

## COMPREHENSIVE APPRAISAL OF AGEING AN AYURVEDIC & CONTEMPORARY PROSPECTIVE

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### ABSTRACT

A constant reactivity and change in the form and probably functioning is one of the important features of living beings in biosphere. Modern scientists say that biosphere is an open system which constantly reacts with the environment. However, the nature of reactivity varies from one organism to another, which is an inherent phenomenon. This is triggered at the time of conception, runs throughout the life span and when it totally ceases, the organism dies. Within the period of life span, the nature has bestowed two important mottoes. One is growth and other is reproduction or multiplication of the species. After birth, growth and senility ultimately leading to death are inevitable process. It is correctly stated that aging begins before birth and continues through and life at different rates, in different races for different individuals and for different tissues of the body. It involves two opposite processes that simultaneously come into operation i.e. growth and atrophy. By the use of Rasayan therapy we can slow ageing process. Rasayana stands as an answer to solve the problem of healthful longevity containing mental development and resistance beside disease. Susruta expresses Rasayana as a measure which extends longevity, develops positive health and rallies mental faculties and provides conflict and immunity against diseases. It is a specialized type of treatment impelling the fundamental facet of the body viz. Dhatus, Agni and Srotamsi and benefits in the prevention of aging. Rasayana contains of two words viz (1) Rasa and (2) Ayana. The word Rasa states to the Rasa Dhatus in the context of Rasadi Saptadhatu and to the pharmacodynamic possessions of a drug in the context of Rasa Guna etc. Ayana means flow i.e. the measures by which one is proficient of getting the nourishing Rasa. Thus Rasayana is that process by which all the body tissues are nourished. Consequently Rasayana helps in renewal, revival and revitalization of Dhatus. Rasayana dravya is very useful for maintaining to Ageing process. Manshika Vikrati factor like Kama, Krodha, Lobha, Moha & Mada induce the Ageing process so we should avoid these manshika vikrati factor for maintaining to health & slowing Ageing process. Yoga, Pranayam & Healthy diet is very essential part for tumbler Ageing Process.

**KEYWORDS:** Ageing Ayurvedic, contemporary.

### 1. INTRODUCTION

A constant reactivity and change in the form and probably functioning is one of the important features of living beings in biosphere. Modern scientists say that biosphere is an open system which constantly reacts with the environment. However, the nature of reactivity varies from one organism to another, which is an inherent phenomenon. This is triggered at the time of conception, runs throughout the life span and when it totally ceases, the organism dies. Within the period of life span, the nature has bestowed two important mottoes. One is growth and other is reproduction or multiplication of the

species. After birth, growth and senility ultimately leading to death are inevitable process. It is correctly stated that aging begins before birth and continues through and life at different rates, in different races for different individuals and for different tissues of the body. It involves two opposite processes that simultaneously come into operation i.e. growth and atrophy. Aging represents structural and functional changes of an organism over its entire life span. Rasayana Tantra is one of the eight major clinical disciplines of Astanga Ayurveda. Accordingly Ayurveda puts a considerable thought on the science of Gerontology including Rasayana Therapy. The prolongation of life is closely

linked with profound economic changes as well as with the changes of social structure. Each of these changes is studied under the special disciplines of Geriatrics and Gerontology. Ayurveda is known to consider the phenomenon of aging from entirely a new angle. It also elaborates a comprehensive clinical discipline called Rasayana Tantra entirely devoted to the study of aging and its prevention with the help of Rasayanotherapy. The process of anabolism and catabolism was clearly known to our revered scholars about three thousand years ago. They understood these processes even without the sophisticated equipment or fully developed technology the present day is having.

## 2. Ageing an Ayurvedic prospective

Ageing occurs as a result of constant biological activities throughout living period. This incessant activity is made possible by continuous process of both consumption and preservation of substances for energy. If Cetana (soul) is considered symbolically as a form of energy in a living entity, then Pravrtti (constant activity) can be observed obviously either at cellular microcosmic level or at systemic macrocosmic level. This was well explained by our revered Acaryas in the very definition of Ayu as an inseparable bond between Sarira, Indriya, Sattva and Atma (Ca. Su. 1/42). Though ageing is restricted to Sarira or physical body, other is essential factors and gives meaningful definition for Ayu. Various activities exhibited by the body indicate the presence of Atma, which is the most important factor in sustaining life and without which the body will be declared dead as no activities could be seen (Ca. Sa. 1/70-74). These narrations of the classical books gain more weight in the light of modern explanation.

## 2. Anabolism and catabolism in ayurveda

The process of anabolism and catabolism was clearly known to our revered scholars about three thousand years ago. They understood these processes even without the sophisticated equipments or fully developed technology the present day is having. This definition of Kaya, the synonym of Sarira, indicates the underlying anabolic activity where as the next one i.e., Sarira directs towards the catabolic activity. Definition of Ayu given in the 1<sup>st</sup> chapter of Sutrasthana of CarakaSamhita also indicates the same. The synonyms given for Ayu show total body's metabolic activity. One that supports the body and stops from undergoing decomposition is called Dhari. As per this definition, the body has greater resistance to combat the invasion of infective agents which if unchecked causes the formation of Puti, thereby leading to decay. This definitely shows the anabolic activities taking place within the body so as to sustain body growth.

### Jivita

One which keeps body healthy and alive by getting proper nourishment; resulting in steadiness of body functions is called Jivita.

### Nityaga

One in which normal functions slow down leading to derangement of total body, eventually to death is called Nityaga. This points towards the underlying catabolic process.

In 7<sup>th</sup> chapter of Sarirasthana, Caraka quotes The body (organism) is made up of a number of minutest entities (cells). Their union and disunion are controlled by Vayu. Commenting on this, Cakrapani says that by governing the union (Samyoga) and disunion (Vibhaga), Vayu plays a vital role in Sarirarambha and Sariravinasa process. This Sarirarambha and Sariravinasa certainly points at the anabolic and catabolic process taking place respectively which are part and parcel of life.

The knowledge of anabolism and catabolism our Acaryas had thousands of years ago. It is evident that anabolic activity gains the upper hand over the catabolic activity in the earlier phase of life and as the age advances, it becomes viceversa. In (normal) physiology, for growth and development of a body, anabolic activity should take place from the initial phase of life itself. As the age advances, i.e., moves towards middle age, this anabolic activity is counterpoised by catabolic activity. During this period, the activity of both will be equal indicating the neutral phase which every individual passes through. With age advancing, anabolic activity becomes overpowered by catabolic activity, triggering off degenerative changes ending in death. This indicates that anabolic process will be followed by catabolic process in (normal) physiology and not the other way. So in childhood, activity of anabolism will be more; in adolescence, both will be equally active maintaining healthy state and in adulthood, there will be preponderance of catabolic process leading to downfall in body metabolism. These processes are the major factors of ageing process and are natural phenomena. The order given in the classics Dhari, Jivita and Nityaga, and Sarirarambha and Sariravinasa, points at the fact that anabolism will definitely be superseded by catabolism in the later stages of life which was known to our ancient scholars at that time itself.

## 3. Definition of vayas

Ageing / life is a continuous process which never stops. Acarya Caraka defines the age (Vayas) as a factor dependent on Kala Pramana Visesa i.e., quantum of time duration. Arunadatta, commentator of Astanga Hrdaya defined Vayas as time bound changes occurring in the body.

## 4. Classification of vayas

Counting the chronological age from the time of birth, Ayurvedic texts divide human life span into three major categories - Balya, Madhya and Vrddha. There is some difference of opinions regarding this amongst our ancient scholars. Acarya Susruta quotes that upto sixteen years, it is Balya (childhood); upto seventy years, it is Madhya (middle age) and thereafter Vrddha (old age). But Acarya Caraka has opined differently. According to him,

Balya is upto thirty years; from thirty to sixty years it is Madhyama period and beyond sixty years, it is Vrddhavastha (Ca. Vi. 8/122).

Kasyapa opines in a different way. He includes Garbha in his classification of age. His classification includes Garbha (foetal life), Bala (upto one year), Kumara (from one to sixteen years), Yauvana (sixteen to thirty four years), Madhyama (thirty four to seventy years) and Vrddha (above seventy years). The child will be on milk diet only upto one year. From Kaumaravastha, diet mainly includes solid diet. In Yauvanavastha, there will be progress in the development of Dhatus, Bala, Sattva, Virya and Parakrama. Later period is Madhyama in which total maturity ensues and lastly in Vrddhavastha, declination in the functions of Dhatus initiates (KasyapaKhilasthana3/72-76).

Harita, another well known scholar of those days, classified Vayas into four namely Bala, Yuvana, Madhyama and Vrddha. Upto sixteen years, Bala, from twenty five to seventy years it is Madhyama and beyond that, Vrddha.

By all the above lines, one can infer that all Acaryas had more or less the same opinion regarding different milestones of life.

#### 4.1 Balyavastha

The period of infancy and childhood is Balya. Though literally synonymous, the word Sisu is referred to as infant specially. No Acaryas have counted the period of life from conception till birth as a period of ageing. The absence of complete human form in the embryological period (Bhrunavastha) might be the cause behind non inclusion of that period in the period of ageing by our Acaryas. AcaryaSusrutahas further classified Balyavastha into three as Ksirapa, Ksirannada and Annada. Ksirapavastha is upto one year wherein only milk is fed to the child. Then, upto two years, it is Ksirannadavastha in which along with milk feeding, light solid food is given. Above two years, it is Annadavastha, i.e., solid food is given. This classification is purely based on the gradual adaptation of child's digestive system to normal adult food. The same criteria were followed by AcaryaKasyapa to scale the period of child's years.

AcaryaCaraka lays stress on the qualitative definition for VayaAvastha. On this ground, he aptly subdivided Balyavastha into two. The first period involving Firstsixteen year sisconsidere dasunderdeveloped periodandnextfourteenyears i.e. upto thirty years, it is the developing period. The basis for such a consideration and determination of undeveloped and developing period are the status of Dhatu, Bala and constitutional faculties.

Caraka considered that till the age of sixteen years, the child will have Sukumarata (tender constitution) and Aklesasaha (unable to bear down any stress). Dhatus are

not fully formed (AparipakvaDhatu) and their functions are not established to full extent (Ajatavyanjana). Gangadhara, commentator of CrakaSamhita, says Ajatavyanjana as non appearance of Smasru, etc. developments which occur later. Cakrapani, another commentator justifies this with the recommendations of the texts for Alpa and MrduBhesaja to the children as adult dose of medicines causes adverse effects because of undeveloped Dhatus (metabolic system) of the children. VrddhaVagbhata (A.S.Sa. 8/22) adds Sneha, Mardava and AlpaKrodha as dominant features during this period whereas Indu, commentator of Astanga Samgraha, says that during this period, process of development takes place. Arunadatta, commentator of AstangaHridaya, adds that during this period (i.e., upto sixteen years) development of RasadiDhatus, CaksuradiIndriyas and Ojas, the essence of all Dhatus takes place. In addition, this period of life is dominated by the activity of KaphaDosa.

The period after sixteen years till the age of thirty years is the developing period in which there will be progress in the development of Dhatus both quantitatively and qualitatively. It has been mentioned that during this period, AnavasthitaSattva can be observed. Gangadhara includes that this stage is dominated neither by Slesma nor by Pitta. Susruta has a different opinion. He included the period of life from sixteen to seventy years as Madhyama period. Further, he divided this into four categories out of which first two come under the above classification of Caraka. First one called Vrddhi is the period between sixteen and twenty years. It is the period of development. Next one is called Yauvana ranging from twenty to thirty years. Commenting on this, Dalhana says "YunoVikaroYauvanam" which means the period in which total maturity is yet to occur. The characteristics of AnavasthitaSattva mentioned by Caraka may be included here. In otherwords, Caraka's period of Balya involves Susruta's period uptoYauvana. Thus, from the standpoint of both classics, it is certain that till the age of thirty years, complete maturation will not occur.

#### 4.2 Madhyamavastha

Literally it means any subject lying in between. So, the authors of classics have also designated the period of life (age) between Balya and Jara as MadhyamaVayas or Madhyamavastha. This seems to be the only chronological criteria for considering the MadhyamaVayas and this is the phase of life wherein total maturity of body ensues.

As mentioned earlier, MadhyamaVayas ranges from sixteen years to seventy years according to Susruta. It was well supported by Vagbhata but Carakaconcised this upto sixty years from thirty years. There is no classification done by Caraka whereas Susrutacategorised this into four as Vrddhi, Yauvana, Sampurna and Hani. In Vagbhata's version, there is no category as Vrddhi. His classification includes only last

three.

Susruta's classification says Vrddhi is from sixteen years to twenty years; Yauvana, upto thirty years; Sampurna, upto forty years and beyond that upto seventy years, it is Hani or Parihani. In first two, i.e., Vrddhi and Yauvana, process of development takes place. Next one, Sampurna indicates completion of total maturity and last one Hani itself indicates start of declination process. But, Caraka does not go through these phases. As per Caraka's version there is no Hani phase. So, graphically, one can see a clear variation in the opinion of different Acaryas. A curve can be seen if we consider Susruta's and Vagbhata's opinion whereas Caraka's opinion indicates a straightline.

No much explanation was found for Vrddhi in the classics. Only point they told about this was during this period development of Dhatus takes place. Though no specification was done, AstangaSamgraha adds few more characteristics such as Diptagni (good digestive capacity), Paripaka (profound metabolic activity), Prajnadhikya (increased capability of judgement) and Vyavasaya (wide field of interest/activities). Yauvana, on the other hand, is the period of further development. Cakrapani, a renowned commentator, in his commentary "Bhanumati" on SusrutaSamhita, states that 'Yauvana is the period wherein the amalgamation of the features of preceding Vrddhi phase and succeeding Purna phase. He further says, there will be no complete maturation of body'. The above said characteristics mentioned by AstangaSamgraha can be attributed to this also.

The phase which follows Yauvana is Sampurna or Purna ranging from thirty to forty years. It is the stage (period) of complete total maturity. Even the literal meaning conveys the same i.e., complete. The maturity is complete not only at the physiological level but also at the psychological level.

Features characteristic of MadhyamaVayas given in the classics are as follows (Ca.Vi. 8/122) - concurrent appearance of proper strength, virility, valour, courageousness, cognition (grasping power), retention, recollection (retrieval abilities), good speech and knowledge and all qualities of Dhatus. Along with this, there will be stability of body and mind and non degradation of qualities / features of Dhatus. Moreover, this phase of life is dominated by the activity of Pitta. Arunadatta adds that no development of Dhatus takes place in MadhyamaVayas.

#### Madhya Vayas (years)

Caraka	30 -60
Susruta	16 - 70
Vagbhata(A.S.)	16 - 60
Vagbhata(A.H.)	16 - 70
Kasyapa	34 -70
Harita	25 -70

#### 4.3 Vraddhavastha

It is the last phase of Vayas accepted by all Acaryas. It is having synonyms like Vardhaka, Jara. From this stage onwards, gradual declination of functions of physical and mental faculties gears up. Susruta holds the view that after seventy years, there occurs day to day decrement in Dhatu, sensory-motor system, strength, virility, enthusiasm associated with wrinkles, graying, baldness, frequent attacks of cough, breathlessness, etc. and will be unable to do one's own functions. (Su. Su.35/29).

Caraka adds further to Susruta's opinion. He along with physical faculties included mental faculties like reduction in the capacity of perception, retention, recollection, speech and knowledge. This period is dominated by Vayu. Vagbhata (A.S. Sa. 8/24) adds more to the above features i.e., this phase of life is accompanied with reduced digestive capacity and tremors. A simile has been given by our ancient scholars for Jaravastha as an old mud house gets crumbled in the pouring rainwater.

Candranandana, another commentator of AstangaHridaya, says that the stage of life after seventy years is the stage of declination of body tissues. This state lasts up to the death, whether death occurs earlier or later than normal life span.

From the classics, we can see that revered Acaryas had great observation of body changes occurring during old age. They clearly distinguished somatic changes (including pathological conditions) from psychic variations. Somatic changes (with pathological conditions) like TvakParusya, Slatha Sara, SlathaMamsa, SlathaSandhi, SlathaAsthi, DhatuKsaya, Indriya Hani, Prabha Hani, Agnisada, KayasyaAvanama, Vepathu, Khalitya, Vali, Palitya, Kasa and Swasa are clearly observed. Mental variations include Grahana - Dharana - Smarana - Vacana - Vijnana Hani along with Paurusa - Parakrama - UtsahaKsaya.

From the above explanation, it is evident that Susruta has concentrated more on physical variations whereas Caraka has given due importance to both physical and psychological changes.

Jara is considered one amongst four SvabhavikaVyadhis by Susruta. i.e., Jara is a natural phenomenon through which an individual has to come across. Commenting on this, Cakrapani in his 'Bhanumati' commentary says-The definite stage of life which appears before death. Again in Sutrasthana 24/7, Susruta has mentioned Jara as SvabhavaBalaPravrttaVyadhi along with Ksut, Pipasa, Mrtyu, etc. Dalhana, commenting on this, told that these occur due to the power or influence of nature (Svabhava). Cakrapani adds further saying the nature (Svabhava) of a particular individual depends upon the invisible factors hereditarily carried out by that particular race in which he born.

The word "Prakrti" here denotes both to the nature of a particular species and nature of an individual within that particular species. For example, onset of ageing process differs from one species to another. Similarly, within the species also, the nature of an individual varies according to Desa, Kala, Prakrti, Ahara, etc. and accordingly, ageing process may initiate early, timely or late.

Susruta further divided SvabhavaBalaPravrttaVyadhis into Kalaja and Akalaja. We, here deal only with, Kalaja and AkalajaJara (Su. Su.24/7).

#### 4.4 KalajaJara

Jara coming at the proper age is KalajaJara i.e., after sixty years of life. KalajaJara is PariraksanaKṛta which means that it occurs at the proper age even after following the daily and seasonal regimen mentioned in Swasthavṛtta. However, this KalajaJara is of less intensity, slow progressing one and less troublesome. This is nothing but chronological ageing.

There is no cure for KalajaJara; it is Yapyā i.e., by Rasayana, the ill effects of ageing can be checked and its progress can be slowed down or halted to some extent.

#### 4.5 AkalajaJara

Jara occurring before the proper age (sixty years) is AkalajaJara. This type of Jara is ApariraksanaKṛta which means that it occurs before the proper age due to not taking the proper care of personal hygiene (Swasthavṛtta) or not following Sadvṛtta. This AkalajaJara is of greater intensity, rapidly progressing one if neglected. This is biological ageing.

AkalajaJara can be treated according to the Dosa involved or Vyadhi associated, with respective treatment and RasayanaDravyas.

Cakrapani told that life span depends on Prakrti, Vikrti, Sara, etc. ten factors. Based on this, life span may be either longer or shorter than normal life span i.e. hundred years. Whether shorter or longer, life span or age is classified into three similar to previous. He says that if the total life span is eighty years, then Balyavastha is up to twenty five years; Madhyavastha, up to fifty years and Vrddhavastha beyond that. If the total life span is one

hundred and twenty years, then Balyavastha is upto thirty six years; Madhyavastha, upto seventy two years and beyond that is Vrddhavastha.

The passage of time also affects the total life span of living beings. The life span at the beginning of creation was unlimited and started diminishing gradually in subsequent Yugas. In Manu Smṛti (1/80), it has been said that total life span of human beings was 400 years in Satya (Kṛta) Yuga. In the subsequent Yugas, total life span reduced by hundred years i.e., Treta Yuga, 300 years; Dwapara Yuga, 200 years and Kali Yuga, it is 100years.

In CarakaSamhita also, it has been mentioned that the rate of diminishing of life span is one year after the passage of one hundredth of the Yuga. Cakrapani states that 'as a result of this, the total life span of human beings is 99 years in Kaliyuga. This reduction in total life span in subsequent Yugas is because of reduced involvement in righteous deeds, decrease in features of Bhumi, etc. faculties and in Yugas itself. Ultimately, the universe lands up in total destruction (Pralaya)'. Hence, it may be stated that the total life span of human beings decreases with passage of time.

#### 5. Ageing starts in different attributes at different period

Thus, the ancient classics give a detailed version on the biological aspects of ageing including growth, puberty and senility. Though the classics have categorised Vayas into Balya (undeveloped), Madhya (developed) and Vrddha (degenerative) Avasthas, they have observed changes occurring during growth and also the initiation of decrement of certain particular faculties of the body. Vagbhata was the first one to record such an observation which was followed later by SarangadharaĀcārya.

In SarngadharaSamhita, he followed the same. From the above quotations, it is clear that ageing does not occur simultaneously in all the tissues. Different body tissues are affected with ageing at different time period. Gradual decline of a particular faculty takes place in each decade of life and by the end of decade, that particular faculty is lost.

**Table-1: The loss of body tissues during various decades of life.**

Sr. Nu.	Decade	Loss of Tissues	
		AstangaSamgraha	SarngadharaSamhita
1.	I	Childhood	Childhood
2.	II	Growth	Growth
3.	III	Complexion	Complexion
4.	IV	Intellect	Intellect
5.	V	Skin	Skin
6.	VI	Reproductive Capacity	Vision
7.	VII	Vision	Reproductive Capacity
8.	VIII	Hearing	Valour
9.	IX	Mind	Knowledge

10.	<b>X</b>	All sensory and motor organs	Motor
11.	<b>XI</b>	-	Mind
12.	<b>XII</b>	-	Life

Vagbhata limits the life span of human beings to hundred years whereas Sarngadhara extends it further by twenty years. After the first decade of life, Balyavastha starts declining. In infancy, the growth rate is rapid and this (accelerated growth) is partly because of continuation of the foetal growth period. Second decade witnesses the gradual halting of Vrddhi of an individual. The rapid growth spurt which occur at the time of puberty is due to growth hormone, androgens and estrogens and subsequent cessation of growth is due in large part to closure of the epiphysis by estrogens. The complete growth of the body is achieved by mid twenties. Third decade starts showing deterioration of complexion / lustre of the body (Skin).

Pigmentation of the skin is due to melanin fed into the basal keratinocyte rather than that stored within the melanocyte. Skin colour is partly due to the amount and activity of the melanocyte and partly a reflection of how melanin is stored and processed in the keratinocytes.

Fourth decade onwards, Medha starts declining. Medha is nothing but the grasping capacity of mind. Lansing, in his book 'Cowdry's Problems of Ageing' has noted that in subjects above forty years there is a marked progressive decline in overall test performances as related to increasing age. There is a progressive restriction in forming new interests, reduction in new learning and conceptual thinking becomes progressively simplified.

Fifth decade signals the declination of functioning of Tvak. Modern scientists also opine the same. Although the skin is constantly ageing, pronounced effects do not occur until a person reaches the late forties. Around that time, collagen fibres decrease in number, stiffen, break apart and form into a shapeless, matted angle. Elastic fibres lose some of their elasticity, thicken into clumps and fray and the skin forms crevices and furrows known as wrinkles. There is a decrease in the number of functioning melanocytes, resulting in gray hair and atypical skin pigmentation.

Sixth decade onwards, the activity of Sukra becomes less i.e., reproductive capacity decreases. In male, declining reproductive function is much subtle than in females. At about age of mid fifties, decline in testosterone synthesis leads to less muscle strength, fewer viable sperm and decreased sexual desire. Healthy men often retain reproductive capacity into their 80s and 90s.

When a person reaches seventh decade, he starts losing his Drsti. As an individual grows older, the lens grows larger and thicker and becomes far less elastic, partly because of progressive denaturation of the lens proteins. Therefore, the ability of the lens to change shape progressively decreases with age. The power of

accommodation decreases as low as zero diopters at age seventy years from about 14 diopters in the childhood. Thereafter, the lens remain almost totally nonaccommodating, a condition called Presbyopia.

Second most common cause of blindness in the elderly is glaucoma, which is characterized by an abnormally high intraocular pressure due to a buildup of aqueous humour inside the anterior chamber. The fluid compresses the lens into the vitreous body and puts pressure on the neurons of the retina. If the pressure continues, there is a progression from mild visual impairment to irreversible destruction of neurons of the retina, degeneration of the optic disc and blindness.

Eighth decade onwards, an individual starts losing his Srutindriya. A gradual hearing loss associated with ageing is evidenced affecting more than a third of those over seventy five years and is probably due to gradual cumulative loss of hair cells (by prolonged exposure to noise) and neurons. This condition is termed as Presbycusis.

Ninth decade witnesses the gradual loss of functioning of Manas. Memory loss or Dementia is a common problem wherein the deterioration in cognitive abilities that impairs the previously successful performance of activities of daily living. Memory loss is frequently observed in individuals over eighty five and it is the most common and important cognitive ability that is lost. Other mental faculties may also be affected such as attention, judgement, comprehension, orientation, learning, calculation, problem solving, mood and behaviour. Agitation or withdrawal, hallucinations, delusions, insomnia and loss of inhibitions are also common. Delirium is an acute confusional state associated with a change in level of consciousness (ranging from lethargy to agitation). Memory functions such as registration (encoding or acquisition), retention (storage or consolidation), stabilization and retrieval (decoding or recall) get deteriorated with advancing age.

Last decade shows deterioration of the functions of both sensory and motor organs. i.e., Sarvendriyas. One of the effects of ageing on the nervous system is loss of neurons. This is a consequence of the ageing process. Associated with this decline, there is a decreased capacity for sending nerve impulses to and from the brain so that processing of information diminishes. Conduction velocity decreases, voluntary motor movements slow down and reflex times increase. Degenerative changes and disease states involving the sense organs can alter vision, hearing, taste, smell and touch.

The evacuatory organs (Payu) comprising rectum and

bladder are often the victim of ageing pathology. Sluggish bowel movements leading to constipation, incontinence of faeces and urine due to reduced tone of sphincters are well acknowledged. These signs may sometimes also be associated with degenerative changes in CNS. 'Hesitancy' for evacuation is commonly seen among aged individuals.

Extremities (Pani and Pada) are the chief organs for locomotion, posturisation and movements. The slowness in movements is mainly due to diminished strength in the skeletal muscles, reduced tone and gonadal steroid deficiency.

Considerable downfall in gonadal endocrinal activity lead to lack of libido, sexual drive and penile erection in male and menopause and vaginal atrophy in women. In addition, reduced tone in pelvic musculature in women and prostatic hypertrophy also add to the hampered reproductive system in the aged.

Speech (Vak) is less affected in the aged unless and until greater CNS pathology occurs. However, phonation and pitch of the voice are affected in varying degrees among the older people. Slowness in the articulation of speech may leave an impression of dysarthria in the aged.

Thus on going through the above details pertaining to Karmendriya and Jananendriya, it is obvious that Indriya Hani does occur in the old age with varying degrees.

Sarnghadhara added one more faculty which gets deteriorated in the eight decade is Vikrama or Parakrama (Valour). It has been noted that there is a marked progressive decline in overall test performance as related to increasing age.

## 6. Causes of ageing process

No specific etiology has been described as such in any of the Ayurvedic classics. But, there are some points which can be considered favourable in this regard. Those points are dealt in detail in coming lines.

**6.1 Kala (Time factor):** Kala is the foremost and important factor to be considered from Ayurvedic standpoint for the onset of ageing process. Caraka mentions that the same foetus after the lapse of definite time becomes child, young and old. (Ca. Sa. 3/8).

All the body parts are in very minute form during the embryological period so that they cannot be distinguished. As time advances, they develop into separate organs distinct from one another taking the shape of foetus. Susruta has also emphasised the involvement of Kala in the development of an individual or ageing process. He says that because of time factor, there will be appearance of secondary sexual characteristics in an individual. This indicates that the childhood has landed up into stage of puberty (Su. Su.14/18).Cakrapani specifies that Due to time factor

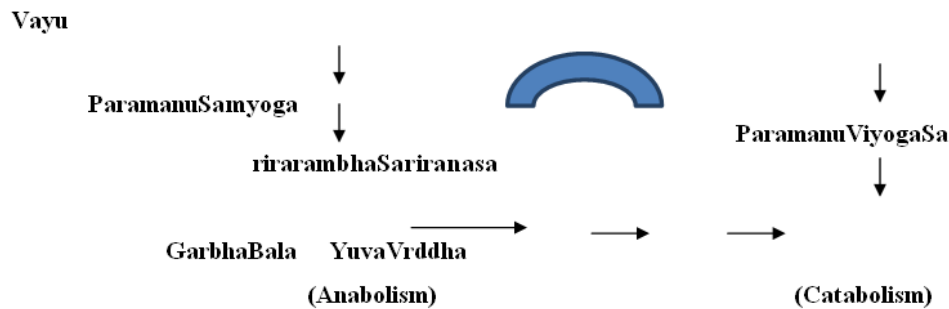
only there occurs the development of embryo within the womb. In SvabhavoparamaVada, it has been mentioned that Kala causes change in every moment and appreciation of these minute changes that take place daily. So, all the things formed or produced will perish to time. For destruction of any object nothing holds major responsibility other than time factor (Ca. Su. 16/32-33).Kala is also responsible for the diminution of Dosas, Dhatus and Malas and Vrddhavastha (Ca. Su. 17/77). Further, Caraka has clearly mentioned the cause of Jara (old age or ageing process) and Mrtyu as KalasyaParinama (Ca. Sa. 1/115).

## 6.2 SvabhavaVada (Theory of Natural phenomenon):

Literally, Svabhava means the 'inherent property' or 'innate property' or 'by nature itself' or 'natural constitution'.

The birth of an individual occurs by itself. (Ca.Su. 11/6) The body tissues are very minute and innumerable. Their union and disunion are under the control of Vayu as well as natural property to combine or separate. Cakrapani says that combination of Paramanus is responsible for Sarirarambha (growth of the body) and their separation for Sariravinasa (degradation of body tissue). The growth and development of body parts from the time of conception till the death of an individual is a natural phenomenon. Moreover, Susruta adds more saying that Jara (old age/ageing process) is a SvabhavikaVyadhi or SvabhavabalaPravrttaVyadhi. (Su.Su. 24/7) i.e., Jara occurs by nature itself which can not be stopped by any intervention.

**6.3 Vayu:** The twelfth chapter of Sutrasthana was totally dedicated to Vayu by AcaryaCaraka. It is the numerouno amongst the three Dosas as it controls the other two, Pitta and Kapha. For the sustenance of life, all the Dosas, Dhatus and Malas should be in equilibrium. Still, they alone can never function or be active. For that, Vayu is needed which dominates the formation of total body structure and functions. Vayu acts not only at microscopic cellular level but also at macroscopic organic level.



**6.4 SvabhavoparamaVada (Theory of Natural destruction):** This theory can be applied from the MadhyamaVayas onwards where in the process of catabolism dominates the process of ageing. There is a causative factor for the formation of beings, but no cause is found for their annihilation. i.e., the destruction of any beings is automatic.

The same view has been expressed in CarakaSamhita while describing the manner with which life process starts during conception. It has been mentioned that the empirical soul accompanied with instruments of knowledge are responsible for the manifestation of life. But, the process of decay, on the other hand, being too quick in succession does not need any cause as such as it is automatic. The reason is that the process of destruction is too quick to allow any other causative factors to leave any impact thereupon (Cakrapani on Ca. Sa. 1/58).

On the basis of this theory, it may be deduced that there is cause for life but no cause of death or when the cause responsible for the life causes to function, death ensues. Similarly, it may be assumed that there is a cause for growth and when it becomes ineffective or stops functioning, process of degeneration or ageing process starts. However, this SvabhavoparamaVada was not accepted much by Ayurveda.

**6.5 Desa and other allied factors:** Though these are not the major etiological factors of ageing process, they do contribute for that. While mentioning the BalavrddhikaraBhavas, Caraka has mentioned a person will be strong enough if his birth has taken place in an environment which is conducive to increase the strength of any people. The people of such area will have good immunity naturally and thereby ageing process becomes slow. In Sariravrddhikara Bhavas (Ca. Sa. 6/12) it has been given that Aharasausthavam and Avighataaso contribute to the development of body. Aharasausthavam means the excellence of properties of food i.e., Aharasampat. So, the development of body tissues depends upon the nutrients present in the food consumed.

## 7. Contemporary View of Ageing

**7.1 Definition:** Though very difficult to define in words, ageing is defined in very general descriptive terms as 'a process of unfavourable progressive change, usually correlated with the passage of time, becoming

apparent after maturity, and terminating invariably in death of the individual'. But, the widely accepted definition of ageing is 'the processes that occur during life which culminate in changes that decrease an individual's ability to cope with biological changes'. In other words, it is a normal process accompanied by a progressive alteration of the body's homeostatic adaptive responses. It is a general response that produces observable changes in structure and function and increased vulnerability to environmental stress and disease. Though ageing and senescence are relative terms, Charles Mobbs gives different views: Ageing is a process of gradual and spontaneous change, resulting in maturation through childhood, puberty and young adulthood and then declines through middle and late age. Senescence is the process by which the capacity for cell division, growth and function is lost over time, ultimately leading to an incompatibility with life i.e., the process of senescence terminates in death.

Although ageing has both the positive component of development and the negative component of decline, senescence refers only to the degenerative processes that ultimately make continued life impossible. Not all of the changes that occur with age, even those that occur in late life are deleterious (e.g. grey hair, baldness) and some may even be desirable (e.g. increased wisdom and experience). Normal ageing refers to the common complex of diseases and impairments that characterise many of the elderly whereas Successful (Healthy) ageing refers to a process by which deleterious effects are minimised, preserving function until senescence makes continued life impossible.

**7.2 Theories related to Ageing:** Many scientists have attempted to explain with individual perviews and put forth various theories in quest of the cause for ageing process. They are briefly noted below.

**7.2.1 Master Clock theory:** One of the oldest theories and no longer has high credibility. It posits that ageing is under direct genetic control. Teleologically, it suggests that the rate of ageing within each species has developed for the good of each species. Individual variation develops because of maladaptation, exposure and lifestyle. In the wild, such maladapted individuals tend to die out and the well adapted ones persist, altering longevity in the best interest of the species.



**7.2.2 Intoxication theory:** Proposed by T.H. Montgomery, an eminent zoologist, as metabolic waste products of a toxic nature accumulate in the tissues through faulty excretory processes to effect a true intoxication and ageing of the organism. The same point of view was urged by Jickeli who speculated that metabolism is an incomplete process and, as a consequence of the incomplete utilisation of materials, toxic materials accumulate gradually in the cell. Child believed that senescence results from accumulation of toxic substances in the cell and that rejuvenation is effected by its elimination. Heilbrunn, who apparently fell in line with the intoxication theory of ageing, observed that 'typically, the living organism has no means of getting rid of insoluble materials which may be deposited within its cells and this may be an important factor in the ageing process'. But, the nature of such cumulative toxic substances was not defined properly so far. Some pathologists have considered what is known as 'brown pigment' in the cellular component as the sign of ageing.

**7.2.3** Probably the earliest modern scientific theory was proposed by Rubner in 1908 when he presented an evidence linking metabolic rate and ageing. He postulated that life is a chemical chain reaction, the duration of which is dependent upon the concentration of the reactants and the rate of reaction. Physiological signs of ageing are gradual deterioration in function and capacity to respond to environmental stresses. Metabolism slows, as does the ability to maintain a constant internal environment (homeostasis) in response to changes in temperature, diet and oxygen supply. These signs of ageing are related to a net decrease in the number of cells in the body and to the dysfunctioning of the cells that remain. The completion of the reaction results in death.

**7.2.4 Rate of living theory:** proposed by Pearl in 1928 and is closely related to Rubner's theory. His theory is based on the concept that the duration of life varies inversely with the rate of energy expenditure.

**7.2.5 Somatic mutation theory:** Put forth by Dr. Leo Szilard in 1959. According to him, genetic mutations of DNA accumulate with time, ultimately resulting in miscopying and functional failure. But, this theory was not accepted as many researchers who investigated exhaustively indicated that somatic mutation is not involved in the ageing process.

**7.2.6 The error catastrophe theory:** Proposed by Dr. Leslie Orgel in 1963. His hypothesis was that if an error was made in the molecular copying processes (transcription or translation) that results in the synthesis of a given protein, the faulty protein could then set off a chain of flawed events which could result in an 'error crisis' - a cascade of altered biochemical processes that impair cellular functioning, such as that which occurs in ageing. This theory differed from the somatic mutation

theory in that it postulated an error in the information transfer which occurs at some site other than in DNA.

**7.2.7 Cross Linkage theory:** Proposed in 1968 by Dr. Johan Bjorksten who stated that an alteration secured in structural proteins which caused them to develop inter and intramolecular cross links with other proteins. The progress of crosslinking process is responsible for the changes that occur with ageing and at one stage it halts leading to the cessation of cellular functions.

**7.2.8 Glycation theory or Loose Cannon theory:** Put forth by Dr. A. Cerami who held the view that non enzymatic reactions of glucose and other reducing sugars with amino groups of proteins and nucleic acids result in a series of events which alter protein and nucleic acid structure and function. This is the same process that causes the 'Caramelization' of sugar [Glucose, the most abundant sugar in the body is added haphazardly to proteins, inside and outside cells, forming irreversible cross links between adjacent protein molecules. The process continues as the age advances contributing to the stiffening and loss of elasticity that occurs in ageing tissues].

**7.2.9 Neuro Endocrine theory or Weak Link Theory:** This theory was of late Professor Vladimir Dilman of the Petrov Institute of Oncology in St. Petersburg, Russia and was proposed in 1983. It was revised and updated in 1992 by Dilman and Dr. Ward Dean. This theory states that ageing is due to the losses of receptor sensitivity to feedback inhibition with time, resulting in a progressive shifting of homeostasis and alterations of hormone levels and their effects with time.

**7.2.10 Free Radical theory:** One of the most popular theories of ageing; was first proposed by Dr. Denham Harman in 1956. It postulates that ageing results from an accumulation of changes caused by reactions in the body initiated by highly reactive molecules known as 'free radicals'. The changes induced by free radicals are believed to be a major cause of ageing, disease development or/and death. These very reactive molecules easily react with vital molecules in the body, such as DNA causing mutations in the sequence of genetic material; leading to the development of ageing. A major premise in this theory is that free radicals and their precursors may be produced endogenously through normal metabolic processes, or exogenously from sources such as air pollution, radiation and foods we consume.

This theory is bolstered by two recent discoveries. Strains of fruit flies bred for longevity produce larger than normal amounts of an enzyme called superoxide dismutase, which functions to normalise free radicals. Also, injection of genes that lead to production of superoxide dismutase into fruit fly embryos prolongs their average life span. There are a number of reasons why the free radical theory has remained popular and

withstood the test of time. First, it provides many plausible explanations for the process of ageing. Second, there are a growing number of studies that implicate free radical reactions in the development of many chronic, age related diseases. Third, the free radical theory of ageing can easily be tested indirectly, using dietary experiments with antioxidant supplements. Fourth, the free radical theory is the only one that encompasses all the concepts in almost all the theories of ageing (except the neuro endocrine theory).

The free radical theory integrates all the theories which pertain to metabolism and energy expenditure with the theories dealing with molecular changes at the DNA level. Thus, it is easy to see how increasing the metabolic rate would generate an explosion of free radical or reactive oxygen species (ROS). The ROS would, in turn, react with DNA to cause mutations which could lead to the destabilization of cellular functions.

As the years pass on, the technology advances further. An intensive research by the scientists has led to the emergence of another concept in the recent years. It remained a hypothesis till now as not proved to full extent. On what does this telomere shortening hypothesis of ageing focus? Cellular ageing is dependent on the cell division, and the total cellular life span is measured by the number of population doublings or cell generations not by chronological time. Telomeres are stretches of DNA at the ends of chromosomes that serve as handles by which chromosomes are moved during the telophase of meiosis and their function is to provide a template for priming the replication of the 'lagging' strand during DNA synthesis, without which the terminal sequences of the chromosomes would be progressively lost. The progressive loss of telomeres eventually induce antiproliferative signals that result in cellular senescence i.e. telomeric sequences shorten each time the DNA replicates, reach a critically short length and cells show signs of genomic instability and eventually stop dividing causing cellular ageing. The hypothesis is gaining prominence as evidences are got supporting this. The activation of telomerase, a special ribonucleoprotein reverse transcriptase, is important in maintaining telomere length stability, thus inhibiting telomerase shortening leading to the extension of life span.

**7.2.11 Apoptosis:** Derived from Greek word used in descriptions of leaves falling from a tree. The cells die and are absorbed under genetic control in addition to their division and growth. So, also called "programmed cell death". It can be called 'cell suicide' in the sense that the cell's own genes play an active role in its demise. It is different from necrosis ('cell murder') in which healthy cells are destroyed by external processes such as inflammation. Unlike necrosis, in apoptosis the cell does not normally rupture to affect the surrounding cells. Apoptosis is important in the regulation of normal cell population density (and suppression of cell death by apoptosis may be determinant of the growth of cancer).

In addition apoptosis may be one mechanism of deleting abnormal cells or cells that have been damaged by toxins, radiation injury or other stimuli. Apoptosis is conveniently thought of in terms of activation, intracellular signaling and execution. When activated, apoptotic genes cause the cell to undergo DNA fragmentation, cytoplasmic and chromatin condensation and eventually bleb formation with cell breakup and removal of the debris by phagocytes. Another mechanism is also said to contribute to senescence i.e., messengerRNA (mRNA) which when transferred from senescent cells into young cells stop cell division in the young cells. The mRNA acts as a gerontogene (a gene mutation that increases life span), whose function may resemble that of a tumor suppressor gene (e.g. p53). Mutations in p53 lead to uncontrolled cell division, cancer and eventually death of the organism. Mutations in gerontogenes extent the number of divisions in cells.

## 8. CONCLUSION

Ageing is the continuous process, many causative factors depend on the Ageing process. By the use of Rasayan therapy we can slow ageing process. Rasayana stands as an answer to solve the problem of healthful longevity containing mental development and resistance beside disease. *Susruta* expresses *Rasayana* as a measure which extends longevity, develops positive health and rallies mental faculties and provides conflict and immunity against diseases. It is a specialized type of treatment impelling the fundamental facet of the body viz. *Dhatu*, *Agni* and *Srotas* and benefits in the prevention of aging. *Rasayana* contains of two words viz (1) *Rasa* and (2) *Ayana*. The word *Rasa* states to the *Rasa Dhatu* in the context of *Rasadi Saptadhatu* and to the pharmacodynamic possessions of a drug in the context of *Rasa Guna* etc. *Ayana* means flow i.e. the measures by which one is proficient of getting the nourishing *Rasa*. Thus *Rasayana* is that process by which all the body tissues are nourished. Consequently *Rasayana* helps in renewal, revival and revitalization of *Dhatu*. *Rasayana dravya* is very useful for maintaining to Ageing process. *Manshika Vikrati* factor like *Kama*, *Krodha*, *Lobha*, *Moha* & *Mada* induce the Ageing process so we should avoid these *Manshika Vikrati* factor for maintaining to health & slowing Ageing process. *Yoga*, *Pranayam* & *Healthy diet* is very essential part for tumbling Ageing Process.