Oration

Susruta and our heritage

P. S. Chari
Department of Plastic Surgery, Postgraduate Institute of Medical Education and Research, Chandigarh-160012, India.

Mr. Chairperson, ladies and gentlemen, I am thankful that the President and the Executive Committee of our Association nominated my name for the Susruta Oration for the 37th Annual Conference at Bangalore. We, in this country, regard Susruta as the "Father of Plastic Surgery." Who was Susruta? When and where did he live and work? These questions can only be imperfectly answered like similar questions. In respect of the lives of our ancient worthies. The Susruta Samhita would have us believe that once upon a time a number of sages approached Dhanwantari alias Divodasa, King of Kasi, who received Ayurveda from divine sources - Brahma via Prajapati, the Aswins and Indra. Dhanwantari imparts medical knowledge to these sages, and one of them called Susruta codified his oral instructions. There is no sure ground proving the historicity of Susruta, which literally means "that which is well heard" or "one who has thoroughly learned by hearing." It is more likely the anonymously edited manual of a school which had selected Susruta as patron. It is only safe to assert that Susruta was of the race of Viswamitra as represented in the Mahabharata- Anushasan Parva, chapter IV. Divodasa, the preceptor of Susruta, is represented as an incarnation or descendant of Dhanwantari, the first propounder of surgical science. The name of the original work was Shalya Tantra (Skt Sala = surgical instrument). Beyond this meagre genealogy we possess no trustworthy information regarding the life and personality of Susruta.

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We have no means of ascertaining what the Samhita was like as originally written by Susruta, the present form is a recession or rather a recession of recessions made by Nagarjuna who opinions identify as the founder of the Madhyamika or Northern School of Buddhist philosophy around the second century B.C. A few quotations from the Vridha (Old) Susruta are all that are preserved of the original Samhita, but their genuineness is of a problematic character, and we are not sure whether they are the production of lesser lights, or of ancient though less renowned commentators, attributed to the master to invest them with greater sanctity and authority. The most renowned commentary on Susruta Samhita is that of Dalhana (12th century A.D.) called Nabanda Samagraha. Other notable commentators were Gayadasa (10th century A.D.) and Candrata (12th century A.D.).

At the time of the Mahabharata which nearly approaches the age of Susruta the number of sects among the followers of the healing art numbered five, which were named Rogaharas (physicians), Shaylyaharas (surgeons), Vishaharas (poision curers), Krityaharas (demon doctors) and Bhisagatharvans (magic doctors). Susruta's Compendium is also mentioned in the Bower Manuscript that was found in 1890 in a ruined Buddhist stupa in Kashgar, on the western outskirts of the Gobi Desert, and translated by A.F.R.Hoernle in 1909 at Calcutta. The medical texts were written in the Pali script of the Gupta period according to palaeographic criterion which gives the beginning of the fifth century A.D. as the latest possible date for the text.

The upshot of these arguments is that in Susruta's text we have a work the kernel of which probably started some centuries B.C. in the form of a text mainly on surgery, but which was then heavily revised and added to in the centuries before 500 A.D. This is the form in which we have received the work in the oldest surviving manuscript today.

Susruta gives us a historical window into a school of professionalized surgical practice almost two millennia ago, and which was in its day, almost certainly the most advanced school of surgery in the world. Many details in the description could only have been written by a practising surgeon and it is certain that elaborate surgical techniques were a reality in Susruta's circle.

The first translation of Susruta Samhita were ordered by the Caliph Mansur (A.D.753 -774) who had embassies come from his province of Sind to Baghdad along with Hindu scholars bringing books. The Caliph Harun (A.D.786-808) appointed Hindu physicians to Baghdad hospitals and ordered further translations into Arabic of books on medicine, pharmacology, toxicology, astronomy and other subjects. Alberuni who was a member of the court of Mahmud of Ghazni (A.D.997-1030) mentions the current translation of Caraka although complaining of its incorrectness. The centres of Indian learning in his times were Banaras and Kashmir, both inaccessible to the invading armies of Mahmud. The first European translation of Susruta Samhita was published by Hessler in Latin in the early 19th century. The first complete English translation was done by Kaviraj Kunja Lal Bhishagratna in three volumes in 1907 at Calcutta. New sources have been discovered in Tibetan versions, Tamil sources and Mongol versions of Tibetan translations. Indian medicine has played in Asia, the same role as Greek medicine in the West, for it spread to Indo-China, Tibet, Central Asia, and as far as Japan.

The contributions regarding Plastic Surgery in Susruta Samhita are the following:

1. Rhinoplasty by cheek flap.
2. Classification of mutilated ear lobe defects.
3. 15 techniques for repair of torn ear lobes.
4. Cheek flap for reconstruction of absent ear lobe.
5. Repair of cleft lip.
6. Piercing children's ear lobe with a needle or awl.
7. Suture materials of bark, tendon, hair and silk.
8. Needles of bronze or bone, circular, two finger-breadths wide and straight, triangular bodied, three finger - breadths wide.
9. Classification of burns into four degrees - singeing, blister, superficial and deep.
10. Different methods of dressings with various medicaments.
11. Wine to dull the pain of surgical incisions.
12. 101 types of blunt instruments (yantras) and 20 varieties of sharp instruments. According to Susruta the hand is the most important yantra, for without it no operation could be done.
13. Surgical demonstration of techniques of making incisions, probing, extraction of foreign bodies, cauterization, tooth extraction, scarification, excisions, trocars for draining abscess, saws for amputations on various natural fruits, dead wood, and clay models.
14. A system of anatomical dissection of cadavers.
15. Operations for lithotomy, intestinal sutures, couching for cataract, caesarian section to save a live baby if the mother dies in labour and other surgical procedures are mentioned. Ligaturing of bleeding vessels was not known, the bleeding being checked by pressure, cautery or boiling oil.
16. A code of ethics for teachers as well as students.

There is little historical evidence to show that these practices persisted beyond the time of the composition of Susruta's compendium. A few references to surgery found in Sanskrit literature between the 4th to the 8th century A.D. were collected by P.V. Sharma (1972), but the stereotypical nature of most of these references and the paucity of real detail, suggests that the practice of surgery was rare in this period. There is some evidence, however, that although surgery ceased to be part of the professional practice of the traditional physicians of the vaidya caste, it migrated to surgeons of the "barber surgeon" type. As such, it was no longer supported by the underpinning of Sanskrit literary tradition, so it became harder to find historical data about the practice. D.C. Sircar (1987) discusses some epigraphical evidence for the heritage and migrations

of the "Ambastha" caste who appears to have functioned as barber surgeons in South India and later migrated to Bengal.

By the 17th century, foreign visitors began to remark on how surgery was virtually non- existent in India. The French traveller, Travernier for example, reported in 1684 that once when the King of Golconda had a headache and his physician prescribed that blood should be let in four places under his tongue, nobody could be found to do it Col. W.S. Sleeman (1893) in his "Rambles and Recollections of an Indian Officer" observed on the same lack of surgeons.

The famous Indian Rhinoplasty method is often cited as evidence that Susruta's surgery was widely known in India even up to comparatively modern times. The operation took place in March 1793 in Poona. A maratha named Cowasjee who had been a bullock-cart driver with the East India Company Army in the Third Mysore War of 1792 was captured by the forces of Tipu Sultan and had his nose and one hand cut off. (A residual puzzle with this account is that 'Cowasjee' in a Parsi name, not a Maratha one). After an year without a nose, he and four of his colleagues, who had suffered the same fate, submitted themselves to treatment by a man who had a reputation for nose repairs. Unfortunately, we know little of this man, except that he was said in one account to be of the brick-maker's caste and by Cowasjee's commanding officer Lt. Col. Ward as an artist' whose residence was 400 miles distant from Poona. Thomas Cruso and James Findlay, senior British surgeons in the Bombay Presidency, witnessed this operation.

They appear to have prepared a description of what they saw and diagrams of the procedure. The details and an engraving from the painting were published at third hand by Barak Longmates a journalist in 1794 in The Gentleman's Magazine and Historical Chronicle (56.4 pp.883, 891 and 892). The key innovation was the transplantation of skin from the site immediately adjacent to the defect, while keeping the graft tissue alive and supplied by blood through a connecting skin bridge. Subsequently, through the publication by Carpue (1816) describing his successful use of the technique this method of nose repair gained popularity amongst British and European surgeons. Personal inquiries by Carpue from Cowasjee's commanding officer Lt. Col. Ward described the understanding in Poona, at the time of the operation, that this artist - surgeon was the only one of his kind in India and that the art was heriditary in the family.

The technique used by Cowasjee's surgeon was similar, but not identical, to that described in Susruta's Compendium. Susruta's version has the skin flap being taken from the cheek; Cowasjee's was taken from the forehead. The Sanskrit text of Susruta's description is brief and does not appear to be detailed enough to be followed without an oral commentary and practical demonstration, although an experienced surgeon might be able to discern the technique even so. It is hard to see how such techniques could have persisted purely textually. Maybe, the Poona operation is indeed an extraordinary survival of a technique from Susruta's time, but in that case it seems to have been transmitted through channels outside the learned practice of traditional Indian physicians.

Ayurvedic literature is preserved almost exclusively in the Sanskrit language, and originally in the form of manuscripts written on birch bark , palm leaves or paper. India has, over the millennia, developed about a dozen different alphabets. The scribe who copied out the manuscripts would use the script that was local to the place of work. So it is quite normal to find Sanskrit medical manuscripts from Kerala in the Malayalam script, while a manuscript of the very same text copied in Bengal would be in the Bengali script. Both manuscripts would still be in the Sanskrit language and would be virtually indistinguishable if read aloud.

No systematic effort has been made to collect together all the known manuscripts of Susruta Samhita, let alone compare them all, try to classify them, to tease apart the historical strata in the texts, weed out scribal errors, and adjust the readings of the texts accordingly. The printed editions are vulgate texts, that is so say, they are books printed on the basis of small number of manuscripts from a local region, normally Bombay or

Calcutta. And the decisions about what to print when the manuscripts disagree was made on the basis of general common sense but without the support which historical philology and textual criticism can offer. Criterion for determining what is intrinsic and what is extrinsic to rationalist medicine in the Susruta Samhita is based on the observation that medical science is concerned with specifically four factors: the doctor, the substance used (drug or diet), the nursing attendant and the patient. The qualifications essential to each are also specified. The discussion concerned with these are intrinsic to medical science. By contrast, any topic unconnected with these - howsoever may be their importance in philosophy, religion and traditional morality - are extrinsic to medicine.

Today, Ayurveda is one of the six medical systems that are officially recognized by the Indian Government, the others being allopathy (modern medicine), homeopathy, naturopathy, unani, siddha and yoga therapy. The practitioners of the six systems must compete for patients with each other and with a profusion of practitioners of other medical skills, including itenerant tonic sellers, pharmaceutical representatives, village curers, bone setters, midwives, exorcists, sorcerers, psychics, divines, priests, astrologers, grandmothers, wandering religious mendicants and experts in such maladies as snakebite, hepatitis, infertility and 'sexual weakness'. Indian people talk knowingly or not in the Ayurvedic idiom. Even the illiterate peasant of a remote village knows that yoghurt causes phlegm to accumulate in the chest, and everyone uses simple herbs like vetiver (cus cus) which remove 'heat' from the body and makes life during the hot summers a little more bearable. Ayurvedic thought is part of the conceptual universe of every Indian and has been a part of its collective consciousness since very early times.

Professor Debiprasad Chattopadhyaya in his book "History of Science and Technology in Ancient India Vol.II (1986) quotes Gordon Childe's comment that science and technology only develop during periods of urbanization. He describes two such periods in Ancient India, to which we can add two that developed in the succeeding centuries.

1. First Urbanization : Indus Vally Civilization (about 2300 B.C to 1750 B.C.)
   Dark Age from : 1750 B.C to about 700 B.C.
2. Second Urbanization : Aryan cities in the upper and middle Ganges plains
3. Third Urbanization : The Industrial Revolution and British colonization
4. Fourth Urbanization : Information Technology Revolution and Global Village.

Archaelogists in the second and third decades of the 20th century dug up the outlines of an imposing civilization with a considerable number of flourishing cities in the Indus River Valley extending into Haryana and Lothal, a sea-port, in Gujarat. The First Urbanization is viewed as resulting from profound socio-economic transformation from the neolithic villages to city life in the full sense. An important trait of city life was the creation of exact and predictive sciences-mathematics and astronomy - for revenue and property, inventories, building cities and calculating the farmer's calender. The farmers surplus could be taken away for trade and commerce and city activities. We are still in the dark regarding the nature of the ruling class as no written material can be used for the purpose since their script has not been deciphered. On the analogy of the situation in Egypt and Mesopotamia it has been suggested that the administration was controlled by priest- groups who used religion, magic and superstitious beliefs to control the people. The city centres of the First Urbanization came to an end about 1750 B.C. for complex reasons as yet not fully understood. Thereafter followed a thousand years called the Dark Age.

About the eighth or seventh century B.C. Indian history started taking a dramatic turn towards the Second Urbanization. After the conquest by the migrating Indo-Aryans of the indigenous people, tribal groups began to settle in towns. Tribal wars led to the establishment of kings and kingdoms first in the upper Ganges basin, followed by the middle Ganges plains and then gradually throughout the sub-continent. There was a profound intellectual turmoil and thinkers explored

various alternative avenues to understand nature. Thus came into being the first Indian scientist with a superb scientific method, which paved the way for the revolutionary move forward from magico-religious medicine to rationalist medicine. His name comes down to us as Uddalaka Aruni of the Gautama clan. He was the first to formulate and apply the essentials of the method of experimental verification. Secondly, he developed in a rudimentary form a promising unified theory of man and nature. Both contributed to the making of the tradition of rationalist medicine in the Indian subcontinent. Its essence consisted of the observation of facts (Skt drstanta) and reasoning or generalizing (Skt. Hetic) based on it.

Without bluntly rejecting the earlier scriptures embodying mythological beliefs and religious injunctions, Uddalaka dismisses all these in favor of a rational search for the ultimate cause of everything in nature recommending direct observation in the real sense. By an experimental demonstration he discovers to his son that which is the finest essence this whole world has that is its soul. That is Reality. That is Atman. That art thou, Svetaketu. (Chandogya Upanishad 13.1 1.4 and 6.3.1-15)

Uddalaka deserves to be placed with Thales of Miletus (640-546B.C.) who is believed by Western scientists to have initiated the spirit of inquiry and the pioneer of scientific observation. The main source of our information regarding Uddalaka Aruni are the Upanishads, particularly one chapter in the Chandogya Upanished exclusively recording his discourse though this needs to be supplemented by some passages from earlier sources like the Satapatha Brahmana (xi, 4.1-9) which mentions him as a man of considerable wisdom, willing to acquire that he himself did not possess from whomsoever possessed it, regardless of caste or status. The early Buddhist literature contains 550 stories called Jatakas which orthodox Buddhists believe to be accounts of Buddha's former births. One of these (Jataka No. 487) bears the name Uddalaka and mentions that he studied in Taxila under a renowned teacher there. He became highly learned and the leader of a group of roving ascetics in quest of knowledge and purity. He seemed to repeatedly point out that the only right method of scientific investigation into the nature of reality is that of inference by way of induction. His basic theme is that of the making (or evolving) of everything in the universe from the primeval matter. From this naturally follows the view that in the ultimate analysis man is nothing but an evolution of it - a view formulated in the text by the oftrepeated formula, "That thou art, Svetaketu." There is no scope in this formula for any divine agency having anything to do with the making of man. The phenomenon called death was understood by him as the return of the body to food, water and heat and therefore ultimately to 'sat', or primeval matter.

The essential core of medical science took shape already before the time of the Buddha who died around 485 B.C. or shortly after Uddalaka's time. The Caraka Samhita admits that various medical systems were in circulation. Apparently, during the formative period of rationalist medicine, different authorities were groping in different ways for determining the most effective therapeutic principles; various avenues had to be explored for medical science to be standardized.

What was the status of doctors in our early history ? While steps were being taken by the ancient physicians and surgeons to move towards remarkable results, the utmost contempt was shown for them in the legal literature, the Dharmashastras, when the law codes were taking distinct shape in the sixth and fifth century B.C. It was declared that they were so inherently impure that their very prescence pollutes a place; food received or given to them was impure, they were not invited for sacrificial ceremonies, in social status they were considered no better than whores, hunters and followers of other despicable professions (Apasthamba 1.6.19; Gautama xvii.7; and Vashistha xiv. 1 - 10, 19). The obvious need of their services to society was acknowledged of course, as was that of the followers of other mean professions. Because the healers were absolutely shorn of respectability it was prescribed that medical practice should better be restricted to the Ambastha caste (Manu X.46-47). According to Manu (X. 116) persons of noble birth are forbidden learning that is different from the learning of the Vedas; medicine, logic and poison-removing being mentioned. The law givers understood that medicine and logic are closely related. Logic was detested for the reason that

excessive indulgence in logic encourages heresy or the tendency to question the scriptures. The Dharmashastras have the primary purpose of validating the ideal of the hierarchial society - an ideal of which the priests were the main theoretical custodians. P.V. Kane in his monumental "History of the Dharmashastras" shows that already "dharma" acquired a sense of "the priveleges, duties and obligations of a man, his standard of conduct as a member of the Aryan community, as a member of the caste, as a person in a particular state of life."

In the translation of Kautilya's "Arthashastra" (about 300 B.C) by Professor R. Shama Shastri of Mysore there is chapter on salaries to be paid by the Mauryan Emperor to his employees. The highest salary was 64,000 panas and only the Queen Mother, heir apparent, the Chief Minister, the Commander - in - chief of the Army, the Chief of the Harem, the Emperor's Purohit or spiritual advisor and the family priest were entitled to it, possibly because of their proximity to the Ruler and the fear of assassination. The next salary slab was halved to 32,000 panas for notable government functionaries and subsequently halved over and over again. The physician was placed in the salary slab of 4 panas flanked by the water-carrier and the horse-groom. The belief got institutionalized creating formidable difficulties for the progress of medical science. As late as 1836 when the Calcutta Medical College was started, when an Orthodox Hindu got enrolled and actually dissected a cadaver his courage had to be boosted by the booming guns of Fort Williams. If, hardly 170 years back, so much courage was needed to overcome orthodox opposition to dissection and all this under the protection and patronage of a powerful Government, it is not difficult to imagine how much greater courage was required of the ancient surgeons to prescribe a detailed mode of dissection as a necessary precondition for attaining medical proficiency.

Europeans after gaining entry into India built a series of hospitals but to start with, and for two centuries thereafter, these hospitals were solely for Europeans. The first European hospital was founded by the Portuguese Albuquerque in 1510 at Goa. Its management was handed over to the Jesuits who made it one of the best managed hospitals in the world. For the care of the native poor the British built a hospital in South Madras called the Native Infirmary which was named the Stanley Hospital in 1940. The French built a hospital in Pondicherry in 1701 and when the French left India the Government of India upgraded it to JIPMER. In Calcutta a hospital for the native poor was built in 1792, a precursor of the later Medical College Hospital. In Bombay the first Britsh hospital was built in 1676. In 1843 through a munificent donation by Sir Jamshetji Jeejeebehoy the J.J. Hospital started and two years later the Grant Medical College was attached to it. At first no Indians were attached to the teaching faculty. The Gordhandas Sunderdas Medical College and the K.E.M. hospital arose as a counter to British managed hospitals in 1925. The most important condition of the endowment was that all members of the teaching faculties should be well qualified Indians. Dr. Jivraj Mehta was its first dean.

It is commonly believed that proper education in India was started by the British. Mahatma Gandhi in a speech at Chatham House, London, in 1931, October 20 said, "I say without fear of my figures being challenged successfully, that today India is more illiterate than it was fifty or a hundred years ago, because the British administrators when they came to India, instead of taking things as they were, began to root them out. They scratched the soil and began to look at the root and left the root like that, and the beautiful tree perished. The village schools were not good enough for the British administrator, so he came out with his programme. Every school must have so much paraphernalia, buildings and so forth. Well, there were no such schools at all. There are statistics left by British administrations which show that, in places where they have carried out a survey, ancient schools have gone by the board, because they was no recognition for these schools, and the schools established after the European pattern were too expensive for the people."

William Adams in his 'Report on the State of Education in Bengal and Bihar in 1835 observed that there seemed to exist 100,000 village schools in Bengal and Bihar attached to temples, mosques and dharamsalas. In the Madras Presidency the Governor, Sir Thomas Munro, stated that "every village had a school' and for areas in

the Bombay Presidency around 1820 G.L. Prendergast found "that there is hardly a village, great or small, throughout our territories, in which there is not at least one school, and in larger villages more." Dr. G. W. Leitner in 1882 showed that the spread of education in Punjab around 1850 was of the same extent. Despite the politically unsettled times the most unscrupulous chief, the avaricious money lender and even the free - booter vied with the small landowner in making peace with his conscience by founding schools and rewarding the learned. Institutions of higher learning existed in many districts of Madras Presidency according to the collector's reports. In Malabar, the Samudrin Raja (Zamorin) maintained one old institution as a family trust. Where no colleges existed such learning in the Vedas, Shastras (Law), Astronomy, Ganeet, Ethics etc. were imparted in agraharams or usually at home. The Malabar data mentioned 194 pupils to be studying medicine.

How was all this education actually organized and maintained? The village to an extent had all the semblance of a State; it countrolled revenue and exercised authority within its sphere. Notwithstanding all that has been written about empires - Mauryan, Vijayanagar, Mughal etc. - throughout its history Indian society and polity has basically been organized according to non-centrist concepts. The annual exchequer receipts of the Emperor Jehangir did not amount to more than five percent of the computed revenue of the empire, and that of Aurangzeb, with all his zeal for maximizing such receipts, did not ever exceed 20 percent. In terms of basic expenses, both education and medical care, like the expenses of the local police and the maintenance of irrigation facilities, had primary claims on revenue. It was this revenue that maintained not only higher education but also the system of elementary education. Other recepients of revenue included those employed in administrative, economic and accounting activities; religious and charitable allowances, agraharams, maintenance of religious places, pundits, poets, joshis, medical practitioners and others.

The dispossession of the various categories of revenue assignees started as soon as the British took over de facto control of any area. Through various means like enhanced rates of assessments, revenue assignments, cash or grain allowance for teachers being appropriated to the total state revenue, slashing down of district charges, that is, the amounts traditionally utilized within the districts. The degeneration of education is ascribable to the gradual but general impoverishment of the country, and the means of the manufacturing classes greatly diminished by the introduction of European manufactures.

The neglect and uprooting of Indian education, and its replacement by an alien and rootless system had several consequences for India. To begin with it led to an obliteration of literacy and knowledge of such dimensions that recent attempts at universal literacy and education have been unable to make an appreciable dent in it. Next it destroyed the Indian social balance in which traditionally, persons from all sections of society appear to have been able to receive an optimum schooling which enabled them to participate openly and appropriately in the social and cultural life of their locality. And most importantly, till today, it has kept most educated Indians not only ignorant of the society they live in , the culture which sustains this society, but yet more tragically for over a century it has induced a lack of confidence and loss of bearing amongst the people of India in general.

Dr. Farouk E. Udwadia noted in his book "Man and Medicine," medicine does not change in an isolated milieu or as an isolated phenomenon. It was merely a part of the change that altered the whole fabric of human society; and each aspect of life and living influenced the other.

How does one acquire learning? In the seventh century A.D. Adi Sankaracharya said, " One fifth is the inherent qualities of the student; one fifth is by discussion and study together with his fellow - students. One fifth by a teacher interested to teach; one fifth by his own hard work and efforts; and one fifth by experience.

The present scenario in teaching hospitals in bleak. All departments are understaffed and the government's policy is to downsize the number of salaried faculty.

The best talent is no longer attracted by the offered salaries. The majority opt for private practice and the problem is to acquire experience, judgment and updating of knowledge and skills. Holding workshops and C.M.E.s are not enough. We need to evolve a more dynamic medical education by harnessing the methods of modern information technology.

Recent decades have seen an explosion in the knowledge base in surgery. The development of sophisticated operative techniques has demanded subspecialization in surgical training. Individual faculty members carry this a step further when they become "superspecialists" with practices confined to anatomically circumscribed targets. This trend towards tunnel vision undermines the clinical practice setting. This phenomenon is ironic. Scientific progress has refined the surgeon's armamentarium - but only if properly recruited. Specialists have lost their common educational moorings, so too have they lost their ability to communicate and to strengthen each other's role in patient care.

Professor K. Mohandas, Director of Sri Chitra Tirunal Institute of Medical Sciences, in an address at the Annual Conference of Vice- Chancellors at Chandigarh in December, 2001 outlined a program of action through an information technology enabled flexible education program. This program may be implemented in a phased manner with the following objectives:

1. To ensure quality, relevance and uniformity of standards in training and evaluation.
2. To encourage evidence- based medical practices and the use of appropriate technology which are proven, essential and cost-effective.
3. To enable a flexible training program allowing not only quick incorporation of the latest advances, but also one that will facilitate learning at one's own pace and place. Most of the training for specialization can be done at the practitioner's place of work or home, thus reducing prolonged absence from professional responsibilities and facilitating conscious learning and updating of knowledge, techniques and technology.

The proposal should ultimately lead to individualization of medical education and training so that the ill-effects of regimented education can be minimized both in quality and quantity. Moreover, the fruits of advances in health sciences would become more easily available to patients across a wider socio-economic spectrum.

PLAN OF ACTION

Phase I

1. Establish internet facilities in all the medical colleges and make it accessible to the students and teachers.
2. Encourage students to gather information from the Internet to supplement those from standard text-books. Small discussion groups mentored by teachers may then discuss all the information, with the teacher lending his/her experience to clarify doubts, assess the credibility of the information and helping to adapt it to the local/regional realities. The whole process should be aimed at synthesizing and assimilating information so that its application becomes clear and practicable.
3. The Health Science Universities and the medical faculties of traditional universities may set up e-groups (discussion groups) within and among themselves so that knowledge, information, experience and problems may be shared and discussed in a wider circle.

This phase should be completed in about 24 months, at the end of which all training institutions will be net worked to optimize information acquisition, dissemination and assimilation, both from the point of view of expanding the knowledge base as well as its most effective application.

Phase II

Aim to establish the necessary infrastructure to utilize the benefits and advances in information technology. With a national nodal agency entrusted to complete infrastructural development and co-ordinating the resultant multi media network, the phase should in five years ensure that the national health sciences network will be able to adopt, absorb and adapt to the rapid technological developments that continuously

repave the information highway.

At the end of this phase the following objectives must have been achieved

1. A National Nodal Agency that coordinates the functioning of health science network.
2. Regional or state agencies responsible for network operations within the region/state and operating in tandem with the national co-ordinator.
3. A reorganized undergraduate curriculum that maximizes learning and optimizes practical application of existing and emerging clinical and research information, using the tools of information technology.
4. Online retrieval of information from a national main frame computer. Knowledge and information from all institutions must also be made available to this central storage facility.
5. Video conferencing facilities, if not in every teaching institution, at least in well dispersed and strategically located centers so that geographical distances will not prove to be major impediment.
6. Facility for digital data transmission of texts, biological signals (ECG, EEG, EMG etc) and images - not necessarily restricted to teaching institutions, but also accessible and available from reputed hospitals, research institutions and even individual practitioners.

Phase III

This phase which should ideally be completed in 10 years should usher in an era of flexible learning and training at the postgraduate level with facilities for continuous updating of knowledge and skills, as well as evaluation and recertification of the competency of medical teachers and practitioners at optimal intervals.

More specifically

1. Acquisition of knowledge and skills for specialist practice and their evaluation at a pace affordable and feasable for the aspirants. The curriculum and training programs must be so designed as to enable the candidates to undergo the training without having to leave their place of practice or work for long periods, and the number of candidates need not have to be restricted as in the existing educational systems.
2. An accreditation system for hospitals which can serve as training centres so that trainees can choose a hospital not too far and not too different from their patient population, epidemiological composition and disease burden.
3. Public health programs integrated into Clinical practice so that the new paradigm of health care delivery system that would hopefully emerge from the reorganized education and training programs, based on flexibility, relevance and feasibility, will have prevention of diseases and promotion of health as the first priority.

The Government of India and the State Governments, in association with the Medical Council of India should adopt the implementation of technology enabled medical education as an urgent priority. It should form part of the new National Health Policy. Perhaps the first step may be the identification of an agency to work out the detailed action plan in a time-bound manner and this could be done by the Union Ministry of Health following a round of consultations with the State Governments, the Ministry of Human Resources Development and the Medical Council of India.

Our heritage of Indian Medicine stretches over 5000 years, from the period of the First Urbanization to the era of the global village. That medical science is not merely a branch of technical knowledge, but that it has an important ethical aspect, have been emphasized in both Susruta and Charka Samhitas as well as in various medical codes of ethics upto the present times. Zoroastrianism, the first monothestic religion in the world, in its scripture, Avesta embodied the tenets of its priest physicians or Magi in the three words-humata, hukata, havarasta-which means "good thoughts," "good words" "good deeds". The same three words are the Tata crest adopted by Jamshetji Tata.

"The difficulty lies not in the new ideas, but in escaping the old ones, which ramify into every corner of our minds."

J. M. Keynes

REFERENCES

1. Alberuni's India. An account of India about A.D. 1030. In: Sachau,

Edward C, editors. Delhi - Jullundur - Lucknow- Bombay: Popular Edition; S. Chand & Co; 1964.
2. Bhishagratna, Kaviraj Kunja Lal. An English translation of the Susruta Samhita. Based on Orginal Sanskrit Text in three volumes. K. L. Bhishagratna Calcutta, No. 10, Kasi Ghose's Lane. 1907
3. Bower, Hamilton. The Bower Manuscript translated by A.G.R. Hoernle. Oxford: The Bodlean Library; 1909.
4. Calders Ritchie. Medicine and Man. George Allen and Unrwin. London: 1958.
5. Chattopadhyaya, Debiprasad: History of Science and Technology in Ancient India. Calcutta: Firma Klm Pvt Ltd; Vol 11. 1986.
6. Da Bartolomeo, Fra Paulino. On Education of Children in India. Voyages to the East Indies. Book 11. Rome: 1796.
7. Dharampal. The Beautiful Tree: Indigenous Indian Education in the Eighteenth Century. New Delhi: Biblia Impex Pvt. Ltd; 1983.
8. Flexner, Abraham. Medical Education in the United States and Canada. New York City: The Carnegie Foundation; 1910.
9. HH Bhagvat Sinh Jee, Maharaja of Gondal. A Short History of Aryan Medical Sciences. 2nd edn. Shree Bhagvat Sinh Jee. Gondal: Electric Printing Press; 1927.
10. Jaggi OP. A Concise History of Science. Chandigarh,Delhi: Atma Ram & Sons; 1974.
11. Jolly, Julius. Indian Medicine translated from German by C.G. Kashikar. Poona: 1951.
12. Kane PV. History of the Dharmshastras. Poona: Bhandarkar Oriental Institute; 1946.
13. Sastri, Shama R. Arthashastra of Kautilya.3rd edn. Mysore: Mysore University Press; 1929.
14. Sigerist HE. History of Medine 11. Early Greek, Hindu and Persian Medicine. New York: Oxford University Press; 1961.
15. Singhal GD, Tripathi SN, Chatuvedi GN. Fundamental and Plastic Surgery Considerations in Ancient Indian Surgery based on Chapters 1 - 27 of Sutra-Sthana of Susruta Samhita. Varanasi: Singhal Publications; 1981.
16. Sri Sankara carya. Viveka cudami translated by Swami Madhavananda. Calcutta: Advaita Ashram (Publication Department); 1989.
17. Svoboda, Robert E. Ayurveda: Life, Health and Longevity New Delhi: Penguin Books (India) Ltd; 1993.
18. Udwadia FE. Man and Medicine. New Delhi: Oxford University Press; 2000.
19. Wujastyk, Dominik. The Roots of Ayurveda. London New York Toronto New Delhi: Penguin Books; 1998.
20. Zimmer, Henry R. The Science of Hindu Medicine. Vadodara: Good Companions Publishers; 2000.