>Adana</i>
<i>Vata</i>	Air	<i>Vikshepa</i>

This *Upama* is an abstract analogy and seems difficult to validate it scientifically. On analysing the commentaries following details are observed: *Nibandhasangraha* explains the meaning of these terms which can be understood through Table 2

**Table 2** *Tridosha karma* as per *Nibandhasangraha*

<i>Visarga- Sarjana of bala</i> – source of genesis of energy
<i>Aadana- Grahana</i> – capturing or holding
<i>Vikshepa- Prerana</i> – distribution or dissipation of energy

*Bhanumati Teeka* gives some more information regarding the terms as in Table 3<sup>4</sup>.

**Table 3** *Tridosha karma* as per *Bhanumati Teeka*

<i>Visarga</i>	<i>Visarjana of soumyamsha</i> by <i>Chandra</i> and <i>Kapha</i> .
<i>Adana</i>	<i>Shoshana of soumyamsha</i> by <i>Surya</i> and <i>Pitta</i> .
<i>Vikshepa</i>	<i>Uchita dhatu vyuhana</i> by <i>Anila</i> and <i>Vata</i>

### Energy at Cellular level:

**Visarjana karma of Kapha in cell:** The source of energy for a cell are the macronutrients present in the food taken<sup>5</sup>. Among the macronutrients, carbohydrates serve as the important fuel molecules. Chemical bond energy in these carbohydrate molecules serve as the fuel for cells. These macronutrients are *Prithvi* and *Jala Mahabhuta Pradhana* and are *Guru*. This means macronutrients are the *kaphamsha* which are the bestowers of energy for a cell. This is in coherence with the *Bala Visarjana karma* as mentioned by commentators.

**Analogy with the moon:** This function is analogous to the role played by moon in maintaining *soumyamsha* in the earth. Latest research explains how earth became a habitable planet by the formation of moon which brought water to the earth<sup>6</sup>. Moreover Moon's gravitational pull is responsible for two low tides and two high ocean tides every 24 hours. These ocean tides in turn affect the ocean currents. The humidity and precipitation patterns of an area are contingent on these currents<sup>7</sup>.

**Adana karma of Pitta in cell:** The term *Adana* is described in the commentaries by two terms *Shoshana* as well as *Grahana*. Food molecules are broken down in three stages to produce ATP.

REVIEW ARTICLE

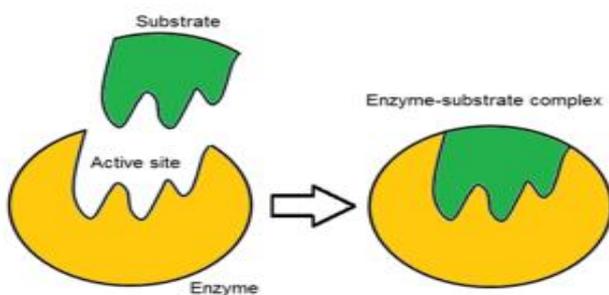
Stage 1: The breakdown of food molecules either in the intestines outside the cell or in a specialised organelle within cells called lysosomes by the action of enzymes is the stage of digestion.

Stage 2: Thereafter a chain of reactions converts each molecule of glucose into two smaller molecules of pyruvate. This is called as glycolysis.

Stage 3: Oxidative breakdown of food molecules takes place entirely in mitochondria called citric acid cycle<sup>8</sup>.

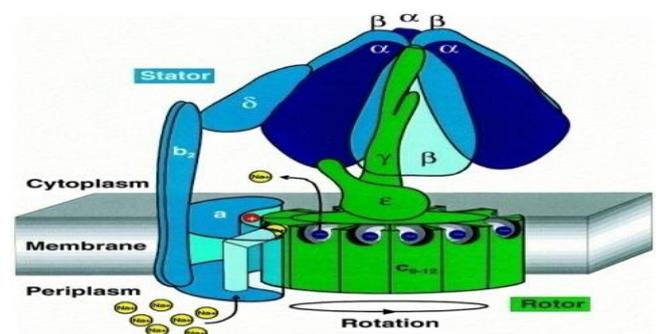
**Analogy with the Sun:** All the biological transformations occurring in an ecosystem require solar energy. *Shoshana* or transformation of macronutrients into smaller form in the cell is brought by the action of enzymes. This action can be attributed to the *Pitta* present in the body.

*Grahana karma* can be explained by the fact that every enzyme has an active site to which specific substrate gets attached by lock and key hypothesis (Figure 1)<sup>9</sup>. This is analogous to *Grahana karma*. Just as the Sun pulls up or grabs the humidity of the atmosphere.



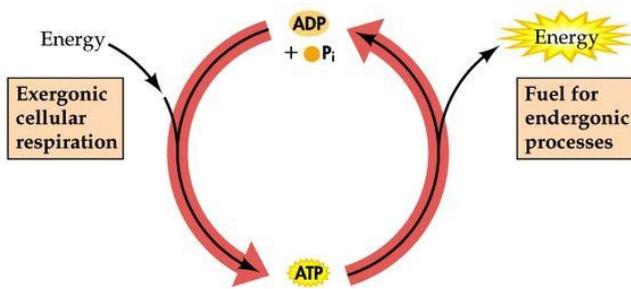
**Figure 1** Lock and Key Mechanism in Enzymatic reaction  
**Vikshepa Karma of Vata:** Flowing things can transfer energy. Just like flowing water can turn a turbine and this kinetic energy can

be then converted into electrical energy, mechanical energy or heat energy as per the requirement. In our cells, **organelles** are there. Mitochondrion is the mill which produces energy. Inside the mitochondrial membrane there are wheels of ATP synthase (Figure 2)<sup>10</sup>. ATP synthase is a molecular machine that works like a turbine to convert the energy. Hydrogen ion passes the wheel and produces energy. Thereafter these ATPs act as mediators of energy system in our body. The functions which require activation energy are called endergonic reaction like excretion. For this energy is derived from ATP. The functions which release energy are called exergonic reactions like digestion, respiration. This energy combines ADP and phosphate to form ATP. Thus basically the turbine like movement of ATP synthase and flow of hydrogen ions is responsible for all the functions in the form of ATP-ADP cycle<sup>11</sup> (Figure-3)<sup>12</sup>.



**Figure 2** Rotatory movement of ATP Synthase

## REVIEW ARTICLE



**Figure 3** ATP-ADP Cycle

**Analogy with Air:** This movement can be considered as *Vikshepa karma* of *Vata* in body just as energy dispersion by *Vayu* in the environment.

## DISCUSSION

Differences can arise in the mode of treatment between contemporary science and *Ayurveda*. But at the level of physiology and anatomy there cannot be two different views between two streams of Medical science. Infact both the streams convey the same process but in two different ways. In *Ayurveda*, the subtle steps involved in a process have been conveyed in a broad manner. The technicalities involved have been kept under 3 major categories of *Vata*, *Pitta*, *Kapha* or at the maximum the five divisions of each variety. While years later, contemporary Medical Physiology has given the full information about the minute details of it. It appears that the scholars of *Ayurveda* were highly skilled in understanding the fine details but they observed a common role of *Tridosha* in every aspect of the body being displayed in different ways at different levels. They found the need to see the

commonality than to diversify the complexities involved. As such there is a need to do an inter-disciplinary analysis of various contexts in *Ayurveda* with a parallel study of the scientific basis documented in allied science to explore the fine details behind the analogies to validate them.

## CONCLUSION

Vast information has been conveyed in a concise manner by the usage of analogies. Analysis of the base and target involved in the analogy throws new light on subtle details of the involved process. Macronutrients play the *visarjana* role of *kapha*, enzymatic break down of macronutrients and cellular metabolism carry out the *Adana karma* of *Pitta* and rotatory movement of ATP Synthase performs the *Vikshepa karma* of *Vata*. The method adopted by the scholars of *Ayurveda* in conveying the physiological aspects suggests that all the processes in the body are ultimately governed by *Tridosha*. The entire process has been conveyed with the aid of easily recallable analogies. Upon Superficial reading such similes can often get disregarded as a myth, but when analysed critically it spurts out the underlying science.

## REVIEW ARTICLE

### REFERENCES

1. Sushruta, Sushruta Samhita with Nibandhasangraha Teeka of Dalhana, Sutrasthana Chapter 1, Verse no. 16, edited by Yadavji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi 2015;10.
2. NK, AKA, P.H. S. Literary study of Upama in Sushruta Samhita- A bird's eye view. AAM. (2020), [cited July 16, 2022]; 9(3): 198-207. [doi:10.5455/AAM.109095](https://doi.org/10.5455/AAM.109095)
3. Sushruta, Sushruta Samhita with Nibandhasangraha Teeka of Dalhana, Sutrasthana Chapter 21, Verse no. 8, edited by Yadavji Trikamji Acharya, Chaukhambha Sanskrit Sansthan, Varanasi 2015;100
4. Sushruta, Sushruta Samhita with Bhanumati Teeka of Chakrapani, Sutrasthana Chapter 1, Verse no. 16, edited by Yadavji Trikamji Acharya, Krishnadas Academy Varanasi 2001;158.
5. Science Learning Hub – Pokapū Akoranga Pūtaiao, Macronutrients, Published 18, March 2011, Retrieved from <https://www.sciencelearn.org.nz/resources/534-macronutrients>.  
DOA 5 March, 2020.
6. University of Munster. "Formation of the moon brought water to Earth: New research explains how Earth became a habitable planet." ScienceDaily, 21 May 2019. [www.sciencedaily.com/releases/2019/05/190521101505.htm](http://www.sciencedaily.com/releases/2019/05/190521101505.htm).
7. Merriam, Elizabeth. (2022, October 24). How The Moon Affects The Weather. sciencing.com. Retrieved from <https://sciencing.com/moon-affects-weather-6529673.html>
8. Alberts B, Johnson A, Lewis J, et al. Molecular Biology of the Cell. 4th edition. New York: Garland Science; 2002. How Cells Obtain Energy from Food. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK26882/>
9. File:Lock and key.png. (2021, August 28). *Wikimedia Commons, the free media repository*. Retrieved 00:26, November 6, 2022, from [https://commons.wikimedia.org/w/index.php?title=File:Lock\\_and\\_key.png&oldid=586770063](https://commons.wikimedia.org/w/index.php?title=File:Lock_and_key.png&oldid=586770063).
10. Adler EM, Of ATPase activity, cellular energy distribution, and linking depolarization and division. *J Gen Physiol.* 2015;146 (4):265–266. doi:10.1085/jgp.201511508, DOA 5 March, 2020
11. Peter Dimroth, Operation of the F<sub>0</sub> motor of the ATP synthase, *Biochimica et Biophysica Acta (BBA) - Bioenergetics*, Volume 1458, Issues 2–3, 2000, Pages 374–386, ISSN 0005-2728, [https://doi.org/10.1016/S0005-2728\(00\)00088](https://doi.org/10.1016/S0005-2728(00)00088) (<https://www.sciencedirect.com/science/article/pii/S0005272800000888>)
12. <https://quizlet.com/527550035/biology-1-biology-1610-ch9-cellular-respiration-and-fermentation-flash-cards/>