

Module III (CSE AxB)

Ayurveda

The traditional system of Indian medicine

I. History :

Ayurveda owes its name to two Sanskrit words:

Ayu-meaning life

Veda- meaning knowledge

Ayurveda originated around 5000 bce(before common era) .It then existed in oral traditions.

It continued through Indus Valley Civilizations, Vedic period, Jain and the Buddha period.

Ayurveda derived its notion from Rg Veda but practice from Atharva Veda

Ayurveda is called Upaveda or auxiliary knowledge.

Ayurveda is also called the Pancam-Veda or the fifth Veda.

II. Difference between Atharva Veda (which contains 114 hymns on magical cure of diseases) and Ayurveda:

1. As regards cause of disease:

Atharva Veda stresses on wrath of God and influence of malefic agents.

Ayurveda emphasise on imbalance of bodily elements.

2. As regards treatment:

Atharva Veda suggests appeasement of God and other agents

Ayurveda

Ayurveda stresses on application of drug.

III. Philosophy of Ayurveda

It is based on Samkhya and Vedanta philosophy of the Vedic Hindus. It accepts

- That man is a part of the cosmic existence. Each individual soul is composed of mind, sense organs and material body.

- That all material body are evolved from interaction of PURUSHA (static but conscious) and PRAKRITI(dynamic but material).
- PRAKRITI is the substratum of three elementary components gunas of creation, viz
- Sattva(intelligence),
- Rajas(energy) and
- Tamas(matter).
- Sattva is white and is like nectar and gives joy; rajas is red and is like intoxication and gives pain, tamas is dark and is like poison and produces unconsciousness.

Ayurveda says this material body is composed of gross elements in the form of *kala*(protective layer), *dhatu*(component matter), *mala*(eliminations),three *dosas* , *agni* (digestive fire) and *Kriya*.

- Diseases are a condition of body and mind which results due to imbalance of dosas /three fundamental elements which are generated in our body as waste products.
 - Pitta(bile)
 - Kapha(phlegm).
 - Vayu/Vata(wind)
- These are the three basic elements activating, sustaining, nourishing and maintaining the life principle.
- These three dosas corresponds to
- Vayu(gaseous substance),
- Tejas(fiery substance) and
- Ap(liquid substance)
- of Panca-bhutas ,of which each and everything in this universe is made of:
 - khitis (earth)
 - ap (water)
 - tejas (fire)
 - vayu (air) and

- akash (ether)

IV. Legends about transmission of medical knowledge

Gods>>>Sages>>>two mythological personages:

1. Punarvasu Atreya: led to medicine school of Ayurveda.
2. Dhanvantari : led to surgery school of Ayurveda

V. Categories of Ayurveda

Ayurveda divides medical science into eight categories:

Kayacikitsa-treatment of diseases affecting the whole body

Kaumarabhrtya-treatment of children and females.

Salya-tantra- surgical techniques and extraction of foreign bodies.

Salakya-tantra-treatment of ailments affecting ears, nose, eyes, mouth etc(ENT)

Bhutavidya-treatment of mental disorder ,pacification of possessing spirits

Agada-tantra- treatment of bites of poisonous snakes etc and also herbal and other poison cases(TOXICOLOGY)

Rasayana-tantra- Rejuvenation, increase in life span, vigour, intellect, prevention of diseases.

Vajikarana-means of increasing virile powers.

VI. Principal Texts on Ayurveda

(A) Susruta-Samhita(6th century bce)

- One of the greatest treatise on Indian surgery, written by Susruta,
- Belongs to Divodasa-Dhanvantari school.
- Redaction on this was done by Buddhist scholar Nagarjuna(2nd century ce).
- A 12th century commentary on Susruta -Samhita is Nibandha -Sangraha , done by Dallanacarya.

- Susruta treatise has 5 Sthanas(books): Sutra, Nidana, Sarira, Cikitsa and Kalpa.
- The sixth sthana is a supplementary work called Uttaratantra, in which subjects like Salakya-tantra, Kaumarabhrtya and Bhutavidya are taken up.

B) Caraka-Samhita (between 2nd century bce and 2nd century ce)

Written by Caraka and redaction done by Drdhabala(9th century ce).

This belongs to Atreya school dealing mainly with therapeutics.

A 15th century commentary was done by Sivadasa.

Caraka-Samhita was translated to many regional languages and even to foreign languages.

Caraka treatise is divided into 8 sthanas(books), namely : Sutra, Nidan, Vimana, Sarir, Indriya, Cikitsa, Kalpa and Siddhi.

VII. Other Texts on Ayurveda

Other works on Atreya school were

Agnivesha tantra by Agnivesha,

Bhela Samhita, believed to be written by Atreya himself.

Both are now extant.

Ayurveda-Dipika, composed by Cakrapanidatta(11th Century).

VIII. More on the Samhitas

Each of these two Samhitas deal with Anatomy, Physiology, Toxicology, Psychic Therapy, Personal Hygiene and Medical Ethics.

In their treatise, Both Caraka and Susruta discussed the following for the treatment of a suffering patient.

- The organism(Sarira)
- Means of maintenance(Vritti) i.e proper conduct both mental and physical

- Causes of diseases
- Nature of pain and disease
- Action(*kriya*)
- Effect(*karma*) i.e restoration of patient to his normal state
- Time(*kala*), with due regards to influence of seasons in persons mind and body,
- Agent(*katri*), the physician and his associates
- Means and instruments(*karana*)
- Prescription.

IX. Ways of Inspection

To diagnose illness in a patient, Ayurveda suggests eight ways of inspection:

1. Nadi(pulses), 2. Mootra(urine), 3. Mala(stool), 4. Jhiva(tongue), 5. Shabda(sound),
6. Sparsha(touch), 7. Druk(vision), 8. aakruti(appearance)

X. Treatment

According to both **Caraka** and **Susruta**, Ayurvedic treatment depends on factors like :

Purusha (patient), Vyadhi (disease), Osadhi (medicine), Kriya (process), Kala (season and climatic factors as well as time and frequency of medicine or process applied.)

XI. Osadhi (medicines)

- A) Ayurveda classifies drugs into two types:
 - Those cure diseases
 - Those give strengths
- B) Drugs in Ayurveda come from mainly three sources :
 - Plant origin
 - Animal Products
 - Minerals

Ayurvedic medicines are generally compounded with bases like *ghrta* (clarified butter), *tai/a (oil)*, water and *milk*.

The preparation of medicines play a very important role in Ayurveda, with full reference to the tastes, potency, inherent efficiency and reactionary properties of the raw materials.

According to Caraka, a medicine has to be administered after taking into full consideration of patient's age, physical condition, digestive power, state of dosas and blood condition.

XII. Kriya

Kriya are the processes involved in treatment aim at correction and pacification of deranged *dosas*. The four processes as suggested by Caraka are;

- Ahara (proper diet): Eating food and drink agreeing with constitutional element of the patient.
- Acara (right conduct and medical regimen): observing hygienic rules like washing face and feet, bathing, nail cutting, hair trimming etc and correct code of conduct like correct posture of sitting, regulating sex life etc
- Samsodhana :done to rectify the deranged dosas. Some processes for cleaning up the accumulated dosas are use of purgatives, use of emetics, blood letting etc. Fasting and massaging are also suggested.
- Samsamana: administration of medicines to neutralise imbalance of dosas.

XIII. Surgical Processes :

Surgical processes as indicated in *Susruta-Samhita* consists of three stages:

- Purvakarma (preparatory measures), consisting of fasting or light food for the patient on day or days before the surgery, keeping surgical instruments ready, placing the patient in a suitable posture on the bed or table,etc.
- Pradhanakarma(principal measure), consisting of surgical operation, expulsion of morbid matter, application of medicinal pastes, bandaging etc.

- **Pascatkarma** (post operative measure), applying paste or medicine on the operated part, bandaging, etc. A great emphasis is given on this part as it relates to healing

There are eight principal types of surgical operations that are included in Ayurveda.

- (a) Chedana (excision)
- (b) Bhedana (incision)
- (c) Lakhana (scraping)
- (d) Esana (probing)
- (e) Veddana (puncturing)
- (f) Arahana (extraction)
- (g) Visramana (draining of fluids) and
- (h) Sivana (suturing).

24 other processes are associated with operation. These include different methods of pulling out the extraneous matter; injecting into or filling a cavity; cleaning or draining a body canal; cleansing the wound etc.

XIV. Medicinal Plants :

India, with its ecological, geographical and climatic diversities is perhaps the richest nation with herbal medicinal wealth. In India the therapeutic use of herbal plants dates back to the Vedic period. Today the entire world acknowledges the process of preparation of medicines from plant origin.

The Rig Veda has documented about 67 medicinal plants, Yajur Veda 81 species and Atharva Veda 290 species. To cite a few:

Name	Part Used	Medicinal Use
Amla	Fruit	Vitamin C, Cough, Cold, Diabetes, Laxative and Hyper-acidity

Aswagandha	Root, Leaves	Restorative tonic, Stress, Aphrodisiac
Bramhi	Whole plant	Memory enhancer, mental disorder
Chiraita	Whole plant	Skin disease, burning sensation, fever
Guggul	Gum Raisin	Arthritis, Paralysis, Laxative
Sandalwood	Oil, Heart Wood	Skin disorder, burning sensation, jaundice
Sarpagandha	Root	Hypertension, Insomnia
Tulsi	Leaves, seeds	Cough, Cold, Expectorant
Peppermint	Leaves, flower, oil	Digestive, Painkiller
Vringraj	Seed, Whole plant	Anti-inflammatory, digestive, hair tonic
Neem	Rhizome	Sedative, Analgesic, Epilepsy, Hypertension
Nagchampa	Bark, Leaf, Flower	Vomiting, Dysentery, Piles

Architecture, ship building, international trade, mining and agriculture in Ancient India

I. Introduction :

- The people of ancient India were well versed with what we today call Architecture, Engineering and Technology
- The proof of such knowledge can be seen in:

Remains of Mohenjo-daro,,Harappa

Literature sources like Kautilya's Arthashastra and many more

Religious monuments like Buddhist Stupas, Lingaraj temple

Historical monuments like Ajanta & Ellora, Taj Mahal etc

II. Indus Valley Civilization (3000-1300) bce

- This was the Bronze age. The remains of this era have been unearthed at Mohenjo-daro and Harappa-now in Pakistan, Lothal- in Gujrat, Kalibangan in Rajasthan. Highlights of the then cities were:

Wide paved roads varying from 10m to 5.5m; alignment either north to South or east to west, crossing each other at right angles.

Houses were made from well burnt bricks of different sizes. Most had more than one floor. They had mastered the technique of load distribution. A typical house included a central courtyard, 4-5 living rooms, a paved bath and due provisions for sanitary amenities - a sewer pipe protected by brick ran beneath the floor into the public drains in the street.

Use of pulley wheel for drawing water from the wells was known

Well defined system of weights and measurements were in vogue. Graduated scales made of shell, bronze and ivory have been found. Terra-cotta plumb bobs and instruments for measuring angles of 45,90 & 180 degrees have also been excavated.

- o Impressive structures of the civilization include:

Great Bath at Mohenjo-daro: The dimensions of the Great Bath is about 54mx33m, with a swimming pool measuring 12m x 7m and verandahs on all sides. On each side the pool is a raised platform and flight of steps. The pool was lined with bricks after proper damp proofing treatment.

Great Granary at Harappa: The great granary was located in the citadel area. It was 200 ft. long and 150 ft. wide. According to some historians there was no granary like this anywhere in the world before the fifth century. Attached to the granary were two roomed tenements with a common courtyard. These tenements housed the workers or the slaves who thrashed the corn to be preserved in the granary.

Marine architecture In Lothal: Defense mechanism against floods - the town was raised on mud bricks and thick mud walls reinforced with burnt bricks. Dock with a wharf 260m long and a warehouses of floor area 1,930m. The dock was built off the main stream to avoid silting and flooding. Ships would enter the dock at high tide and there was a mechanism to float the ships at low tide. The inner walls were vertical so that cargo could be loaded and unloaded directly. The warehouse was adjacent to the dock and stood on a 4m high platform. There were 64 blocks of mud-brick, each block 3.6m and 1m high, interspersed with 1m wide passages to allow ventilation and easy access to goods

III. Literary sources

- o The Vedic people were mainly pastoral. Still there were references of private houses mainly constructed of wood. The houses were spacious with arrangement for water supply. References of forts and detailed descriptions of chariots with names of its different parts were also found.
- o In the post Vedic period, references of towns and cities (janapadas) are found. Around 7th century bce, important janapadas like Ayodha, Varanasi, Ujjaini, Vaishali etc flourished.
- o Kautilya's Arthashastra (4th century bce) gives us an idea of the Indian approach to town planning. Different chapters talk construction of royal buildings and houses for different categories of citizen. Roads of different dimensions were prescribed for

different purposes. The layout and organization of forts are portrayed in a meticulous way.

- From writings of Fa Hien, we know that by the time Chandragupta II (380-413bce), city life became more and more organized. From the time of Asoka (269-232bce), use of stone became important in buildings.

IV. Religious monuments: Buddhist

- In the construction of religious edifices like stupas(to heap) and caiitya-grha(alter room), the Buddhists showed their engineering skill.
- The early stupas built by Asoka were made of bricks and mud mortar. Later stupas gained in size & grandeur. A solid hemispherical dome (anda) was placed on tiered bases and surmounted by a railed pavilion (Harmica)
- The Sanchi stupa(1st century bce) in Madhya Pradesh is of developed form and included a circular passage and a railing around it with gates(torana). Later specimen showed more ornate forms like in Nalanda and Ratnagiri.
- Another Buddhist structure is the caiitya-grha, a stupa-cum-sanctuary. Initially the stupa was the object of worship. Later, an image of Buddha was placed on it. A caiitya-grha usually had an apsidal ground plan with stupa at its apsidal end and a central nave separated from the side aisles by a row of pillars. Many examples of rock cut caiitya-grha still exists.
- At Ellora, in Maharastra, the Bishwakarma cave is a developed example of Chaitya-grha with two –tier roof .
- The Buddhist temple at Sarnath has a tower 33.4 metres high and with seven clearly marked receding floors demonstrates the engineering skills of those days. The remains of Nalanda, the ancient University town shows a 33.4metre high stupa.

V. Religious monuments : Hindu

- During the Gupta period(300-600 ce), temples were constructed on the basis of the following structural principles

A square sanctum(garbha-grha) for the image

A small pillared portico(mukhamandapa)

A covered circumambulatory passage(pradikshinapatha) around the sanctum.

The early temples had a flat roof. Spire type (Sikhara) came up later.

Early temples were built of stone. Later use of bricks came in vogue

- o Two broad temple architectural styles emerged

North Indian style called *nagara* and

South Indian style known as *vimana* or *dravida*

- o The North Indian temples showed vaulted roof sikhara, linear in elevation. The Rajarani temple & Lingaraj temples have sikhara clustered around the Janga (bottom portion of the spire). The temple components are Ardha-mandapa (entrance porch), mandapa (hall), antarala (vestibule) and the garbhagriha (sanctum).
- o Khajuraho's *nagara* (970-1030ce)style temple in Madhya pradesh has a plain Sikhara with no embellishment of miniature spires (uru-srngas).

VI. The Brahmanical temple in Ellora

- o Kailasa temple at Ellora (556-773ce),in Maharashtra show the highest artistry and craftsmanship. It was made by cutting away more than 50 million tonnes of rock from the sloping hill by means of hammer and chisel. First, a massive block of stone (60mx30mx30m) was to be isolated, it was then carved from the top downwards and hollowed out in the form of a temple with its intricate carvings.
- o Brahmanical caves at Badami, Ellora, Elephanta and Mahabalipuram have beautifully curved-out sculpture

VII. The south Indian temples (Vimana style)

- o The South Indian temples are characterised by pyramidal sikhara, large mandapas, Gopuram(gateway to the temple enclosure) and nasikas(arched opening above the superstructure wall, projecting over the façade). The shrine is either of salas type (miniature oblong shrine with barrel vault roof or karna-

kutas (miniature square shrine at the corner of the roof). A typical temple of this category is found in the Mahabalipuram(Tamil Nadu).

VIII. Taj-Mahal, the muslim architecture

Today it is one of the most famous and recognizable buildings in the world

It extends over 55.5 acres and was complete by 1648 ce.

Components of the complex:

Mausoleum: is the symmetrical white marble tomb; a cubic building with chamfered corners, with arched recesses. In plan, it has a near perfect symmetry about 4 axes

It is topped by a large dome (35m in height) and several pillared, roofed chhatris. The dome shape is emphasised by four smaller domed chhatris placed at its corners.

The lower basement chamber containing the tombs of Shah Jahan and Mumtaz,

The main chamber containing identical cenotaphs of the tombs below in a much more elaborate chamber, an ambulatory storey and a roof terrace.

At the corners of the plinth stand minarets: four large towers each more than 40 metres tall.

IX. Shipbuilding & sea voyages of Ancient India

- o Shipbuilding too has an ancient tradition. We know these from archaeological finds, indigenous literature and accounts of foreigners.
- o There are evidences that Indus Valley people carried on trade with civilisations of Egypt, Sumer, Persia, Crete and Central Asia. Ruins unearthed at Lothal (once on Arabian Sea) shows the existence of a huge dock. Also seals discovered at Harappa depict ships and anchors meant for deep water use.
- o Rig-Veda clearly indicates existence of sea vessels and merchants that journeyed across the ocean to distant countries in pursuit of wealth. A kind of vessel called **plava** is described which can withstand battering of storms. There are descriptions of archaic stabilisers and rudders of a ship.

- **Astadhyayi** makes distinctions ~~ware~~~~ware~~ between coastal island cargoes and mid-ocean Island cargoes. **Digha Nikaya** (fifth century bce) mentions use of birds by Mariners to ascertain directions.
- **Arthashastra** mentions ship building activities. The **navadhyaksa** was in charge of navigation in the ocean along with port duties. Vessels were made of timber, bamboo and inflated leather bags.
- **Stone Inscriptions** speak of Emperor Asoka sending abroad missionaries to propagate Buddhism to Sri Lanka. The Pali chronicle **Mahavamsa** narrates the conquer of Sri Lanka by **Vijaysimha** of Bengal with seven hundred men. It was later named **Simhala** after his name.
- The cave paintings of Ajanta bear evidence of shipbuilding activities between 2nd and 8th century bce.
- The **Yukti-kalpataru** attributed to king Bhoja (11th century bce), offers an elaborate and analytical study of shipbuilding. It mentions four classes of wood, but only **Ksatriya wood** which is light but hard and can be joined only with difficulty is recommended for making of ships. It warns about use of iron at the ship bottom. The text divide ships into 2 major categories: **Samanya** for inland river traffic & **Visesa** for sea vessels. These two types are again divided into several types and detailed measurement of each of them with their advantages and disadvantages are given in details in this very book.
- Also the above text suggests that a ship with four masts should be painted white, that with three red, with two yellow and ship with a single mast should be of blue colour.
- The Indian ship-builders used various metals like gold, silver, copper to decorate their vessels. Figures of many animals along with celestial figures were carved on the ship body.
- Megasthenes's account speaks of shipbuilders of the Maurya kings. The admiral of the fleet used to let out ships on hire for the transport of passengers and merchandise. Pliny observed that Maurya ships weighed 75 tons. Navigators were aware of the fact that sea between mainland India and island Sri Lanka is not of equal depth and ships were like wise constructed.

- The Greek historian Arrian mentions the construction of Dockyard and existence of a tribe called Xathroi(most probably Ksatriyas), who specialized in making oars and transport vessels. They had built Alexander's thirty-pared galleys and trading vessels to carry the Greek army down the Indus.
- The Ain-i-Akbari by Abul Fazl speaks of maintenance of a naval department by Akbar where sea going ships were constructed. Mughal emperors maintained a well functioning naval department.
- Thomas Bowrey, an English traveler to India between 1669 and 1679, has left an account of various types of ships and boats that were made in India.

X. International trade :

- Though India is guarded in the north by massive mountain ranges, yet a number of mountain passes provided natural access from India to Central Asia and to West Asia and China
- India's commercial and cultural contacts with Central Asia, West Asia and Egypt extended to prehistoric times. International maritime trade with the Roman Empire flourished
- A national highway, Uttarapatha, spanned the whole of North India from Manipur in the north-east to Purusapura (near Peshawar in Pakistan) in the north west. It passed through Maharashtra, Gauda, Pundravardhana, Vaishali, Kapilavastu, Indrapastha, Taxila and Purusapura. From Indraprastha, a branch extended towards Bolan Pass connecting Agroha, and Mulaстана (Multan); another turned south towards Arabian Sea via Mathura and Ujjaini. Taxila and Purusapura on either side of the Indus was linked with Tamralipta on Bay of Bengal and with Broach and Minnagara on Arabian Sea.
- Taxila, the capital city of Gandhara, played an important and strategic position in the inland and foreign trade. The most important western route passed through Purusapura and Kapista to Bactria. Purusapura was like gateway to India, being situated at the entrance of the all weather Khyber Pass.
- Around 2nd century BCE, Bactria developed into an international trading centre and a clearing mart for Indian goods. It was the normal converging point of several

routes like Babylon-Bactria, Susa-Heart-Bactria in the west and Tashkent-Samarkand –Bactria in the north, and a number of routes from Kashgarh on the west.

- Sea route: India had a trade relation with Sumerian cities through maritime activities along the Persian Gulf. These can be ascertained from archaeological finds at Mohenjo-daro, Harappa, and extensive literature dug up in the cities of Mesopotamia.
- The most popular items of International trade were Pepper, Ginger, Cardamom, Cinnamon, Gum-resins, Indigo, sugar, fragrant woods like ebony, teak and sandalwood, Copper, Iron and steel, precious stones like diamond, quartz, opal and crystallised silica.

XI. Mining :

- Evidence of mining in ancient India is strictly circumstantial. Hatti gold mine (c760bce) in Karnataka and the Dariba copper mine area in Rajasthan(c1260bce) have been properly dated
- Gold, silver, copper, tin and lead were known to the Indus Valley people. Ganeshwaran site in Rajasthan yielded about one thousand copper objects belonging to middle of third millennium bce. Use of iron started in the middle of 2nd millennium bce.
- Literary data supports this archaeological evidence. Arthashastra captures in detail issues like gems- testing, mining equipment, mineral handling etc. There are references to mines of diamond, gold, ruby, copper, lead and iron in Ain-I-Akbari
- Geological literature has many references to ancient mine workings encountered in course of field work. Some of these sites are:- a) Baragunda & Moasbani copper mines (Singbhum), b) Gnidundala copper mine (Guntur), c) Wynad goldfields (South India), d) Gavulabhavi lead deposit(Andhra Pradesh, e) copper workings in Kulu (Himachal Pradesh)

XII. Agriculture :

- Agriculture was the corner stone of the Indus Valley Civilisation economy. The crops cultivated were wheat, barley, peas, lentils, flax and cotton while among the fruits grown were date and melon.
- The variety of wheat unearthed at Mohenjo-daro & Harappa is still cultivated in Punjab. Charred rice grains was discovered in Lothal & Rangpur in Gujarat. This is the oldest record of use of rice in the world.
- In the Vedic period agriculture was the chief occupation of people. Rig Veda mentions:
 - ✓ Sowing of grain by means of plough (drawn by 6, 8 or 12 oxen),
 - ✓ use of manure and importance of irrigation,
 - ✓ conservation of rain water and digging wells,
 - ✓ rotation of crops in a particular land and fallowing to restore its fertility,
 - ✓ use of sickle to cut ripe grains and binding in bundles,
 - ✓ beating the harvested crop on the floor of the granary to separate the grain from the straw.
- Yajur-Veda mentions 12 grains: Vrihi (rice), yava (barley), godhuma (wheat), masura (lentil), tila (sesame) etc some among them.
- Taittiriya Samhita mentions agricultural seasons - barley to ripen in summer, rice in autumn, beans and sesame in winter. It is mentioned that in a course of year, two crops can be harvested in the same field.
- The post Vedic literature provides more detailed information on agriculture in its different aspects: land and soil, manure, tillage ,crops and seeds, irrigation, protection of crops from diseases and pests.
 - ✓ Land and soil: Panini(5th century bce) refers to cultivated land (*karsa*), wasteland(*usara*) and pasture (*gocara*). Susruta & Charaka(1st century ce) divided land into *jangala* (barren), *anupa* (moist) & *sadharana* (ordinary)

- ✓ Manure: Kautilya suggests use of bone & cow dung. Agni Purana refer to application of fish, animal excreta, bone, beef. Bharat Samhita identified usefulness of seed treatment prior to sowing
- ✓ Tillage: Arthashastra speaks of field preparation by ploughing the field 3 times in heavy rains. Mahabhsaya suggests the use of oxen for ploughing and removal of weeds, stones, thorns prior to ploughing