Original Research Paper



UNDERSTANDING 'CONCEPT OF DHATU GATI AND POSHANA' AS MECHANISM OF TRANSPORT OF NUTRIENTS AND TISSUE FORMATION; IN GENESIS OF METABOLIC DISORDERS.

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ABSTRACT There are different theories described in Ayurvedic texts as Dhatu Gati (transport) and Dhatu Poshana (Transformation) Nyaya. Namely 1) Kshirdadhi Nyaya, 2) Kedarikulya Nyaya, 3) Khale Kapot Nyaya for transformation and transportation of nutrients. The mechanism of these theory and their scientific technical terms are explained in the paper. Also, discussions of dhaatu gati and dhatu poshana tantra is given. Dhatupradoshaja vikaara (Metabolic disorders) is due to Aadibalapravritta (by chance), shukrashonita sankramanam(inherted). Most metabolic disorders are autosomal recessive in transmission. Because of inherited reasons Dhatuposhana (Growth and development of tissues) gets deranged on their own quickly by birth or due to external factors as in Prameha (Diabetes); santarpan janya (Excessive feeding) or aptarpan (mall nourishment) janya (derived) awastha (conditions). If the clinical disturbance in Dhatu Gati, Dhatu Poshana and manifestations of all saptadhatvagni (transforming factors) studied well with evidence-based researches in collaboration with modern medicine, it will certainly bridge the gap between two the knowledge of Metabolic disorders. Aim is to maintain Sharir dhatu samya (equilibrium of bodily tissue) with Prashasta dhatu (Excellent tissue) for preciousness of health in life.

# KEYWORDS : Dhatu, Gati, Poshana, Metabolic, Disorders

The Chronological nourishment (Dhatu anukramena anugat poshana) of Rasa-Raktadi dhatu is well defined in Ayurveda<sup>(1).</sup> The chyme (ahararasa) is converted into circulatory body fluid (rasa dhatu); then specific enzyme (Dhaatwaagni) acts on the substrates (poshaka dhaatu anu) to form particular tissue (poshya dhatu) with integration of many enzymes, coenzymes and co-factors (dosha -dhatu-upadhau and malagata agnis, panchamaha bhutagnis etc)<sup>[2]</sup>.

As these substrates bathes (avagaha) into body fluid; they are metabolized (upachaya) and transformed (dhatugatiparinati, paka, udbhava upachaya,) and transported (dhatugati- dhatuvyuhana, rasasamvahana, absorption and assimilation) to form new dhatu (matrix and tissue). There are different Nyayas (theories) described in Ayurvedic texts as Dhatu Gati and Dhatu Poshana Nyaya. Namely 1) Kshirdadhi Nyaya, 2) Kedarikulya Nyaya, 3) Khale Kapot Nyaya for transformation and transportation of nutrients.

These theories resemble to evolutionary stages of animal kingdom. Life is generated in sea water where the amoeba like unicellular creature is evolved by complete transfo rmation (Sarvatmaparinaman). There after multicellular creature like starfish with open channels evolved with the growth and development. further closed circulatory system is evolved by the formation of various vessels (augmentation). This is reflected in embryonic life of human fetus and continued impression in living state through the life.

### 1) KSHIRDADHI NYAYA

This theory says that the ahararasa (chyme) is completely transformed into Rasadhatu(body fluids)<sup>[3]</sup>. Rasadhtu is compl etely converted into Rakta dhatu and so on transformations of dhatu into next dhatu goes on till Shukradhatu (reproductive tissue). This is described as rasoraktatwam murcchati in Arundutta critic<sup>[4]</sup>. That means the initial molecule lose its form (prachyati- swabhave ksharana) to transform into another form (samantaram eva). Kshir means milk and Dadhi is curd; as all milk is transformed into curd then butter after that into ghee and liquid form of ghee. Likewise, ahara rasa is converted into Rasa-Rakta- Maumsa- Meda- Asthi- Majja-Shukra and their subtle forms of tissue and waste materials (Upadhatu and Mala) specifically in proportion within specific time (samyak gatya antaram eva).

Dhatu transcript, translation and transformation takes place within specific period according to this theory. The time is

different in different conditions such as genesis in embryonic life, after birth as per the need gender wise phases of life and whether the individual is in fed or starved state. It is six days or thirty days to form last tissue of Shukra dhatu<sup>[5]</sup>.

Ayurveda

The mechanism is well defined by giving the simulation model example of Shabda (sound waves), Archi (light rays) and Jala (water flow) santanvad (like offspring) anu gati (molecular movement). The time of transformation into similar molecule (swa atmabhava) is dependent upon the power of Agni (transforming enzymes and factors). The power of Agni decides rate of metabolism; whether it is manda (low) as jala gati, teekshna (fast) as archi gati or Vishama (irregular) as shabda gati is described in this reference<sup>[5]</sup>. The movement of molecules depends upon the dimensions, speed and frequency.

To attain its final specific differentiation form for the maintenance of health and for the prevention of bodily tissue from various disease conditions including Jara (aging) many molecules has to go under specific reactions. The role of various dhatwagni and bhutagni is also important in these metabolic processes<sup>[7]</sup>. Thus, the theory of tissue formation and differentiation described in Ayurveda is need to be explained in terms of contemporary knowledge.

The saara bhaga (essence) of ahararasa or any dahtu is liable to transform into another. This is called as Dhatusneha Parampara. Sneha means continuous attachment to siblings by binding particular protein receptor; Parampara means inheritance. One dhatu generates similar molecules and cells as in genetic transcription and translation and formation of tissue or organ from stem cells. The stem cells are therapeutically used for rejuvenation. The rejuvenation therapy along with the main treatment is the unique approach of Ayurveda.<sup>[8]</sup>

#### 2) KEDARIKULYA NYAYA-

When Annarasa reaches the state of dhaturoopa<sup>(9)</sup> rasa (nutrients for specific differentiation form); it continues to increase rasa by their aumsha (elements) in it. Components of nutrients increases in extra cellular fluid- ECF (kiyataapi aumshena tam rasam vardhayati). Ever more rasa by measure goes to turn in blood as the smell and color of red blood cells (Shonitamiva bhutwa) as per Chakrapani on Charak Samhita<sup>(10)</sup>. Some elemental part of it similar to red blood cells nourishes (tarpayta) the specific differentiation

## 3) KHALEKAPOT NYAYA

form; the cellular part of blood (dhaturoopam Shonitam) in seven days just like erythropoiesis <sup>(11)</sup>. Rest of the part nourishes the Maumsa, Meda based on the Kedarikulya (field and cannels) theory as in the case of Shonit formation simultaneously (Ekkaal Dhatu Poshana)<sup>(12)</sup>. The word 'Plawan' is used for stooping down towards/ kind of water/ plunging in or bathing by bulk flow. In cannels water moves quickly downwards and absorbed by the nearest (pratyasannya) root of plants in the field <sup>(13)</sup>. Likewise, in human body all dhatu are nourished by cannels by downhill theory passively <sup>(14)</sup>. The husbandry of circulation must be careful for regional flow through the various parallel circuits. The same pressure for each tissue (dhatu) but the local tissue resistance varies. Therefore, the different time duration may require to nourish them individually.

The functional physiology of this theory is described in some terms as Rasadi margachaarita (membrane physiology), Dhatupratigamana (Metabolic pool). Formation of srotasa, marga and ayanamukha (systemic circulation, capillary bed and arterioles) is described in this theory.

As per Chakrapani Sushruta says that normally three thousand and fifteen Kala (A measure of time of that era) are required to nourish each dhatu<sup>[15].</sup> It is about five days period required to change the compound of each dhatu. Total time period required about eighteen thousand and ninety Kala to form last dhatu is approximately thirty days The functions of blood vessels are described by Sushruta and Dalhana as Kedar eva Kulya (field and water cannels). ECF (Rasa) in tissue matrix (dhatu) diffuses (upsnehana) through cannels like arterioles and venules linked to blood vessels (Sira) by Metabolic transformation in fed state (samaan vaayu). The propagation (pratarpayati) and facilitated Diffusion (adhigamana) of elements through blood vessels and capillaries is done with the lateral pressure of blood (Vyana vayu vikskipta rasa) on vessels at a time (yugapat) everywhere (sarvato) continuously (ajastram, santatya)<sup>[16]</sup>.

The continuous streaming of nutrients from one end to other (Viduradhaatu poShaNa Gati) transport nutrients to deeply situated tissues by Kedarikulya Nyaya. This is described as KoShtha- Shakha-Marma-Asthi- Sandhi (organs-walls-vital places-bones-joints) Gati. Another type of theory is shabdaarchi-jala santanvad gati (by ligand- gated ion channels) to all places in the body. Shabda gati if multiport action in any dimension / direction whereas Archi and Jala gati are uniport actions are in upward and downward direction respectively.

The direction and time of the similar molecule to transport and transform is dependent upon its velocity (muhushachri action) enforced by Vyan Vayu (type of Vata) to fill ECF. The osmotic (Sayandana / nisyandana) pressure until equilibrium (sama nayana) reaches is controlled by Saman Vayu from ECF to ICF, upward movement (udnayana) is generated by type of Vata the Udan vayu (action potential),speeding up (shegra gati) activity is controlled by Vyana Vayu, assimi lation (grahana) by Pran vayu(type of Vata), holding (dharana) by Apana Vayu (type of Vata) and chemical changes (parinati) by the power of Agni at cellular level. The role of various Agni (enzymes, co-enzymes, co-factors and hormones) is equally important in transformation of molecules into one another.

The transportation of molecules into another srotas (system) by ayanamukha and nava dwara (arterioles / vents / pores an d external orifices) is called as Gamana and Visarga (en docytosis and exocytosis). This mechanism is an irreversible change (Na punhsya gamana) to form new compound (nivrutti)<sup>[17]</sup>. In Khalekapot Nyaya the first or nearest dhatu is nourished quickly and the far or later one gets late nourishment. To overcome this situation the impression of late evolutionary stages shows the upgraded channels of metabolism by active transport. Generation of action potential and selective absorption in membranous transportation of nutrients is described by this theory of Khale (pots or compartments as observed in bone remodeling) and Kapot (birds) as they collect grains from the pots situated near or at a far distance. Sookshma mukha srotasa (channels of tiny openings) and deergha (long) srotasa (systemic paths) are defined in this theory.

While circulating ahararasa, rasadahtu and Rakta all over the body (sarvadehachari) a chronology is usefully maintained as rasadraktam (Rasa to Rakta) and so on that means dhatu poshana (growth and development) is done one after the other as described in Kshirdadhi Nyaya and Kedarikulya Nyaya. But where the nutrients cannot reach there this third Nyaya applies.

During absorption, diffusion and assimilation of the nutrients following the circulating (rasanusari) blood is divided into Sthaye (stable form), asthaye (unstable form) and mala bhaga (By- products and waste material) of each dhatu. Similar elements (Dhatu poshaka saman bhag) of formed elements (sthaye dhatu) are bind to the similar elements of the same dhatu by protein binding capacity (samam sambandha anubhavati) (12) in srotasa chronologically or directly in need (sadyah tarpana). These srotasa may be long channels (deergha) or tiny pores (sukshma mukha) and samvruttaasavmrutta (open wide and close or tight). The metabolism to the later dhatu (Vidoordhatu) is due to action potential generated from the dhatu elements (poshakaunsha/ poshka bhaga - ions) available through pores opened (samvrutta) in different channels (srotasa/ marga) of different directions (bhinna dig gaminam) within specific duration. Nearest dhatu(pratyasanna) is nourished quickly and the far (viprakrushta) situated is fed later on (Chirena) in different cycles (sweyasweya margena gacchati). Arundutta said that all dhatu are nourished at a time (Ek-kaal dhatu poshana) as rasarakta spreads (dhatu yugapat pravesh sarvatram) at a time in all channels. These theories are also called as 'Tridha dhatu poshan krama'.

The kshaya (decrease) and Vruddhi (increase) in drvya (quantity), guna (quality) and karma (function) of any dhatu is affected due to disturbance in metabolic pathway. If initial (Poorva) dhatu is increased next (uttar) analogous dhatu is also increased and so the next (paramparaya vardhytavya). If initial dhatu decreases the next analogous is decreases in every channel. Less amount of nutrients from diet or less down flow of blood and plawana in ECF is the cause (Rasa nimitta) to reach in less amount to the systemic binding area (prati srotas to bandha sthala) sooner or later; described by Dalhana. If anyhow the channels are closed (vibaddha marga); the uttar dhatu (next dhatu) cannot be formed as in the case of Rajyakshma (tuberculosis or Aids like diseased conditions).

Dhaatvohi dhaatvaahaara (Metabolic transformation of reserve nutrients in fasting state) Dosha Dhatvagni Samata (state of equilibrium/ homeostasis) <sup>[18]</sup>. Dhaaturupa grahaNa (absorption in specific form of nutrient- specific protein bound complex), Avayava janakatwam (organ formation), Sadytarpana (immediate nourishment) of VruShya dravya (Aphrodisiacs), Indriya dravya poshana (supplementation of biosensors) is possible according to this theory by Direct or Indirect transport.

Dhatupradoshaja (spoiled dhatu) vikaara (diseases) is due to

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Aadibalapravritta, shukrashonita sankramanam (Most meta bolic disorders are autosomal recessive in transmission). Most disorders are evident at or soon after birth like Sickle cell anemia and multiple skeletal deformities.

Formation of sickled red blood cells <sup>[19]</sup> may be due to due to derangement in physiological growth and development as per Kshirdadhi Nyaya by birth and continue in fetal life and adult life. Further clogging of blood cells may be due to disturbance in circulation physiology as per Kedarikulya Nyaya.

Because of inherited reasons (prakrutastu swaroopas hchalanti) Dhatu poshana gets deranged on their own (swa skhalita bala pramaana) quickly by birth or due to external factors as in Prameha (Diabetes); santarpan janya (over fed) or aptarpan (less fed) janya (Metabolic disorders affect amino acids and proteins, carbohydrates and lipid metabolism).

Early detection and treatment are essential to prevent irreversible cognitive impairment and early death.

Some Dhatu pradoshaja vikara (disorders due to true deteri oration of dhatu / spoiling dhatu in reality due to influx of bad karmas -lifestyle) are as fallows.

The dhatu are damaged slowly by repeated diseases, foul treatment of transient disorders, auto immune disturbances and environmental changes. Over the period; the younger or older people fall seriously ill or may die within few days, months or year. In elderly above the age of 40-60 metabolic disorders get established. Example of spreading Sarpa visha (snake poisoning) in dhatu is given in the text <sup>[20]</sup>.

Rasanimittaja sthaulya (Obesity) Karshya (thinness), Raktapitta (hemophilic disorders), Pandu (anemia) due to Rakta, manifestation of Mansa kshaya, Mansavrudhi and Mansavaha strotas dushti (vitiation) in Fibromyalgia, mus cular dystrophy, myasthenia grevis, gangrene, myoma, myom alacia, myopathies. Medodushti like granthi (glandular growth), vruddhi (hernia), galaganda (Goiter), arbuda (Tum or), madhumeha (Diabetes mullitus), atisthoulya (Obesity), atisweda pravrutti (profuse sweating). Asthi saus hiry a(Osteoporosis) is a degenerative physiology of bone due to vata prokopa as in a senile osteoporosis. Osteogenic, paget's disease (excessive bone remodeling may result in soft bone formation), Sandhivaata (osteoarthritis, osteopenia) are the common disorders of bone calcium metabolism. Disorders related to kesha (hair), nakha (nail), roma (bread) are described in asthi prsdoshaja roga (bone deformity). This is a special area for research in ayurveda. Disturbance in growth and development of majjadhatu may lead to parvasandhi shool (Gout). Bhrama (Vertigo), moorchha (Faint), tamodarshana (Coma), arushaa (Big boils), sthoola parva mula (Bunion toe), daurbalya (weakness), laghuta (lightness in body),sarvanga netra gauravam (heaviness in body).Degeneration, vertigo, transient ischemic attack, lethargy, neuralgia, swelling following viral infection in syndrome like Reye syndrome and mental retardation etc. are the diseased conditions. Disorders of reproductive substance the sperm and seminal fluid in males lead to Shukra dosha like painful infections, impotence, week libido, premature ejaculation, infertility with degenerative changes in mal nourished. Inadequate sperm production Spermo-lithiasis, testicular cancer, leucorrhea, infertility, miscarriage in females (Artava dosha). Some of the reproductive abnormalities are delayed puberty, Abnormalities of sex determination, Abortions sterility etc. Likewise, in un ovulatory cycles and menstrual disorders can be included in shukravaha srotodushti (reproductive system). These problems are given much more importance in Ayurveda and various chikitsopakrama (therapies) are described in details.

If the clinical disturbance in Dhatu Gati, Dhatu Poshana and manifestations of each saptadhatvagni (seven types of locally acting transforming factors of seven tissues specifically) can be studied well with evidence-based researches in collaboration with modern medicine, it will certainly bridge the gap between two the knowledge of Metabolic disorders. Aim is to maintain Sharir dhatu samya (Homeostasis) with Prashasta (exellent) dhatu for preciousness of health and happiness in life.<sup>[21]</sup>

Oja is sarabhoot aumsha (essence) of shukra <sup>[22]</sup> and all dhatus, different than agni as immunoglobulin. Oja kshaya (decreased immunity), Ojovyapada (complications in diseased conditions due to vitiation of Oja) and Oja visraumsa (dislocation of Oja) are the situations in hampered immunity in Metabolic derangements and infections.

Following Scientific technical terms of Dhaatu Gati /poShaNa (Transport / Transformation of nutrients) are generated from above reviwe and discussions.

- 1) Saara bhaaga vivechana and shoShana (Assimilation and Absorption of nutrients)
- 2) Dhaatusneha parampara (Genetic transcription and translation as in embryonic growth)
- 3) Vikshepana (Pumping out / Stimulation and cessation)
- Avgaha (bathing), Plaawana (stooping down for diffusion), Tarpana (simple diffusion), Grahana (drink ing), Munchana (Propagation)
- 5) Rasadi margachaarita (membrane physiology), Dhatupratigamana (Metabolic pool).
- 6) Rasa adhigamana (filtration and facilitated diffusion)
- 7) Ayana gamana (Permeability)
- Aapyaana (Change in molecule glycolysis, proteogenic activity)
- Ayana mukha unnmitam / udvahana (micropinocytosis / opening of pores / upward movement)
- 10) Dhaatu Poshana (Unchanged molecule transport)
- 11) Yaapana (Maintenance of tissue)
- 12) Murcchana (Change in molecular state)

# YANTRA/ SROTAS/AVAYAVA RELATED TO DHATUP OSHANA (MEDIUM OF TRANSPORT)

- Annavaha (GIT), Grahani and Pakwashaya (Small and large intestine), ShoShyamaan Aahaara Rasa (state of absorption of Chyme)
- 2) Garbhanaadi (fetal circulation),
- Hridaya (Heart), Dhaatuvaha srotasa (circulatory system), Rasa- Rakta vaha, Doshavaha Naadi(blood vessels), Dhamani and Sira (blood vessels).
- 4) Srotasanugamita (systemic absorption)
- Sukshma srotocharan through Ayana and Ayana mukha, Chhidra (cellular transport from ECF to ICF, various metabolic cycles)
- 6) Poshya Rasa dhatu (ECF/ICF)
- Poshaka Rasa through Sira mukha (plasma through arterioles)
- 8) Anu srotomukha (cellular membrane pores)
- 9) Dhaatu through dhaatuvaha sira of respective srotasa (Dhatu in systemic circulation)

# SAMPRAPTI OF DHATU GATI (MECHANISM OF TRAN SPORT)

- 1) Dhamani Prapadya (by Hepatic portal system)
- 2) Kshirdadhi nyaya (complete transformation)
- Kedarikulya nyaya (Downhill passive transport), yugapat (bulk flow)
- 4) Upasnehana (diffusion) through Pratyaasanna srotasa (systems near to nutrients)
- 5) Kedarikulya (passive transport)
- 6) Viduradhaatu poshana by kedarikulya to KoShtha-

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shakha-marma-asthi- sandhi (Metabolic transformation to deeply situated tissues in fed state by ligand- gated ion channels)

- 7) Durghata srotopurana by Khalekapota (Supply to very difficult places by Active transport)
- 8) SrotopreeNana (supply by part assimilation)

# KRIYANAM ANULOMYAM (PHYSIOLOGY RELATED TO DHATU POSHAN)

- Tejabhoota (ionic form), parama sukshma (minute), dwividh veerya (duel potent), ashtavidh veerya(octo potent) vaa (or) aneka guna (of multiple properties) upayukta (having) Saara grahaNa (essential nutrients of diet) does Rasa poShaNa (gives Plasma substrates)
- 2) Rasaadraktam-----Shukra (Embryonic tissue formation complete transformation by stem cells)
- 3) Rasaadi dhaatu poShaNa (tissue maintenance)
- 4) Uttarottar dhaatu poShaNa (anabolism)
- 5) Tridha pariNamana (metabolic products of three types)
- 6) Shabda-archi- jala santaanvad aNunaa (gaited / non gaited channels)
- 7) Sayandana / nisyandana (Osmosis)
- Visarga/vikshepa- (circulation, exocytosis and endo cytosis)
- 9) Dhaatvohi dhaatvaahaara (Metabolic transformation of reserve nutrients)
- 10) Dosha Dhatvagni Samata (Homeostasis)

## Applied Physiology Table 1.1

- Dhaaturupa grahaNa, Avayava janakatwam (organi fication),
- 12) Sadytarpana, of VruShya dravya, Indriya dravya etc. (Direct or Indirect transport)

### PLEASE SEE APPLIED PHYSIOLOGY TABLE 1.1 VYADHI AWASTHA DUE TO DOSHA-DHATU-AGNI SAMATA VIKRITI AFFECTING DHATU POSHANA

- Dushta Rasa poShaNa (Abnormal profile of Plasma substrates)
- 2) ShoSha (Malformation, growth retardation)
- 3) Vaatarakta(Gout)
- 4) Raktapitta (Hemophilic disorders)
- 5) Rasa nimmitta sthaulya / kaarShya (disturbed fat metabolism)
- 6) Rajayaskmaa (Tuberculosis like disorder)
- SrotoduShti- vimargagamana (changed membrane potentials)
- 1) Ati pravritti, (accumulation debility) Sira sanga (block)
- 2) Granthi (glandular growth in channels)
- 3) Dhamani pratichaya (Atherosclerosis)
- 4) Dhamaniupalepa (Arterio sclerosis)
- 5) Dhamanikathinya (Hardening of vessels)
- 6) Shukrashmari (prostate),
- 7) Baadhirya (deafness),
- 8) Ojakshaya (general debility)

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Functional terms of Dhaatu poShaNa tantra (Transport of nutrients)	Yantra/ Srotas/Avayava/ (Medium of transport)	Samprapti of Dhatu Gati (Mechanism of transport)	KriyaNam anuloyam (Physiology	Dosha-Dhatu-Agni samata vikriti (Applied Physiology
Saara bhaaga vivechana and shoShaNa (Assimilatiom & Absorption)	Annavaha (GIT), Grahani and Pakwashaya (Small and large intestine), ShoShyamaan Aahaara Rasa	Dhamani Prapadya by Samaan vaayu (by Hepatic portal system) into tissue matrix.	Tejabhoota, parama sukshma, dwividh veerya, ashtavidh veerya vaa aneka guNa upayukta Saara bhhaga avagah and grahaNa (essential nutrients), Rasa poShaNa (Plasma substrates)	Dushta Rasa poShaNa leading to samata, kshya or vruddhi (Abnormal profile of Plasma substrates)
Dhaatusneha parampara (Inheritance)	Garbha (Embryo),Stem cells	Kshirdadhi nyaya (complete transformation)	Rasaadraktam Shukra. (transcription and translation)	ShoSha (Malformation, growth retardation)
VikshepaNa (Pumping out),	Hridaya, Dhaatuvaha srotasa, Rasa- Rakta (Heart, blood)	Kedarikulya nyaya (Downhill passive transport), yugapat (bulk flow) by vyaan vaayu	Rasaadi dhaatu poShaNa (tissue formation)	Rasa nimmitta sthaulya / kaarShya (disturbed fat metabolism)
Plaawana, Aplawana, PuraNa,Grahana, Munchana (supply and availability of nutrients)	Respective srotasa (systemic absorption)	upasnehana through Pratyaasanna srotasa (system near to nutrients)	Uttarottar dhaatu poShaNa (anabolism)	Rajayaskmaa
Rasamargachaarita / Dhatupratigamana (membrane physiology)	Sukshma srotasa (cellular transport, various metabolic cycles)	KoShtha- shakha- marma-asthi- sandhi by samaan vaayu (Metabolic transformation in fed state)	Tridhaa pariNamana	SrotoduShti- vimargagamana (changed membrane potentials)
Rasa adhigamana (facilitated diffusion)	Rasa (ECF)	SrotopreeNana (capillary circulation, assimilation)	Shabda-archi- jala santaanvad aNunaa (gaited / non gaited channels-)	Ati pravritti, (accumulation)
Ayana gamana (Permeable)	Rasa through sira mukha (arterioles)	Kedarikulya (passive transport)	Sayandana / nisyandana (Osmosis)	Sira sanga (block)

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Ayana mukha unnmitam	Anu srotomukh	Viduradhaatu	Dhaatvohi	Granthi (glandular
(opening of pores) /	(cellular membrane	poShaNa by	dhaatvaahaara	growth in channels)
Aapyaayna (transport of ATP	pores)	kedarikulya	(Metabolic	
for tissue specific)		(ligand- gated ion	transformation of	
Kriyanam		channels)	reserve nutrients in	
anulomya(Glycolysis)			fasting state)	
			Dosha Dhatvagni	
			Samata, Dhamani	
			praticchaya.	
Dhaatu PoShaNa (Unchanged	Dhaatu through	Durghata srotopuraNa	Dhaaturupa	Shukrashmari,
molecule transport)	dhaatuvaha sira of	by Khalekapota (Active	grahaNa,	deafness, Ojakshaya
_	respective srotasa	transport)	sadytarpana, of	(decreased immunity)
	(ICF)		vruShya dravya,	
			Indriya dravya etc.	
			(Direct or Indirect	
			transport)	

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