

Traditional and modern sciences and technologies in India: trading new paradigms for old

Paper for the Compass panel in the conference: Bridging Scales and Epistemologies: Linking Local Knowledge with Global Science in Multi-Scale Assessments

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Abstract

The Indian sub continent contains a fascinating range and array of knowledge systems and practices that exist side by side even today. In this presentation I present the following:

1. Summarize the nature and characteristic of Traditional Indian Knowledge Systems drawing particular examples from some branches of Sciences and Technology.
2. Spell out some specific ways in which this traditional knowledge systems differ from their modern counterparts.
3. Reflect on the possibilities of interlinkages and cooperation between these varying traditions as they take place today as well as in terms of future possibilities.

Present day scholarships on science from points such as Sociology, Epistemology or Historiography are mostly based on the assumption that western science in its modern phase is THE paradigm for a: "Scientific Knowledge System". If we were to accept this criterion it is unlikely that we shall discover scientific knowledge in any other tradition since we do not find any knowledge systems identical with the modern western knowledge system anywhere. To free ourselves from this limitation we must first evolve an unbiased criterion for calling a knowledge system: "Scientific". We shall initially take up one specific branch of traditional Indian Knowledge System and examine it based on such an acceptable criteria to see how it measures up to being scientific.

Secondly we look at certain specific aspects of traditional knowledge systems, which make it identifiably different from modern knowledge systems. Some aspects that will be highlighted are: Approach to measurement and quantification, outlook towards experimental methods, the nature of parameters used to build theories as well as the social organization of knowledge. The social organization of knowledge is a fascinating aspect. Knowledge in India prevails and is expressed at varied levels in diverse areas. In many areas such as Medicine, Arithmetic, Agriculture, Grammar, Language, Dance, Music and Astrology to name just a few there is wide and extensive knowledge both at the level of classical texts and folk traditions. They are commonly referred to as: "Shastra" and "Lok Parampara" respectively. There is a commonality of technical terms and approaches in both the streams and they represent it as if they were two extreme ends of what is really a continuum expressing the same cosmovision. This has great possibilities in terms of revitalisation of a folk stream of knowledge, which being an oral tradition is liable to decay by employing the theories and techniques of the classical traditions. There is every reason to believe that on the ground today folk traditions are widespread in various walks of life and vibrant.

Research on traditional knowledge by scientists from the mainstream science and technology institutions is not a new phenomenon. However a lot of this research suffers from the limitations of a

mind set which essentially looks upon physical resources as well as technologies and knowledge of traditional societies as “raw material” that needs to be prospected so that one may extract what is worthwhile and useful to incorporate it into a modern western framework. This is a hang over of a colonial past and today there is an increasing perception that such activities do not lead to revitalisation of traditional knowledge or wholesome development of the communities involved. However in recent times there have been instances of healthy collaboration between various knowledge systems and we shall spell out some examples and possibilities of how different systems can work hand in hand to meet specific requirement or social goals.

Paper

The Indian sub continent contains a fascinating range and array of knowledge systems and practices that exist side by side even today. In this presentation I would attempt the following –

1. Summarize the nature and characteristic of Traditional Indian Knowledge Systems drawing particular examples from some branches of Sciences and Technology
2. Spell out some specific ways in which these traditional knowledge systems differ from their modern counterparts
3. Reflect on the possibilities of interlinkages and cooperation between these varying traditions as they take place today as well as in terms of future possibilities

I. RECOGNISING “SCIENTIFIC KNOWLEDGE”

All present day scholarships on science from various points such as Sociology, Epistemology or Historiography are mostly based on the assumption that western sciences in its modern phase is THE paradigm for a – “Scientific Knowledge System”. If we were to accept this criterion it is unlikely that we shall discover scientific knowledge in any other tradition since we do not find any knowledge systems identical with the modern western knowledge system anywhere. To free ourselves from this limitation we must first evolve an unbiased criterion for calling a knowledge system – “Scientific”. We shall initially take up one specific branch of traditional Indian Knowledge System and examine it based on such an acceptable criteria to see how it measures up to being scientific.

Fortunately, evolving such a criterion is not difficult. One can simply turn back to the school-text definition of ‘science’. ‘Science’ is the body of knowledge based on observation of phenomena and their classification under a theoretical framework, which itself is tested in observation’. Thus, all that one has to look for is a knowledge system that has the following characteristics – methodological, epistemological and sociological.

Methodological Criteria

- M1 It is based on a sufficiently large body of observational data.
 - M2 It has a sufficiently elaborate theoretical framework to classify the data.
 - M3 The basis of legitimisation of theoretical speculation is based in observation
- The above methodology obviously presupposes the epistemological position that:

Epistemological Criteria

- E1 The above method is a legitimate method for acquiring knowledge about reality.
- E2 The knowledge so acquired is always limited and subject to modification in the light of new data.

Since the above epistemological – methodological criteria make knowledge an accretional process – ever increasing and changing through the addition and assimilation of new data – acquisition of such knowledge can only be a collective activity. Therefore, in order to show that in a society a knowledge system based on the above criteria actually flourished, we must also show the presence of a community of practitioners. Thus to the above list of methodological – epistemological criteria, we must add the sociological criterion that :

Sociological Criterion

S1 In the society there is a professional community of practitioners of knowledge in the above sense, well governed by some social norms.

If in a knowledge system of an ancient civilization we can find all the above characteristics, he can have no hesitation in calling such a knowledge system 'scientific' – whether that system fits in with the 'modern science' paradigm or not. The current tradition of scholarship on science-obsessed as it is with the 'modern science' being the only 'scientific' knowledge system that mankind has produced – may not agree with it, but for any unbiased observer such a knowledge system must have all claims to be called 'scientific'.

II. TRADITIONAL MEDICINE

We would now like to take the example of the Traditional System of Medicine in India to see how it measures up to the above criteria in detail.

Methodological Criteria

M1 Empirical Basis : The Ayurvedic texts lay great store by empirical observation. The texts give detailed instructions about how to collect data on drugs, on pathological symptoms, and even on anatomy through dissection of corpses. And the data accumulated on all these aspects is stupendous. To take the case of data on drugs alone: Ayurvedic texts mention drugs of vegetable, animal and mineral origin. The number of drug plants mentioned in the three *Samhithas* (*Charaka*, *Susruta* and *Ashtaanga Hridaya*) is somewhere between 600 and 700 and the number of Sanskrit names (excluding their derivatives) of vegetable drugs is about 1900. To this it needs to be added that the medical works do not discuss plants as such. What these discuss instead are the effects on our bodies of the different parts and products of the plants.

As far as the drugs of animal origin are concerned, *Charaka Samhitha* (alone) discusses one hundred and sixty-five varieties of animals. Enumerating the different animal products used for medical purposes, it says (in *Suthra Sthaana*, Chapter I, *Shloka* 68 – 69), “Honey, milk, bile, fat, marrow, blood, flesh, excrement, urine, skin, semen, bones, sinews, horns, nails, hooves, hair, *gorocana* – these are the substances used in medicine from the animal world”. Again, *Charaka-Samhitha* mentions 64 main minerals used for drugs. If we add to these – 600 to 700 drug plants with their different parts forming different drugs, 165 varieties of animals again with different products and parts acting as different drugs, and 64 main minerals – the various pharmacological preparations to which each of these drugs could be subjected, then one can have some idea of the enormity of the pharmacopoeia on which Ayurvedic medicine was based. In fact, the *Charaka-Samhitha* itself speaks of “six hundred purgatives and five hundred decoctions”, besides the eighty four varieties of wines...” The respect for empirical observation of the Ayurvedic physicians is so great the *Charaka-Samhitha* states (*Vimaana Sthaana*, Chapter 118, *Shloka* 14), “The entire world is the teacher of the intelligent physician, as it is the foe of the fool”. And both *Charaka* and *Susruta Samhithas* declare, “No substance is found in the world which is without relevance for medicine.”

M2 Theoretical Framework to Classify the Empirical Data : The Ayurvedic physicians are clearly aware of the need for a theoretical framework to understand empirical data in order to go beyond mere empiricism. They feel that something more than the mere knowledge of substances is required for their purpose. This something is the intellectual discipline of The Ayurvedic physicians are clearly aware of the need for a theoretical framework to understand empirical data in order to go beyond mere empiricism. They feel that something more than the mere knowledge of substances is required for their purpose. This something is the intellectual discipline of *Yukti*. Hence they claim, “*Yukti* (rational application) is the ultimate foundation of (therapeutic) success. A physician accomplished in rational application is always superior to one with the mere empirical knowledge of the substances”. Or as *Charaka* states (*Suthra Sthaana*, Chapter I, *Shloka* 121-122) “... No one can

claim to have a perfect knowledge of pharmacology by the mere acquaintance with the names or even forms of herbs. If one who knows the uses and action of herbs, though not acquainted with their forms, may be called a pharmacologist, what then need be said of the physician who knows the herbs botanically, pharmacologically and in every other respect?...”

In accordance with their expressed preference for a medicine based on theoretical formulation (*yukti-vyapasrayabheshaja*) the Ayurvedic physicians develop an elaborate theoretical framework to classify and understand data on drugs and diseases and to infer the ways of curing diseases. This is not the place to go into the details of the theoretical framework of Ayurveda. Suffice it to say that the framework established was elaborate enough to classify and understand the huge amount of data on drugs, diseases, diet, soil conditions etc., that the physicians collected.

M3 Basis of Legitimation : In spite of the fact that the physicians laid so much stress upon a theoretical formulation of the problem of medicine, the physicians always insisted that the final test of any hypothesis lay in practice. As *Charaka Samhitha* states (*Suthra Sthaana*, Chapter 1, *Shloka* 134) “He is the best of physicians who can in actual practice cure people of diseases”. Or – “All this is what we prescribe, because all these are based on what we directly observe (*samyak upadisamah; samyak pasyamah ca iti*)”.

Similarly Susruta states “A learned physician must never try to examine on grounds of pure logic the efficacy of a medicine, which is known by direct observation as having by nature a specific medical action. Thus, for example, even a thousand logical grounds will not make the *Ambastha* group of drugs have a purgative function”.

We can similarly go on to describe the results of our assessment based on Epistemological and Sociological criteria. However we do not wish to enter into the details of discussion here, except to state that indeed by these criteria also Traditional Medicine stands the test of being a “Science”.

III. COMPARISONS WITH MODERN SCIENCE

We would now like to highlight certain aspects of traditional knowledge system, that make it identifiably different from modern western systems. Some of them aspect are – the social organization of knowledge, nature of parameter used to build scientific theories and measurement quantification and achieving rigour. We would look into them in some detail since each of them has, implications for how we comprehend and interact with this knowledge.

1. The Social Organisation of Indigenous Health Traditions

The Indian sub-continent abounds as it were in a variety and diversity of health traditions. We have with us what is perhaps the longest unbroken health tradition which has not only a stream of practitioners but also a textual and theoretical backing in terms of the Ayurvedic and Siddha systems of medicine (1). They have made their presence felt even outside India, in other parts of Asia such as China, Thailand, Cambodia and Indonesia. However, what is most remarkable about the Indian medical tradition is that it prevails at two different levels, namely the classical system and the folk system. By the classical system, we refer to the codified systems such as Ayurveda, Siddha and Unani traditions. They are characterised by institutionally trained practitioners, a body of texts and highly developed theories to support their practices. As against this, we also have a folk tradition (or what may be termed as the *Lok Parampara*) which is an oral tradition passed on from father to son or mother to daughter (or daughter-in-law) or from *guru* to *sishya* in tens and thousands of our villages through the ages. These folk traditions are rich and diverse and include several practitioners as the following list illustrates.

- Home remedies and cures for common ailments
- Hundreds of thousands of folk and tribal practitioners known as – *Vaidus, Nattu Vaidhyars, Bhagats* who learn through oral traditions and who treat a variety of ailments.
- Knowledge and beliefs regarding foods – *Pathyam* and *Apathyam*, i.e., foods to be preferred or avoided during specific diseases or conditions such as pregnancy, by lactating mothers etc.
- Folklore on health (eg. Proverbs relating to health)

- Individuals/families specialising in the treatment of specific diseases. (e.g.) jaundice, asthma.
- Knowledge of diagnostic procedures
- Knowledge of preventive measures
- Knowledge of *Rutucharya* or adaptation of food and regimen to suit the seasons.
- Yoga and other physical cultural practices of a preventive and promotive nature.
- Special areas such as bone setting, *Visha Chikitsa* (Treatment for poisons), *Panchakarma* (Five purificatory procedures) etc.
- Over 600,000 *Dais* (Traditional Birth Attendants) who perform home deliveries

The relationship between folk and classical traditions is found to be symbiotic. There is a strong commonality of underlying theory and worldview expressed at the level of – *Panchamahabhoota* – theory of composition of matter and *Tridosha* – theory of causation of disease. There is also a striking common ground between the technical terms that are used by the expert practitioners and what is known to the folk practitioners. The technical vocabulary such as - *Vaata, Pitta, Kapha, Ushna, Sheeta, Laghu, Guru, Guna, Veerya* etc are also very much part of the knowledge of folk practitioners and the households.

It is also interesting to see what the classical texts of Ayurveda say about folk tradition. The *Charaka-Samhitha* states that – “*Oushadihi naama roopabhyaam, jananthe hyajapaa vane, avipaashchaiva gopaashcha ye cha Anye vanavaasinaha*” – “the goat herds, shepherds, cowherds and other forest dwellers know the drugs by name and form...” (2). Similarly *Susrutha-Samhitha* states that – “*Gopaalasthaapasaa vyaadha ye chaanye Vana charinaha, Moola jaathihhi cha tebhyo Bheshaja vyakthi Ishyathe* – “one can know about the drugs from the cowherds, thapasvis, hunters, those who live in the forest and those who live by eating roots and tubers” (3).

2 The Nature and Social Organisation of Knowledge in The Indian Tradition

I would like to sum up some aspects of the traditional Indian systems of knowledge, specifically theory construction and its relation to popular knowledge. The main feature is that the theories do not employ a great degree of “formalisation” in the sense of providing laws or rules that are ‘absolute’ and can be blindly applied outside of or irrespective of the context of their formulation. The terms and variables used in the theory and laws are closely related to actual observed phenomena or measured quantities often being their refinements. This does not mean that the theories lack rigour or precision or power. For example the most rigorous and precise formulations and argumentation in areas such as logic or grammar or metaphysics are carried on in our tradition in *Shastric* Sanskrit, which is but a refinement of the natural language Sanskrit without recourse to any ‘formal’ devices of abstraction. Thus the laws, theories and its terminology bear a very live and intimate relation to the popular mode of discourse on the subject and the ‘folk knowledge’ of it.

This points to a very important feature of our Science and Technology namely that its knowledge, theories and principles are not meant to be reposed in a small number of experts, institutions or texts, but are created and shared on a wide scale, even by the ordinary folk who are the day to day practitioners of the arts and sciences. In fact, though we have used the term ‘folk knowledge’ to denote knowledge with out people for want of a better term, its connotation is quite different in the modern context. In the modern Western view, ‘Folklore’ is used to denote knowledge that prevails with the common people and gets propagated by oral tradition. This is as against classical or ‘proper’ scientific knowledge which uses its own terminology, theories and abstractions and resides in a different body of people – viz. The experts. But in our tradition, this kind of a sharp qualitative difference does not seem to exist. The ‘folk’ practitioner’s are also equally the innovators in the frontiers of their discipline and the theories and technical categories belong to their domain as well. If we consider for example a highly developed branch of Indian Science such as medicine, the basic theories at its foundation, such as the *Panchabhuta* theory of matter and the *Tridosha* theory of causation of disease and its treatment are part of common knowledge of our people and a number of technical terms such as *Vata, Pitta, Kapha, Agni, Rasa, Ushna, Sheeta, Veerya* etc are all part of the vocabulary of our households.

The expert or specialist, seems to play a very different kind of role here, namely that of systematising the corpus of knowledge. For example, in a discussion about the role of the Grammarian, the famous

Grammarians Patanjali says: “He who has the use of a pot goes to a potter’s house and says ‘make a pot; I have to use it’ But no one similarly goes to a Grammarian and says ‘coil words; I shall make use of them.’ He thinks of objects and makes use of words denoting them... the *loka* (i.e. what prevails in the world as usage) is the authority for the use of words’ (4). Thus there is no looking down upon the common folk or the lay practitioners; on the contrary the *Sastras* themselves assert repeatedly that it is in the concrete particular and in their use in a real situation that the truth of the *Sastras* ultimately reside.

3. Nature of Parameters Used to Build Scientific Theories

It is widely believed and expressed that traditional science in India has not developed over the last few centuries and that it has stagnated. As per one view this has happened due to the disruption and disorganization of Indian society during the colonial period but as per yet another popular view it is considered that there is an intrinsic problem with the Indian society and thinking which makes our knowledge repetitive and stale and accept authoritative pronouncements of masters and sages unquestioningly. What is seen as a manifestation of this tendency, is the apparent constancy and lack of change of the basic theories with which traditional sciences tend to explain anything – for example the traditional theory of composition of matter or cause of disease is believed to have remained more or less unchanged for a couple of millennia. This is in direct contrast to modern scientific theories, which on the face of it show dramatic change and improvement. Early in the last century, Captain G. Srinivasamurthy, a modern trained physician who undertook a deep study of traditional knowledge of medicine used an interesting analogy to understand this (5).

The subject of aetiology provides us with a striking illustration of this characteristic feature of Indian Analytical thought. That causation of diseases is by agencies outside of oneself is common ground between aetiology of both Ayurveda and Allopathy shows the characteristic features differentiating the two viewpoints. An analogy may perhaps serve a useful purpose in this context. Let us suppose we wish to classify the various invasions of India; we may do it in two ways: in one we may classify the invasions as those by either land or sea or air; in the other we may classify them as those by the Greeks, the Scythians, the Muhammadans, the Europeans and so on. The first classification is all-comprehensive and applicable for all time; because, all invasions must take place in one or other of these three modes – singly or combined. This is equivalent to the Ayurvedic view where all disease is classified and understood as being due to the imbalance of *Vata*, *Pitta* or *Kapha* – recognized by the symptoms of the patient. But, the second classification is applicable only to the present and the past and that too, only so far as it is known; and if there are new invasions in the future by people other than those given above, the list will have to be added to, whereas, in the first case, all future invasions will naturally go in under one or other of the three categories that have been laid down once for all and for all times as it were.

Thus we can see that even new conditions and diseases can indeed be dealt with by Ayurveda within the traditional framework because of the nature of parameters that are used to build their theories. This writer was present at a fascinating discussion in the 1990s where a modern Ayurvedic physician from Pune analysed – “blood cancer” in a patient using Ayurvedic theories a couple of millennia old and identified it to be – “vata afflicting the *astha* and *majja* tissues and severe depletion of *dhatu*s”.

4. Measurement and Quantification : Achieving Rigour

Assigning numerical values and making precise measurements is indeed a hallmark of the modern scientific method not only in physical sciences, but also increasingly in the biological and even social sciences. It is sometimes felt that traditional sciences are not up to the mark since we see no precise measurement of quantities in this sense.

Measurement and quantification are indeed present in our traditional sciences though they occur in a manner which is somewhat different from the modern notion on the matter. Most measurements in traditional medicine are by using units which are normalized to a given individual. For example this means that while measuring the height of a person’s body or the length of his limbs, it is expressed in units of *Anguli* – that is the dimension of a finger of the same person rather than an arbitrary standard external to the individual – like the standard international meter. In fact such normalized units exist for measurements of not only length but also volume and even for the measurement of time. In Yoga a unit of time has been defined which is normalized to the individual. In *Yoga Cintamani* a *Maatra* of

time has been defined as the time taken by an individual who is asleep to complete one cycle of breath, namely one inhalation and one exhalation.

In any scientific discourse it is essential to achieve precision and rigor. In the Western tradition, the geometry of Euclid is considered the paradigm of an ideal theory, and various other branches of knowledge tried to emulate Euclid by setting out their knowledge on the basis of a formal axiomatic system. In contrast, in Indian tradition, an attempt was made to use natural language and to refine and sharpen its potential by technical operations so that precise discourse was possible even in natural language. This is so, particularly in Sanskrit, where we find that even the most abstract and metaphysical discussions regarding grammar, mathematics, or logic are still written in natural language. In Indian knowledge systems, it is the science of linguistics that occupied the central place which, in the West, was occupied by mathematics. Hence traditional sciences have a different approach to achieving rigour.

IV. DIALOGUE BETWEEN SCIENTIFIC TRADITIONS : CURRENT LIMITATIONS

The current status of interaction between the two scientific traditions in India – traditional and modern suffers from several limitations. In a broad sense some of these are the result of the colonial hangover. Here we would just like to look at two aspects of this interaction namely the limitation of the overall approach to studying traditional knowledge in the form of – “prospecting” traditional knowledge and the assumed universality and neutrality of the methodology of modern science.

1. “Prospecting” Traditional Knowledge

Research on traditional knowledge by scientists from ‘mainstream’ western science and technology institutions is not a new phenomenon. A lot of this research, however, suffers from the limitations of a mind set, which essentially looks upon physical resources, as well as the technologies and knowledge of the local communities, as raw material that needs to be scanned, prospected and refined, in order to get incorporated into the modern/western framework. Over the past centuries, a large number of herbs have been screened in this way for their potential pharmacological action, leading to some outstanding success stories, such as quinine from the Cinchona bark. At the same time, many perceive that these research activities do not lead to the revitalisation of traditional knowledge and endogenous development of the communities involved. Take for example, the case of –

Rauvolfia serpentina is a plant known in Ayurveda for a very long time. This small shrub used to be widely distributed throughout India, reputed for its medical potential in treating hypertension, fever, wounds, insomnia, epilepsy and certain conditions of Kapha and Vatha (Ayurvedic categories) disorders. At the beginning of the 20th century modern research was carried out on this plant, and the ‘crude drug’ was fractionated into ‘active ingredients’. One of these ingredients, the alkaloid Reserpene, was identified as a powerful drug for hypertension. Subsequently, the drug based on Reserpene had several undesirable side effects, which were not present in the original formulation of *Rauvolfia serpentina* used in traditional medicine. Meanwhile, the research and use of the plant did not lead to strengthening of the traditional knowledge of the subject, while the industrial demand resulted in over-exploitation of the plant in the wild. In fact, *Rauvolfia serpentina*, once growing abundantly throughout India, is today on the list of endangered species, and the traditional medical practitioners are unable to get sufficient supplies for local use. Similar cases of modern research to traditional herbal medicine have led to patenting of the knowledge and violating the intellectual property rights of the original carriers of the knowledge.

2. Methodology of Modern Science: Is it Universal and Neutral ?

Yet another factor that has characterized the interaction between the two traditions is the confusing picture regarding the methodology of modern science. It is generally assumed that the methodology employed by modern science is universal in the sense that it is applicable to all cultures and scientific traditions and that it is neutral in the sense that it can be used to assess or evaluate the validity of any scientific tradition. However, this is quite deceptive since a closer examination of the elements of modern scientific methodology shows that quite often they may carry within themselves the stamp of their origin, and that underlining this methodology may indeed be presuppositions and assumptions that are specific to the modern scientific tradition. Let us take for example the modern scientific method of drug assessment by employing blind trials, double blind trials and placebos.

In modern testing procedures, only one group of the patients receives the new drug, while the others are given a 'placebo'. But what if we are dealing with a medical system where the patient is not just a passive recipient of a treatment, but is an active participant in the therapy? If a patient is treated by an Ayurvedic physician, not only a drug may be prescribed, but the patient is also given advice about how to regulate his diet - to avoid certain foods or methods of preparations - and may be given specific behavioural guidelines, such as the timing of meals, the spacing between meals, or sleeping habits. This difference is even more striking, if a patient is being treated by the system of Yoga, which implies the active participation of the patient by performing certain *asanas* (assuming specific postures) or *pranayama* (regulated breathing). In such cases, it is impossible to 'blind' the patient. Hence, it appears that the system of performing blind or double blind trials is, in fact, the product of the cultural context in which the patient is the passive recipient of treatment. Therefore, we need to re-examine the assumptions behind the various methodologies of research, and determine the methods suited to the specific knowledge system.

V. TOWARDS A NEW PARADIGM FOR COLLABORATION BETWEEN SCIENTIFIC TRADITION

In the previous sections I have given an overview regarding the nature of Indian scientific tradition, spelt out some specific ways in which it is distinct and different from the modern western tradition and also summarized some of the limitations of the interaction between the two traditions in the past. However, looking forward at the future, I would like to conclude by drawing attention to two factors that hold great promise for a new paradigm for future collaboration. They are – some recent attempts to build healthy collaboration as well as the creativity exhibited at the grass roots level in terms of traditional knowledge.

1. Healthy collaboration and co evolution

In varied areas of traditional knowledge systems there are instances of healthy collaborations with modern knowledge. If we take the case of healthcare systems we see this occurring between Ayurveda, Yoga, Siddha and modern medicine and to a limited extent also with Homeopathy. Some of the kinds of partnerships that have sprung up between these traditions in recent times can be illustrated below.

- In some cases, modern medicine is used as a main line of treatment with traditional system offering supplementation and long term care. For example, in the case of heart patients those with acute problems of great severity may indeed go in for surgery but during the recovery period their treatment is supplemented with the use of Ayurvedic drugs, Yoga exercises and counselling regarding life style based on traditional medicine which can help remarkably in their recovery and even taper off and limit the use of drugs.
- In some cases traditional medicine may offer the main line of treatment with modern medicine playing a complementary role. For example, in the case of asthma, a patient can be kept fit based only on Yoga exercise and dietary restrictions. However, in rare instances where there is an acute and sudden attack (due to stress, change of place or allergens etc.) the modern medicine may step in for emergency care.
- The production and distribution of traditional Ayurvedic drugs has been increasingly modernised over the last 100 years while there are active debates still in progress on some aspects of modernisation and quality control. Today the Ayurvedic drug industry is organised along modern lines and caters to a vast majority of the market requirement.

In the initial period, the collaborations suffered from the limitations that they were often no formal arrangements between experts and the linkage was worked out by the patients themselves with the experts being not completely in the know of things or even an active participant in the "collaboration". This might mean for example that a patient who suffers from Asthma may quietly go for Yoga exercise without even informing his modern doctor and consult him only in the case of an acute attack. Very often such a strategy was indeed forced upon the patient because of deep rooted distrust and unfamiliarity regarding traditional medicine among the modern physicians and vice versa.

However, the situation is taking an interesting turn for the better. Very frequently, these days we have Ayurvedic clinics or Yoga experts operating with the premises of an ultra modern hospital and conversely we have several instances of Ayurvedic physicians or hospitals making use of modern medicine in-house such as for diagnostic purposes (blood test, xrays etc) or contract by partnerships with the modern medical practitioner.

For example in the 1980s I had the personal experience with some such partnership while I was a teacher at a well known Yoga Training Centre at Chennai which had an international reputation for Yoga therapy. For example, the approach regarding a problem like Prolapse of the Uterus was –

- If our institution received a patient with this condition at the first or second degree we could treat it ourselves and only if there were a more severe case we would refer it to a modern gynecologist for surgical relief.
- Conversely, there were some modern gynecologists who would refer to us patients with a first or second degree problem since they realized that it could be effectively corrected with Yoga therapy.
- Several partnerships of this kind flourished in areas such as – asthma, low back pain, hypertension etc. to name just a few examples.

2 Folk Traditions Today : Creativity at the Grass Roots

There is every reason to believe that on the ground today, folk traditions are wide spread in all areas in various walks of life and vibrant. There is every indication that they are showing dynamism and continuing to develop. Take for example the case of the resource base of traditional medicine. In the 1980s the Department of Environment of the Government of India initiated an – “All India Coordinated Research Project on Ethno Biology” with the objective of taking up a detailed assessment of the knowledge and use of Natural Resources by the tribal communities of India. The mid term report of this programme that was published in 1994 indicated that these communities have knowledge of about 9,500 species of plants of which the single largest use category is medicinal plants accounting for over 7,500 species (6). This should be seen in the light of the fact that in the classical systems of medicine it has been estimated that the total number of medicinal plants referred to in the three major texts of Ayurveda is about 900 species. Hence this is a truly stupendous number by any standard. We should also assess the information in the light of the fact that tribals constitute only about 7% of the total Indian population even though they are perhaps a section of the population that live most closely in communion with nature

Several examples can be seen all around of the active use of not only natural products but also the new synthetic products for a variety of purposes. A remarkable instance of the use of an exotic species by the tribal has been documented by Winin Perietra (7). In the 1980s the Forest Department had started to introduce the species *Acacia auriculaeformis* in rural areas of Maharashtra. The seeds of these exotic species were first introduced in the area of Warli Adivasis around 1985. It was observed as early as 1987 that the Warlis have been catching fish by stupefying them with the seeds of *Acacia*. It takes about two years for *Acacia* to flower and fruit and the Adivasis’ research has indeed been carried out very quickly. What makes this achievement truly remarkable is that there is no record of the use of seeds of *Acacia* for this purpose as of that time either in modern literature or a traditional use in Australia which is the place of its origin. It is a remarkable testimony to a keen sense of observation and creativity at the grass roots. Many such examples can be illustrated

3 Synergy between multiple traditions

In retrospect, we can see that through the ages, every geographical location of the world has nurtured and produced sciences and technologies that bear the distinct stamp and character of its own people and civilisation. However, during the last few hundred years and increasingly for a hundred years or so, a myth has developed to the effect that the western tradition of science and technology is unique and universal. This viewpoint has not only been propagated by the mainstream scientists in the West but has also been internalised by professionals in various other parts of the world, particularly developing countries. While, it is true that in the West, there is scholarship that points to multiple traditions of sciences and technologies, most often, this literature and discussions are confined only to

theoreticians and professionals working in the frontiers of philosophy or epistemology of science. Meanwhile, this has not influenced the thinking of mainstream scientists, policy makers and others in any significant way. Therefore, there is an urgent need for new initiatives and paradigms of development, with a balanced view on traditional sciences, technologies and knowledge systems. While modern science and technology has limited its benefits to a minority of people, the vast majority of the people in the world still survive on the material and intellectual sustenance from their own indigenous traditions. The activities of the Compas partners in India and other parts of Asia may be considered a contribution to this reevaluation of indigenous traditions of sciences and technologies.

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