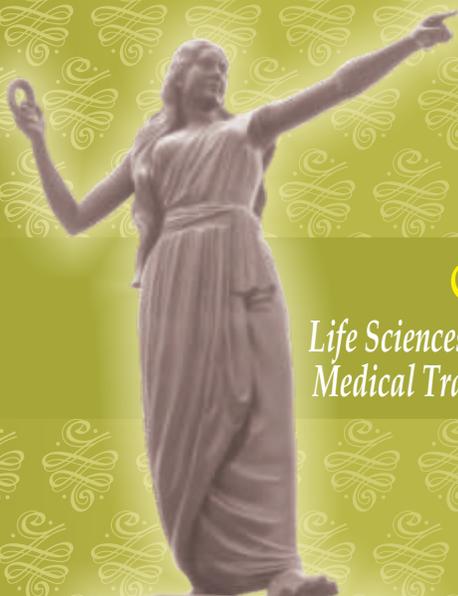


Knowledge

TRADITIONS & PRACTICES OF INDIA

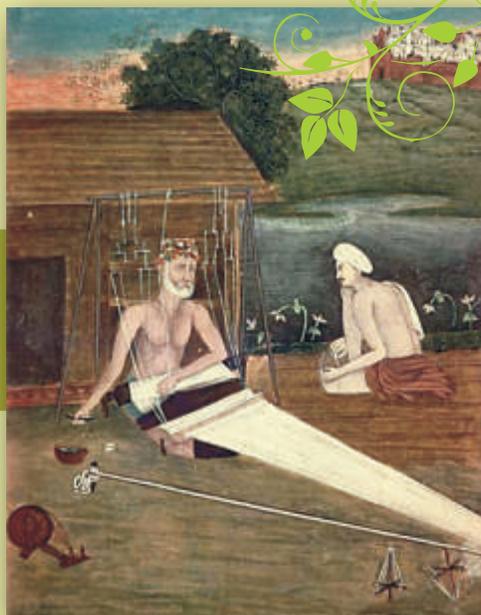
Textbook for Class XI



Statue of Kannagi, Chennai

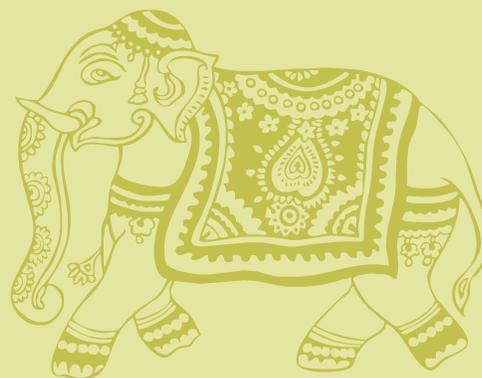
Module 6

Life Sciences (2) The Historical Evolution of Medical Tradition in Ancient India - Part 2



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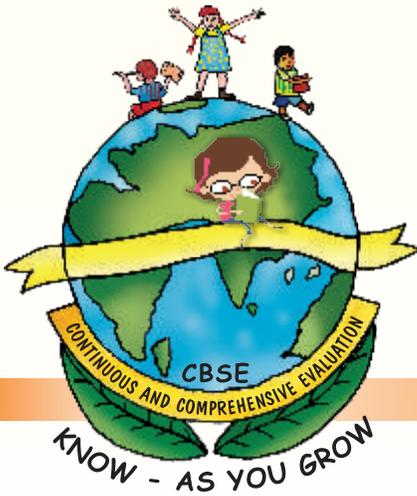
नया आगाज़

आज समय की माँग पर
आगाज़ नया इक होगा
निरंतर योग्यता के निर्णय से
परिणाम आकलन होगा।

परिवर्तन नियम जीवन का
नियम अब नया बनेगा
अब परिणामों के भय से
नहीं बालक कोई डरेगा
निरंतर योग्यता के निर्णय से
परिणाम आकलन होगा।

बदले शिक्षा का स्वरूप
नई खिले आशा की धूप
अब किसी कोमल-से मन पर
कोई बोझ न होगा

निरंतर योग्यता के निर्णय से
परिणाम आकलन होगा।
नई राह पर चलकर मंज़िल को हमें पाना है
इस नए प्रयास को हमने सफल बनाना है
बेहतर शिक्षा से बदले देश, ऐसे इसे अपनाए
शिक्षक, शिक्षा और शिक्षित
बस आगे बढ़ते जाएँ
बस आगे बढ़ते जाएँ
बस आगे बढ़ते जाएँ.....





Knowledge

TRADITIONS & PRACTICES OF INDIA

Textbook for Class XI

Module 6

*Life Sciences (2) The Historical Evolution of
Medical Tradition in Ancient India - Part 2*



CENTRAL BOARD OF SECONDARY EDUCATION

Shiksha Kendra, 2, Community Centre, Preet Vihar, Delhi-110 092 India



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Preface

India has a rich tradition of intellectual inquiry and a textual heritage that goes back to several hundreds of years. India was magnificently advanced in knowledge traditions and practices during the ancient and medieval times. The intellectual achievements of Indian thought are found across several fields of study in ancient Indian texts ranging from the Vedas and the Upanishads to a whole range of scriptural, philosophical, scientific, technical and artistic sources.

As knowledge of India's traditions and practices has become restricted to a few erudite scholars who have worked in isolation, CBSE seeks to introduce a course in which an effort is made to make it common knowledge once again. Moreover, during its academic interactions and debates at key meetings with scholars and experts, it was decided that CBSE may introduce a course titled 'Knowledge Traditions and Practices of India' as a new Elective for classes XI - XII from the year 2012-13. It has been felt that there are many advantages of introducing such a course in our education system. As such in India, there is a wide variety and multiplicity of thoughts, languages, lifestyles and scientific, artistic and philosophical perceptions. The rich classical and regional languages of India, which are repositories of much of the ancient wisdom, emerge from the large stock of the shared wealth of a collective folklore imagination. A few advantages given below are self explanatory.

- India is a land of knowledge and traditions and through this course the students will become aware of our ancient land and culture.
- Learning about any culture particularly one's own culture - whatever it may be - builds immense pride and self-esteem. That builds a community and communities build harmony.
- The students will be learning from the rich knowledge and culture and will get an objective insight into the traditions and practices of India. They will delve deeply to ascertain how these teachings may inform and benefit them in future.
- The textbook has extracts and translations that will develop better appreciation and understanding of not only the knowledge, traditions and practices of India but also contemporary questions and issues that are a part of every discipline and field in some form or another.

This course once adopted in schools across India can become central to student learning: each student brings a unique culture, tradition and practice to the classroom. The content is devised in a way that the educator becomes knowledgeable about his/her students' distinctive cultural

background. This can be translated into effective instruction and can enrich the curriculum thereby benefitting one and all. This insight has close approximation with the pedagogy of CCE.

The course is designed in a way that it embodies various disciplines and fields of study ranging from Language and Grammar, Literature, Fine Arts, Agriculture, Trade and Commerce, Philosophy and Yoga to Mathematics, Astronomy, Chemistry, Metallurgy, Medicine and Surgery, Life Sciences, Environment and Cosmology. This can serve as a good foundation for excellence in any discipline pursued by the student in her/his academic, personal and professional life.

This book aims at providing a broad overview of Indian thought in a multidisciplinary and interdisciplinary mode. It does not seek to impart masses of data, but highlights concepts and major achievements while engaging the student with a sense of exploration and discovery. There is an introduction of topics so that students who take this are prepared for a related field in higher studies in the universities.

The examination reforms brought in by CBSE have strengthened the Continuous and Comprehensive Evaluation System. It has to be ascertained that the teaching and learning methodology of CCE is adopted by the affiliated schools when they adopt this course. The contents have to cultivate critical appreciation of the thought and provide insights relevant for promoting cognitive ability, health and well-being, good governance, aesthetic appreciation, value education and appropriate worldview.

This document has been prepared by a special committee of convenors and material developers under the direction of Dr. Sadhana Parashar, Director (Academic & Training) and co-ordinated by Mrs. Neelima Sharma, Consultant, CBSE.

The Board owes a wealth of gratitude to Professor Jagbir Singh, Professor Kapil Kapoor, Professor Michel Danino, and all those who contributed to the extensive work of conceptualizing and developing the contents. I sincerely hope that our affiliated schools will adopt this new initiative of the Board and assist us in our endeavour to nurture our intellectual heritage.

Vineet Joshi
Chairman



Convenor's Note by Professor Jagbir Singh

In 2012, CBSE decided to introduce an Elective Course 'Knowledge Traditions and Practices of India' for classes XI and XII and an Advisory Committee was constituted to reflect on the themes and possible content of the proposed course. Subsequently Module-Preparation Committees were constituted to prepare ten modules for the first year of the programme to include the following Astronomy, Ayurveda (Medicine and Surgery), Chemistry, Drama, Environment, Literature, Mathematics, Metallurgy, Music and Philosophy.

Each module has;

- I. A Survey article
- ii. Extracts from primary texts
- iii. Suitably interspersed activities to enable interactive study and class work
- iv. Appropriate visuals to engender reading interest, and
- v. Further e- and hard copy readings.

Each module in the course has kept in mind what would be a viable amount of reading and workload, given all that the class IX students have to do in the given amount of time, and controlled the word-length and also provided, where needed, choices in the reading materials.

Each Module consists of:

- I. A Survey Essay (about 1500-2000 words) that introduces and shows the growth of ideas, texts and thinkers and gives examples of actual practice and production.
- ii. A survey-related selection of extracts (in all about 2000 words) from primary sources (in English translation, though for first hand recognition, in some cases, where feasible, the extracts are also reproduced in the original language and script).
- iii. Three kinds of interactive work are incorporated, both in the survey article and the extracts - comprehension questions, individual and collective activities and projects (that connect the reading material and the student to the actual practice and the environment).
- iv. Visuals of thinkers, texts, concepts (as in Mathematics), practices.
- v. Internet audiovisual resources in the form of URLs.
- vi. List of further questions, and readings.

The objective of each module, as of the whole course, is to re-connect the young minds with the large body of intellectual activity that has always happened in India and, more importantly, to

enable them (i) to relate the knowledge available to the contemporary life, theories and practices, (ii) to develop, wherever feasible, a comparative view on a level ground of the contemporary Western ideas and the Indian theories and practices, and (iii) to extend their horizons beyond what is presented or is available and contemplate on possible new meanings, extensions and uses of the ideas - in other words to make them think.

We have taken care to be objective and factual and have carefully eschewed any needless claims or comparisons with western thought. Such things are best left to the readers' judgement.

This pedagogical approach clearly approximates CBSE's now established activity-oriented interactive work inviting the students' critical responses.

It is proposed to upload the first year's modular programme to be downloaded and used by schools, teachers and students.

As a first exercise, we are aware that the content selection, a major difficult task, can be critically reviewed from several standpoints. We do not claim perfection and invite suggestions and concrete proposals to develop the content. We are eagerly looking forward to receiving the feedback from both teachers and students. That would help us refining the content choice, the length and the activities. We will also thankfully acknowledge any inadvertent errors that are pointed out by readers.

The finalisation of this course is thus envisaged as a collective exercise and only over a period of time, the Course will mature. We know that perfection belongs only to God.

If our students enjoy reading these materials, that would be our true reward.

Prof. Jagbir Singh
Convenor



Acknowledgement

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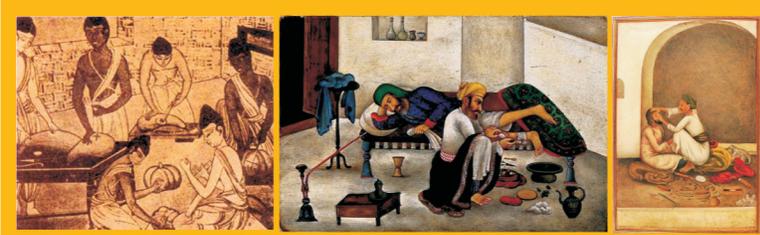


Content of Module 6



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Life Sciences (2) The Historical Evolution of Medical Tradition in Ancient India -Part 2

LIFE SCIENCES (2)

The historical evolution of medical tradition in ancient India: A survey

Specialization into eight branches

The history of medicine in India spans a period of several thousand years, definitely dating back to a few centuries before the Common Era. There is evidence that the earliest textbooks of Ayurveda like *Caraka Saṃhitā* (General Medicine), *Suśruta Saṃhitā* (Surgery), and *Kāśyapa Saṃhitā* (Paediatrics) were edited and revised several times over a thousand years. They attained their current form in the first few centuries of the Common Era. It is an amazing fact that so early, Sanskrit texts were composed dealing exclusively with specialties like Paediatrics, Surgery, Ophthalmology, ENT and so on. In these texts, Ayurveda is already seen in a developed form specialized into eight branches: General Medicine, Surgery, Ophthalmology-ENT-Dentistry, Paediatrics, Psychiatry, Toxicology, Rejuvenative Medicine and Reproductive Medicine. Around the 6th or 7th centuries CE, the renowned physician Vāgbhaṭa compiled the specialized knowledge of the eight branches of Ayurveda into one compendium; the larger version is known as *Aṣṭāṅga Saṃgraha* and the shorter version is called *Aṣṭāṅga Hṛdaya*.

To what extent do the eight branches of Ayurveda cover the medical field as we know it today?

The tradition of surgery

The tradition of surgery in Ayurveda has a long history. Researchers at the University of Missouri-Columbia discovered that physicians in ancient India had developed technology to drill teeth and remove decay 8,000 to 9,000 years ago. Study of fossils from Mehrgarh,

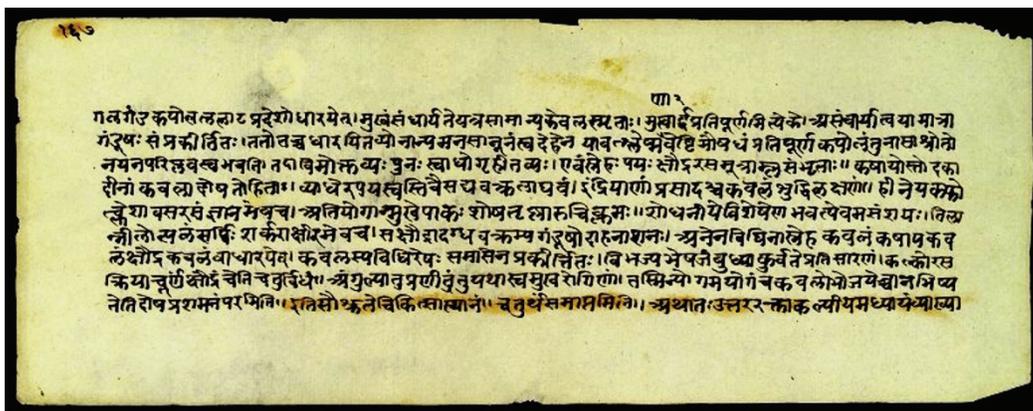
Life Sciences (2) The Historical Evolution of Medical Tradition in Ancient India -Part 2



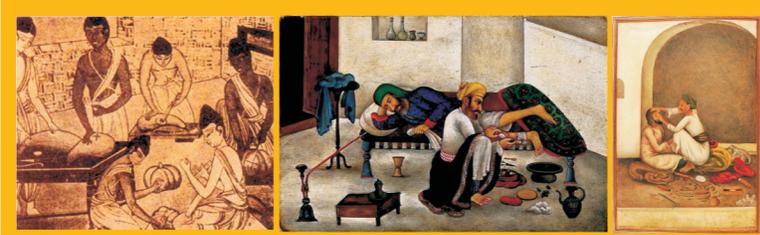
now in Pakistan, revealed tiny holes drilled into teeth on the biting surface of male molars. Evidence has also been unearthed from Harappa and Lothal revealing an ancient surgical practice on a Bronze Age skull dating back to nearly 4,300 years ago. Trepanation, a common means of surgery practised in prehistoric societies starting with the Stone Age, involved drilling or cutting through the skull vault, often to treat head injury or to remove bone splinters or blood clots caused by a blow to the head.



A mesolithic (15,000 – 6,000 BCE) rock painting from Bhimbetka, Madhya Pradesh, seems to depict surgery being performed on a subject's head or eye.



A folio from a manuscript of the *Suśruta Saṃhitā*, an Ayurvedic textbook on various surgical procedures and surgical instruments. (Courtesy: Wellcome Library, London)



Life Sciences (2) The Historical Evolution of Medical Tradition in Ancient India -Part 2

The saga of Indian surgery continued to flourish and reached its acme in the time of Suśruta, who is believed to have lived in the 2nd century BCE. Suśruta is now revered as the father of surgery and advocated a thorough study of anatomy by dissecting the dead body. He introduced the method of sterilizing surgical instruments to prevent sepsis after surgical procedures. The compendium of Suśruta describes hundreds of sharp and blunt surgical instruments and many of them resemble instruments used by surgeons today. Suśruta is recognized for having developed innovative surgical procedures like reconstruction of the nose or rhinoplasty through plastic surgery, use of a specific species of ants as dissolvable sutures to close the intestines, surgical removal of cataract, and surgical management of urinary calculi.



Medical and surgical implements of 19th century origin from India. (Courtesy: Science Museum, London)

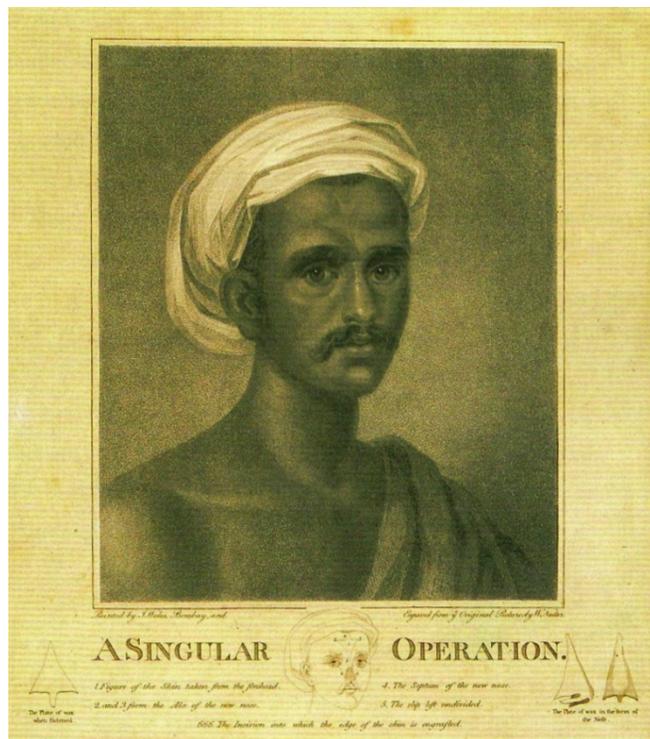
Life Sciences (2) The Historical Evolution of Medical Tradition in Ancient India -Part 2



How far do you think one can learn surgery by practising on vegetables?

This painting shows Suśruta's disciples learning surgery by working on vegetables.

This painting by James Wales, commissioned in 1794 by two British surgeons, was published along with the first known description of plastic surgery in the West. (Courtesy: Wellcome Institute, London)



Life Sciences (2) The Historical Evolution of Medical Tradition in Ancient India -Part 2

The Indian rhinoplasty technique was (re)discovered by Western medicine in the 18th century, when the East India Company surgeons Thomas Cruso and James Findlay witnessed Indian rhinoplasty procedures at the British Residency in Poona. The surgeons published photographs of the procedure and its nasal reconstruction outcomes in the October 1794 issue of the *Gentleman's Magazine* of London.



An oculist treating a patient with specialized instruments.
(Painting of 1825, courtesy The British Library, London)



Medical genetics in Ayurveda

In the *Caraka Samhitā* one comes across the earliest reference to the genetic basis of diseases. Caraka points out that the reproductive element is composed of seeds (*bīja*) which are further divided into parts (*bījabhāga*) and subparts (*bījabhāgāvayava*). Each part or subpart of a seed represents a particular organ of the body and damage to the part can damage the organ.

Inoculation for smallpox

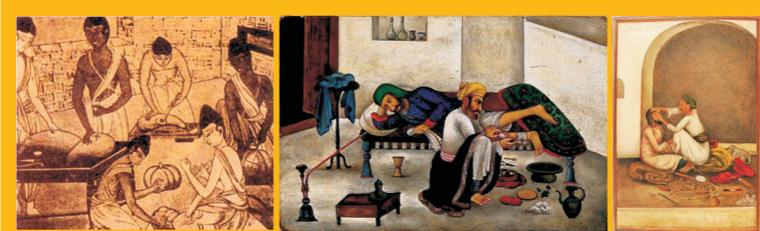
In the 18th century, British officials and travellers observed and documented the practice of inoculation for smallpox, which was in vogue in India centuries before vaccination was discovered by Edward Jenner. In an account written for London's College of Physicians, J.Z. Holwell, who studied and himself practised the Indian method of inoculation, testified to its great effectiveness in preventing the occurrence of smallpox.

Microbiology and parasitology

There are references to microbial life in textbooks of medicine like *Caraka Samhitā* dating back to several centuries before the Common Era. Lower life forms were classified into pathogenic and non-pathogenic. The pathogenic organisms include microbes that cannot be seen with the naked eye. Technical nomenclature was developed for different types of microbes and their shapes and sizes have also been described. How those physicians were able to provide such descriptions, or even conceive of microbes, centuries before microscopes were invented remains a mystery.

Communicable diseases and epidemics

Suśruta Samhitā describes communicable diseases and explains that disease can be transmitted from one person to the other by close contact, through air, sharing of



Life Sciences (2) The Historical Evolution of Medical Tradition in Ancient India -Part 2

clothes, sleeping together and so on. Fumigation is mentioned as a measure to prevent infectious diseases from spreading. *Caraka Saṃhitā* devotes an entire chapter to epidemiology and prescribes methods to prevent epidemics as well as manage the outbreak of epidemics. During the period of King Aśoka, an efficient public healthcare system was established.

An evolving pharmacopoeia

The practice of medicine in Ayurveda is based on the principle that there is no substance in the world that does not potentially have medicinal property. The evolution of Ayurvedic pharmacopoeia represents a continuous and unfinished quest for discovering new medicines from natural resources. About 1,500 medicinal plants have been described and formulated into thousands of medicines in the tradition of Ayurveda. Hundreds of animals and animal products have also been mentioned in the texts. Around the 6th century in the Common Era, the branch of medicine specializing in the use of minerals and metals known as *Rasaśāstra* developed and established itself, especially in the North of India (see module on **Chemistry in India**). The older tradition of herbal medicines continued to be practised in India's southern states. In Tamil Nadu, the system of Siddha medicine (traditionally regarded as having been founded by eighteen 'Siddhars' or realized beings, but in practice similar to Ayurveda) added to its pharmacopoeia drugs metallic and mineral components.

Pluralistic approach to healthcare

Ayurveda nurtured a pluralistic approach to healthcare in India. From ancient times, healthcare in India developed in the two streams of the folk and classical expressions. India has a rich tradition of folk medicine, which was organized into a paramedical force of health practitioners, bonesetters, poison healers and birth attendants who delivered

Life Sciences (2) The Historical Evolution of Medical Tradition in Ancient India -Part 2



primary healthcare for the people. Many of these traditions have survived into modern times. Today India is perhaps the only country in the world that officially recognizes a pluralistic healthcare system patronizing medical systems like Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy.

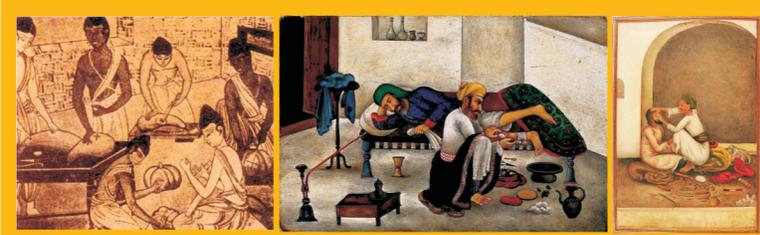
How is India's pluralistic healthcare in tune with Indian conditions and ethos?



This painting shows an Ayurvedic surgeon attending to a wound with his surgical instruments. (Courtesy: Wellcome Library, London)

Cross-cultural interactions

Ayurveda benefited from cross-cultural interactions and spread out of India into neighbouring countries like China, Sri Lanka, Tibet, Thailand and Indonesia. Buddhism played a major role in the spread of Ayurveda outside India. When Alexander the Great



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invaded India in 325 BCE, he was so impressed by the snakebite healers and Ayurvedic physicians that he invited them to Greece. There is historical evidence indicating interactions between the physicians of Greek medicine and Ayurveda. Important textbooks of Ayurveda like *Caraka Saṃhitā*, *Suśruta Saṃhitā* and *Aṣṭāṅga Hṛdaya* were translated into Tibetan, Persian and Arabic languages in the Middle Ages.

Travellers from China and the Middle East narrated in their accounts the advanced state of medical practice in India.

A dynamic literary tradition

The history of Ayurveda reveals the evolution of a vibrant and dynamic medical tradition with compendia, medical lexicons, pharmacopoeias, handbooks, manuals of treatment and so on being composed at important chronological and geographical landmarks. For example, in the 8th century CE, a treatise devoted exclusively to diagnostics was composed by Mādhava known as *Mādhava Nidāna*. In the 11th century, a new treatise was composed on dietetics by Viśvanātha Sena called *Pathyāpathyaviniścaya*. In the 13th century the *Śārṅgadhara Saṃhitā* was composed on the subject of pharmacy and pharmaceuticals, providing the first description of the physiology of respiration. When pulse diagnosis was introduced in Ayurveda, independent treatises were composed on the subject. This tradition of constant updating and documentation of medical knowledge continued without a break right up to the colonial period. In the 19th century, Ayurveda suffered a setback when unfavourable policies and regulations were enforced by the colonial rulers. However, with the publication of the main Ayurvedic texts, a revival set in around the turn of the 20th century, with a few leading Indian scholars coming out in defence of the discipline.



Global resurgence of Ayurveda

In the post-independence period, Ayurveda's resurgence continued, and in recent years it has been gaining prominence as a whole system approach to healthcare under the banner of Complementary and Alternative Medicine. Although it is not fully recognized in the West, Ayurveda is taught and practised in many countries like Germany, Italy, United Kingdom, Austria, Netherlands and so on. There are many schools of Ayurveda in the United States.

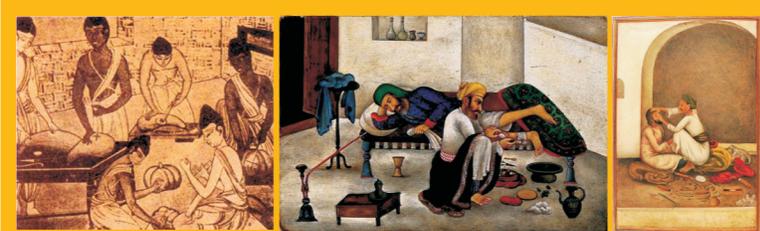
Why should Western nations be taking a growing interest in Ayurveda?

Contemporary status

Ayurveda continues to manage a wide range of conditions effectively like chronic degenerative diseases and life style disorders and is being sought after by people around the globe. As the world is moving towards an integrative approach to healthcare, Ayurveda continues to inspire visions of healing that is holistic, pluralistic and integrative at the same time through a tradition that has exhibited remarkable continuity, resilience and adaptiveness to the vicissitudes of time.

Comprehension questions

- Did you expect people to drill teeth or cut open skulls thousands of years ago? If not, why not?
- Name three fundamental texts of Ayurveda. What do they deal with?
- What areas of specialization do these texts reveal for Ayurveda?
- What important information regarding diseases does *Caraka Saṃhitā* contain?



Life Sciences (2) The Historical Evolution of Medical Tradition in Ancient India -Part 2

- Why do you think were British surgeon interested in India's method of nasal reconstruction?

Project ideas

- Make a list of the traditional systems of medicine in operation in India, and identify commonalities as well as differences.
- Studying closely the above photograph of surgical instruments, identify those that look like modern instruments and describe their functions. Then propose possible uses for those have not been identified.
- Fill up the table below with all names at your disposal:

| Physician | Period | Contribution | Relevance |
|-----------|--------|--------------|-----------|
| Suśruta | | | |
| Caraka | | | |
| Vāgbhaṭa | | | |
| Etc. | | | |

Extension activities

- Dharampal's book, Science and Technology in 18th Century India (which can be downloaded from the Internet*), has material (in chapters 3 and 7) on the smallpox inoculation practised in India up to colonial times. Study the material and prepare a two-page summary of it.

* <http://multiworldindia.org/wp-content/uploads/2010/05/Indian-Science-and-Technology1.pdf>

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- The same book has some data on eye and nose surgery (clue: search the text for 'surgery', 'nose' and 'caute'). Prepare a brief note, and compare the nose surgery with the procedure spelt out by Suśruta (see **Extracts from Primary Texts** below).
- Aśoka's Edicts are easily available on the Internet (for instance, www.cs.colostate.edu/~malaiya/ashoka.html). Locate the passages where he refers to healthcare and elaborate.

Further Reading

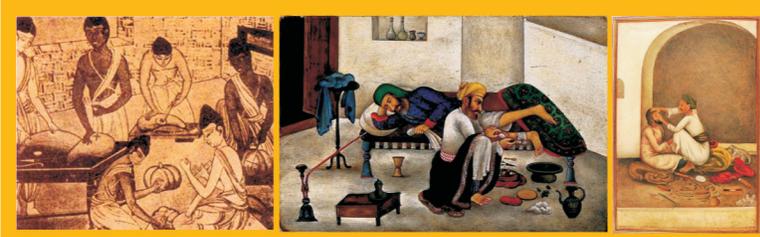
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Internet Resources (all URLs accessed in May 2012)

➤ Rhinoplasty

Dominik Wujastyk, a historian of Indian medicine explains the contributions of Suśruta in developing an effective method of plastic surgery for reconstruction of severed noses, which paved the way for modern rhinoplasty.

www.youtube.com/watch?v=kEpHFesE30E&feature=youtu.be



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➤ **Eye Surgery**

This video clip captures a traditional Ayurvedic eye specialist performing a minor surgical procedure on the eyelids of a patient using the stalk of the buds of the hibiscus flower. This is safer than and as effective as using a sharp surgical instrument.

www.youtube.com/watch?v=7wk7F2yA2h8&feature=youtu.be





Extracts from Primary Texts

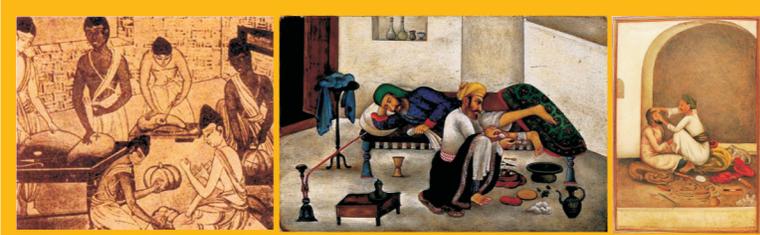
Dead body dissection

Verifying textual descriptions

Therefore the surgeon who desires to obtain undisputed knowledge should examine a cadaver and observe the anatomy of the body in detail. What is observed by direct perception and that which has been learnt from the texts will together enhance one's knowledge (1).*

One should take a cadaver of a person whose body is intact (2), who was not killed by poison (3), was not afflicted by chronic disease (4) and was below 100 years of age at the time of death. The intestines along with faecal matter should be removed and the body should be enclosed in a cage (5) after being packed with *muñja* [*Saccharum munja*] grass, *kuśa* [*Desmostachy abipinnata*] grass, sun hemp or other similar material (6). The body should be then immersed in a flowing stream and allowed to decompose in an area where there is not much light (7). After the body has decomposed, it should be examined thoroughly within a span of seven days, by scraping the skin layer by layer so that one can see clearly with one's own eyes the external and internal parts of the body. *Suśruta Saṃhitā, Śārīrasthāna*, 5.47-49 (tr. Dr. P. Ram Manohar).

* Numbers inserted in the extracts refer to the notes that follow them.



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Notes

1. Suśruta makes it clear that one should gain practical knowledge of anatomy to become a surgeon.
2. The body has to be intact to ensure that all parts and organs are preserved. Otherwise, the observations will contradict the textual descriptions.
3. The body of a person who has been poisoned should be avoided as the toxic effect of the poison will change the natural appearance of the skin and internal organs.
4. The characteristics of skin and other organs will be abnormal in a person who has been afflicted by chronic diseases. Bodies of such persons should not be used for dissection.
5. The body has to be kept in a cage when it is immersed in the stream to prevent the strong flow of the water from damaging it.
6. The body has to be packed with grass or bark to prevent it from being eaten by fish, which would result in deformation of the body parts.
7. If the body is kept in a very bright place, it will be attacked by vultures and eagles.

Rhinoplasty

Surgical repair of nose

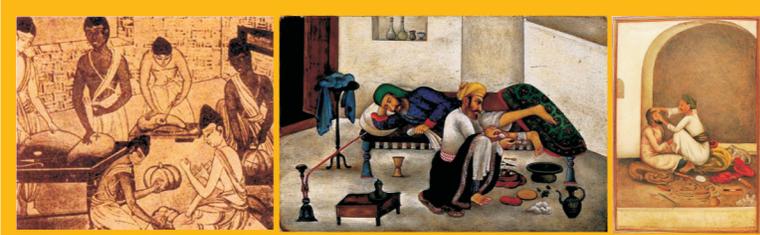
I shall explain the procedure for repairing a nose that has been severed (1, 2). The portion of the nose to be covered should be first measured with a leaf (3). Then a piece of skin of the required size should be dissected from the living skin of the cheek, and turned back to cover the nose, keeping a small pedicle attached to the cheek. The part of the nose to which the skin is to be attached



should be made raw by cutting the nasal stump with a knife (4). The physician then should place the skin on the nose and stitch the two parts swiftly, keeping the skin properly elevated by inserting two hollow reeds in the position of the nostrils, so that the new nose gets proper shape (5). The skin thus properly adjusted, it should then be sprinkled with a powder of licorice, red sandal-wood and barberry plant. Finally, it should be covered with cotton, and clean sesame oil should be constantly applied. Ghee should then be administered to the patient and when it has been digested, purgation should be induced as per the guidelines. When the skin has united and granulated, if the nose is too short or too long, the middle of the flap should be divided and an endeavour made to enlarge or shorten it (6). *Suśruta Saṃhitā, Sūtrasthāna*, 16.27-31 (tr. adapted from Gunakar Muley, 'Susruta: Great Scientists of ancient India', www.vigyanprasar.gov.in/dream/july2000/article1.htm).

Notes

1. This procedure of nose repair was practised in India right up to modern times and was witnessed by British surgeons during the colonial rule (see the first part of this module). A documentary can be viewed on YouTube: www.youtube.com/watch?v=cV-xZFic6m4
2. Rhinoplasty was attempted in other parts of the world, but Suśruta's method was far superior because he used the skin close to the site of the injured nose to reconstruct it. In the 16th and 17th centuries, Tagliacozzi used a tubed pedicle flap from the skin of the inner upper arm to reconstruct the nose, which was not very successful. On 23 October 1814, Joseph Carpue successfully reconstructed a nose using the Indian method, 30 years after he had first read about it. In due course of time, it became an established practice in modern plastic surgery and even today textbooks of surgery



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refer to this procedure as the Indian Method and credit Suśruta for having invented this technique.

3. A leaf was used as a template to cut the skin from the cheek. In due course of time, the surgeons in India preferred to use skin from forehead instead of the cheek.
4. The edges of the severed nose would be scraped to ensure blood supply and to facilitate union with the graft skin from the cheek.
5. Two hollow reeds are inserted into the nostrils to keep the airway patent so that the patient can breathe easily.
6. A second sitting was sometimes necessary to give the final shape and contour to the nose.

Genetic basis of diseases

Damage of seed and its parts

When the *doṣas* cause derangement in the seed or part of the seed representing a specific organ of the body, that particular organ becomes deranged (1).

In the female reproductive element, when the part of the seed representing the uterus becomes deranged, then the woman becomes infertile, if part of the seed is deranged, then the woman gives birth to a deformed baby (2), and if a fraction of the part of the seed representing the uterus is damaged, then a eunuch who looks like a woman but is devoid of the true characters of a woman is born (3). *Caraka Saṃhitā, Śārīrasthāna*, 4.30 (tr. Dr. P. Ram Manohar).



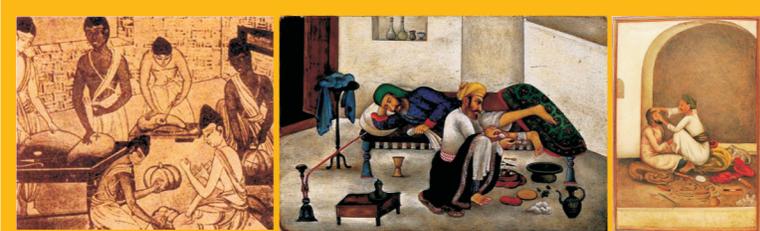
Notes

1. In these passages from the *Caraka Saṃhitā*, we find earliest speculations on genetic basis of disease. The genetic transmission of diseases was understood in many cultures and systems of medicine. However, the *Caraka Saṃhitā* stands out in having proposed a theory to explain the mechanism of transmission of genetic diseases. According to this text, every organ in the body is represented in a seed form in the reproductive elements of the father and the mother. When the seed or its part that is responsible for the development of a particular organ is damaged, then that organ is malformed from birth.
2. Here the consequences of the damage to the part of the seed or fraction of the part of the seed responsible for development of the uterus are explained. This means that Caraka was aware of the fact that every organ of the body was represented in seed form in the zygote and there were further fractions representing parts of these organs.
3. It is interesting to note Caraka pointing out the genetic basis for development of the secondary sexual characters in an individual.

Communicable Diseases

Modes of transmission

By repeated association, touching the body, by means of breath, eating together, sleeping together and using another's clothes and garlands, diseases like leprosy, fever, consumption, conjunctivitis and other communicable diseases spread from one person to another (1, 2). *Suśruta Saṃhitā*, *Nidānasthāna*, 5.33-34 (tr. Dr. P. Ram Manohar).



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Notes

1. Communicable diseases have been identified and described by ancient medical traditions. However, Suśruta was far ahead of his times in elaborating the mechanisms of transmission of disease.
2. In Ayurveda, the existence of invisible microorganisms was recognized. These microorganisms were also held responsible for causing diseases. (Refer to the first part of this module.) But microorganisms had not been identified as the cause for transmission of diseases from one person to the other. Nevertheless, *Suśruta Saṃhitā* refers to flies as vectors in disease transmission when it warns the physician that wounds should be dressed to prevent flies from depositing pathogens on the wound.

Comprehension questions

1. What strikes you in Suśruta's description of the preparation of the cadaver to be used for dissection?
2. How accurate are Suśruta's explanations for the transmission of communicable diseases?
3. How does Caraka explain what is now called genetic malformations?



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Aśoka — who called himself ‘Devanampiya Piyadasi’ or ‘Beloved-of-the-Gods, He Who Looks On [All] With Affection’ — left numerous edicts engraved on rocks and pillars. This is an extract from his rock edict at Girnar (Saurashtra, Gujarat), which reflects Aśoka’s concern for the welfare not only of his subjects, but ultimately of all humans and animals.

‘Everywhere within Beloved-of-the-Gods, King Piyadasi’s domain, and among the people beyond the borders, the Cholas, the Pāndyas, the Satiyaputras, the Keralaputras, as far as Tamraparni [Sri Lanka] and where the Greek king Antiochos rules [in Syria], and among the kings who are neighbours of Antiochos, everywhere has Beloved-of-the-Gods, King Piyadasi, made provision for two types of medical treatment: medical treatment for humans and medical treatment for animals. Wherever medical herbs suitable for humans or animals are not available, I have had them imported and grown. Wherever medical roots or fruits are not available I have had them imported and grown. Along roads I have had wells dug and trees planted for the benefit of humans and animals.’ (Tr. Ven. S. Dhammika)





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