

Quantum Logic in Ayurveda

Abstract

Mechanistic biomedical model based on classical physics is the basis of our current understanding of human system. Real world, however, is non-classical as predicted by Quantum Physics, which in a nutshell says everything in the universe is interrelated and a change in one part of the system will be reflected in the other parts as well. This quantum worldview is entirely consistent with the vedic concept of 'innate unity' and mutual interrelationship of everything in the universe. Ayurveda, which has its roots in *vedas*, has integrated this concept of interconnectedness into its understanding of health and disease. It considers human body as an indivisible whole with a network of interrelated functions, mind and consciousness wherein a disturbance in one part will have repercussions in other parts as well. Disease is seen as a perturbation in this network. The key to health is for these factors to maintain the stability of the network, not only within the system but without as well. Quantum physics and the *vedic* hypothesis of interrelatedness finds a practical expression in ayurveda, which has integrated this into its theory and practice.

1.1 Healthcare : emerging trend

Western medicine, which is striving to provide professional healthcare system with the aim of eradicating diseases, has undergone an explosion of knowledge leading to diagnostic and therapeutic breakthroughs. Yet, the disease burden has not reduced and the overall results in terms of complete cure without side effects have left much to be desired (Dean 2005; Gandhi et al. 2003; Lazarou et al. 1998; Moore et al. 1998). A number of diseases previously under control are no longer manageable with the currently available medicines. For eg, new strains of drug resistant bacteria have developed, which defy treatment with conventional antibiotics (Goossens 2005; Hawkey 2009). In addition, factors such as altered

lifestyle and environmental conditions are also contributing to new health threats. Diseases now defy state-of-the-art diagnosis and treatments (Avenell et al. 2004; Illich 2003; Mackenbach 2006, Shahri and Hagemann 2011).

It is becoming apparent that despite specialised knowledge and use of sophisticated technologies, modern medicine seems unable to handle the mushrooming of diseases underscoring the need for a relook at alternative approaches to medicine. Moreover, with an increasingly chemicals-weary population turning to alternative systems, a pluralistic and integrated approach to healthcare is emerging world over (Bishop et al. 2010; Wade et al. 2008). Even in Western countries at the forefront of modern medical research, there is growing interest in alternative systems of treatment (Kemper et al. 2008; Xue et al. 2007). This inevitably brings into focus one of the longest unbroken healthcare system in the world, i.e. ayurveda, indigenous to Indian subcontinent. As western medical science contemplates alternative approaches, it is pertinent to understand ayurveda, whose concepts and approaches to health and diseases are at variance with that of western medicine (Jayasundar 2009, 2011) but resonates with some of the concepts of quantum physics applicable to the macroscopic world. This article explores points of contact between ayurveda and quantum physics, in particular, quantum reality and worldview. It also gives a bird's-eye view of the two streams of medicine – the currently prevalent classical physics-based reductionistic western medicine and the vedic sciences-based holistic ayurveda.

1.2 Classical worldview and Western medical science

Physics has been very influential in shaping the development of biology and medicine. It has contributed tremendously to the advancement of medical diagnostics and therapeutics - eg. ultrasound, Magnetic Resonance Imaging (MRI), Computerised Tomography (CT), nuclear medicine, radiotherapy, etc. From x-rays to laser, applications of physics have been successfully translated into medical technologies (Davidovits 2007; Kane 2009). While these contributions of physics are well appreciated, very little is understood about the impact of its worldview in medicine. That it has influenced medicine in a way more than one can appreciate, is much less known. Before we explore how worldviews have shaped medicine, it is imperative to know the development and specific viewpoints on health and disease of both the Western and ayurveda systems, both of which are outlined in brevity in the following sections.

1.2.1. Classical worldview

The classical / Newtonian physics deals with macroscopic objects and the forces governing them. Its laws formulated in terms of physically describable variables have been extended with tremendous success from atoms to terrestrial bodies. Physics came to be known as deterministic physics since the entire physical universe from the smallest to the largest were seen to be bound by these laws and the concept of physical determinism (Burt 1952; Butterfield 1997). A worldview based on this had emerged by 19th century, which considered the world as being made up of building blocks of atoms. This Newtonian worldview considered everything from human body to universe as a machine composed of separate interacting material particles / objects behaving in accordance with the physical laws. According to this worldview, even nature could be reduced to fundamental entities of matter. This viewpoint became the platform from which everything, including biology and medicine, was viewed and understood. Consequently, human body also came to be considered as being made up of building blocks of atoms and molecules. More importantly, the focus of classical physics has been on the physical aspects with elements of the mental realm completely left out. Consequently, body and mind also came to be viewed as two entirely separate entities in western medicine.

1.2.2. Western medical science

Hippocrates, the father of western medicine, brought in for the first time the concept of logical rather than supernatural explanations for illness. Since dissection of human cadavers was forbidden on religious grounds then, he relied primarily on logic and tangible evidence to understand health and disease. He considered the latter a result of imbalance among the four humors (blood, black bile, yellow bile and phlegm), each of which was also associated with a personality type. Centuries later, Galen (130 AD - 201 AD), a Greek philosopher and physician, extrapolated human anatomy from that of pigs, which was considered most similar to humans. The Hippocratic-Galenic theories on the body-mind-personality relationship and views on anatomy dominated Western medicine for the next 1500 years (Conrad et al. 1995; Nutton 2004).

The dissection of human cadavers of executed criminals by Vesalius in 1539, following a landmark judgement, corrected the mistaken notions of human anatomy proposed by Galen and marked a historical milestone in Western medicine. However, developments such as the discovery of blood circulation by William Harvey in 1628 began an era of viewing human body as an assemblage of organs supplied with energy/fuel by blood. The use of microscope to view cells by Robert Hooke in 1664 AD marked yet another stage of development in Western medicine. Slowly, symptoms till then considered to be natural physiological responses to disease began to be viewed as pathologic consequences and the body-mind-personality connection fundamental to Galenic medicine was also discarded

(Conrad et al. 1995; Nutton 2004; Ventura 2000). The concept of linear and singular causality for diseases, however, started with Morgagni's work connecting etiology of diseases to specific anatomical locations (Ventura 2000). This marked the beginning of pathological anatomy, which focuses on a single, dominant factor considered responsible for the pathology and uses it for targeting treatment.

1.2.2.1. Impact of classical worldview in Western medicine - reductionism

While the above mentioned developments in the field of medicine set the stage for understanding human body from a predominantly mechanical perspective, advances in physics played a crucial role in catalysing and developing them further. The Newtonian mechanistic worldview considering the world as being made up of fundamental units of matter / building blocks became the platform for the reductionistic approach in medicine. Reductionism as a systematic method to understand the world was proposed by Descartes, who suggested the world was clock-like and could be understood by reducing it to parts and studying the individual components (Cottingham et al. 1988; Haldane and Ross 1911). This concept of breaking down of a complex system into smaller parts and studying them separately, has been a very successful approach in biology for studies ranging from understanding the working of cells to the unravelling of human genome (Keller 2000; Morange 2001).

The reductionist model is hierarchical, with atom in the lowest level forming the basic building block. Atoms make molecules, which in turn form cells and then tissues. A group of tissues working together form an organ and a group of organs referred as an organ system perform a major function. The human body is understood in terms of various systems such as skeletal, circulatory, reproductive, etc. Disease is understood and treated at the lowest level of the structural hierarchy, i.e. at molecular level (Conrad et al. 1995). Treatment is corrective and generally involves bringing deviated parameters (eg. blood glucose in diabetes) within normal range. For example, the focus in conventional diabetes management is on the symptom, i.e. hyperglycemia and treatment aims directly at lowering the glucose level. Corrective treatment is based largely on control or suppression of symptoms by manipulating the body's chemistry with drugs. Methodological reductionism, thus, pervades clinical medicine from diagnosis to therapeutics (Morange 2001; van Regenmortel and Hull 2002).

1.2.2.2. Caveats in reductionism and changing perceptions

The reductionistic approach, though very effective in providing significant information on biology and disease processes, has not been able to translate its success from bench to bedside for delivering complete cure without side effects. Much of this is attributed to the limitations of the reductionistic approach, which focuses on the identified molecular target but excludes the rest of the system (Beresford 2010; van Regenmortel and Hull 2002). There is increasing realisation that this compartmentalised approach underestimates the complexities of biological systems. For example, this approach views brain in terms of wired circuits and chemical processes with even consciousness and mental states reduced to chemical reactions (Ito 2006; Miller 2011). The classical idea of matter and linear causality of diseases, may not be compatible with the complex nature of various processes involved in brain because not only are the synapses non-linearly connected but there is also causal effect by conscious experience (Libet 2003). Although one cannot ignore the strengths of reductionistic approach, the question whether it is still valid in clinical medicine as once thought, is being increasingly asked by biologists (Joyner 2011). There is now a slowly changing perception that the structural / chemical constituents in an organism are not in isolation but are in dynamic relationships, which decide the overall functioning of not only the cells and organs but the entire organism. There is also a growing appreciation that no part can be understood outside of the whole to which it belongs and is in relationship with (Sauer et al. 2007). The need for a different framework considering the complexly networked human system, taking into account the role of mind and consciousness as well, is being felt. Realising that health cannot be limited to parts, modern medicine is now striving for an integrated and systems biology approach (Chaussabel 2004; Dinicola 2011; Naylor and Chen 2010).

1.3 Quantum worldview and medical science

By the 19th century, physicists felt everything in the universe including natural phenomena could be understood by Newtonian mechanics and expressed in quantitative mathematical terms. Within a few decades, however, a major revolution took place in the form of quantum mechanics, which studied atoms and beyond. The submicroscopic realm of these particles, it was found, was not deterministic but a very different one, where the particles can exist simultaneously in multiple states and possess a number of other seemingly contradictory properties defying the carefully built up logic of classical physics. While the classical worldview assumes reality to be made of localisable material objects, the quantum world dealt with probabilities of existence and energy states (Alistair 1988; Feynman 1965).

Quantum theory did not stop at being a theory of atomic phenomena but had repercussions for the macroscopic world as well. Challenging the conventional view of the physical world as a solid and stable material body, quantum physics

brought in radical changes in the fundamental ideas about the nature of physical reality (Alistair 1988; Heisenberg 1958a). The universe came to be understood as a dynamic web of interconnected energy patterns, in which matter is a slowed down form. In this web, no entities including humans, are isolated, i.e., there is logically no such thing as a 'part' in the universe. Although at a macro-level, the organization and behavior of the atomic world are stable giving the world an appearance of a solid form, the energies within this seemingly solid realm are not only moving but are also interconnected (Heisenberg 1958a). This new understanding of the universe as a stable pattern within which energy moves, has brought about a change in the worldview - a very different concept of reality from that which grew out of the classical reductionistic physics. Quantum worldview has abandoned the idea of fundamental building blocks, which was central to the classical view.

The other radical shift brought in by quantum mechanics was the introduction of mind into the basic conceptual structure of physical reality. The central role a conscious observer plays, has made the quantum physical worldview radically different from the conventional one, where the observer had no active role but only a passive one (Stapp 2007). The practical successes of the Quantum theory, such as the applications of MRI, lasers, electron microscope, transistors, etc., have had significant impact in diagnostic and therapeutic medicine. The radical changes that have taken place in the worldview, however, have not translated as a new paradigm in western medicine, which has persisted with the old reductionistic worldview model of Newtonian physics.

1.4 The quantum and vedic worldviews

Questions about the nature of matter and reality have been raised in all civilizations and have been addressed by Indian seers of yore as well (Brunton 1939; Capra 1999; Jones 1986; Knapp 1990). These are elaborated in depth in *vedanta*, considered the culmination of vedic philosophies (Saraswati 2004) just as quantum physics is seen as the cutting edge of modern science. Though both these disciplines discuss the nature of reality, their approaches are from divergent view points. According to *vedanta*, nature exists as a continuum and common principles underlie both the microcosm (individual) and macrocosm (universe) resulting in a unifying law binding everything in the universe. It goes on to say everything in this universe has evolved from a single entity and is an extension of that and so everything, including living beings, is interconnected and exist in a dynamic relationship (Saraswati 2004). The basic oneness of the universe is not only the essence of the *vedic* worldview, but also one of the most important revelation of quantum physics. Like the *vedic* seers, the quantum physicists were also dealing with a non-sensory experience of reality through their studies on atomic particles, which provided them the first glimpses of the fundamental nature of matter. They

found that underlying all physical matter is the intrinsically interconnected dynamic network of energy leaving nothing isolated in the universe (Heisenberg 1958a).

That there is an undeniable correlation between what physicists have discovered through observations, laboratory experiments and mathematical reasoning and what the Indian seers inferred from their observations, experiential experiments and logical reasoning has been commented by none other than Heisenberg, the architect of Quantum Mechanics. He says “After the conversations with Tagore about Indian philosophy, some of the ideas (of Quantum Physics) that had seemed so crazy suddenly made much more sense. That was a great help for me” (Capra 1989). He also says, “All the same, some statements of ancient philosophy are rather near to those of modern science. This simply shows how far one can get by combining the ordinary experience of nature that we have without doing experiments with the untiring effort to get some logical order into this experience to understand it from general principles”.

Erwin Schrodinger, one of the fathers of quantum mechanics, also known for his deep interest in *Upanishads* (Capra 1989) had commented, “the unity and continuity of *vedanta* are reflected in the unity and continuity of wave mechanics” (Gewali 2009; Schrodinger 1944). The logical point of contact between quantum theory and *vedic* thoughts, hence, lies in their worldviews and understanding of the nature of reality. Worldview has a bearing on the way a biological system is understood. We have seen the influence of classical worldview in western medicine. The following sections outline the role of the integrative worldview of *veda* in ayurveda.

1.5 Ayurveda

Long been the major healthcare system in India, the beginning of ayurveda is lost in the mists of antiquity but is closely interwoven with the history and culture of the Indian sub-continent. Ayurvedic thoughts and methods have had a deep impact on the lifestyle of Indians. Its principles of healthy living, incorporated into day to day practices, are reflected in their daily activities, traditional cuisine using spices and medicinal ingredients and even religious rituals. In almost every household, there was (and still is) knowledge of ayurvedic treatment for common ailments. Ayurveda continues to have a pervasive influence in the daily life of Indians and has perhaps the longest unbroken health tradition in the world (Mukerjee 2006a; Varier 2005; Vidyanath and Nishteshwar 2006).

Ayurveda is an applied science like Western medicine. While the basic sciences of the latter are physics and chemistry, the fundamental basis of ayurveda are found in ‘*darshana*’, which are ancient Indian treatises on the physical and metaphysical aspects of the universe (Cowell and Gough 1978; Tigunait 1983). It is interesting to note the similarities between the words ‘theory’ and ‘*darshana*’.

'Theory' is derived from the Greek root word 'theoria' (θεωρία) meaning to 'view or observe'. A theory is primarily a view / observation. Modern science has many theories such as those of motion, gravity, evolution, etc. A number of them are named after the scientists who first described them - eg. Newton's laws of motion, Einstein's theory of relativity, etc. Although the word '*darshana*' has deeper philosophical meaning and implications, it also literally means 'to see or view'. As in modern science, the various '*darshanas*' are also associated with names of those who formulated them – Kanāda's *Vaiseshika*, Gautamā's *Nyāya*, Jaimini's *Purva Mimāmsa*, Kapilā's *Sāṅkhya*, Patanjali's *Yogā* and Vyasa's *Vedānta* (Cowell and Gough 1978; Muller 2003; Sandal 1999; Tignait 1983).

The Indian seers of yore did not remain mere observers of nature but had theorised their observations using logical reasoning. *Sāṅkhya*, *Nyāya* and *Vaiseshika* explain the physical universe from a logical perspective, whereas *Vedānta* understands it from a spiritual perspective. The *Nyāya-Vaiseshika* are best known for their rigorous analytical approaches and logical arguments (Tignait 1983; Vidyabhushana 2003). *Vaiseshika* deals with the physical aspects of universe and their practical implications and interestingly, postulates atomic nature of matter (Muller 2003). The concepts, logical reasoning and analytical methodologies of these materialistic schools have been used by ayurveda to understand human body, health and ill-health (Sharma and Dash 2001a). While *yoga* focuses on the inner realms of humans, *Sāṅkhya* and *Vedānta* deal with creation, worldview, relationships and their philosophical implications (Saraswati 2004; Muller 2003; Nair 2005). These concepts have been used by ayurveda to understand the various relationships governing life / life processes and also the relation between humans and the cosmos (Rao 2002). Ayurveda has thus provided a practical platform elevating these concepts from philosophical realms to that of science (Jayasundar 2008). The coherent theoretical framework drawn from these different *darshana* has given the base for ayurveda's comprehensive knowledge of life. Ayurveda is essentially a science of life encompassing both health and ill-health.

1.5.1. Impact of vedic / quantum worldview in ayurveda – holism and interconnectedness

Ayurveda is based on a concept of wholeness and unity that goes beyond a purely mechanistic view. Over the centuries, ayurveda has collected enormous amount of empirical data on which it has based all its theoretical generalisations. Though a number of theories are used to describe the human system, its viewpoint is predominantly functional (Jayasundar 2010). According to ayurveda, the whole organism constitutes a functional entity. Function is a collective effort of several contributing factors ranging from structures, biochemical processes to various activities such as electrical, mental and even spiritual. Functional perspective is

inclusive taking into consideration all the contributing factors including those of structures and biochemistry. Of the various theories, that of *tridosha* (*vata*, *pitta* and *kapha*) runs as an undercurrent to the entire ayurvedic understanding of health and ill-health, defining its functional perspective. How the quantum concept of interrelatedness is inbuilt into ayurveda is best understood through the theory of *tridosha* and hence discussed in detail here.

The Sanskrit words *vata*, *pitta* and *kapha* are referred to as ‘*dosha*’, meaning ‘that which can become impaired and also has the potential to impair other tissues’. The *tridosha*, as they are collectively known as, are concepts derived from nature (macrocosm) to explain human beings (microcosm). Their functional / governing factors were derived from those of the universe. *Susruta* says (Sharma 2004),

“*visargādānavikshepai: soma surya anilā yathā/
dhārayanti jagat deham kapha pitta anilā tathā*” (ch 21/verse 8)

i.e., just like moon, sun and wind sustain the universe by their cold, heat and dispersion / movement, respectively, likewise *kapha*, *pitta* and *vata* support the body with similar functions. These principles extend to all living beings from the smallest to the largest. *Caraka* says (Sharma and Dash 2001a),

“*prajāhitam dheergamāyush ..vedam ...*” (ch.1/verse 27)

i.e., this is a science for well-being of all creatures. He goes onto say,

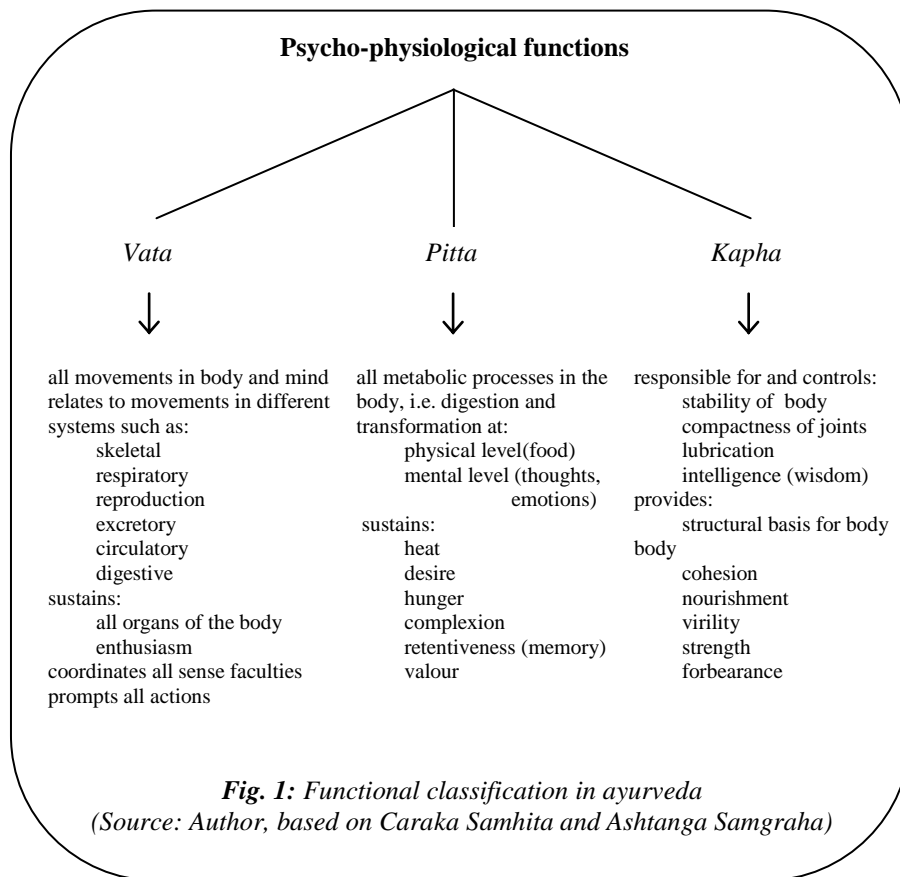
“*tantrāni ... bhavāya bhutasanghānām pratishṭām bhūvi lebhire*”
(ch.1/verse 40)

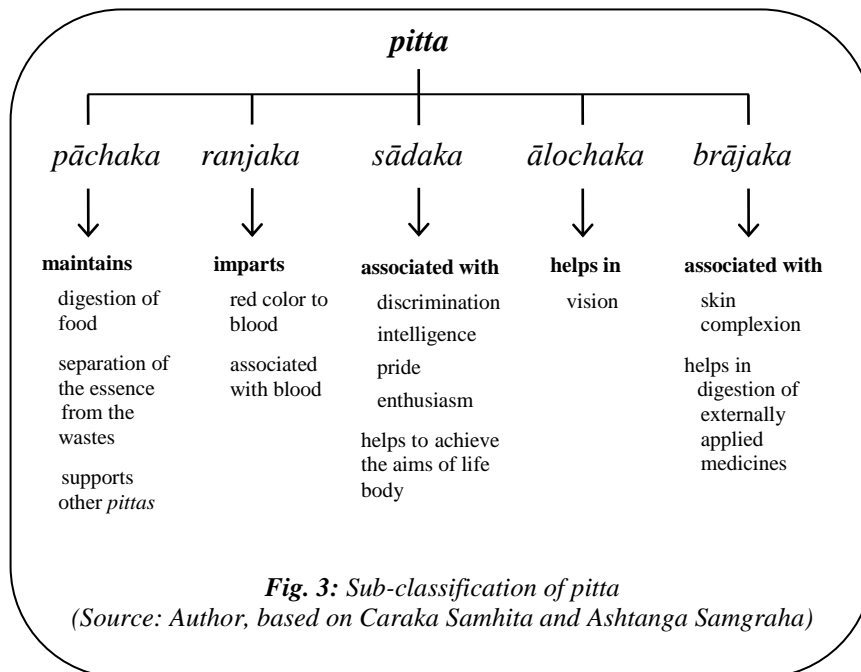
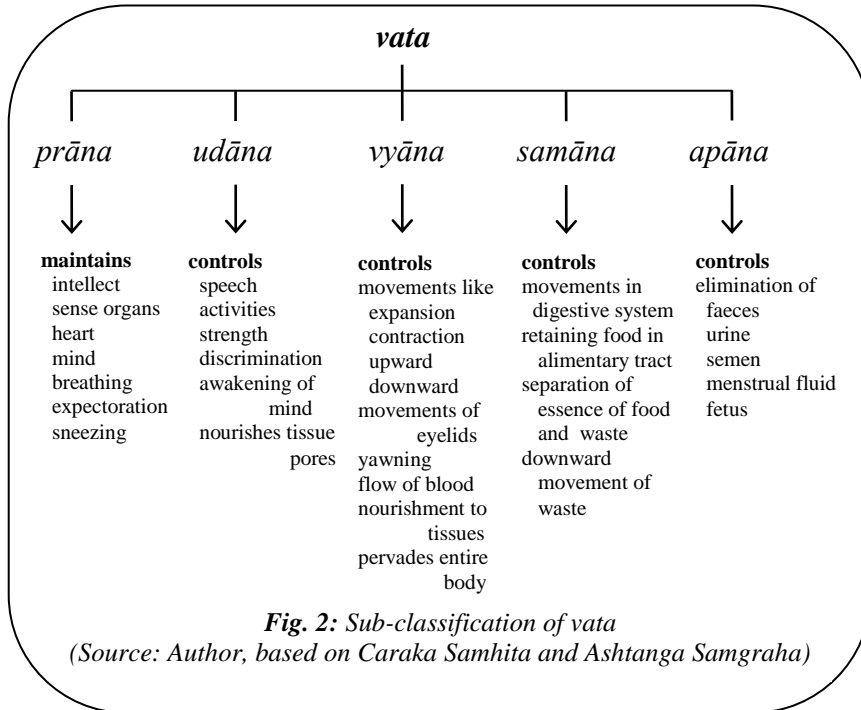
i.e., these works were established on this earth for the good of all creatures. All biological systems from humans to animals and plants are thus described within this single framework of *tridosha*. For example, *vrksha* ayurveda (ayurvedic botany) (Sadhale 1996; Sircar and Sarkar 1996) and *mrga* ayurveda (ayurvedic veterinary science) (Anjaria 1894; Mukerjee 2006b; Somvanshi 2006) use the same *tridoshic* theory to explain their respective systems. It is, thus, an unifying theory encompassing all living organisms.

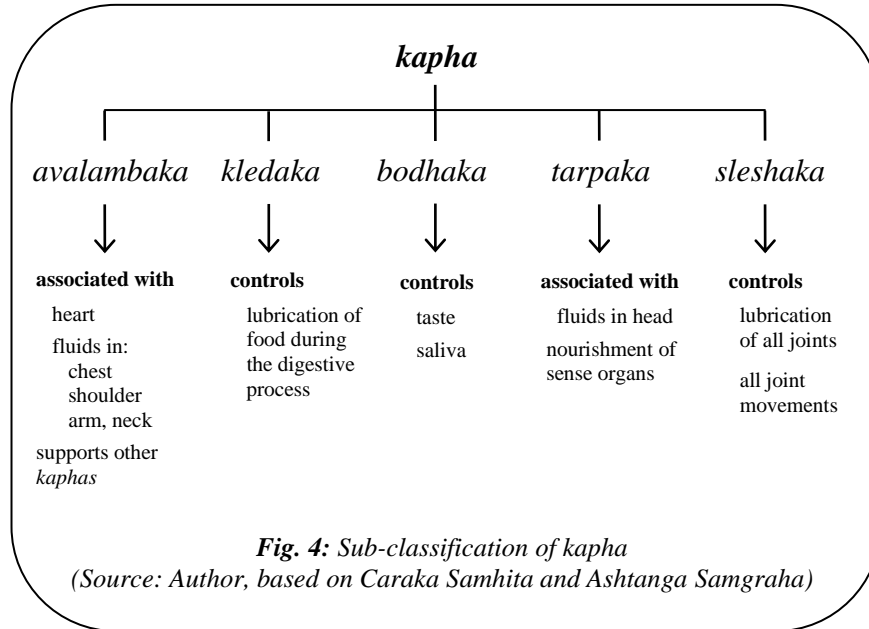
1.5.1.1. Interconnectedness within the system

Ayurveda has grouped the vast information in the human system into three most fundamental functions and their contributing components / properties. These are *vata*, *pitta* and *kapha*, indicating respectively, movement, transformation, and support & growth (Jayasundar 2010). Figure 1 shows the classification and figures 2-4, the further sub-classifications of *doshas* (Sharma and Dash 2001a; Srikantamurthy 2005). It is to be noted that an exhaustive list of functions and parameters is not given in these figures. *Vata*, *pitta* and *kapha* cover not only

physiological but also psychological parameters such as enthusiasm, memory, wisdom, forbearance, etc. *Vata* indicates movement in the physical plane and also the flow/movement of thoughts in the mental space. Similarly *pitta* refers to digestion and transformation both at the physical and mental planes. The *tridosha*, thus, encompasses both the physical and mental frame of the individual. Between them, the three *dosha* and their 15 sub-classifications cover all psycho-physiological functions in the body and the associated properties. Ayurveda also mentions the theory of three *guna*, viz. *sattva*, *rajas* and *tamas*, which make up one's personality (Sharma and Dash 2001c, ch.4 /verse 36). This is not discussed here since it is beyond the scope of this article. However, there is close association between the three *doshas* and *gunas* (Sharma and Dash 2001a).







Functions cannot be reduced to fundamental entities like matter, eg. atoms and molecules. There is, hence, no functional hierarchy or fundamental entity in this ayurvedic perspective. The *dosha*, i.e. the functions and the associated properties, exist at all levels - from macroscopic to the subtlest, like cells. The *tridosha*, in addition to functions, also include physico-chemical and physiological parameters as shown in Figures 5 and 6 (Jayasundar 2010; Sharma and Dash 2001a). For example, *vata* includes parameters like dryness, lightness, coldness, roughness and subtleness, all of which influence movement. *Pitta*, in addition to the function of metabolic transformation, includes parameters such as heat (temperature), acidity (pH), unctuousness, penetrating power and fluidity. *Kapha* indicates cohesion and structural growth and also properties such as coldness, heaviness, softness, unctuousness, sliminess, stability and sweetness. These physico-chemical and physiological properties are expressed through the physical medium of the *dhātu* (tissues) and give them their functionality. Without going into details, it is pointed out that while some of the properties are overlapping (such as unctuousness in *pitta* and *kapha*), some are mutually contradictory and inverse of each other, such as dryness (*vata*) and unctuousness (*kapha*).

Just as functions include structures, *dosha* also encompasses structural entities. This can be inferred from the physical attributes associated with *doshas*. Moreover, the three *doshas* are constituted of *panchamahābhūtā*, which refer to the five basic elements of the visible material world. These are earth, water, air,

space and fire/light. While the first three refer to the three states of matter, viz. solid, liquid and gas, the last two, i.e. space and fire/light, refer to other important elements / aspects of the visible world. While *vata* is constituted of space and air, *pitta* is a combination of water and properties of fire and *kapha* is formed of earth and water. That the *doshas* are physical entities are also inferred from their clinical usage. For example, during palliative treatment, *doshas* are handled in the form of properties that have to be altered to maintain the *doshic* balance. During elimination therapy, however, they are handled as physical substances (Sharma and Dash 2001b). Thus, the *doshic* functional model encompasses the structural aspects as well. *Doshas* at one level are functional properties yet at another level are considered physical entities. They are dualistic on a pragmatic, therapeutic level but are non-dualistic on a conceptual level.

Within the system: the non-linear functional network

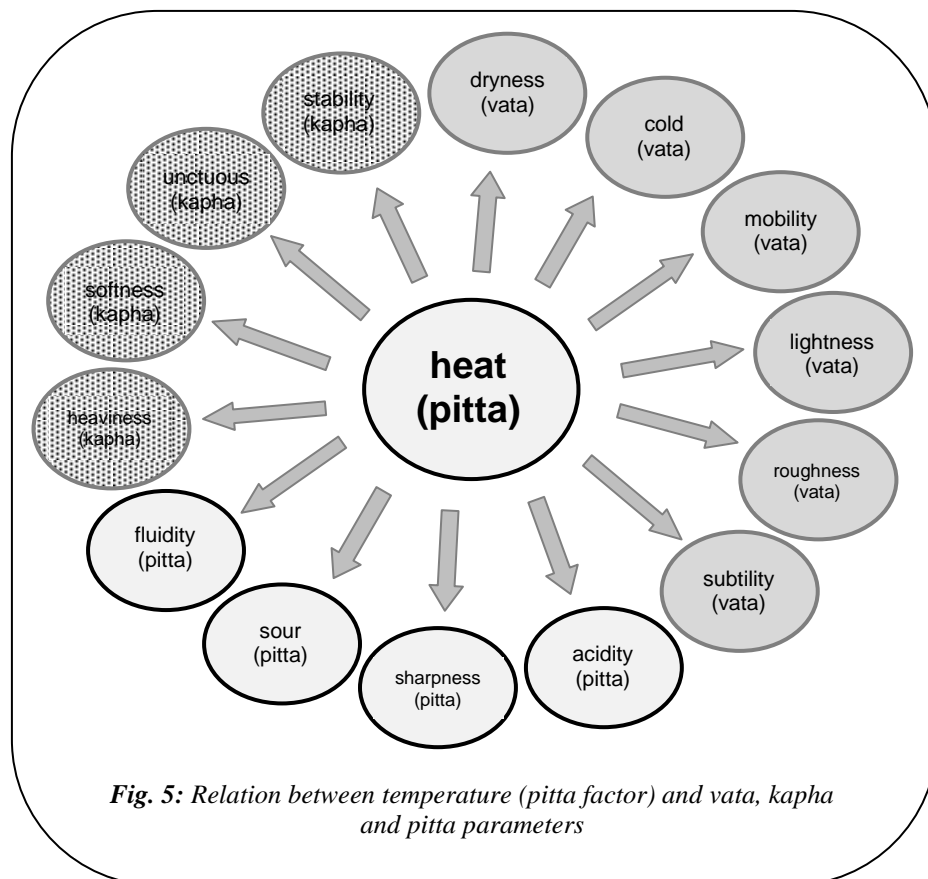


Fig. 5: Relation between temperature (pitta factor) and vata, kapha and pitta parameters

Life, in ayurveda, is viewed as a complex network of interrelated functions and properties and not as a system of chemicals or structures. Figure 5 is an illustrative example of how the *doshas* are intra- and inter-connected. For example, the *pitta* factor, heat (temperature) is intra-connected with its own parameters and inter-connected with those of *vata* and *kapha*. A change in temperature, therefore, is likely to effect changes in many other parameters. Ayurveda expresses these connections as a network of interdependent relationships, where the functioning of one influences many others.

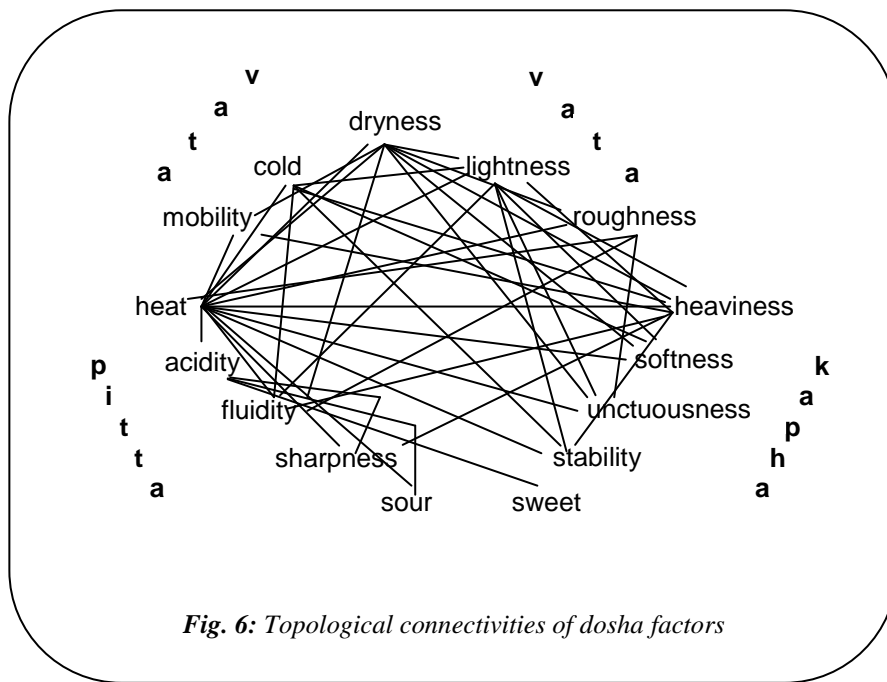


Figure 6 showing the relational interdependence between some of these parameters also indicates the intricate interplay between them. It can be seen that some of the factors are connected to more than one parameter in this network. Consider a change in the ‘dryness’ associated with *vata*. The dryness could occur at any level – from cell to organs to the entire system. At whichever level it occurs, the parameter can simultaneously reduce one *dosha* and increase the other. For example, when dryness increases, there will be reduction in the ‘unctuous’ property of *kapha* and increase in the ‘heat / temperature’ of *pitta* and changes in a number of other parameters including ones from its own category of *vata* such as roughness and lightness.

Interestingly, the resulting increase in temperature due to dryness will also cause changes in other parameters. Infact, each of these parametrical changes will affect the system in different ways leading ultimately to functional changes in movement, both at the initial level ‘dryness’ had occurred and also at other interacting levels. It is pertinent to note that Western medicine considers diseases such as keratoconjunctivitis sicca, xerostomia, atrophic vaginitis, xeroderma, etc. as ‘medical dryness’ (Berk 2008; Haslett et al. 2001; Petrone et al. 2002). The parameters interact at all levels and are continuously perturbed as a result of influences from other factors. These properties are entangled, i.e. they are dynamically interlinked to one another and form nonlinear causal connections. The balance of the network depends on the dynamical behaviour of the parameters.

In a complex biological system, there are various levels of functions (eg. cellular, tissue, organ, etc.) and multiple layers of integrative interaction to give functionality to the system. A change at a lower level can produce changes at other integrative levels and vice versa. For example, a mutation in a gene can be seen as a DNA change at a macromolecular level, a histological change at the tissue level and behavioural change at the organism level (Lobo 2008). Similarly, a change in one of the *dosha* parameter at one level will be reflected at various levels and exercise a downward / upward control over the course of physiological events affecting the entire system since these are system properties applicable at all integrative levels. Through this *tridoshic* theory, ayurveda networks the complex human system as a dynamic web of relationships defining functions.

The framework of *tridosha*, thus, connects the entire system, encompassing its inherent complexity with its various levels of interactions. The *dosha* parameters are not a set of rigid linear causal connections but rather interdependent non-linear functional links encompassing also the physical entities. *Dosha*, thus, offers a different perspective of human body and provides a conceptual framework very different from that of western medicine. Ayurveda’s view of life as a dynamic interrelationship between *vata*, *pitta* and *kapha* gives it its distinctness in dealing with human system in an integrated and holistic way.

The key to health is for these parameters to maintain stability in the network despite perturbations, not only within the system but also without. *Vagbhata* says (Srikantamurthy 1999),

“*yogastu doshavaishamyam dosha sāmīyam arogatā*” (ch.1/verse 20)

i.e., equilibrium of *doshas* is health and their imbalance denotes disease. Health is indicated by the balanced interplay between the various functions and parameters and disease is viewed as a system perturbation and a functional failure, because of which ayurveda looks beyond the behaviour of individual parts and addresses the system properties in an effort to rebalance the system. Ayurvedic treatment aims at restoration of the functional balance. Since the *doshas* are non-linearly networked, ayurveda’s determinants of health and disease do not follow the linear causal pathways of western medicine. Response of a non-linear system to

variations in parameters are complex making causal thinking difficult (Albert 2007; Variano et al. 2004). The increase or decrease of *dosha* is accompanied by symptoms which are described in detail in ayurvedic texts. One can, therefore, infer the state of *dosha* from the symptoms and take corrective measures to bring it back to equilibrium state. What is interesting is how ayurveda has incorporated this concept of interrelatedness in a meaningful way into its diagnostic decision and therapeutic management. Integration of the theory of *tridosha* with clinical practice is discussed in detail by Jayasundar (2011).

Within the system: the structural network

The functional classification does not imply that ayurveda does not recognize the importance of the structural aspects of human body. It very clearly says all physical entities, including humans, are made of matter in five forms (*pancha mahābhuta*) (Sharma and Dash 2001a).

“*sarvam dravyam pānchabhautikam asmin arthe;
tat cetanāvāt acetanam ca*” (ch. 26/verse10)

“According to this science, all matter is constituted of five *mahābhuta*;
some are animate and some others inanimate”

Even substances endowed with consciousness are as much the products of matter as substances without consciousness. This categorical statement in *Caraka Samhita* gives clear indication that ayurveda has a structural viewpoint as well. This is logical and understandable since the physical body, where the clinical symptoms ultimately manifest, is the only tangible reality to the treating physician. A physician cannot, therefore, but have a structural perspective as well.

Caraka says in no uncertain terms, “Detailed knowledge of the human body is useful to the well-being of the individual. Understanding the components of the body provides knowledge regarding the factors responsible for its well being. It is because of this that experts extol the knowledge of the details of the body” (Sharma and Dash 2001c). He goes onto say “When tissues (*dhātu*) in the body become discordant, then there is disease” (ch.6/verses 3,4). Surgical discipline, which gives importance to structures, was a highly developed branch in ayurveda. *Susruta*, the ayurvedic surgeon acknowledged as the father of surgery by Western medicine, describes the importance of anatomy and dissection and explains many surgical procedures (Chari 2003; Das 2001).

All the structural entities in the body are divided into minute units known as ‘*paramānu*’. These, like cells, are numerous, subtle and beyond sensory perceptions (Sharma and Dash 2001c, ch.7/verse17). All the structural components (gross to subtle) are interconnected by *srotas*, a system of channels (Sharma and Dash 2001e, ch.5). These are a complexly networked system for

biotransport of all essentials in the body such as fluids, nutrients, impulses, energies, etc. The *srotas* system is a continuum connecting the subtle and the gross structures. Despite these, ayurveda goes beyond a purely structural view and considers life as a complex and coordinated interaction of various functions and properties encompassing also subtle realms such as mind and consciousness.

Within the system: network of the gross and subtle

Ayurveda considers human being as a combination of two basic elements, viz. consciousness (*chetana*) and inert matter (*jada*). The relationship between these two entities makes a human being. The realms within, hence, consist of not only the physical and physiological but also the mind and subtler levels of awareness/consciousness. Ayurveda says that the subtler levels within, influences the physiology. It connects these realms and adopts a comprehensive view of life and health. While *Caraka* says,

“*shareera indriya sattva ātma samyogo dhāri jeevitam*” (ch.1/verse 42),

i.e., life is a combination of body, senses, mind and consciousness (Sharma and Dash 2001a), *Susruta* defines a healthy individual as (Sharma 2004):

“*sama dosha: samāgnischa samadhātu malakriya:|
prasanna ātma indriya manā: svastha iti abhidheeyate|*” (ch.15/verse 41)

In short, a healthy person is one whose *dosha*, *dhātu* (structural entities) and metabolic end products are in equilibrium. He further states, there must also be clarity in consciousness, senses and mind for a healthy state.

While the *tridosha* parameters (along with *triguna*) indicate the connection between the physical and mental planes, the theory of *panchakosha*, used more extensively in yoga, deals in depth with the mental and subtler realms of existence. These are seen as comprising of discrete yet interdependent levels of awareness. Ayurveda and yoga are closely related disciplines. They share the common framework of *tridosha* theory and ayurvedic texts support concepts and applications of yoga. So, although the texts do not explicitly mention about *panchakosha*, it is understood it takes cognisance of this when it discusses mind and *buddhi* (intellect) and the role of different levels of consciousness in health and disease (Frawley 1998; Sharma and Dash 2001c). For example, while it considers mind (*manomayakosha*) and intellect (*vijnānamaya kosha*) to be separate (Sharma and Dash 2001c, ch.1/verse 23), faulty understanding or mistake at the level of ‘*prajnā / buddhi*’ (the capacity to understand and discriminate) is considered a major causative factor for diseases (discussed in the next section).

According to the theory of *panchakosha*, there are 5 hierarchical levels of awareness / consciousness, from gross physical body (*annamaya kosha*) to the subtle spiritual body (*ānandamaya kosha*) (Aurobindo 1981; Johnsen 2003). Each

level from gross inwards refers to a more refined dimension of the consciousness. The 5th level is the state where impurities of mind are removed and realisation of self is experienced. What is of interest is the link between the subtlest level of consciousness (*ānandamaya kosha*) and the gross physical body (*annamaya kosha*) through the intervening layers of *prānamaya*, *manomaya* and *vijnānamaya koshas*. These levels are progressive in scale of subtlety and refinement. Moving from the gross to the subtle helps one to develop discriminatory wisdom and detachment, enabling a shift towards a more happy and productive, and less destructive realms of existence. The direction of evolution is towards subtler / higher levels of awareness culminating in unity with the infinite, resulting in happiness and freedom from causes of suffering.

The functions and purpose of each layer and its relation with other layers are stated in the following two lines from the *Yogavāsishtha* (Murthy 2002).

“*bhāro vivekina: shāstram, bhāro jnānam cha rāgina: /
ashāntasya mano bhāro, bhāro nātmavibho vapu: ||*”

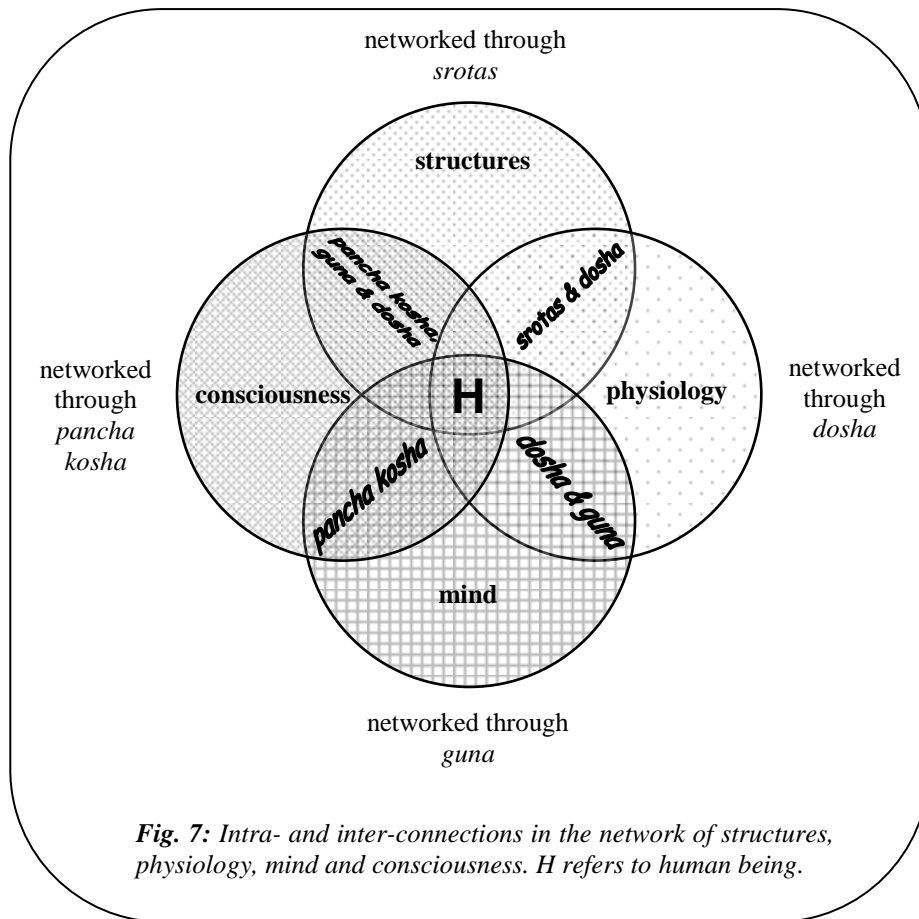
This may be broadly translated as,

“For one without discrimination (of what is right and wrong),
application of sciences is a burden;
For one with knowledge but unwilling to use it properly,
the knowledge itself is a burden;
For one who is agitated, mind is a burden;
For one who does not understand oneself,
body itself is a burden”.

A mere possession of faculties and knowledge will not lead to one’s well-being unless accompanied with right values and thinking to sustain harmony within and without. Awareness of oneself is necessary for health. Ayurveda refers to a healthy individual as ‘*svastha*’, which is defined as ‘*sve tishtati iti svastha:*’, i.e. one who is established in oneself. Implicit in this is the fact that lack of awareness will lead to impaired knowledge, which ayurveda points out is a causative factor for all diseases (Sharma and Dash 2001d, ch.1/verse 3). Any change in perception that takes place in *buddhi* is reflected in the body / physiology. This is why training the intellect is considered important in maintaining health. Regimens which influence *buddhi* is considered as important as diet and behaviour routines. It helps bring mind under control so that one does not make errors in judgement and action. There are important *mantras* like *Gayatri mantra* which help train the intellect and keep it in a healthy condition by their sound and content. That this has a measurable effect on brain has been demonstrated using MR spectroscopy by Jayasundar and Rajshekar (2000). Ayurveda clearly considers mind and body to be intrinsically linked with consciousness, which acts as the fulcrum of health. *Caraka* says ‘mind is the link between consciousness and physical body’ (Sharma and Dash 2001c, ch.2/verse

13). Ayurveda, thus, links and networks the gross (physical body) and subtle (mind and consciousness).

Figure 7 shows in a nutshell, how the physical, physiological, mental and subtler planes within the body are intra- and inter-connected. Each domain is networked within and also with the next one and all are linked into a whole. For example, *srotas* networks the structures, *dosha* the physiology, *guna* the mind and *panchakosha* the levels of consciousness. The structures and physiology are connected via *dosha and srotas*, physiology and mind through *dosha and guna*, mind and consciousness through *panchakosha*, consciousness and structures through all these. So, each domain while acting as a network within itself is also networked with others. They form several interlocking networks making a coherent whole. The sub-networks are not functionally insulated, so failure / imbalance in one affects the entire human system. This highlights the centrality of the quantum concept of interconnectedness in ayurveda.



1.5.1.2. Interconnectedness outside the system

Individual and the Universe

Human being is not a separate entity dissociated from the universe but is like an open system. i.e. there is exchange / interaction with not only the environment but also the universe. The subtlest level (*ānandamaya kosha*) of consciousness in the human microcosm is linked to the cosmic consciousness and yoga helps one connect these two (Saraswati 1998; Sharma and Dash 2001c, ch.1/verse 155, ch.5/verse 21). In this state, the external universe is no longer considered external, the internal no longer internal and everything is seen as an undivided whole – there is no boundary. Thus, not only is the physiology linked to the microcosmic world of consciousness, it is also connected through the levels of awareness (*kosha*) to the macrocosmic consciousness. This theory, thus, provides a workable interface between the microcosm (individual) and the macrocosm (universe). *Caraka* says the individual exists as a continuum with the entire universe – ‘the whole universe is the expansion of one’s consciousness’ (Sharma and Dash 2001c, ch.5/verse 20). *Caraka* calls the microcosmic consciousness as ‘*viśvarūpa*’, meaning prototype of the universe (Sharma and Dash 2001c, ch.4/verse 8) and establishes the relationship between the individual and universe by saying (Sharma and Dash 2001c),

“*yāvanto hi moorthymanto bhāvavisheshā: lokè
tāvanta: purushe yāvanta: purushe tāvanto lokè||*” (ch. 4/verse 13)

“All the manifest objects in the universe are present in the individual and all that is present in the individual manifests in the universe as well”

Implicit in these statements is the understanding that the objective world is potentially inherent in the individual and everything without is related to the subject from which they expand / proceed. The relevance of this knowledge in the context of medicine is also explained by *Caraka*. He says - ‘this is true knowledge and realisation of this leads to serenity of mind’ (Sharma and Dash 2001c, ch.5/verses 6, 20, 21), which in turn will lead to harmony and health.

Individual and the environment

Ayurveda recognises that the health of an individual is dependent and intertwined with that of the environment and advises a harmonious relationship

between the two. Preservation / maintenance of such a harmony is essential to the health of a living organism, be it human, animal or plant. *Doshas* increase or decrease naturally during different seasons and also in the course of a day (eg. diurnal cycle, seasonal rhythms, etc.) and affect one's health. This interconnectedness of individual with the environment finds practical expression in various ayurvedic concepts such as daily and seasonal regimens (Sharma and Dash 2001a) and in its understanding of causative factors during epidemics (Sharma and Dash 2001e, ch.3/verse 4). These regimens consisting of do's and dont's for diet and activities take care of the response of the body to outside changes and establish a functional harmony between the individual and environment. While personal interface with macrocosmic consciousness is through yoga, that with the physical environment is through these regimens, which ensure both individual and community health.

The case of a 45 year old patient (personal communication) is discussed here to illustrate this point – the patient was suffering from heavy bouts of cough and cold every spring season for nearly 6 years and was on heavy antibiotics during the affected period. From an ayurvedic perspective, this *kapha* related seasonal problem was identified as indulgence in diet and activities incompatible with spring season, during which there is a general aggravated manifestation of *kapha* in everyone. The patient had been indulging in *kapha* aggravating foods such as citrus fruits, curd and fruit juice, incompatible with spring season. The patient's problem was addressed simply by correcting the diet and activities. Post intervention, the patient has faced three spring seasons without recurrence of the problem. This example shows how a person's well-being is connected to environmental changes and how ayurveda's seasonal and daily routines can be effectively used to avoid seasonal diseases. Ayurveda is peppered with information on how to achieve welfare for all by working in conjunction with nature. It is a way of life contributing to harmonious health within and without.

1.6 Quantum framework of ayurveda

Is ayurveda an ancient or state-of-the-art science?. It is an interesting question that can be addressed by looking backwards from today's vantage point of modern scientific knowledge. Quantum physics, considered the cutting edge of western science has exposed concepts similar to those discussed in the Indian knowledge system of *vedas* (Capra 1999; Jones 1986; Talbot 1993). Two quantum concepts that find practical expression in ayurveda are interconnectedness and the role of consciousness. The first concept relates to the fundamental interrelatedness of all phenomena and the dynamic and interdependent nature of reality.

The central core idea of ayurveda is that everything within (microcosm) and without (macrocosm) the human body are interrelated and their balance denotes health or ill health. The whole existence is like a network, where a change in one

part is likely to perturb the entire system. Ayurveda has integrated and implemented this concept through theories like *tridosha*. It offers a practical method to sustain the relation between individual and the universe. Interconnectedness is part of the terminology of both quantum and *vedic* / ayurvedic worldviews which sees oneness in all things. Ayurveda's paradigm, thus, is closer to the quantum physical worldview and offers a practical scope by helping one to live in harmony within and without.

The other quantum concept is the role of consciousness. An observer is critical to the quantum concepts since behaviour of a quantum system cannot be predicted without the involvement of this macroscopic conscious entity. There is, thus, an interaction between observer and the observed in the microcosmic world of atoms, where an object does not exist independent of its observer. Human consciousness entered the realm of physics through this involvement of a conscious observer. John Wheeler's famous statement was, "We are not only observers. We are participators" (Wheeler 1990). Although the reference was initially to a conscious observer, later on it was suggested by David Bohm that this consciousness was at a deeper level and intrinsic to matter (Bohm and Hiley 1993; Penrose 1987).

Human experience was, thus, elevated from the role of a detached observer of classical physics to a participatory observer in quantum physics. As Heisenberg notes in 'The Copenhagen Interpretation of Quantum Theory', "our scientific work in physics consists in asking questions about nature in the language that we possess and trying to get an answer from experiment by the means at our disposal. In this way quantum theory reminds us, as Bohr has put it, of the old wisdom that when searching for harmony in life one must never forget that in the drama of existence we are ourselves both players and spectators. It is understandable that in our scientific relation to nature our own activity becomes very important when we have to deal with parts of nature into which we can penetrate only by using the most elaborate tools" (Adams 2000).

Consciousness is an integral part of health in ayurveda, which defines it as a complete balance of body, mind and soul. By including mind and consciousness, ayurveda has included the invisible realms within human body in its understanding of health and disease. Just like the quantum model makes consciousness causally effective (Heisenberg 1958b), ayurveda also considers consciousness causally effective in the emergence of disease (Sharma and Dash 2001a, ch.8/verse 13; 2001c, ch.1/verses 35, 39-42; 2001d). Consciousness and physical body are considered entangled in ayurveda. Although quantum physics' usage of the term 'consciousness' may not be the same as that in ayurveda, the parallels and the inclusion in both are interesting. The consciousness attributed to in quantum physics could refer to one of the '*panchakosha*' levels of awareness - *manomaya* or *vijnānamaya kosha*.

Ayurveda in the way it was originally developed and practiced, understood the interaction between consciousness and physical body to be the primary factor in creating health or illness. Main cause of disease in ayurveda is '*Prajnāparada*',

i.e. impairment of knowledge / fault of the intellect, a mistake at the level of the inner consciousness (one of the *kosha*) (Sharma and Dash 2001d, ch.1/verse 3). It refers to the deliberate, wilful indulgence in unhealthy practices leading to imbalance in *doshas* resulting in disease. Ayurveda's concept that one's thoughts create health or ill health in the physical body resonates with that of quantum physics which says that our thoughts create the physical reality (Alistair 1988; Stapp 2007). One's perception of the world and the consequent behaviour affects the physiology to an extent that errors in perception can lead to psychosomatic disorders. Ayurveda emphasises the individual's ability to shape his /her health based on how they choose to think and believe. The physical event in gross body and psychic event in the mental space are seen in ayurveda as two correlated events.

There are other interesting conceptual parallels between ayurveda and quantum concepts. For example, quantum physics highlights the fact that while there is certainly a matter-based classical universe, there is also a mind-based quantum universe. Nature is a continuum having both mechanical as well quantum aspects and quantum theory underscores this dualistic aspect of nature. According to ayurveda, human as an entity has two states, namely consciousness and inertness, which has two distinguishable aspects, i.e. dispersed and localised. Its dispersed aspect is mind and localised state is body. But they have a common origin and hence are related to each other and incessantly dynamic. Ayurveda says mind and matter exist in a continuum. It has incorporated this concept by considering the human body as mechanistic at one level and as levels of consciousness in the subtler realms. Mind and consciousness are, thus, inbuilt into ayurvedic's understanding of humans. *Caraka* says 'mind, consciousness and body are like a tripod (for sentient beings) and constitutes the subject matter of ayurveda' (Sharma and Dash 2001a, ch.1/verses 46-47). The seemingly different worlds of gross (localised) and subtle (dispersed) are thus connected and networked in ayurveda.

1.7 Concluding thoughts

The fundamental difference that exists between western medicine and ayurveda largely stems from their worldviews – the former focuses on parts and ayurveda on the system. The worldviews, rather than being merely topics of interest in metaphysics, have influenced the perspectives of biology and medicine both in western medical system and ayurveda. Classical physics remains an excellent approximation at macroscopic level and Newtonian reductionism, a very successful approach in western medicine for in-depth understanding of the system components. However, by omitting all references to mental realities, classical physics has also produced a logical disconnect between the physical and mental realms. The necessity for a system perspective in clinical medicine has now been

recognised. Science now acknowledges that human system cannot be explained in purely deterministic and objective terms. It confirms that psychological effects are not restricted to the psyche but get translated into the physical plane and plays a crucial role in health and disease (Dubovsky 2008; Kubzansky and Thurston 2007). Although the role of mind in health and disease is being increasingly acknowledged in conventional western medicine, it is yet to successfully incorporate it into its health and therapeutic managements. Psychoneuroimmunology is a new medical speciality in modern medicine (Ader 2007).

Quantum physics has indicated a shift from the classical, reductionistic worldview where consciousness has no role, to a holistic and non-deterministic concept of nature with a definite role for consciousness. The detached, objective observer of classical physics is actually consciously involved in the world he / she observes. The concept of consciousness, however, finds no place in the current working of biomedicine, which connects physiology to structures in contrast to 'physiology to consciousness' connection in ayurveda. In the western approach, everything translates into chemical reactions at body level and therefore, has to be treated from a chemistry point of view. Biology is understood in terms of biochemistry and cellular mechanics.

It is important to note that the basic logic system in ayurveda has also been derived by observing nature at the macroscopic level as in classical physics. Ayurveda, while accepting the reality of gross physical body, also emphasises the interplay of forces beneath the physical structures and has evolved a practical method of handling these through the functional theory of *tridosha*. However, since ayurveda is based on doctrines that understand the universe from both physical and spiritual perspectives, it also encompasses mind and consciousness in its concept of health and disease management. Infact, it uses both physical and metaphysical methods such as yoga and *mantra* in its therapeutic management. Ayurveda understands the human system as a network of relationships that includes consciousness in a fundamental way.

Interconnectedness being an integral part of its understanding of health and disease, ayurveda goes beyond linear relationships and single causative factors for disease. It uses multiple parameters from different realms within and without the system to achieve a holistic perspective of the individual and brings into focus the contextual milieu responsible for a disease. By incorporating the *vedic* worldview, which is similar to the quantum view, ayurveda has integrated the concept of interdependent interconnectedness in humans, thus opening the door to an interesting dialogue between quantum physics and ayurvedic approach to health and disease. While western medicine's paradigm lies outside the quantum concepts of interconnectedness and the role of consciousness, ayurveda's unifying approach lies within this quantum framework. It is a health model that connects gross and subtle within the body, individual and environment/society, human and cosmos.

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