

Ayurvedic Inheritance of India
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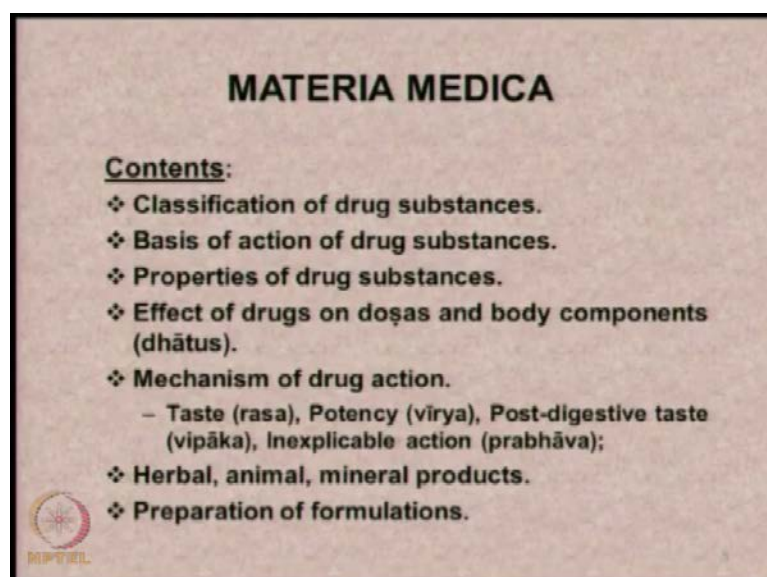
Lecture - 12
Diseases Materia Medica

In the lecture on medical treatment, many places we have referred to the use of formulations. And, the formulations really dominate the treatment in Ayurveda, are a conceptual domain of Ayurveda. There is no place, where medicinal formulations do not find a prominent mention. In fact, Ayurvedic research in India today, is largely dominated by medicinal formulations. This is not surprising, because Charaka Samhita consists of a large number of seminars being held with Atreya in the chair and certain number of disciples sitting there and discussing various themes, and several places, you would find the mention of particular formulations and somebody adding an item, obviously based on his own experience, how that particular formulation is useful in treating a particular disease.

This, you will find in many places with the result, that particular formulation is named after that individual Manibadra, or Krishnatreya; like that, you will find formulations named after these proponents during those discussions. So, obviously, the Charaka Samhita, what you read there, it is something like a national formulary, a large number of formulations suggested by various physicians from different parts, advancing this on the basis of their experience, that being added to the national formulary. That is the way it appears; and, according to expert estimates, Charaka Samhita which we have today, mentions around, more than 1900 medicinal plants, of which less than 1000 have been identified on the basis of unanimity; there is a lot of controversy about the others. But even that is a huge number, to have studied their therapeutic properties and to be made into formulations.

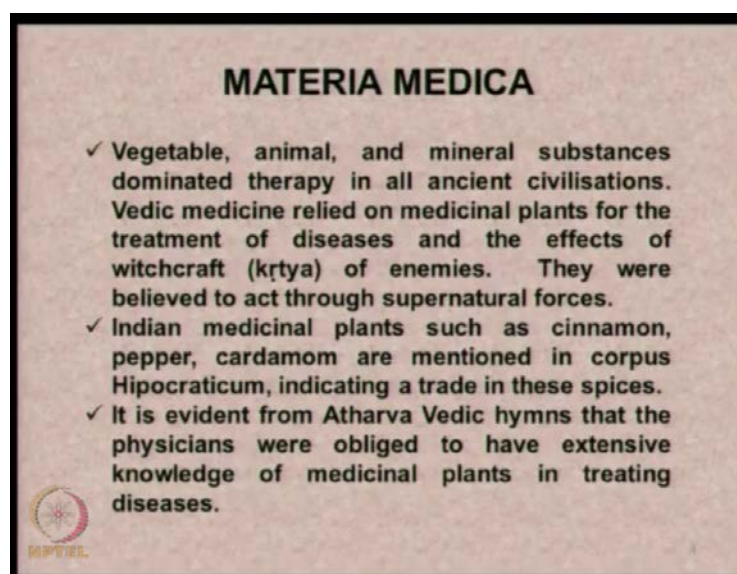
And, today in India, the Indian Ayurvedic formulary has over 1000 herbal formulations and perhaps many more are in circulations. So, you can imagine, how vast this subject of Materia Medica in Ayurveda is.

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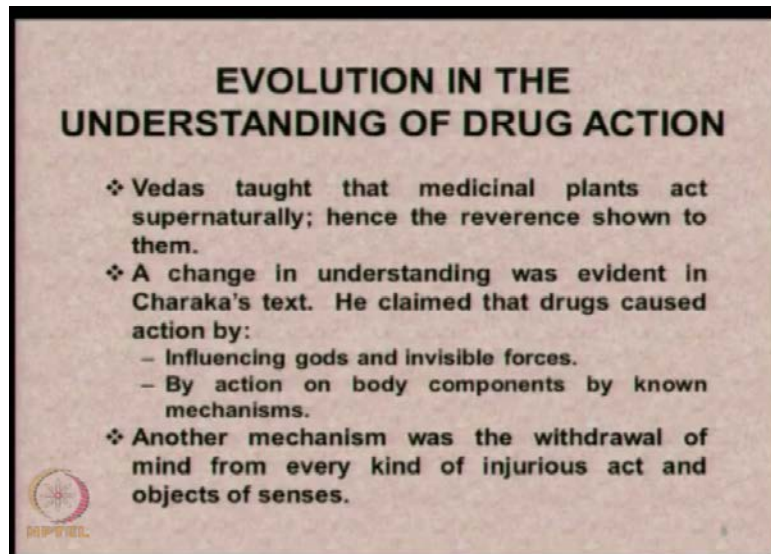
Now in this lecture, I will be covering the following topics; one is the classification of drug substances, the basis of action of drug substances, properties of this drug substances, and how these drug substances act on the dosas and components of the body, that is, dhatus, and the mechanism of drug action; how do they bring about various actions, what are the mechanisms, what are the properties which enable them to bring about these; and then, a brief reference to the different types of products which are used in formulations; one is herbal products, animal products, mineral products; and lastly, the preparation of formulations which are sold in the market. So, these are all the subjects which we will be covering in this lecture.

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And, the vegetable, animal, mineral substances, that dominated therapy in all ancient civilizations; it is not only in Indian civilization, in China, in Greece, everywhere you will find that these formulations, they were the mainstay of treatment. The Vedic medicine relied on medicinal plants for the treatment of disease; not only for diseases, but also for the ill effects produced by witchcraft, what are called krtyas. In those days, it was believed that, an enemy could bring about disease, or even death on his enemies by doing various types of witchcraft; and even in dealing with this, Atharvaveda prescribes that medicinal plants have a role in that. And, but the action of all these, in those days, was supposed to be through supernatural forces. If there was an evil effect brought about by witchcraft, obviously, it could not be treated through pharmacologic means; so, it was believed that, this was brought about by supernatural forces. And, Indian medicinal plants such as cinnamon, pepper, ginger, these are all mentioned in Corpus Hippocraticum, which is the basis of Greek medicine composed around 500 B.C. So obviously, there was some kind of a trade going on between India and Europe in those days; we do not know much about it, how this trade took place, what we got in return, those are not known. But it is known that, these plants were used in Greek medicine and also praised for their good effects. And, Atharva Vedic hymns, some of which we have seen, it is very obvious when you read them, that they had extensive knowledge of medicinal herbs; and also, the physicians, or (()) as they were called, they were required to have a detailed information on these medicinal plants.

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Now, the Vedas taught the medicinal plants act at supernaturally which we have seen many times and hence, the reverence shown to these plants. And, some of these reverences survive even in Ayurveda, much later, many centuries later, Susruta, for example; there is a detailed description of harvesting a particular plant called Mushkaka in making caustic preparations. And there, he is urging his disciples, before cutting down that plant, you have to have an invocation to express their admiration, the reverence for the divinity residing in that plant. So, this is something surviving from the Vedic times, a kind of reverence for medicinal plants, which helped us drive away diseases and give us new life. And, this changed with Charaka, and Charaka claimed that, therapeutic effect was brought about by three things.

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**EVOLUTION IN THE
UNDERSTANDING OF DRUG ACTION**

- ❖ Vedas taught that medicinal plants act supernaturally; hence the reverence shown to them.
- ❖ A change in understanding was evident in Charaka's text. He claimed that drugs caused action by:
 - Influencing gods and invisible forces. ←
 - By action on body components by known mechanisms.
- ❖ Another mechanism was the withdrawal of mind from every kind of injurious act and objects of senses.

'Daiva Vypasraya'



One is the influencing gods root invisible forces that also has a small role in Charaka. He does not totally deny that; that is one way. But most important for Charaka was, action on the body components by known mechanisms; that was what dominated Charaka Samhita, what he calls Yukthi Vypasraya. The first part includes in gods and invisible forces took a backseat, whereas, this influencing body components by known mechanisms, that became a dominant element in Charaka. But he also recognized by a third mechanism, psychologic effect; in other words, ability for withdrawing completely, your mind from the disease and symptoms and so on. In other words, almost detaching yourself from the body; like, some of the great saints are supposed to do that also, what he calls Satyavajaya; that was also a mechanism. But these are not applicable to common human beings. Most of them will be governed by the second, that is by action on body components through known mechanisms.

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**CLASSIFICATION OF
DRUG SUBSTANCES**

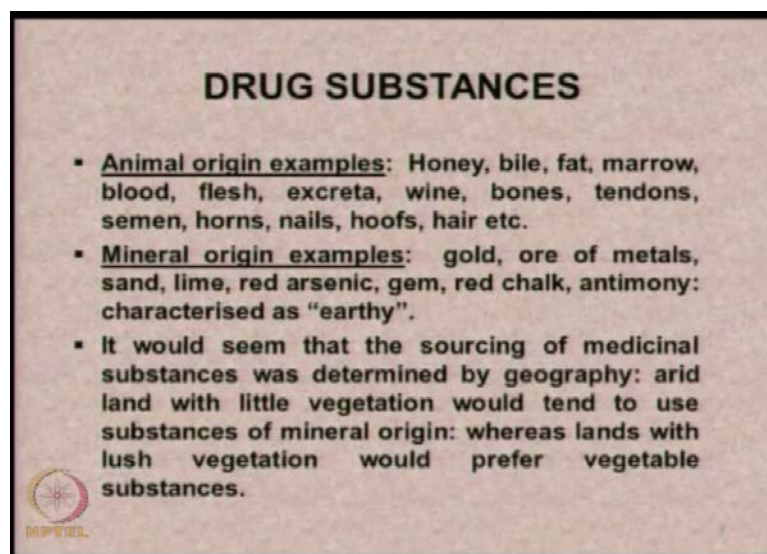
- A widely accepted classification of drug substances was based on origin.
- Vegetable origin: Four varieties;
 - trees and plants that produce fruits, but no flowers (vanaspati)
 - Those that produce both flowers and fruits (Vānaspatya)
 - Those that perish on fruiting (Oṣadhi)
 - Creepers (Virūdh)

Various parts such as root, bark, exudates, stalk, juice, fruit, leaves etc., were used.

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Now, a widely accepted classification of drug substances was based on their origin; that is, vegetable origin, which is simple to understand. And, there were types here; one was trees and plants that produce fruits, but no flowers; these are called vanaspati; that was one group. And the second, they produce both flowers and fruits; vanaspatya, that was a second group. The third group, they perished after producing fruits, osadhi's; and the last was creepers, virudh. So, there were types in the, all these were used in the, as medicinal plants; and various parts of these plants, roots, bark, exudates, stalk, juice, fruit, practically all parts of the plants were used; sometimes all the parts were used together in preparing medicinal formulations.

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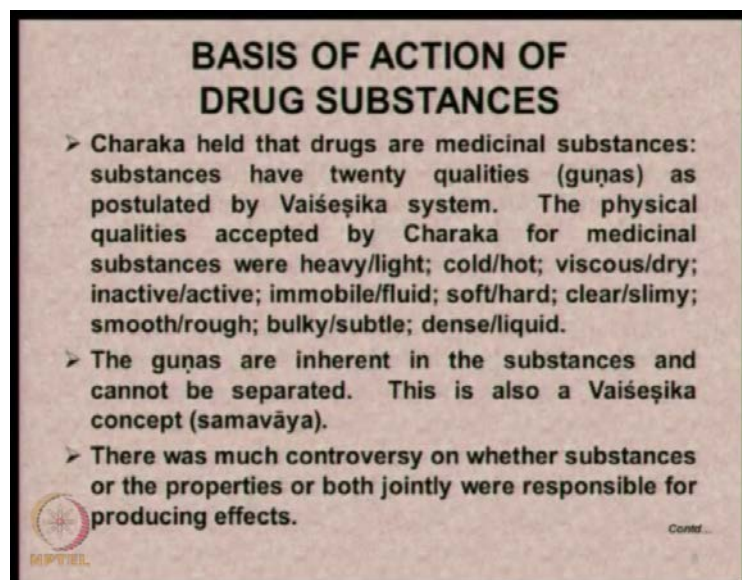
Now, drug substances continuing, animal origin; look at the wide variety; honey, bile, fat, marrow, blood, flesh, excreta, wine, bones, tendons, semen, horns, nails, hoofs, hair, all these are used in preparing medicinal plants. This is continuing to be important, because as you all know, there is a huge problem today, rhinoceros. They are endangered today; in many parts of the world they have disappeared, because of the belief that rhinoceros horn can be used as medication. The demand for it is so great in China, this, it is bought at very high prices. So, people exploit; in many countries the rhinoceros has ceased to exist and there is an international ban on rhinoceros hunting because of this.

So, there is a wide spread belief about many of these even today, that taking animal parts and for rasayanas, cure of fever, cure of various diseases. So, that faith is very strong, not only in India, but all over the world, including China, especially. And then, drugs of mineral origin, gold, ore of metals, sand, lime, red arsenic, gem, red chalk, antimony, characteristic, they are all characterized as earthy, because they are derived from earth. These are only examples; there are many, many more drugs of mineral origin.

Now, the sourcing of these, it would...So, the general observation, it would seem like Middle east, many of these Arab medicine, they have a great tendency to use earthy materials, that is mineral origin, with the list is given here. Now, this is understandable, because they do not have enough medicinal plants there; it is, land is so dry; it is desert, arid land. So, that is perhaps one reason, why move towards these mineral origin drugs. Whereas, when it comes to the Himalayan country, so abundant in flora, the Indian

Ayurvedic medicine, there is a great predominance of medicinal plants. So, that preference for these groups is largely determined by the geography, geographic conditions under which these civilizations group.

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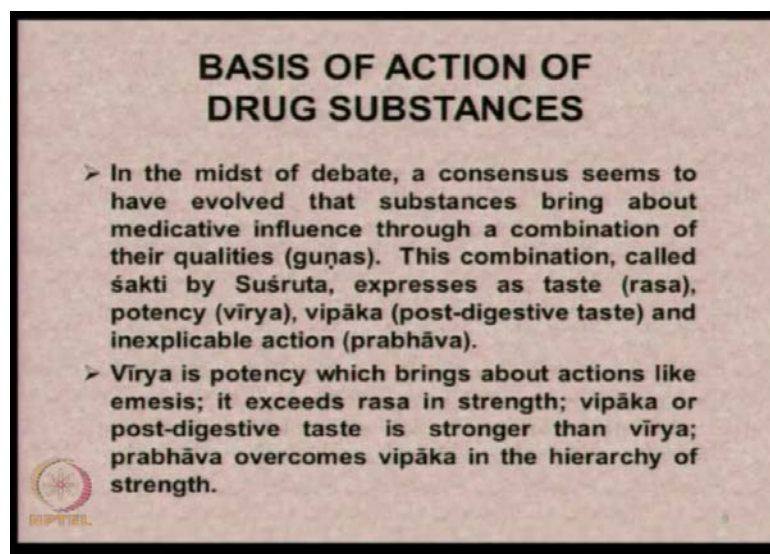
Then, we have the basis of action of these drug substances, how do they act on the body? What is the basis for this? Now, the drugs, all these drug substances which compose drugs, they have properties, a variety of properties; and Charaka claimed that, there are 20 properties which was, which are very important. And, as you know Ayurveda, according to Charaka, he has taken a lot from our Indian philosophy, and the guna's, properties of substances, that was a part of the Vaisesika system of philosophy. And the Vaisesika, it is an ancient system of philosophy, that classifies, categorizes the, all that exists in the universe, padartha's. And there, they talked about properties, 40 types of, 40 properties of substances, dhravya's; and Charaka took only 20 out of them. These are largely physical, as you see here; these are, take for example, heavy and light, cold and hot, viscous and dry, inactive and active, immobile and fluid, soft and hard, clear and slimy, slimy or turbid, smooth and rough, bulky and subtle, dense and liquid. So, these are all opposites. So, there were total of 20 qualities.

So, all substances they have, they belong to one or the other; and in practice, he does not even use the 20, he only uses around 10 out of this. So, he has greatly shortlisted, what was originally 40, many of them were philosophic. So, he eliminated all of them. He

took only 20 physical properties in dealing with these drug substances, but he uses largely 20, or 10 only. And, these gunas are inherent in substances. In other words, if you take away the guna, that substance ceases to be that substance. So, that property is also a Vaisesika concept called Samavaya. If you take a substance which is fluid, if you take away that fluidity from that, then, that substance ceases to be what it was.

So, they are integral. The importance in Ayurveda, early days, it look, looks like, there was a great deal of controversy about whether the substance, that dravya, is that produced the therapeutic effect? Or, is it the quality or the guna which is producing the therapeutic effect? Today, all these sounds strange to us, because they are not separable; but there was a great debate, even difference of opinion between Charaka and Susrutha on this, whether it is the guna which is producing effect, or whether it is the substance, which is more important. This was a matter of great debate long ago.

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BASIS OF ACTION OF DRUG SUBSTANCES

- In the midst of debate, a consensus seems to have evolved that substances bring about medicative influence through a combination of their qualities (guṇas). This combination, called śakti by Suśruta, expresses as taste (rasa), potency (vīrya), vipāka (post-digestive taste) and inexplicable action (prabhāva).
- Vīrya is potency which brings about actions like emesis; it exceeds rasa in strength; vipāka or post-digestive taste is stronger than vīrya; prabhāva overcomes vipāka in the hierarchy of strength.

But in the midst of this debate, slowly a consensus developed, and that is a combination of these qualities, gunas; that is probably what is producing these effects that we observe. And, this combination was known in Susrutha's language as sakti, or some kind of power, and that expresses itself this sakti, or the combination of gunas, that expresses itself as taste, rasa, which is recognizable, and potency, vipaka, post digestive taste and inexplicable action, prabhava. We will have lot to say about these, because these are things which really constitute Ayurvedic pharmacology. Without that, it is difficult to understand Ayurvedic pharmacology; that is, in other words, a substance that you take, a

medicinal substance or a drug, how does it produce effect in the body? Now, that whole subject of pharmacology is explained by these; we will talk about them.


So, the properties, the gunas of these medicinal substances, they collectively, they express in practical terms as these. Of course, the first of this taste, we have already discussed it earlier; that is one. And the next is virya, rasa, virya and what is virya? That is potency which brings about the action. Suppose there is a particular drug which is considered to be an emetic, and when you take that, it produces vomiting. So, that ability to produce vomiting, produce that action, may be purgative, may be something else; so, any of these, that ability to produce that particular action, therapeutic action, that is virya; that is potency. Now, if these things which are mentioned, rasa is taste; then, it is virya, the potency; then, there is vipaka; vipaka is a variant of taste; taste is what you feel in the tongue. But after it is gone into the stomach, that is digested, then, it becomes a different material altogether, with a different taste; that post digestive taste is important; that is vipaka.

And, the last is prabhava, which is a kind of action brought about by these substances, in a way which defies explanation; that also, we will come to that, that is prabhava. Now, the basis of action, this we have seen earlier, in ayurveda, there are 6 primary tastes and 63 secondary tastes; we have had a discussion on this. These tastes are important, because they reflect bhutas; all the components in the body, human body itself, medicinal substances, these are ultimately traceable to the five bhutas, or elements, which is one of the fundamental concepts in Ayurveda; we have discussed it at some length earlier. So, in these tastes, six primary tastes, these bhutas, they are reflected; not uniformly, not equally. So, some tastes, certain bhutas are dominantly shown, dominantly expressed; in others, another bhuta is expressed; maybe earth, maybe water, it maybe air and so on.

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BASIS OF ACTION

- ❖ Though the choice of drugs is made on the basis of six primary and sixty three secondary tastes which reflect their bhūta provenance, it is clear from the differing views of Charaka and Suśruta that rasa alone would be inadequate to explain the range of drug action. This led to roles being assigned to potency (vīrya), post-digestive taste (vipāka) and inexplicable action (prabhāva). Prabhāva does echo the supernatural activity of drugs envisaged in Vedic medicine.
- ❖ The choice of drugs with properties opposed to those of the perturbed doṣas is not simple like administering an alkaline substances to neutralise an acidic one. This is because diet substances undergo changes during digestion and the products of digestion would differ in taste; they too would need to be dealt with in therapeutics.



Now, Charaka and Susruta, they felt that, this taste alone, the rasa, that alone cannot explain the therapeutic action of all these substances. So, they also underlined these other, virya, potency, post digestive taste, prabhava, all these put together, only we can explain the complexity of a drug action. Because you can see even in the discussions in those days, a great deal of difference of opinion contradicting each other, because it is difficult to explain a drug which produces in action in one person; the same drug, with a same taste, failing to produce that action in someone else. These type of conflicting observations, it was difficult to explain. But slowly, a consensus developed that, this rasa, virya, vipaka and prabhava, they could explain and these are the collective expression of all the gunas which are observed in all these plant substances.

Now, the choice of drugs opposed to those of the perturbed dosas, this is not very simple as giving an alkaline substance to neutralize acid; that is very simple. If there is an acidity, hyper acidity, you give an alkaline substance and you can neutralize it. But in the case of digestion, in the case of human body, if dosas for example or substances, food substances that we eat, all these undergo constant changes in the body. Now, when these changes take place, new substances are produced. So, when a drug is taken, it has to take account of all these changes, as, in order to produce the desired effect; that makes the choice exceedingly difficult.

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PROPERTIES OF DRUG SUBSTANCES WITH REFERENCE TO THEIR DOMINANCE BY ELEMENTS (BHŪTAS)	
TABLE 1	
Bhūta dominance	Properties
Earthy	Thick, heavy, firm, rough, strong smell, generally sweet: tendency to move downwards.
Watery	Cool, moist, oily, heavy, mobile, soft, smooth, slightly astringent, acid, saline, sweet tastes: lubricates body; strengthens joints; promotes cheerfulness.
Fiery	Hot, pungent, dry, rough, light, clear; slightly acid, saltish, tendency to move upwards.

Now here, this is very important in the choice of substances for treatment; on the left hand side, we have the bhuta dominant, that is, the five basic elements earth, water, fire, three; now, these will be dominating substances and when they dominant, all substances, including drug substances. Now, if earth element is dominating, the properties are thick, heavy, firm, rough, strong, smell generally sweet and tendency to move downwards; that is an important point; you will see, why it is important. And, watery if it cool, moist, oily, heavy, mobile, soft, smooth, slightly astringent, acid, saline, sweet taste, lubricates the body, strengthens joints, promotes cheerfulness; these are the properties of water dominant elements, water dominant substances. The fire is dominating the substance, the properties would be hot, pungent, dry, rough, light, clear, slightly acid, saltish, tendency to move upwards. Now, you saw the, if it is earth dominant, it moves downwards, if it is fiery, it moves upwards. So, you can see the difference and you will see why it is important later on.

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PROPERTIES OF DRUG SUBSTANCES WITH REFERENCE TO THEIR DOMINANCE BY ELEMENTS (BHŪTAS)	
TABLE 2	
Bhūta dominance	Properties
Airy	Thin, dry, rough, cold, clear; slightly bitter and astringent; causes different sensations of touch.
Ethereal	Thin, mild; aphrodisiac; undeveloped tastes; noisy: causes porosity, lightness of the body.


The bhūta based properties help the physician in choosing appropriate drug substances for patients. The following Table 3 gives examples.

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And, if the air is dominating bhuta, or element, the properties would be thin, dry, rough, cold, clear, slightly bitter and astringent; it causes different sensations of touch. And ethereal, it will be thin, mild, aphrodisiac, undeveloped tastes; tastes are very mild in other words, noisy, causes porosity, lightness of the body. These are all the properties associated with that. Now, this bhuta based classification of substances, this is of help to the physicians in choosing the appropriate drugs.

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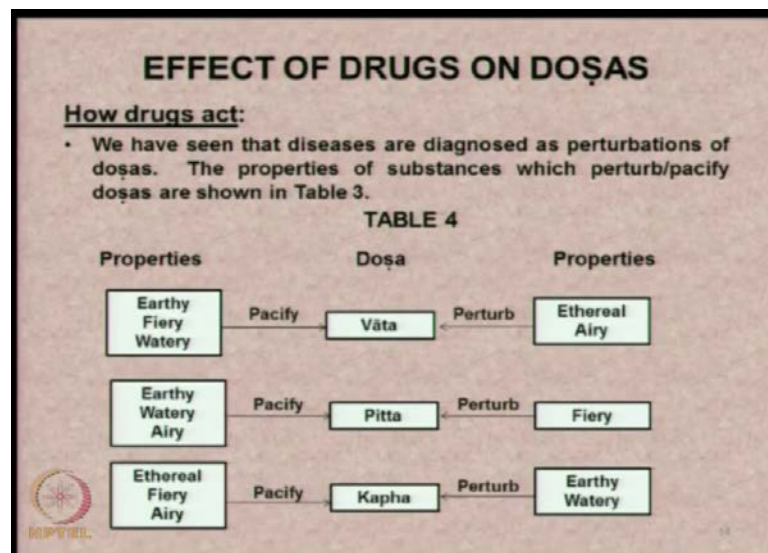
THERAPEUTIC EFFECT OF DRUG SUBSTANCES	
TABLE 3	
Drugs	Bhūta-based properties
Purgatives	Earthy, watery; moves downward.
Emetics	Fiery and airy: moves upwards
Pacifying drugs (Śamana)	Ethereal
Digestive	Fiery
Lightening	Airy and fiery
Building	Earthy and watery



And, why is it important, here, if you look at this slide, these are some examples. Purgatives, and there are hundreds of purgative substances in ayurveda. They are bhuta based; it should be earthy, watery and moves downwards. So, these are properties associated with the bhuta dominated, earth, watery dominated substances; these are used as purgatives. Emetics, fiery, airy, moves upwards; again, that is another large number of substances, which have properties of producing emesis and they have the element, the elemental of dominants is fire and air then, pacifying drugs. This morning we found that, mild illnesses can be treated by samana, by pacification.

Now there, very small numbers of drugs of mild properties are used, and these are dominated by ether. So, these are ethereal. And digestive, like an appetitiser and so on, if you want to stimulate deepana, very crucial in Ayurveda, large number of substances; again, that is dominated by fire. And lightening, airy and fiery, somebody who is obese, you want to make him light, and those kind of drugs, they are dominated by air and fire. And building, if you want to build up, brahmana, that is dominated by earth and water. So, the choice of drugs, the elemental domination is a crucial consideration and that is one choice the physicians make, important to them for drugs, different applications.

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Now, here is a table, this table and the next are kind of linked in a way, if you have, at the left hand side, you have elemental domination, say the first block, it is earthy, fiery and watery. Now, this particular group, they will pacify vata disturbance; that is the importance. So, if a physician sees somebody with a vata perturbed disorder, then the


substances he uses, medicinal substances, or drug substances, they should be earthy, fiery, watery. So, that large cluster, large number of medicinal substances, he will choose one appropriately to treat the vata perturbed disorder; whereas, he should also know that, ethereal and airy dominated substances would do exactly the opposite; they would perturb the vata dosa.

Similarly, the earth, water, air properties, they would pacify pitta, whereas, fiery would perturb pitta. And lastly, the ethereal, fiery, and airy, they would pacify kapha, whereas, earthy and watery would perturb kapha. So, the various elemental dominations is shown in the left hand side and right hand side columns. Now, their effect, opposing effect on the 3 dosas are shown in this table and this is very critical for an Ayurvedic physician who is trying to choose a particular medicinal substance for somebody (()) from vata disorder, or pitta disorder, or kapha disorder. Now, all these are difficult for us initially to understand, but for an ayurvedic physician with long experience, using this, using his mental computer everyday, many, many times after a while, it comes easy to him when he sees a particular vata disorder. He can easily discern that and he will at once know, what is the particular bhuta dominated medicinal plant, which should be appropriate for this person. That is how these choices are made.

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DRUG ACTION

- ❖ "No substance can be excluded from drugs in the universe". This was emphasised by Jivaka – Buddha's physician.
- ❖ Substances chosen well and used rationally produce effects on the basis of their properties and potency.
 - When they act refers to time (kāla); season, stage of disease, age of patient etc.
 - What they do is action (Karma); emesis, purgation etc.
 - By what they act is potency (vīrya); or power to produce action.
 - Where they act is location (adhikaraṇa); organ, dhātu etc.
 - How they act is means (upāya); neutralising the properties of perturbed doṣas.
 - What they produce is result (phala).

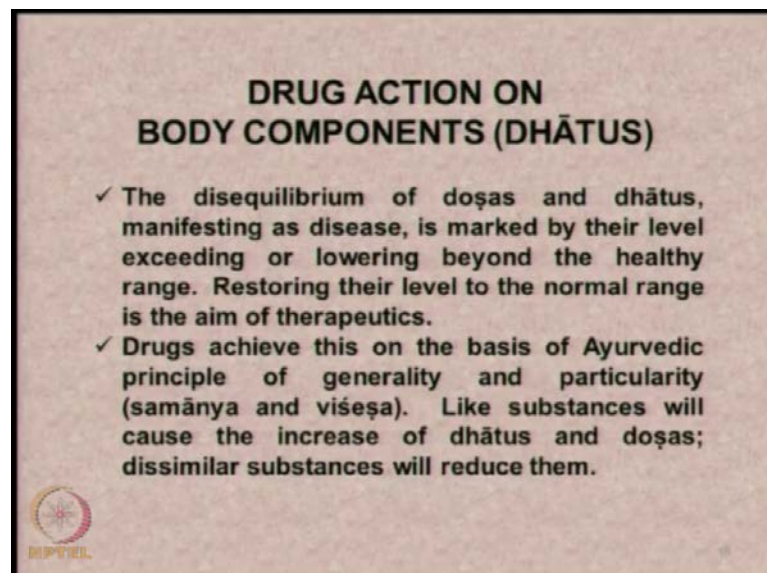


Now, the drug action, this is known from Jivaka's time, no substance can be excluded, because properly chosen, everything has some drug action. And, Susruta puts in, what is the role of time in this. He says, they act, in time, these drugs; season has a very

important role; stage of the disease has a very important role; age of the patient; all these are related to time and they do effect the action of this drug. For example, the same drug will not act the same way in different seasons; in the height of summer, the height of winter, it may produce different effects; may not have the, dosage may have to be changed; or composition of that formulation may have to be changed.

So, time is important. Similarly, the stage of the disease; what works in the early stage may not work in the late stage. And similarly, the age of the patient; a child, or an aged person. So, these are all factors related to time having an effect on drug action, what produces that action like emesis or purgation. That is the quality of a, virya, the property, or potency. And then, what is the location of action? Adhikarana; some drugs acts selectively on the gut, stomach for example; some will act on the muscles, some may act on some other organ, so that, Adhikarana the location of action that is important. And, how they act, the mechanism, that, how do they neutralize for example, a perturbed dosa, how do they neutralize that? That is upaya and what they produce finally, is the phala, the result of treatment. So, these are all different aspects of drug action which are given, described, or listed in this classification.

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Now, drug action on body components, dhatus, the disequilibrium of dosas, dhatus manifesting as disease is marked by their level of lowering or rising. Now the ayurveda, as you know, the health is defined as a state of equilibrium where dosas, dhatus, they all have to keep within a certain range. Now, as long as they retain themselves within that

range, there is equilibrium; there is good health. But as soon as it is exceeded, that goes beyond the range, it goes above the range, or below the range, that is what we call disease, dosa vaisamya, or dhatu vaisamya; that is the time for medical intervention. Now, that medical intervention is done, so, something is gone down, a level of a particular dhatu, then, you have got to intervene to supplement that, to bring it up; suppose, it has gone excess, then, you have to eliminate that excess and bring it down to within the normal range.


This is essentially the function of medical treatment and also to some extent, diet in Ayurvedic treatment of diseases, these are the two methods used, that is the drugs, drug formulations and diet; both these are used to bring dhatus and dosas within range. If it is excess, we reduce it; if it is too low, we raise it. Both these are done by manipulating diet and also giving appropriate formulations. And here, the Ayurveda basis, its method on the old principle of vaisesika, samanya and visesha. So, like substances will add; unlike substances will reduce or detract; that is the basic mechanism used; that Charaka quote also essentially says the same thing.

So, when you choose a particular medicinal formulation, you have to make sure that the properties are such, if you are trying to reduce the level of a particular dosa, the table which you saw earlier, again, it attempts to do this. So, if you want to reduce the level of a dosa which is too high, then, you would chose a substance with a property which would bring it down, which would be opposing. If you want to increase the level of a particular dhatu, you will use a particular diet, or a particular medicinal formulation with properties, which are very similar to that dhatu, so, that, you can build up. So, that is the method which is used in treatment.

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MECHANISM OF DRUG ACTION

- ✓ Once a diagnosis was made as a particular disequilibrium of doṣas in patient, treatment would nearly always involve the administration of formulations among other things. Table 3 has already indicated the effect of properties of substances on doṣas. Since substances constitute drugs, the drugs too would have effect on doṣas, which has great practical importance.
- ✓ However the choice of drugs to pacify perturbed doṣas is far more complex than prescribing an alkaline substance to neutralise acidity.
- ✓ The main difference is that the taste (rasa) of the drug and diet undergoes a change during digestion in the body; and their effect on body components is influenced by the property of potency (vīrya), post-digestive taste (vipāka) and an unknown factor superseding all (prabhāva).




Now, once a diagnosis is made as a particular disequilibrium of dosas, that is the basis of ayurvedic diagnosis. And, the treatment would always involve the use of formulations, among other things, like procedures. Now, table 3, we have already shown the effect of properties of substances on dosas; that is based on the dosa, on the basis of bhuta dominance; that we have already seen.

Now, bhutas, you cannot really, how do you detect the bhutas? You cannot see it; you cannot touch it. So, how do you know the bhutas are dominant in this particular substance. The practical method used, as we have seen earlier, is through taste. Taste gives you indirectly, the information on which bhuta is dominant; that is how, in practice, if you want to take an agneya, a fire dominant substance, it is done through the mechanism of taste, because certain taste, agni is dominant; that is easy,; it is detectable. So, that is the method which is used.

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TASTE (RASA)

- In ancient times when the chemical means for classifying drugs did not exist, its forerunner – taste (rasa) - became the basis for the choice of drugs and diet in Ayurveda.
- The Sanskrit name for chemistry in later years became “rasatantra”.
- There were 6 primary tastes and their combinations amounted to 63.
- A detailed knowledge of substances (dravyas) and tastes associated with them is a prerequisite for choosing the appropriate drugs and diet for countering the disequilibrium of doṣas.



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So, how it is done? That particular table, listing the taste relating it to bhutas. Now, here, ancient times, the chemical means for classifying drugs did not exist. So, they used the term rasa, which is a synonym for chemistry. In fact, later on, when chemistry developed, it was called rasatantra in India. So, the taste was extremely important and that became the choice, basis for choosing ayurvedic drugs; and, that indirect indications tells you that, certain tastes, they are dominated by certain elements, or bhutas. And, there were 6 primary tastes, 63 secondary tastes; a detailed knowledge of substances and tastes associated with them, is a prerequisite in choosing this, which I have...


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TASTE (RASA)

- When a particular rasa perturbs or pacifies a doṣa, it means substances/drugs possessing that taste perturb or pacify. Tastes have no independent existence – they inhere in substances and drugs.
- The effects of tastes on doṣas are shown in Table 5.

TABLE 5: Effects of Tastes on doṣas

PACIFYING TASTES		PERTURBING TASTES
SWEET SOUR SALTY	→ VĀTA ←	PUNGENT BITTER ASTRINGENT
SWEET BITTER ASTRINGENT	→ PITTA ←	PUNGENT SOUR SALTY
PUNGENT BITTER ASTRINGENT	→ KAPHA ←	SWEET SOUR SALTY



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Now, here is a table. If you compare it with the previous table, previous table very similar to this; the central part is the 3 dosas. There we looked at the bhuta dominated substances and the effect on these dosas; that is, 5 panchabhutas like fire, water, earth, those, their effect on 3 dosas was shown in that table, table 4. Now, here, in this table, looks very much the same, but the central part, you see the vata, pitta, kapha, the 3 dosas. But what you see here are the taste; sweet, sour and salty, these are easily recognizable; every day we use them, and they pacify vata. If you have vata disturbance, that is the particular disease or disorder, and if you give these pacifying taste, or pacifying taste means, substances having these tastes; if you give that, you can pacify disturbed vata, or deranged vata.


On the other hand, if you give pungent, bitter and astringent, substances having these tastes, then you would perturb vata. Now, these tastes which you see here, these are dominated by the bhutas which you have seen earlier; that is the scientific basis for it. And, it takes the practice of ayurveda back to the original panchabhuta doctrine. Now, when you look at the next, pitta, you will find sweet, bitter and astringent substances, they will pacify; if a patient comes with a particular pitta disorder, and if the physician has to choose drugs appropriate to treat, he would prefer these. He would choose substances, medicinal substances, or drugs, with these tastes. And, pungent sour and salty, they are to be avoided, because they are known to perturb pitta. And kapha, the third dosa, you will find pungent, bitter and astringent taste, substances having these tastes, they will pacify kapha; whereas, sweet, sour and salty they would derange kapha.

So, these are the absolutely necessary information for an Ayurvedic physician. He would be choosing it on this basis. And, they tell you, they indirectly, they indicate the dominance of these substances by bhutas, elements; since you cannot really, without the help of a taste, you cannot say whether a particular substance is dominated by earth, or fire, or air. So, that, this becomes the most important way for physicians to determine what substance should be chosen for treating a particular disorder. So, that is the importance of rasa or taste.

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TASTE (RASA)

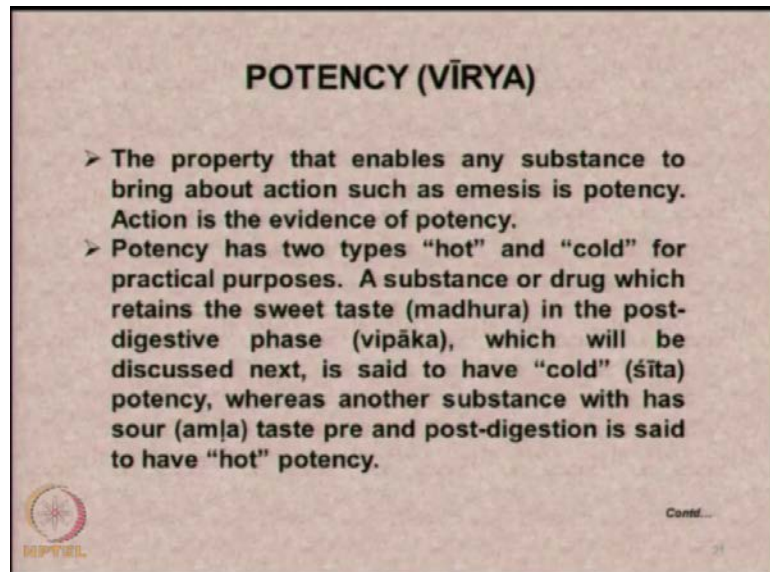
- Armed with the knowledge of tastes inhering in substances/drugs, a physician would know what to prescribe which would have properties opposed to those of the perturbed doṣas. For eg. He would know that substances/drugs which are pungent, bitter and astringent would perturb vāta whereas sweet, sour and salty would pacify it.
- This kind of knowledge matures a physician.
- The other factors influencing the therapeutic action of substances and drugs are potency (vīrya), post-digestive taste (vipāka) and prabhāva. These will be considered.

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Now, armed with this knowledge of taste inhering in these substances, a physician would know what drug to prescribe to bring up the level of certain dhatus, or dosas, or bring down the level of certain dhatus and dosas. He would know that, substances and drugs which are pungent, bitter and astringent would perturb vata, whereas, sweet, sour and salty would pacify, which we saw in the previous table. Now, this is the kind of information which matures a physician. Over the years, this becomes second nature for him and he sees a particular disorder of a dosa, or particular type of disease, he knows that is the diagnosis; and then he knows what particular combination of medicinal substances would be appropriate to deal with that; that becomes his second nature; that is how a physician matures in Ayurveda, in the management of diseases.

Now, this is, rasa alone is not enough as we saw; because once, if it is rasa is digestive, a substance is digested, it is no longer the same; it has become something else; it transforms into other things. So, it can, effects of those will have to be taken into account. So, therefore, that alone cannot explain the therapeutic action; other actions are involved and that is where this post-digestive taste and prabhava, they also become important. So, each one will have its own importance.

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POTENCY (VĪRYA)

- The property that enables any substance to bring about action such as emesis is potency. Action is the evidence of potency.
- Potency has two types "hot" and "cold" for practical purposes. A substance or drug which retains the sweet taste (madhura) in the post-digestive phase (vipāka), which will be discussed next, is said to have "cold" (śīta) potency, whereas another substance with has sour (amḷa) taste pre and post-digestion is said to have "hot" potency.

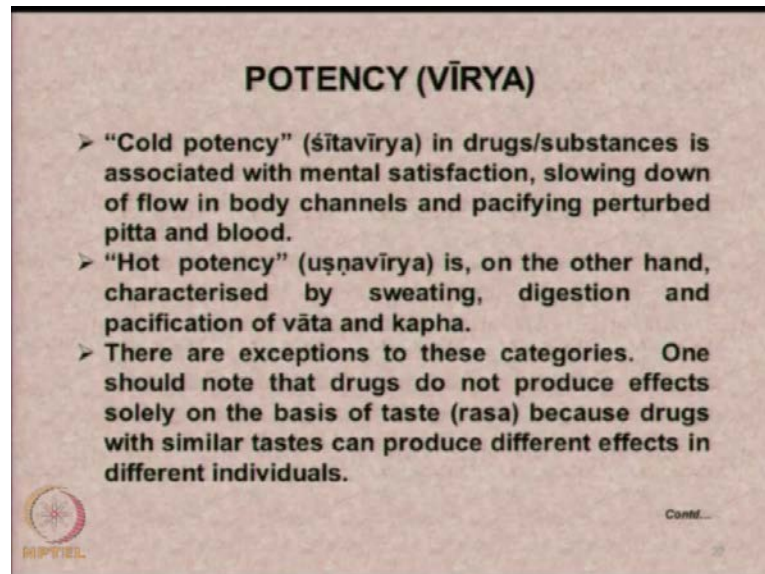
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MPTEL

Having done with rasa, now, we move to virya, or potency. A substance, when it is taken, it produces a certain action like emesis, or purgation, or anything else. Now, that particular action, bringing down fever, that is, property is virya or potency. Without potency, this potency can be destroyed. Suppose, there is a group of drugs which are known to have the potency to bring about emesis, suppose, you boil it or fry it, you may lose that property. So, therefore, that property of virya is so important in producing any kind of action. Now, there is some controversy about the potency itself, whether it is hot or cold; there are others who claim there are three types; whatever it is, this is some kind of a consensus, hot and cold virya. Now, substance which retains the sweet taste, madhura, in the post digestive phase also; that is, when you take it first, it tastes sweet; after the initial digestion, it again remains sweet; this is supposed to have cold virya.

Now, another substance, which has sour taste initially, and post digestive taste is also sour, that is supposed to have hot potency. Now, it is a bit difficult to understand this, because what, how do we know this post digestive taste; one simple way described is, when you taste something, it, let us say it tastes sweet. And, after a while, when somebody belches, what is the taste that you have? It has a totally different taste; that is a reflection of post digestive taste. Now, if that is also sweet, we can say, that is cold potency; but if the, similarly, sour taste remains unchanged, then, it becomes hot potency. But what does this mean? What is its significance?

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POTENCY (VĪRYA)

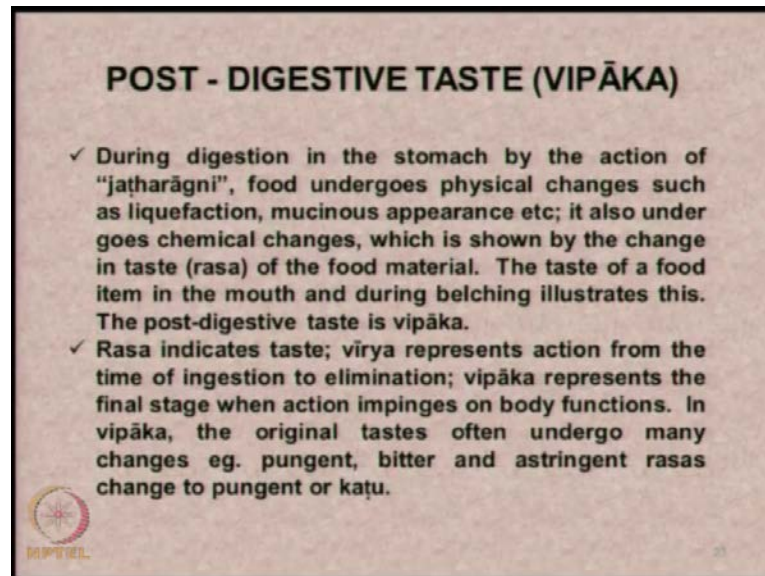
- “Cold potency” (śītavīrya) in drugs/substances is associated with mental satisfaction, slowing down of flow in body channels and pacifying perturbed pitta and blood.
- “Hot potency” (uṣṇavīrya) is, on the other hand, characterised by sweating, digestion and pacification of vāta and kapha.
- There are exceptions to these categories. One should note that drugs do not produce effects solely on the basis of taste (rasa) because drugs with similar tastes can produce different effects in different individuals.

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Now, here, cold potency in drugs, or substances, is associated with mental satisfaction, slowing down the flow in body channels and pacifying perturbed pitta and blood. So, therefore, there is some importance in the type of potency associated, whether it is cold, or hot; that is why it is considered important. This is not agreed to by everybody, but there is a consensus, or most people seem to agree that, there is a cold and hot, two different types of potency, whereas the hot potency is characterized by sweating, by digestion and pacification of vata and kapha; that is why these two potencies are separately considered and they are considered to be important.

But there are exceptions to these categories; that is where the problem comes, because one should note that, drugs do not produce effect solely on the basis of taste; because drugs with similar tastes can produce different effects in different individuals. So, therefore, this classification which we are using rasa, virya, vipaka and prabhava, it can explain a large number of therapeutic actions, but it cannot explain all therapeutic actions of substances; that is where these controversies arise.

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And then, we come to post digestive taste. During digestion in the stomach, in the, that is jatharagni is acting on these, and the food undergoes physical changes, liquefaction, it becomes mucinous and so on, they are physical changes. But there are also chemical changes taking place, in the taste of the food material. And, the taste of the food in the mouth, and during belching, which I mentioned, that illustrates that the change, there is a chemical change, which has taken place in addition to the physical changes which go through in the stomach. That, second, after the digestion, the taste that it assumes, is vipaka.

Now, rasa indicates a taste; virya represents potency, or ability to bring about action, and what does vipaka do? Vipaka represents the final stage, when all these digestions go on, eventually, the products of these digestion, they have to reach all the dhatus. Then only the action can be produced, in all the remote parts of the body. Now, that final stage of producing action on the tissues, on the dhatus, that is the role of vipaka. So, we have a role assigned, taste, initially; then, we have the potency, and then, vipaka, that is the final stage, when it brings about these, body, the effect on body functions. So, the original taste would have undergone a series of changes by the time it reaches vipaka at the dhatu level. So, we have three different phases; one is the taste initially, then the potency which is an inherent property; then the vipaka, it changes, transformations until it reaches all the dhatus and produces effects.

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INEXPLICABLE ACTION (PRABHĀVA)

- ✓ It is observed sometimes that the effect of a particular substance on a patient cannot be explained on the basis of taste, potency and post-digestive taste. The effect may even be dramatic. This is termed "prabhāva", which is a special effective action.
- ✓ Prabhāva would explain phenomena such as a substance with a characteristic taste produces a certain effect while another with a similar taste fails to produce the same effect. It would also explain how the sporting of precious stones produces beneficial effects in certain individuals.
- ✓ In a trial of strength, post-digestive taste overcomes rasa, potency subdues both, and prabhāva triumphs over all three.

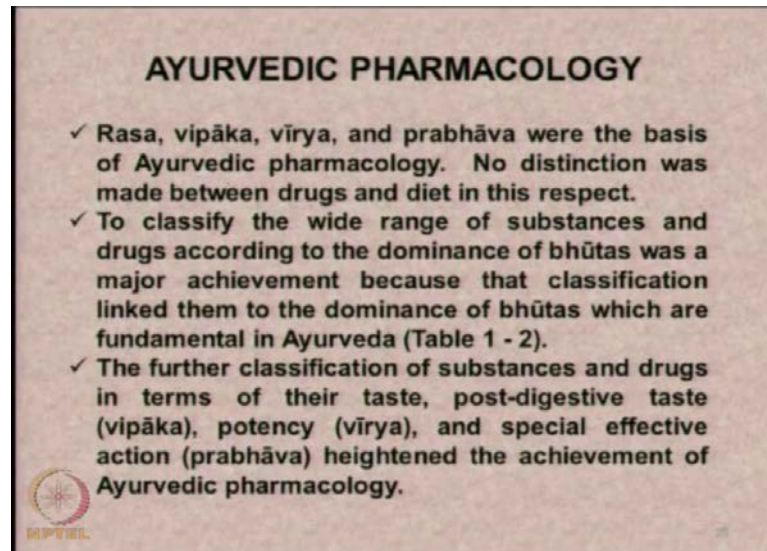


And lastly, we come to the prabhava. All these three cannot explain all the therapeutic activities of substances, and that is where this prabhava comes. And here, there example is given; taste produces a certain effect; while another substance with the same taste fails to produce that effect. Now, this is something which is not explainable on the basis of the taste, vipaka, potency; on those three, we cannot explain; we would expect something with a particular taste producing a certain action, it should produce the same activity and action in another; but that does not happen. So therefore, the one example. Another example given, it was shown, it was believed that, if you tie a precious stone on somebody, that can produce a therapeutic effect; it is not explainable on the basis of rasa, virya and vipaka; how does that effect come?

Now, these, examples like these, there are many, and they are not explicable according to our pharmacology and this was attributed to that mysterious property called prabhava. So, in the range of these, rasa, virya, vipaka and prabhava, rasa is less strong than virya; virya is more important, more powerfull. Vipaka is more powerful than rasa and virya. And, prabhava is more important, more powerful than all the three others; that is the kind of hierarchy in strength, in therapeutics. Now, this prabhava, is in a way, it is similar to the way atharvaveda believed that medicinal substances acted. It almost looks like atavistic, we are going back to the Vedas, because vedic, atharvaveda believed that medicinal substances, medicinal plants, they activated by, acted by a mysterious force.

Now, here also, prabhava, it is not explicable on the basis of our pharmacology. So therefore, it is a throwback to the old vedic concept of therapeutic action.

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Now, Ayurvedic pharmacology therefore, rasa, vipaka, virya and prabhava, constitutes the basis of Ayurvedic pharmacology. There was no distinction really made between drugs and diet, in this case. In fact, in the lecture on food and drinks, many of these, you might have heard there also; discussion on taste etcetera, because food as well as medicinal substances, they play more or less identical roles in the management of disease in Ayurveda; pathya, which deals with food, mainly food, that is just as important as giving medicinal formulations. If you are not observing the rules of pathya and simply giving medicinal formulations, it is very likely that they may not produce any good effect.

So, they are always synergistic; they act on similar principles, and they are administered together in close synergy with each other. Now, to classify the wide range of substances and drugs according to the dominance of bhutas was a major achievement. The first table that we showed, that itself must have taken close to 2000 medicinal plants, if they have to be identified on the basis of bhuta dominance; that is a huge job. And then, a further classification based on rasa, virya, vipaka. So, these are the two essential classifications, the two tables that you have seen. To do this, to these large number, hundreds of medicinal plants, that is an enormous undertaking and a great achievement of Ayurvedic pharmacology.

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CLASSIFICATION OF DRUGS

- Several classifications exist: source oriented (plant/ animal/mineral); effect oriented (śamana/śodhana); application oriented (for restoration of equilibrium in various diseases where disequilibrium has occurred); Charaka grouped herbal products into 50 “great decoctions” which sought to address almost every disease encountered in daily practice; Suśruta grouped them into thirty seven groups for the same purpose.
- Among the classifications, the obvious and frequently used relates to drugs of vegetable, animal and mineral origin.




Now, classification of drugs, the source oriented plant which I showed in the beginning, plant, animal or mineral, or it can be on the basis of samana and sodhana, that is another classification. Then, Charaka grouped all the medicinal plants into 50 different decoctions; there is a classification strictly for the practicing physician. Susruta made a classification on similar grounds, 37 groups for the practicing physician. Now, all these classifications are, they are used in particular context, but the most frequently used are what we started with, vegetable, or animal, or mineral derived medicinal substances.

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HERBAL FORMULATIONS

- To be included in the Ayurvedic formulary, a medicinal plant had to be identified from nature's stupendous garden; activity had to be located in some or all its parts; a process had to be developed for enhancing the therapeutic effect and neutralising any toxicity; a method of storage had to be found.
- The drug had to be converted to forms such as pills, paste, decoction etc., to suit different patients.
- The schedule of administration had to be decided taking into account the influence of locale, time of the day etc.
- The effort involved in developing many hundreds of formulations through such an extensive protocol took centuries.



Now, if you look at the herbal, the first group to be included in the Ayurvedic formulary; just look at this; the medicinal plant had to be identified. There are probably, one estimate I have seen, less than 10 percent of all the medicinal, all the plants that exist, is even known and catalogued; all the rest are not even catalogued. So, in the enormous collection of nature, we have only scratched the surface, a small number. Out of these, to collect those which have potentially medicinal effect, then, you have to test for activity in some part of this plant. And then, you have to have a process developed, how to make it in the medicinal formulation. And, you have to find out what activity it has; if it has some toxic affect, how to neutralize that toxicity. And, a method has to be found to store it for some period of time. So, you can imagine the kind of enormous effort involved in this exercise.

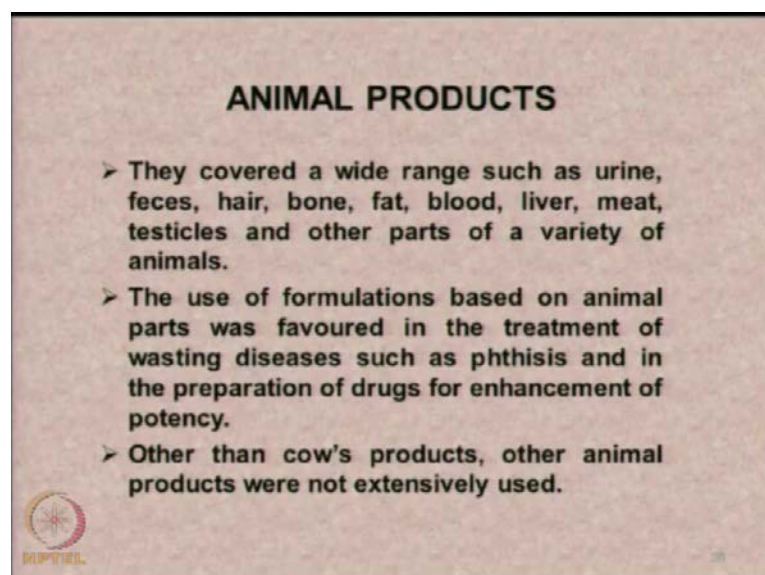
And, the difficulty becomes obvious, when you realize, that after the Charaka, Susruta, Vagbhata that time, how many new drugs have been added? How many new medicinal plants have been added? Now, there has been very, very few. So, that shows, it is not easy to identify totally new plants, or for therapeutic activity, and make them into formulations which find wide spread acceptance. It has happened, if you look at Charaka Samhita, the number of formulations and the medicinal plants which are used, and some 600 years later, or 500 years later, what Vagbata used, there are differences, because many which Charaka used, are not very popular in Vagbata's time. But some new drugs have appeared, mainly on geographical reasons, because Charaka was practicing in Kashmir, Punjab area, whereas Vagbata was from Sindh.

So, geographically the plants available in Sindh would be different; so new drugs would come; but those are understandable. But after their time, there are plenty of plants available; nobody has really prospected and found certain plants which could be added to extend the armamentarium; that has not happened, because of this great difficulty in doing this. Identifying these plants, finding suitable therapeutic activity, how to remove the toxic effects, how to make it into a formulation which should be acceptable; so, that is a very big effect in the development of Ayurvedic herbal formulations. Now, these drugs, once they are made into formulations, they have to be in form of pills, or paste, or decoctions, to suit different individuals. So, many patients maybe (()), they may have some other problems. So, you have to prepare it in a form which should be acceptable to

different types of patients. Now the, again, the mode of administration is important, the locale, the time of the day, the season.

So, when you prescribe a particular drug, you have to tell the patient, how much to take, or what time you should take, what drink you should take after this; all these details have to be developed, before it is used in practice. So, the protocol therefore, is very extensive in developing herbal formulations; that is one of the admirable achievements of Ayurveda.

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And animal products, again they cover a very wide range, like urine, faeces, hair, bone, fat, blood, liver, meat, testicles, all these are used, of different animals and the use of formulations based on animal parts was favored in two types of illnesses. One is the wasting diseases like tuberculosis, and second in enhancement of sexual potency. These are the two areas, where you will find wide use of animal products; otherwise, they are not widely used. Other than cow's products however, other animal products are not used extensively; that is something which we should note.

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MINERAL PRODUCTS

- Gold, ordure of metals, sand, lime, red arsenic, gems, salt, red chalk and other items do find mention in the three classical texts.
- But the number of references ranks far below that of herbal products.
- The Siddha system in Tamil Nadu had widely used metal/mineral products in therapeutics for centuries; the practice continues to remain popular.
- Metal based drugs in India gained importance and popularity with the advent of Arab medicine which interacted with Ayurveda.




Mineral products, gold, ore of metals, sand, lime, red arsenic, we have gone through that earlier. Now, Siddha system in Tamilnadu widely uses these mineral substances; they continue to do that, and the practice continues to be very popular in Tamilnadu. We will have occasion later on to deal with this, because there is a great deal of controversy as you know, in modern medicine, modern pharmacology, metal based drugs are practically forbidden, because of the fear of toxicity. But here in India, Ayurveda and to a much greater extent Siddha system, they place great emphasis on metal based drugs. And there, we will make a reference to it later on, on some interesting research which is going on in this area. But these are used in India, and again they got a very big fillip with the entry of Arab medicine, because Arab medicine had always used these metal based, mineral based drugs. And, with the Islamic rule in India made a major effort to promote the Unani system, and along with that, these metal and mineral based drugs gained a lot of importance.

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CHOICE OF DRUGS FOR TREATMENT

- ❑ Taste (rasa), vīrya (potency), vipāka (post-digestive taste), and inexplicable action (prabhāva) formed the foundation of Ayurvedic pharmacology. However, in addition, substances also possess the property of being heavy or light.
- ❑ A substance is light when it has (largely) the properties of air and fire; heavy substances contain (largely) properties of earth and water.
- ❑ From bhūta angle, earth and water are heavy; fire, air and ether are light.




Now, the choice of drugs for treatment. The basic principles are taste, virya and vipaka and inexplicable action; but in addition, there are two properties of heavy and light often being mentioned. And, the substance is light, when it is largely air and fire dominated; again, that bhuta dominance, that makes it light; whereas, heavy substances are dominated by earth and water. This is somewhat different from the rasa, virya, vipaka. So, Charaka often uses these properties also. So, from the bhuta angle earth and water are heavy and fire and air and ether are light.

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USE OF MERCURY IN THERAPEUTICS; RASAŚĀSTRA

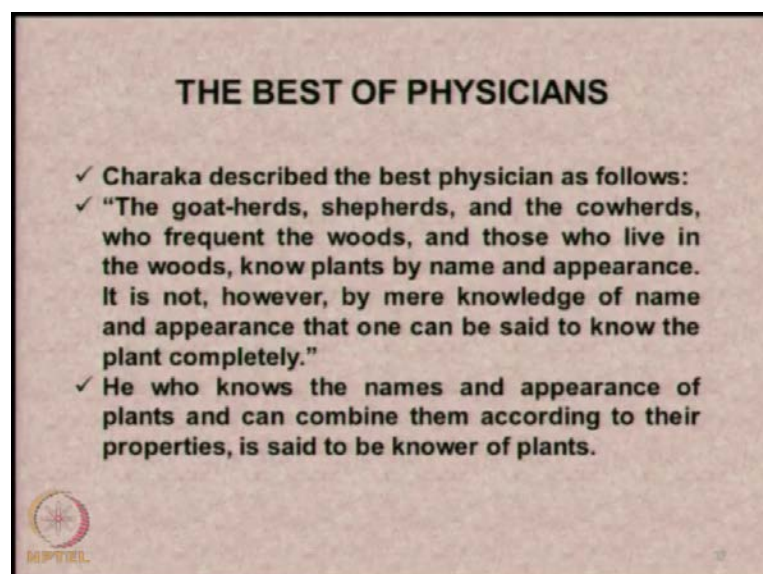
- The interaction of Arab medicine with Ayurveda was probably responsible for the entry of mercury into Ayurvedic therapeutics. It has little role in the texts of Charaka, Suśruta and Vāgbhaṭa.
- Arab medicine had a long tradition of using mineral drugs extensively such as white and black sulphur, sulphate of iron, arsenic sulphide, antimony, mercury, bitumen and so on.
- The introduction of mercury opened a new chapter in the history of Ayurveda, thanks to the great fame of Nāgārjuna, advent of new schools, numerous texts and a large variety of "rasouśadhis".



Now, use of mercury in therapeutics, that is a big subject in ayurvedic colleges; it is a special subject, rasashastra. They have even professor of rasashastra; it is a very important subject in ayurveda. But this is hardly mentioned in the Charaka, Susruta and Vagbata. So, in the early days, the, up to the 5th century, mercury has very little place in Ayurveda. Subsequently, it has found a place, and that is a time the Arab medicine had come into India. There was a close interaction between Ayurveda and Arab medicines. And, a lot of interest developed into rasashastra; large number of texts were written; a certain amount of philosophy developed on this.

Nagarjuna became the great name as an alchemist, who could convert metal from copper to gold and so on. And, Hiuen Tsang, the Chinese pilgrim who came here, he had given very many laudatory references to Nagarjuna. And, there was an University, Srisailem in Andhra Pradesh, which was noted for rasashastra. A large number of texts were written and Acharya P C Ray, the founder of modern chemistry in India, he has actually studied and written, edited several books on rasashastra, including one called rasargnava. It is a very important subject. But its therapeutic use remains controversial. It is widely used in Unani systems. It is used in Tamilnadu. It is also used in Ayurveda in the form of certain drugs. But it is subject to intense investigation at this time.

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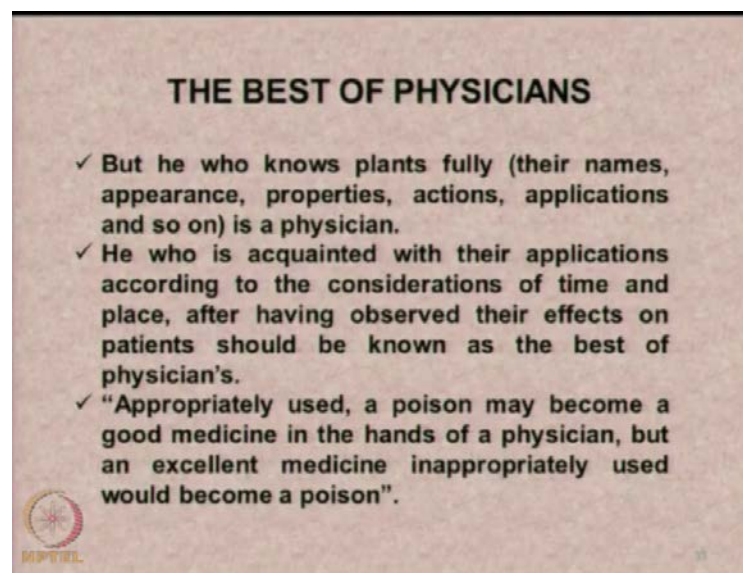


Now, Charaka says, the best of physicians; that is an interesting...He says the goat-herds, shepherds, and cowherds, who frequent the woods, and those who live in the woods, they know plants by name and appearance. It is not, however by mere knowledge

of name and appearance that one can be said to know the plants intimately. Now, here in the beginning also, Charaka Samhita, he says, Ayurvedic physician, who wants to know about medicinal plants, he should go to the shepherds, the cow herds; they are the people who will tell you about this.

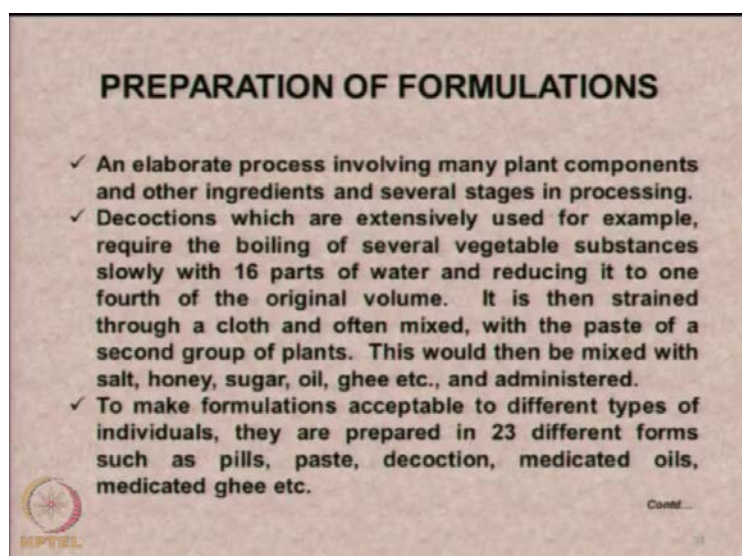
So, they should also be your teachers. So, he had great respect for them; but they cannot, said to know the plants completely; they can only identify the plants. He who knows the names and appearance of plants, and combined them according to their properties is known to be a knower of plants; he has to know a little more than that. The properties plants he has to know; he has to know how to combine them; then, he becomes a knower of plants, but that is not enough.

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He who knows the plants fully, their names, appearance, properties, actions, applications and so on, he is a physician. And, he who is acquainted with their applications, according to the considerations of time and place, after having observed their effects on patients, should be known as the best of physicians; that is his definition. And, appropriately used, a poison may become a good medicine in the hands of a physician, but an excellent medicine, inappropriately used, would become a poison. So, that is a good statement of...

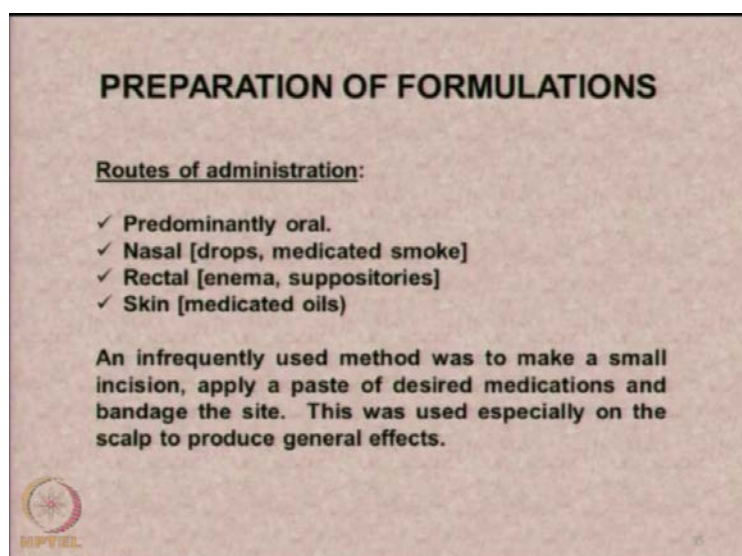
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Then, we come to preparation of formulations; after all, we have a large number of medicinal plants, but how do you make it into a medicine, a form in which the patient takes it; a decoction for example. There are many, many preparation methods are available for decoctions, for preparing lickables and so on. I just thought, in general, what I would say, the decoctions which are extensively used, number of medicinal substances, medicinal plants, may be sometimes 40, 50, usually less than that. These are boiled with 16 parts of water, in that ratio; one part of the plants and 16 parts of water, they are boiled, and they are reduced to one-fourth of the original volume. That is a first step, and then, this is strained through a cloth.

And then, the second phase is a paste of a similar substances with properties which are synergistic, a paste is made; that is mixed with this filtered, that extract. Now, that is....So, there are two groups of plants; one is boiled and then extract is made, one-fourth, and to which this paste is added; that is the preparation, and this is mixed with salt, honey, sugar, oil, ghee etcetera, so that, they have a taste and effect, which is acceptable to the body. Now, that is how a decoction is made, the principles of making these. And, once they have made, some people cannot take that decoction; the taste is not acceptable; they want it in the form of a pill; some like to have it in the form of a lickable; that is more acceptable to them. So, to suit different taste, different types of people, they are prepared in 23 different forms, like pills, paste, decoction, medicated oils, medicated ghee and so on.

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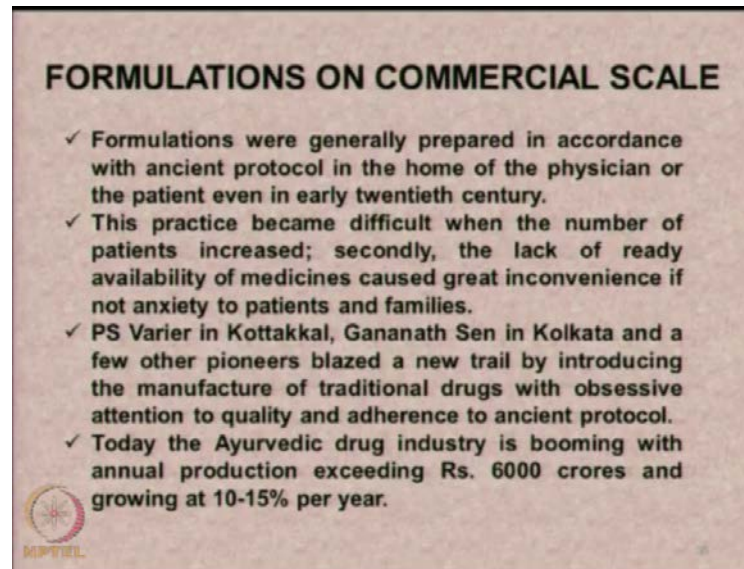


Now, the routes of administration. Most of these are given orally, nasally they are given especially for head and neck disorders. Also, they are given as medicated smoke, much less, but it is used. And, rectal administration, which I mentioned this morning; enemas, suppositories; it is interesting in this connection, I will tell you that, a politician from abroad, a noted person who came to Kerala many years ago with severe arthritis, painful arthritis, confined to a wheel chair, and that patient was brought to Kerala for treatment, by Ayurvedic treatment. But the doctors who came with that politician insisted, they wanted the Ayurvedic treatment; they insisted that, no medication can be given by mouth. These were modern physicians coming with that politician.

So, this Ayurvedic physician who was treating, initially, he was inclined to say, no, then, I do not want to have anything to do with this patient; but he felt sorry for that patient, suffering such severe pain. Then, he decided, alright, I will treat. So, along with his panchakarma, when he was giving enema, the drugs which he wanted to administer, he administered in the form of enema. And, that patient underwent treatment for 3 weeks and going from here, climbed the steps of the aircraft; it came in all the newspapers of that time. So therefore, enemas can be used also for administering, administering drugs, and not only for evacuations; and some can be applied through skin, dermal application; so, all these are described. There is one method which is infrequently mentioned, but apparently used; to make an incision, a small incision on the scalp, apply a medicinal paste there and bandage it. And for some time, that was also believed to be absorbed;

that is another method; again, it is transdermal; these were the routes of administration of formulations.

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Now, then we come to this present practice, the old practice of medicinal formulations, Materia Medica was, a physician would prepare it in his own house, or a patient who could afford, it would be made in the patient's house; that is how medicinal preparations were made; old gurukula style. But this became increasingly difficult; in the early part of the 20th century, the number of patients started increasing, and it was difficult to, for the physician to keep on manufacturing; there was no such facility there; it was a physicians house, or a patients house, where manufacturing or large scale production was simply not possible.

And secondly, a patient, who was ill, who came, he wanted to get a medication straight away. He did not want to wait for several days when the medicinal preparation was being made, or being asked to go and procure the medicinal plants, all that; that became very difficult, unacceptable to patients. So therefore, in the early part of the 20th century, we had pioneers like P. S. Warriar in Kottakkal, or Gananath Sen in Kolkata and Lakshmiopathy in Chennai, these were all a great pioneers who recognized that this problem, this is not going to be solved by the traditional methods; we have to break new ground.

So therefore, manufacturing of Ayurvedic drugs; today, we all take it for granted; nobody gives any thought to it; but these pioneers who started, they faced a great deal of oppositions from conservative Ayurvedic physicians. They said no, this is not the tradition; you should not have this manufacturing. They faced a lot of opposition, but they stood the ground. And today we see, the, what they did is flourishing; otherwise, Ayurvedic drug industry would not be existing today.

Today, Ayurvedic drug industry is worth 6000 Crores; production every year, growing at the rate of 15 percent. That is a big economy; and that all we owe it to pioneers like these, who developed manufacturing of Ayurvedic drugs. The medicinal plants are the same which are used. A lot of new production technology is used; preservation of drugs, quality control, all these concepts have been introduced into this, today. But, one must remember, in adapting the old protocol, you do have to make some changes which are inevitable, because the weights and measures mentioned in those days, they are not the same today.

Similarly, the soil, it is not the same today. So, there are a number of changes. And similarly, if a particular formulation being made, it has to manually stirred for 24 hours, it is very difficult to do that; so, a mechanical stirrer would be used. So, that way, a lot of improvements in the production technology have taken place, which is all for the good. So, that is the current situation in Ayurvedic pharmacology, Ayurvedic therapeutics and Ayurvedic Materia Medica.