EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 4
Issue: 8
185-195
Year: 2017

RASAYANA THERAPY- A NON-INVASIVE, NON- PRAGMATIC TECHNIQUE OF TISSUE REGENERATION

Kajaria Divya*

Assistant Professor, Department of Kayachikitsa, All India Institute of Ayurveda, New Delhi.

***Corresponding Author: Dr. Kajaria Divya**
Assistant Professor, Department of Kayachikitsa, All India Institute of Ayurveda, New Delhi.

Article Received on 22/05/2017 **Article Revised on 12/06/2017** **Article Accepted on 03/07/2017**

ABSTRACT
Immortality is an everlasting dream of mankind which he always eager to achieve, but death and aging are two inevitable truths that are not conquer by the scientist beside tremendous efforts. Death and aging are natural adversity for which medicines still have to search. Many researches are working on stimulation of stem cell by molecular tools, use of functionalised nanostructure material etc, for development of regenerating medicines but none of them claim to be successful. Growing older and death are subsequent phenomenon but it is not essential that later is always followed by former. Therefore preventing aging and rejuvenation (i.e. new growth) is two different phenomenons. Interestingly, description of both these technique (technique for arresting tissue damage thereby preventing aging and technique for new tissue growth) is elaborately described in ancient Ayurvedic text dated 3000 year back. *Rasayana* is a branch of Ayurvedic medical science that deals with the destruction of aging and promotion of longevity. Acharya Sushruta was perhaps the first to describe the in-vivo stimulation of skin stem cell technique and documented its effects. Unfortunately due to lack of insight and research, this technique is neither flourished nor used anymore. The present article discuss the Rasayana therapy as described in the Ayurveda with the hope that it may prove beneficial for scientific community for developing regenerative medicine especially for neuronal diseases and Hematopoietic diseases.

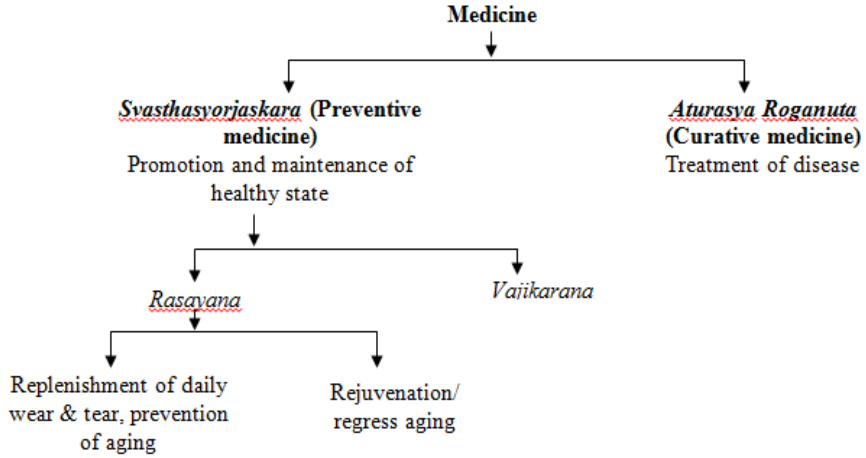
KEYWORDS: *Rasayana*, *Kaya- Kalpa*, Skin stem cell, Rejuvenation.

INTRODUCTION
Treasure of Ayurveda grabs many secrets for promotion and maintenance of good health as well as destruction of diseases. Since ancient time men is searching tools and techniques to conquer death and gain immortality but unable to ascertain any such remedy. As said -Aging is an inevitable phenomena that has to be accepted by every living creature and no one can escape from it, this is true but can it be delayed or revert back? There are many researches done and still many going on to search what exactly causes aging and how it can be prevented and regress. There are two things 1. To prevent aging 2. To regress aging, these two things sound to be one but are totally different. When we are talking about prevention of aging then factors that can amplify the cellular destruction or causes degeneration should be overcome. In such case life expectancy of the existing cell/ tissue is enhanced as its metabolic activities is improved by improving the mitochondrial respiration through use of antioxidants, decreasing calorie intake or decreasing oxygen basal metabolism rate. But, when we are talking to revert back the aging process then it means replacement of existing death and damaged tissues with the newer one. Now question arises will it be possible to regress an inevitable phenomenon? How it can be achieved? And what will be the benefit?

As we grow older our colour of hairs changes from black to white, wrinkles starts to appear on face, our physical ability declines and many more things occur, suppose what can happen if ones hair again grow as black, his wrinkles disappears, his physical ability boost-up and he again become young? This is the concept of reverting aging or in-vivo tissue regeneration that we will discuss in this article.

In the oldest treatise of medical science, Ayurveda there is lot of description available regarding the methodology to regress aging through in-vivo tissue regeneration. Ayurveda devotes one whole branch for studying the methodology for prevention of aging, rejuvenation and achieving the bliss of ever youthfulness termed as "*Rasayana*". Vivid description regarding Rasayana drugs, method and effects is present in all available Ayurvedic texts. According to Ayurveda there are two types of medicine- one which are use for the promotion of good health and prevention of diseases (*Svasthasyorjaskara*) and second are those which cure diseases (*Aturasya roganuta*). Thus Ayurveda broadly

divided medicines in two categories namely, 1. Preventive medicines and 2. Curative medicines. Preventive medicine that can enhances the body immunity and thereby promote healthy life are again divided into two categories – 1. *Rasayana* and 2. *Vajikarana*. *Rasayana* therapy is related to vitality (science of rejuvenation) and *Vajikarana* is related to the science of healthy sexual life.



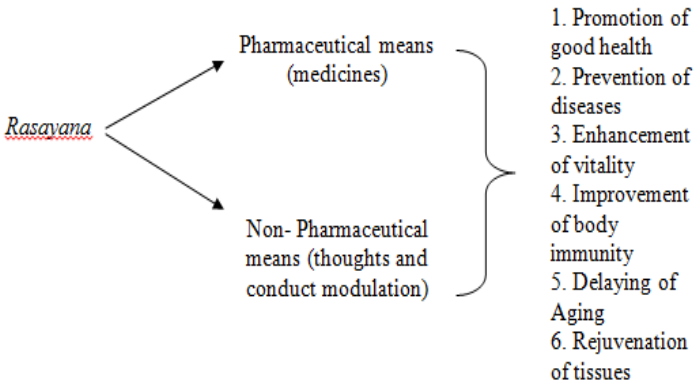
What is Rasayana?

The expression '*Rasayana*' is a unified state of two words – '*Rasa* and *Ayana*'. In general terms it refers to the flow of nutrients or more specifically to the acquisition of excellence of vital fluids of the body to achieve a state of positive health, youth and disease free senescence.

Rasa means the first nutritive *dhatu*. In Ayurveda, *dhatu* refers to constitutional unite of the body that support as well as nourish the body. On the basis of its morphology and physiology it can be correlated with the " Lymphoid plasma" which is believed to be the nutritious fluid part of the blood that has escaped from the blood-vessels, and which has irrigated the tissues and ministered to their nutrition.

Ayana refers to acquire, in the present context it means the method or technique (pharmaceuticals and non-pharmaceuticals) for acquiring best *Rasa dhatu*.

Thus, *Rasayana* refers to all pharmaceutical as well as non-pharmaceutical methods by which vitality and body immunity can be enhanced and that can be use for the promotion and maintenance of healthy tissues, for the replenishment of daily wear and tear and also for the regeneration of tissues.



Function of Rasayana

Acharya Sushruta says that Rasayana hass following functions

1. *Vayasthapana*

Maintenance of age. It is well known that telomere maintenance appears to be essential for the prolonged persistence of stem cell function in organ with extreme cell turn over. According to telomere theory, telomere have experimentally been shown to shorten with each successive division. Certain cells, such as egg and sperm cells use telomerase to restore telomere to the end of their chromosomes, insuring that can continue to reproduce and promote the survival of the species. When the telomere reaches a certain length, the cell stops replicating at an appropriate rate, so it dies off, this eventually leads to the death of the entire organism. As the telomere length is epigenetically controlled, meaning it is influenced by nutritional status. Vitamins, protein rich diet and antioxidant help protect and enhance DNA's repair capacity, including that of telomeres. All

rasayana drugs are rich source of vitamins and antioxidants (mostly Rasayana drugs have Vitamine C & E). Use of *Ajashrika Rasayana* like milk, ghee etc. provides adequate amount of protein for repair of daily wear & tear. Thus the concept of *Vayasthapana* refers to epigenetically modulation of telomere length for ensuring continuous mitosis and cellular growth.

2. *Ayu*
Promotion of longevity. Rasayana drugs are rich sources of Polyphenols and it is documented that polyphenols acts as modulator of immune system. The effects of polyphenols on the immune system are associated to processes as differentiation and activation of immune cells. It assists in formation of antibodies and red blood cells.

3. *Medha*
Promotion/ improvement of intelligence. A recent study shows that telomeres shorten with age in neural stem cell of hippocampus and the telomerase deficient mice exhibit reduce neurogenesis as well as impaired neuronal differentiation and neuritogenesis. *Medhya Rasayana* are helpful in promoting intelligence by improving neurogenesis as well as neuronal differentiation and neuritogenesis.

4. ***Balakara***
Increases body strength. Rasayana drugs are helpful in promoting growth and repair of body tissues; promotes growth and muscle tone; aids in the proper functioning of the muscles, helps in formation of healthy bones and teeth thereby strengthen the body.

5. *Rogapaharana*
Reduces susceptibility to infections, builds resistance to infections.

6. *Prabhavarnasvaroudarya*
Promote and maintain healthy skin.

All the above mentioned functions of the Rasayana are similar to those of vitamins A, B complex, C, D, and E.

Mostly Rasayana drugs (like Emblica officinalis, Terminalia chebula, Tinospora cordifolia are good source of Vit. C & E) have abundant Vitamins content.

Pharmacological and Biochemical Mechanism of Rasayana Therapy

1. Nourishes and maintain the cell life (nutritional action)
2. Encouraging the growth of new cells (regenerative action)
3. Preventing recurrent infection, expelling the damage cells (immunomodulatory action)
4. Eliminate the toxic metabolites and pollutants (antioxidant action)
5. Keep the balance between mind and body (adaptogenic effect)

Classification of Rasayana as described in Ayurveda
Following is the most rational classification of *Rasayana* according to the textual description and commentaries there upon.

A. According to the mode of administration (Charaka)
1. *Vatatapika* or *Sorya Marutika* (daily use of Rasayana in outdoor practise)
2. *Kuti Praveshika* (Non pragmatic use of Rasayana in controlled experimental condition)

B. According to Object (Sushruta)
1. *Kamya Rasayana* (use of Rasayana in healthy persons for enhancement of specific ability)
a. *Prana Kamya* (for enhancement of life span)
b. *Medha Kamya* (for enhancement of intelligence)
c. *Shree Kamya* (for enhancement of lusture of body)

2. *Naimittika Rasayana* (use of *Rasayana* in specific disease for enhancement of body immunity).
3. *Ajasrika Rasayana* - Routinely use of *Rasayana* for maintenance of good health

C. Specific Rasayana
1. *Achara Rasayana* - (Non pharmaceutical *Rasayana*, modulation of conduct and thoughts).

D. Purpose of administration of *Rasayana* therapy - (use of Rasayana for internal purification and pacification of vitiated humors*).*
1. *Sansodhana* Rasayana – use of *Rasayana* for internal purification
2. *Sanshamana Rasayana*- use of *Rasayana* for pacification of vitiated humors.

Use of Rasayana Drug according to Age (according to Sharagadhara)

Life Decade	***Desired effect***	***Suitable Rasayana***
01 – 10	Childhood (Balya)	Vacha, Svarna
11 – 20	Growth (Vriddhi)	Ashwagandha, Bala
21 – 30	Complexion (Prabha)	Amalaki, Loha
31 – 40	Intellect (Medha)	Shankhapushpi, Jyotishmati
41 – 50	Skin (Twak)	Bhringaraja, Tuvaraka
51 – 60	Vision (Drishti)	Chakshushya, Saptamrita Loha
61 – 70	Reproduction (Shukra)	Kapikachhu, Ashwagandha
71 – 80	Vilour (Virya/ Vikram)	drug may not be effective

81 – 90	Reasoning (Buddhi)
91 – 100	Motor organs(Karmendriya)

Use of the Rasayana Drugs as per promotion of specific Dhatus

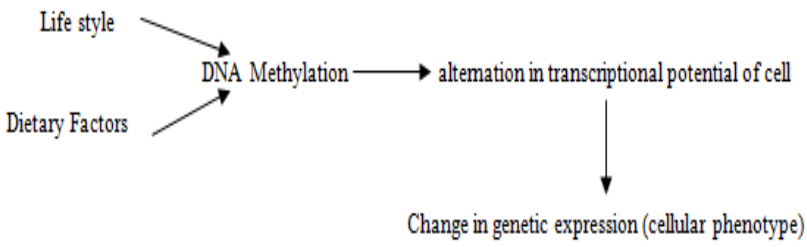
Dhatu	*Suitable Rasayana*
• Rasa	Kharjura, Draksha, Kashmari
• Rakta	Amalaki, Bhringaraja, Palandu, Lauha
• Mamsa	Bala, Nagabala, Ashwagandha
• Meda	Guggulu, Shilajit, Amrita, Haritaki
• Asthi	Laksha, Shukti, Shankha
• Majja	Vasa, Majja, Lauha
• Shukra	Atmagupta, Shatavari, Mushali

Curative Rasayana (Rasayana drugs useful for specific organ)

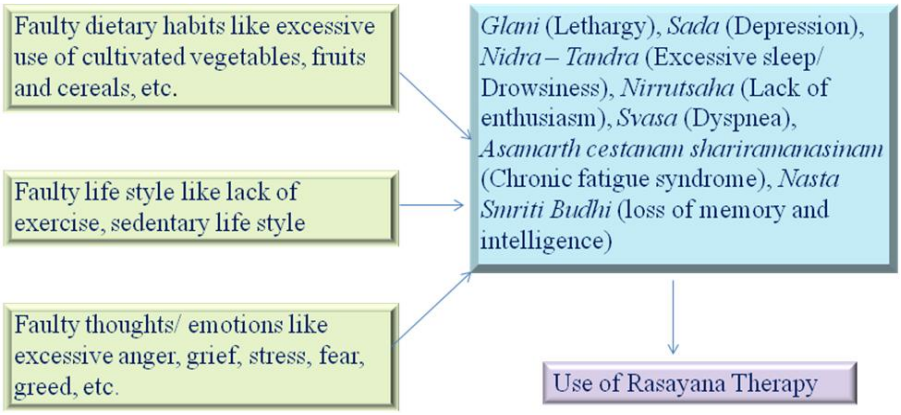
- **Eye:** Jyotishmati, Triphala, Shatavari, Yashtimadhu
- **Heart:** Shalaparni, Arjuna, Guggulu, Pushkaramula
- **Skin:** Tuvaraka, Bhallataka, Vidanga, Somaraji
- **Tuberculosis:** Rasona, Nagabala, Shilajit, Pippali
- **Anemia :** Lauha, Makshika, Mandura
- **Asthma :** Agatsya Rasayana, Bhallataka, Shirisha, Haridra
- **Neuropathies :** Rasona, Guggulu, Bala, Nagabala
- **Diabetes :** Shilajatu, Amalaki, Haridra, Guduchi, Jambu, Methika
- **Lipid disorders :** Guggulu, Haritaki, Pushkaramula, Vacha
- **Hypertension :** Rasona, Bala, Rasna, Sarpagandha, Ashwagandha
- **Psychosis :** Shankhapushpi, Brahmi, Mandukaparni

Indication for the Rasayana Therapy (Description of Metabolic Disorders in Ayurveda)

In Charaka Samhita Acharya Charka descried a cluster of symptoms that appears due to faulty dietary habits, faulty life style and faulty thoughts what we know today as Metabolic Syndrome. Acharya says that excessive use of cultivated grains, vegetable, fruits and poultry products without appropriate work out (exercise), sedentary life style, unstable emotions like excessive fear, grief, greed, stress, etc produces an array of syndrome that should be treated with Rasayana only. All these factors cause oxidative stress on cell an deposition of adipose tissue that further causes obesity, dyslipidemia, hypertension or collectively Metabolic Syndrome. It is evident that the expansion of visceral adipose tissue caused by overconsumption of nutrients plays a central role. As visceral fat stores expand, adipocytes generate increasing levels of reactive oxygen species (ROS) that incite increased expression and secretion of inflammatory adipokines[1-3]. Oxidative stress leads to insulin resistance within adipose tissue as well as in peripheral tissues. Insulin resistance is one of the hallmarks of obesity and accounts for many of its comorbidities, including hypertension[4]. Accumulation of oxidative stress in adipose tissue is one of the early events in the development of metabolic syndrome in obesity[5]. On the other hand, weight loss by calorie restriction and/or exercise can ameliorate the state of oxidative stress[6]. Nonetheless, a cause and effect relationship between oxidative stress and obesity is not well understood. In this issue, Youn et al.[7] propose that oxidative stress contributes to obesity rather than the other way around, as has been the conventional thinking (a chicken-and-egg scenario). The most significant finding of their study is the first demonstration that ROS of vascular origin play an important causal role in the development of obesity. They hypothesize that ROS generated in vascular smooth muscle cells (VSMCs) by NADPH oxidase induce obesity. The best example of an epigenetic change in eukaryotic biology is the process of cellular differentiation. At the time of morphogenesis, totipotent stem cells become pluripotent cells, which in turn become fully differentiated cells. Thus, a single fertilized egg cell continue to divide and the resulting daughter cells change into all the different cell types including neurons, muscles cells, endothelium of blood vessels, etc., by activating some genes while inhibiting the expression of others.



Change in genetic sequence = Genotype ((Hereditary = Bija dosha/ Sahaja)
Change in genetic expression without any change in genetic sequence = Phenotype / Epigenetic (Apathyanimittaja)



Commonly used Rasayana Drugs (Single or combination and their pharmaceutical actions) for Vatatapika method

1. **1. Shilajeet (Natural) -** Antioxidant, Immunomodulatory, Adaptogenic and Aphrodisiac.
2. Aswagandha (Withania somnifera) - Adaptogenic, Antioxidant (small doses), Aphrodisiac (at large doses).
3. Guduci (Tinospora cordifolia) - Immunomodulatory, Antioxidant.
4. Amalaki (Emblica officinalis) – Antioxidant.
5. Haritaki (Terminalia chebula) – Antioxidant.
6. Bala (Sida cordifolia) – Antioxidant and Adaptogenic.
7. Punarnava (Boerrhavia diffusa) – Antioxidant.
8. Tulsi (Ocimum sanctum) - Antistress, Adaptogenic, Antioxidant.
9. Arjuna.

Description of Kuti Praveshika Rasayana

Acharya Sushruta starts description of *Rasayana* with the *Sarvopaghata samaniya rasayana – Rasayana* which can destroy every disease or that can pacify all the causes of destruction / tissue damage.

In this chapter Acharya describe two mode of drug administration for the obtaining the desired effect i.e.1. To sustain long life by destroying disease and by enhancing general body immunity, *Rasayana* drug can be taken daily in routine way as cold water, milk, honey, and ghee. Such mode of drug administration in un-restrained environment is known as *Vatatapika.* 2. Second method is administration of drug in well controlled experimental environment by keeping patient/ healthy individual in specially prepared sanatorium known as *Kutipraveshika* (*Kuti*- cottage /shack, *Pravesha*- indoor). Such mode of drug administration is helpful in repairment and replenishment of damaged tissues with new one. He described use of Vidanga (*Embelia ribes*), Gambhari (*Gmelina arborea*), Bala (*Sida cordifolia Linn.*), Varahikanda (*Dioscorea bulbifera*), Bijakasara.

Effect of Kuti-Praveshika Rasayana

Describing the effect of such drug administration Acharya says- After one month of this therapy, worms come out from the entire body, they should be removed by anointing with Anu taila and scraping with slices of bark of bamboo; in the same way pipilika (ants) and yuka (lice), should be removed during the second and third months respectively. During the fourth month, his teeth, nails and hairs fall off, and in the fifth month auspicious signs appear; the man acquires divine strength, shining like sun, capable of hearing sound and seeing objects present even far away; satva guna becomes predominating supervening rajas and tamo gunas, produces capacity to understand and retain sruti (Vedas) as never before, acquires strength of an elephant, speed of a horse, becomes a youth and lives for eight hundred years. Anu taila should be used for anointing; decoction (paste) of ajakarna (name of the herb) for massaging, water from a deep well (water from Phreatic zone) fragrant with Ushira (*Vetiveria zizanioides*) can be used for bath, paste of Chandana (*Santalum album Linn.*) for applying on the body. The patient should have to follow diet regimen during the therapy.

Acharaya further says that Bala (Sida cordifolia), Nagabala (Sida Veronicaefolia), Vidari (Ipomoea Digitata) and Satavari (Asparagus racemosus) may be made use of; specially atibala (*Abutilon indicum*) should be used along with water; powder of Nagabala (*Sida Veronicaefolia Lam.*) along with honey; powder of Vidari (*Pueraria tuberosa*) along with milk; and Shatavari (*Asparagus racemosus*) also in the same way (with milk). These drugs also produce the same effect when taken in controlled experimental set-up.

Description of Kaya- Kalpa

The method of Kaya- kalpa (regeneration) is only described by Acharya Sushruta. Striking fact to be considered in this description is the use of *Soma* (a controversial auspicious herb). As available description, it is very clear that the process of regeneration is possible with the help of *Soma* . Before discussing the role of Soma and its availability we first take a glimpse of the available description about regeneration as given in Sushruta Samhita.

Entrance in Trigarbha Kuti (Specially constructed cottage with controlled internal environment)

Preliminary step

Elimination of *doshas* by Panchakarma therapy (detoxifying body with the expulsion of all morbid commodities).

Person who is desirous of making use of Soma, should first equip himself with all necessary equipments, attendants, etc. get a house constructed in an auspicious place, having three compartments (one inside the other); on the day of auspicious stellar constellation and auspicious time, he should enter the special house and reside there;

Administration of drug (*Soma*)

Amsumanta Soma plant should bring into the house according to Adhvara kalpa (procedure of Agnisthoma rites according to Dalhana), sanctified by chanting of sacred hymns, performance of auspicious rites and offering oblations to Gods through.

Dose of the drug: One Anjali (160ml) of kseer/ paya (milky secretion) of tuberous root of *Soma* Should be taken in vessel of gold or silver and should be consumed immediately without tasting it; afterward he should touch water (perform acamana rites).

Do's & don't after taking *Soma*

Person who has consumed rasayana recipe should reside in a house devoid of breeze, with an attentive mind and being clean; he may sit, stand or walk but should never lie down (to sleep during day time). He should have to control himself (may be the effect of drug is very furious) by *Yama* (control of senses), *Niyama* (control of activity of mind) and *Vak* (control over speech) and should be relaxed.

Patient should have to sleep on a bed of kusa grass, and its top covered with a sheet of krshnajina (leather of deer). He should be given only cold water to drink and milk if he feels hungry.

Description of Regeneration

2nd Day

Next day after digestion of *Soma paya* (milky secretion), there will be vomiting (vomitus may contain blood and worms). After vomiting the person should be given boiled and cooled milk in the evening.

3rd Day

Purgation containing worms. After proper purgation, person should be allowed to take bath in evening and drink milk, and to lie on a bed covered with linen cloth.

4th Day

Swelling develops in his body and worms come out from the entire body; he should lie on a bed of sand during day and in the evening he should be given milk to drink only.

5th & 6th Day

Drink only milk at both times.

Stage of Depletion

7th Day

His body become depleted of muscles and skin and only bones remain; he breaths/ survives only by drinking soma juice. On that day he should be given bath with comfortably warm milk applied with the paste of tila (*Sesamum indicum*), madhuka (*Madhuca indica*) and candan (*Santalum album*) and given milk to drink as food.

8th Day

Muscles of his body decreases, his skin peels off; teeth, nails and hairs fall off.

From 9thDay up to 16th Day

Anointed with anu taila (medicated oil), bathed with decoction of somavalka (*Acacia catechu*).

Stage of Regeneration

17th & 18th Day

Diamond like teeth erupts (smooth, shining like vajra, vaidurya and sphatika gems, evenly placed, firm and capable of withstanding). He should be given with ksirayavagu (thick gruel cooked with milk) prepared from old shali (rice) as food, till the 25th day.

25th Day to 30th Day

His nails grow shining like coral, coccineal insect and rising sun, his hair become firm, unctuous, thin and endowed with other good qualities, then skin obtains colours like nilotpala (*Nelumbo nucifera* Gaertn.), atasipuspa (*Linum usitatissimum*) and vaidurya gem (shining skin).

After 1 month

The hair should be shaven off, the head should be anointed with the paste of usira (*Vetiveria zizanioides*), candana (*Santalum album*) and black tila (*Sesamum indicum*); or given bath with milk (or water). This should be continued for next seven days.

After 37 days

Thick, curly, firm, unctuous and dark black colour {like the bee and anjana (collyrium)} hair comes.

40th Day

On 40th day the person should be brought out from the Kuti (cottage) to get the exposure of external environment for short duration (1 muhurtha= 48 minutes) and again brought back inside Kuti. Balataila should be used for anointing, paste of yava (*Hordeum vulgare*) for massaging, comfortable warm water for bath, decoction of ajakarna (*Vateria indica* Linn) for mild rubbing, water of deep well added with ushira(*Vetiveria zizanioides*) for bathing, paste of candana (*Santalum album*) for applying on the body, soup of grains and of meat added with juice of amalaka (Emblica officinalis) should be used to drink,

Krishnatila cooked with milk and madhuka (*Madhuca indica*) should be used as food. The patient will keep on this regimen for next 10 days.

From 50th to 70th days

The person should bring to the second garbha of the Kuti (second inner chamber of the cottage) and kept there for next twenty days. During this period he should have to expose slightly to sunlight and wind. He should have to avoid seeing his image.

From 70th to 80th Day

The person should reside in the first chamber of the cottage and have to expose external environment for longer duration and trained to control emotions like anger, stress, etc.

There are three markers used for the assessment of regeneration in the above mention procedure by Acharya:

1. Hair.
2. Nails and
3. Skin.

As per the recent advancement in the research area in regenerative medicines it is bring in knowledge that skin is consider as an excellent model to study the basic biology of organ regeneration and translational approaches. Due to easy accessibility of the skin, a long history of regenerative approaches already exists. Identifying the commonalities between skin regeneration and the regeneration of other organs provide major breakthroughs in regenerative medicine. The hair follicle represents a miniature organ with readily accessible stem cells, multiple cell lineages, and signaling centers. During the normal lifespan of a human, this miniature organ regenerates itself more than 10 times. The cells responsible for this remarkable process are called bulge stem cells.

Recent studies suggest that the epidermis and hair may have an untapped potential to form other organs. Understanding the mechanisms that regulate adult stem-cell proliferation is a major goal for regenerative medicine. In the hair follicle, pharmacologic agents, recombinant proteins, and artificial cell-permeable proteins have been developed to manipulate the proliferation of the quiescent bulge stem cells. Researchers are advances to use this potential roadmap for regenerative medicine using molecular tools developed for skin biology to promote organ regeneration by manipulating adult stem cells *in situ*.

As documented, the first allo- and autologous skin grafts were performed in ancient India (600 B.C.) and later in Europe (1400–1800s) to repair injuries and tissue destruction caused by syphilis.[8-9] *Ex vivo* expansion of skin cells called keratinocytes was developed in the 1970s, and in 1998 and the FDA approved the first tissue-engineered skin for diabetic ulcers.[10] More recently, gene replacement therapy has been used successfully to treat a life-threatening skin congenital disorder caused by laminin (*LAMB3*) deficiency.[11] Future skin regenerative therapies may have even broader medical applications. Engineered skin grafts in mice are capable of producing physiologic levels of hormones, such as leptin[12], and replacing systemic deficiencies in plasma proteins such as Factor VIII.[13] These studies provide the proof-of-concept that ectopic production of proteins in skin grafts could provide an alternative approach to treating human endocrine or hematological disorders. Advances in differentiating human embryonic stem (ES) cell into keratinocytes provide a possible avenue for genetic engineering of human skin and a limitless source of tissue.[14] The ground-breaking discovery of induced pluripotency in somatic cells bring closer to reality patient-derived stem-cell treatments for skin and many other disorders.[15,16]

Despite of all these magnificent development of modern science for producing replacement cells, the prospect of producing replacement organs seems to be beyond the horizon. To regenerate an organ as complex as a kidney or lung would likely be more difficult than differentiating pluripotent stem cells to the correct lineages. Adult stem cells have several advantages over Embryonic Stem cell (ES) or induced pluripotent stem (iPS) cell transplantation for organ regeneration.[17] First, adult stem cells have likely undergone most of the developmental steps necessary to regenerate an organ. Secondly, delivery of ES or iPS cells to the precise anatomical site for regeneration may be difficult. In contrast, adult stem cells are already in niche environments and near signaling centers that carry all the extrinsic information necessary for patterned growth. Thirdly, although new advances in induced pluripotency greatly reduce the risk of cancer in transplanted ES or iPS cells, uncertainty about the risk of malignancy still exists because of genetic manipulation or because of the inherent potential for ES and iPS cells to form teratomas.

Analysis of the description given by Acharya Sushruta shows that drug may stimulate skin stem cell and carry out regeneration of skin and hair follicle. As such, control of Stem Cell fate is one of the most crucial issues that is still not fully understood to realise their tremendous potential in regenerative biology. The use of functionalized nanostructured materials to control the microscale regulation of Stem Cell has offered a number of new features and opportunities for regulating Stem Cell.

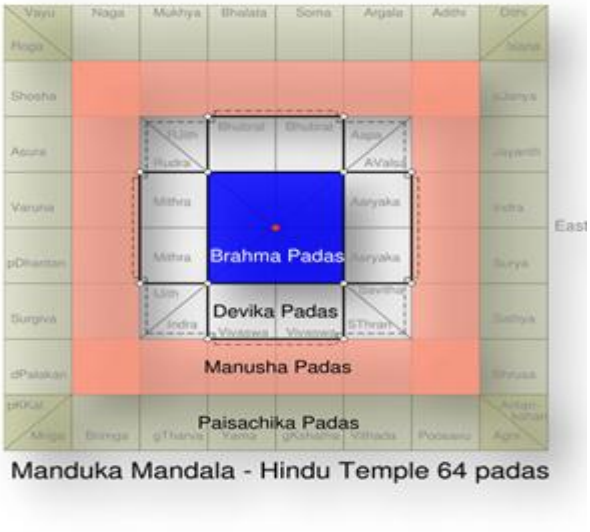
Studies also show that it is not only the chemical factors but also the physical interaction between the biomaterials and Stem Cell that influence the behaviour of cells in culture.[18,19], since it directs the forces exerted by cells on the ECM and are believed to trigger gene activation and suppression.[20-23]

This suggest, that similar to skin stem cell stimulation neural stem cell, hematopoitic stem cells mesenchymal

stem cells and epithelial stem cells stimulation can also be possible through *Kuti- praveshika Rasayana vidhi* and if this will make possible the whole scenario of medical world change.

Construction of Kuti

Administration of Rasayana through Kuti praveshika method is highly technical and required skilful management. The first step in this mode of drug administration is preparation of Kuti. The desired effect of Rasayana as described by Acharya Sushruta can only be gained if the Kuti is prepared properly. Earlier also many attempt had been done for preparing Kuti and administration of Rasayana drugs according to the textual description, but till now no one reported to be successful in achieving
the effects as described in the Sushuta Samhita.



Manduka Mandala - Hindu Temple 64 padas

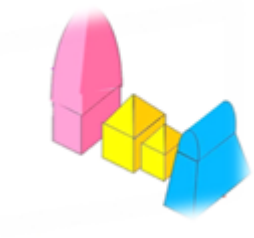
The 8x8 (64) grid Manduka Hindu Temple Floor Plan, according to Vastupurusamandala.[24,25]

Vedic Concept of Construction

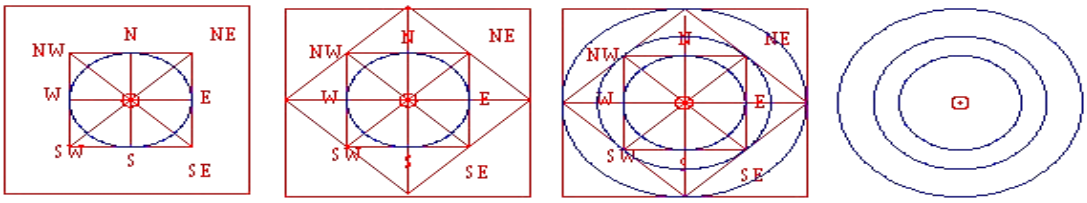
Architectural designs of Hindu temples are very important in solving the mystery of Kuti preparation. As written in the text that it should be Trigarbha

Peculiarities of *Kuti* according to the text:

1. *Trigarbha* (three concentric rooms).
2. *Sukshma lochana* (having small size ventilators).
3. *Kuti* (cottage shape, i.e. rounded or circular with triangular roof).
4. *Ghanabhitti* (having thick walls).
5. *Vistara- Utsedha sampanna* (should be spacious in the plinth area).
6. *Mritusikham* (should be pleasant to reside in all season).
7. *Manasa Priyam* (well furnished with all facilities so that patient enjoy residing inside).



Architectural design of pilgrimage based on three concentric circles.[26]



Ancient geometry of constructing three concentric circles in a square.[27]

As described by Acharya Charaka the Kuti should be constructed in a good site inhabitate by the king, physician, Brahmins, saints and those who perform virtuous acts, a place which is free from harm, which is worthy in all seasons.

Ancient Vedic pilgrimage design follows a geometrical design called *vastu-purusha-mandala*. *Mandala* means circle, *Purusha* is universal essence at the core of Hindu tradition, while *Vastu* means the dwelling structure.[28] This *Vastupurushamandala* is a yantra, meaning a working structure.[29] The architectural design used for the construction of pilgrimage is similar to the architectural design of *Kuti*. The term *Kuti* means a circular dwelling space with triangular roof similar to *Mandal* and the residing space of the *Purusha* (in the center of the temple) can be consider as the third *garbha* of *Trigarbha Kuti* (third concentric room) dwelled by person during Rasayana therapy.

The circle of *mandala* (*Garbha*) circumscribes the square. The square is considered divine for its perfection and as a symbolic product of knowledge and human thought, while circle is considered earthly, human and observed in everyday life (moon, sun, horizon, water drop, rainbow). Each supports the other.[30] The square is

divided into perfect square grids. As mention by Acharya Charaka that the *Kuti* should be spacious (i.e. built in large space) therefore 8x8 or 64 grid structure used for construction of large temple or 81 sub-square grid designs should be use for construction. In Hindu temple manuals, design plans are described with 1, 4, 9, 16, 25, 36, 49, 64, 81 up to 1024 squares; 1-16 pada can be consider as unsuitable for construction of *Trigarbha Kuti* as these are use for smaller size construction, therefore 64 pada that is considered the most sacred geometric grid in Hindu temples can be used for constructing Kuti.

In Hindu temple there is three concentric layers similar to that of three concentric *Garbha* in *Kuti*, the outermost layer *Paisachika padas*, next inner concentric layer is *Manusha padas* and the inner most is *Devika padas*. The *Paisachika padas*, *Manusha padas* and *Devika padas* surround *Brahma padas*, which signifies creative energy and serves as the location for temple's primary idol for *darsana*. Finally at the very center of *Brahma padas* is *Garbhagruha* (*Garbha*- Centre, *gruha*- house; literally the center of the house) (*Purusha* space). Beneath the mandala's central square(s) is the garbha-griya (literally womb house) - a small, perfect square, windowless, enclosed space without ornamentation that represents universal essence. The *Garbha gruha* (third concentric *garbha* of *Trigharbha Kuti*) as per architectural design should be windowless this support the concept of positive air pressure in third concentric chamber in *Trigarbha Kuti* and also identify the mistakes in previous *Kuti* construction designs that were based on the concept of cross ventilation and making small ventilators in all the three concentric rooms. The roof of the temple called *Shikhara* in north India, and *Vimana* in south India, that stretches towards the sky.

Scientific exploration of concept behind creating *Trigarbha Kuti*

The major requirement of Kuti is the need to maintain an aseptic area and therefore it is preferred to protect the working environment from dust and other airborn contaminants by maintaining a constant, unidirectional flow of filtered air over the work area. The flow can be horizontal, blowing parallel to the work surface, or it can be vertical, blowing from the top of the camber onto the work surface. It should be large enough to be used by one person at a time, be easily cleanable inside and outside, have adequate lighting, and be comfortable to use without requiring awkward positions. It is required to keep the work space clean and uncluttered, and keep everything in direct line of sight.

The purpose of the *Trigarbha Kuti* is to provide the appropriate environment for cell growth. It should have to be constructed in such a way that the temperature, air pressure, sunlight and other external environmental confounder during experiment can be kept under strict control.

Successful tissue regeneration depends heavily on keeping the tissues free from contamination by microorganisms such as bacteria, fungi, and viruses. The simplest and most economical way to reduce contamination from airborne particles and aerosols (e.g., dust, spores, shed skin, sneezing) is to develop positive air pressure room. This kind of positive pressure also used in operating theaters and in vivo fertilization (IVF) labs. The concept of *Trigarbha* (three consecutive room's one inside other) is to maintain positive pressure by preventing egress of air. Now a day, Hospitals are also required to have positive pressure rooms for patients with compromised immune system. In such rooms, air will flow out of the room instead of in, so that any airborne microorganisms (e.g., bacteria) that may infect the patient are kept away.

Description of *Soma* (drug used for *Kaya- Kalpa*)

Soma is a controversial drug, it is said to be the king of herbs and the Vedic literature are studded with its eulogy. History of Soma plant and drinking its juice is mentioned in Rigveda (3000 B.C) and probably even earlier to the period when Arayans live in the central Asia. Soma pland is greatly eulogized in Rigveda, a separate section- the 9th mandal with 144 suktas (hymns) being described for it. The *Soma* as described in Ayurvedic texts and Vedic literature is not presently available or it can be said that it is not documented. According to Ayurveda it is a medicine of immortality, as written in the text that God himself created the nector called *Soma* to defend against old age and death. Soma is one only; it is of twenty four kinds depending on its habitat, name, shape, potency etc; such as 1. Amsuman,2. Munjavan, 3. Candrama, 4. Rajatprabha, 5. Durvasoma, 6. Kaniya soma, 7. Svetaksa, 8. Kanakaprabha, 9. Pratanavan, 10. Talavrnta, 11. Karavira, 12. Amsavan, 13. Svayamprabha, 14. Mahasoma, 15. Garudahrta, 16. Gayathri, 17. Sthraistubha, 18. Pankta, 19. Jagata, 20. Sankara, 21. Agnisthoma, 22. Raivata, 23. Tripada gayathri and 24. Udupati. These are the names of Soma plant mentioned in the Vedas. In all varieties of Soma plant there are fifteen leaves, these spring up and fall off in white and black fortnights respectively; one leave develops on every day of bright fortnight and on the full moon day it has fifteen leaves; there after one leaves falls off every day and at the end of dark fortnight it become a creeper only (without leaves).

Amsuman variety of soma has the odour of ghee, its tubers shine like silver; *Muunjavant* kind has tubers like *kadali* (banana fruit) and leaves like those of lahsuna (*Allium sativum*); *Candrama* kind shines like gold (yellow), travels (reside) in water always; the *Garudahrta* and *Svetaksa* kind are yellowish- white in colour, resemble snake peel and are found supported by top branches of trees; the other kind appear as though having different kinds of marks (on their leaves, stem etc).

Thus it can be concluded that all varieties of Soma must have:
1. Fifteen leaves,
2. Their stem contains latex (milky secretion),
3. They are all creeper (twining to other plant/ trees) and with leaves of many kinds
4. Found at high altitude residing mostly in water (aquatic creeper) or marshy area. In Sushruta it is mentioned that all varieties of Soma are grow in mountain such as Himalaya, Arbuda, Sahya, etc, near the lake Devasunda, in mountain spread to the north of Vitasta river, in the five regions below and middle of the great river Sindhu; in these regions *Candrama* kind floats on water like *hatha* (aquatic weed); in these regions itself *Munjavan* and *Amsuman* kinds are also present; in Kashmir province there is a divine lake named Ksudramanasa saras and in that *Gayathri*, *Satistubha*, *Pankta*, *Jagata* and *Sankara* kinds of Soma are found.

A lot of research work has been done by Vedic scholars and botanist To identify the plant but so far, no satisfactory conclusion has been reached. Some of the plants identified as probabilities of Soma are- *Sarcostemma brevisitgma*, *Ceropagia bulbosa Roxb*., *Cannabis Sativa Linn.*, *Rheum emodi Wall.*, *Ephedra vulgaris Rich.*, *Mushroom* called *Amanita muscaria Linn.*, *Vitis vinefera Linn*, *Saccharum officinarum* etc. None of these possess the botanical features of Soma as mentioned in Rigveda or letter texts as discuss above (Sushruta Samhita), though they exhibit certain qualities such as causing exhilaration, intoxication similar to Soma.
It may be possible that real *Soma* plant extinct and therefore is not available.

From the above discussion, the following points deserve to be noted-
1. The instruction to swallow its juice without noticing its taste indicates that it has an unpleasant taste, either very bitter, sour, astringent or a mixture of taste.
2. That it produces both vomiting and purgation after its digestion which may have to be treated.
3. That the quantity of one anjali (about 160ml) is enough as daily dose for rejuvenation therapy.
4. References in Rigveda, points out that drinking the juice in more quantity or too often produces intoxication similar to or even profound than that produces by wine and can even gives rise to diseases.

Now- a days, part of the plant – *Ephedra vulgaris Rich* is being used as *Somalata* in the treatment of dyspnoea, asthma, and other respiratory disorders.

CONCLUSION

It is very unfortunate that due to ignorance and proper insight such wonderful techniques for rejuvenation is lost and we are still far away from the nectar of blissful ever youth life. This article merely gives the glimpse of the treasure borrowed in the ocean of Ayurvedic medical science with the hope that it will provide a roadmap for developing future rejuvenating medicines and gives medical science a new horizon.

REFERENCES

1. Otani H. Oxidative stress as pathogenesis of cardiovascular risk associated with metabolic syndrome. Antioxid Redox Signal, 2011; 15: 1911–1926.
2. DeMarco VG, Johnson MS, Whaley-Connell AT, Sowers JR. Cytokine abnormalities in the etiology of the cardiometabolic syndrome. Curr Hypertens Rep., 2010; 12: 93–98.
3. Keaney JF Jr.,Larson MG, Vasan RS, et al., Framingham Study. Obesity and systemic oxidative stress: clinical correlates of oxidative stress in the Framingham Study. Arterioscler Thromb Vasc Biol., 2003; 23: 434–439.
4. Sowers JR, Whaley-Connell A, Hayden MR. The role of overweight and obesity in the cardiorenal syndrome. Cardiorenal Med., 2011; 1: 5–12.
5. Furukawa S, Fujita T, Shimabukuro M, et al. Increased oxidative stress in obesity and its impact on metabolic syndrome. J Clin Invest, 2004; 114: 1752–1761.
6. Imayama I,Ulrich CM, Alfano CM, et al. Effects of a caloric restriction weight loss diet and exercise on inflammatory biomarkers in overweight/obese postmenopausal women: a randomized controlled trial. Cancer Res., 2012; 72: 2314–2326.
7. Youn J-Y, Siu KL, Lob HE, Itani H, Harrison DG, Cai H. Role of vascular oxidative stress in obesity and metabolic syndrome. Diabetes, 2014; 63: 2344–2355.
8. Lim U, Song MA. Dietary and lifestyle factors of DNA methylation. Methods Mol Biol., 2012; 863: 359-76.
9. F. F. Borghi, A. E. Rider,S. Kumar, Z. J. Han, D. Haylock, K. Ostrikov. Emerging Stem Cell Controls: Nanomaterials and Plasma Effects. Journal of Nanomaterials, Article ID 329139, 2013; 15.
10. K. Saha, J. F. Pollock, D. V. Schaffer, and K. E. Healy, "Designing synthetic materials to control stem cell phenotype," Current Opinion in Chemical Biology, 2007; 11(4): 381–387.
11. A.J. Engler, S. Sen, H. L. Sweeney, and D. E. Discher, "Matrix elasticity directs stem cell lineage specification," Cell, 2006; 126(4): 677–689.
12. J. A. Burdick and G. Vunjak-Novakovic, "Engineered microenvironments for controlled stem cell differentiation," Tissue Engineering A, 2009; 15(2): 205–219.
13. G. H. Altman, R. L. Horan, I. Martin et al., "Cell differentiation by mechanical stress," The FASEB Journal, 2002; 16(2): 270–272.
14. D. L. Butler, N. Juncosa-Melvin, G. P. Boivin et al., "Functional tissue engineering for tendon repair: a multidisciplinary strategy using mesenchymal stem

cells, bioscaffolds, and mechanical stimulation," Journal of Orthopaedic Research, 2008; 26(1): 1–9.
15. V. Terraciano, N. Hwang, L. Moroni et al., "Differential response of adult and embryonic mesenchymal progenitor cells to mechanical compression in hydrogels," Stem Cells, 2007; 25(11): 2730–2738.
16. Chakravorty R.The duties and training of physicians in ancient India as described in the Sushruta Samhita. Surg. Gynecol. Obstet, 1965; 120: 1067-1070.
17. Herman A.R. The history of skin grafts. J. Drugs Dermatol, 2002; 1: 298-301.
18. Singer A.J., Clark R.A. Cutaneous wound healing. N. Engl. J. Med., 1999; 341: 738-746.
19. Micheloni A., De Luca N., Tadini G., Zambruno G., D'Alessio M. Intracellular degradation of beta4 integrin in lethal junctional epidermolysis bullosa with pyloric atresia. Br. J. Dermatol, 2004; 151: 796-802.
20. Larcher F., Del Rio M., Serrano F., Segovia J.C., Ramirez A., Meana A., et al. A cutaneous gene therapy approach to human leptin deficiencies: correction of the murine ob/ob phenotype using leptin-targeted keratinocyte grafts. FASEB J., 2001; 15: 1529-1538.
21. Fakharzadeh S.S., Zhang Y., Sarkar R., Kazazian H.H. Jr. Correction of the coagulation defect in hemophilia A mice through factor VIII expression in skin. Blood, 2000; 95: 2799-2805.
22. Aberdam D.Derivation of keratinocyte progenitor cells and skin formation from embryonic stem cells. Int. J. Dev. Biol., 2004; 48: 203-206.
23. Takahashi K., Tanabe K., Ohnuki M., Narita M., Ichisaka T., Tomoda K., Yamanaka S. Induction of pluripotent stem cells from adult human fibroblasts by defined factors. Cell. 2007; 131: 861-872.
24. Stella Karmrisch. The Hindu Temple, Motilal Banarasidas, 1. ISBN 978-81-208-0222-3.
25. George Michell. The Hindu Temple: An Introduction to its Meaning and Forms. University of Chicago Press, 1988. ISBN 978-0226532301.
26. Jack Hebner. Architecture of the Vastu Sastra-According to Sacred Science, in Science of the Sacred (Editor: David Osborn). SBN 978-0557277247, 2010; 85-92.
27. N Lahiri. Archeological landscapes ant textual images: a study of the sacred geography of late medieval Ballabgarh. World Archeology, 28(2): 244-264.
28. Geometry and Measure in Indian Temmple Plans: Rectangular Temples. Artibus Asiae, 44(4): 266-296.
29. Yu J., Vodyanik M.A., Smuga-Otto K., Antosiewicz-Bourget J., Frane J.L., Tian S., et al. Induced pluripotent stem cell lines derived from human somatic cells. Science, 2007; 318: 1917-1920.
30. Raff M. Adult stem cell plasticity: fact or artifact? Annu. Rev. Cell Dev. Biol., 2003; 19: 1-22.
31. Susan Lewandowski, The Hindu Temple in South India, in Buildings and Society: Essays on the Social Development of the Built Environment, Anthony D. King (Editor), ISBN 978-0710202345, Routledge, 68-69.