MODULE 3
PART 2

INDIA CONTRIBUTION TO MEDICINE,SURGERY,MATHEMATICS

India’s contribution to medicine

India, with its rich cultural heritage, has been in the forefront in contributing the medical science, and there is plenty of proof of the same. Indian medical tradition goes back to Vedic times. During that period, the Ashwinikumars- who were practitioners of medicine were given a divine status.

We also have a God of Medicine called Dhanvantari. Although very few ancient texts are available today, this method of healing was systematized in early times.. The art of healing was considered a sacred one, and was spread among sages, hermits and medicos who roamed from place to place. Vaidyas, who generally belonged to Brahmin caste, were those who practiced solely this art.

One of the first Indian text dealing with medicine is Atharvaveda. The Atharvaveda also contain prescriptions of herbs for various ailments. Subsequently, the use of herbs to treat ailments, in a much broader way, later formed a large part of Ayurveda.

Ayurveda-”complete knowledge for long life”- is one of the earliest medical system known to human civilization. Charaksamhita and Sushrutasamhita, the two main texts of Ayurveda, are surprisingly alike the textbooks of modern medicine

Ayurveda

- Ayurveda is an ancient holistic system of medicine that originated in India over 5,000 years ago. The word "Ayurveda" is derived from Sanskrit, with "Ayur" meaning life and "Veda" meaning knowledge or science.
- Ayurveda is often referred to as the "Science of Life" or the "Art of Living" because it provides guidance on how to maintain and promote well-being through a balanced and natural lifestyle.

- Ayurveda, one of the world's oldest holistic healing systems, originated in India. It emphasizes a balance between the body, mind, and spirit and relies on natural remedies, herbs, and lifestyle practices to prevent and treat diseases.
- **Ayurveda** is an alternative medicine system with historical roots in the Indian subcontinent. It is heavily practiced in India and Nepal, where around 80% of the population report using Ayurveda.
- Ayurveda is based on the belief that the human body is a microcosm of the universe, and its health is determined by the balance of three fundamental energies or doshas: Vata (air and ether), Pitta (fire and water), and Kapha (earth and water). Imbalances in these doshas are thought to be the root cause of diseases, and Ayurveda seeks to restore harmony through a combination of diet, herbs, yoga, and lifestyle practices.

- https://youtu.be/wtVsFfFeYNs?si=glab0BZHsVqaU3eb
- Key Ayurvedic contributions to medicine include:
- **Herbal Medicine**: Ayurveda has an extensive pharmacopoeia of herbs and plant-based remedies. Ayurvedic practitioners use a holistic approach to select herbs that address not just the symptoms but also the underlying imbalances in the body.
- **Yoga and Meditation**: Ayurveda emphasizes the importance of mental and emotional well-being in overall health. Yoga and meditation are integral components of Ayurvedic healing, promoting physical strength, flexibility, and mental clarity.

- **Dietary Guidelines**: Ayurveda offers personalized dietary recommendations based on an individual's constitution (prakriti) and the current state of their doshas (vikriti). This approach promotes a balanced and nourishing diet.
- https://youtu.be/6ZUFT0CwU1w?si=tjwU-P_mytZG_Bu1

Charaka:The Pioneer of Clinical Medicine

- **Charaka: The Pioneer of Clinical Medicine**
- Charaka, another ancient Indian physician, is often regarded as the "Father of Medicine." He lived around 300 BCE and is best known for his comprehensive medical treatise, the "Charaka Samhita." Charaka's contributions to clinical medicine are immense and continue to be respected worldwide.
- https://youtu.be/sPVPWYsD2QM?si=GC1H1FS7yMEOp--y
- Key contributions of Charaka include:
- **Diagnostic Techniques**: Charaka outlined detailed diagnostic methods, including the examination of pulse, tongue, and urine, to determine the nature of diseases.

- **Pharmacology**: He provided extensive information on the preparation and use of medicinal herbs and minerals. Charaka's pharmacological knowledge laid the foundation for the development of modern pharmacology.
- **Clinical Observations**: Charaka emphasized the importance of clinical observation and experience in medical practice. He encouraged physicians to continually update their knowledge and adapt to changing circumstances.
- Charaka's teachings on clinical medicine and diagnosis remain relevant in modern medical education, emphasizing the importance of a systematic approach to patient care.

SUSHRUTA: The Father Of Surgery

- In the realm of surgery, India boasts the ancient sage Sushruta, often referred to as the "Father of Surgery." Sushruta lived around 600 BCE and authored the "Sushruta Samhita," one of the earliest known texts on surgery and medicine. His contributions to the field were groundbreaking and continue to be revered.
- https://youtu.be/XzZUXcypTD8?si=91lOkwepCh1RBFiF
- **Authorship of the "Sushruta Samhita"**: Sushruta is best known for his authorship of the "Sushruta Samhita," an ancient Sanskrit text that is one of the earliest known works on medicine and surgery. This text is often considered the foundational document for surgical knowledge in India.

- Sushruta Samhita is divided into six sections or books, covering various aspects of medicine and surgery.
- **Innovative Surgical Techniques**: Sushruta's contributions to surgical knowledge were revolutionary for his time. He described a wide range of surgical procedures, many of which were highly advanced. These included techniques for:
  - **Extraction of Bladder Stones**: Sushruta detailed procedures for the removal of bladder stones, a common medical issue in his era. His methods involved using specialized instruments for stone extraction.
  - **Plastic Surgery**: Perhaps one of Sushruta's most remarkable contributions was his description of reconstructive surgery, including techniques for repairing damaged noses and ears. This makes him one of the earliest pioneers of plastic surgery.
  - **Fracture Management**: Sushruta provided guidance on the treatment of fractures, including setting broken bones and using bandages to immobilize injured limbs.

- **Detailed Knowledge of Anatomy**: Sushruta's work included detailed descriptions of human anatomy, which was instrumental in advancing surgical knowledge. His understanding of anatomy was based on careful observation and dissection.
- **Medical Instruments**: Sushruta was not only a practitioner but also an inventor. He designed and described various surgical instruments, some of which were quite sophisticated for his time. His instruments were designed to aid in surgical procedures and minimize patient discomfort.
- **Legacy and Influence**: Sushruta's teachings and techniques were not limited to India. His work was translated into various languages and spread to other parts of the ancient world, including Greece and the Middle East. It is believed that the Greek physician Hippocrates might have been influenced by Sushruta's surgical knowledge.

Contribution of India in Science

- Indian heritage is one of the richest and oldest among the world. From the time of ancient India, scientific and technological developments were done. Many famous mathematicians from India contributed a lot in the development of theories that we still use and applied in the majority of fields. Indian civilization has a long recorded history of scientific culture that goes back to more than 5000 years. Indian heritage has been known for its various developments like gemstone therapy, ayurvedic medicine, physics, farming, literature and many more.

- Mathematician Aryabhata was the first person to create a symbol for zero and it was through his efforts that mathematical operations like addition and subtraction started using the digit, zero. The concept of zero and its integration into the place-value system also enabled one to write numbers, no matter how large, by using only ten symbols
- India gave the ingenious method of expressing all numbers by means of ten symbols – the decimal system. Due to the simplicity of the decimal notation, which facilitated calculation, this system made the uses of arithmetic in practical inventions much easier and faster.
- Indians, as early as 500 BCE, had devised a system of different symbols for every number from one to nine. This notation system was adopted by the Arabs who called it the hind numerals. Centuries later, this notation system was adopted by the Western world who called them the Arabic numerals as it reached them through the Arab traders

- Binary numbers are the basic language in which computer programs are written. Binary basically refers to a set of two numbers, 1 and 0, the combinations of which are called bits and bytes. The binary number system was first described by the Vedic scholar Pingala, in his book Chandahśāstra, which is the earliest known Sanskrit treatise on prosody (the study of poetic metres and verse)
- Excavations at Harappans sites have yielded rulers or linear measures made from ivory and shell. Marked out in minute subdivisions with amazing accuracy, the calibrations correspond closely with the hasta increments of 1 3/8 inches, traditionally used in the ancient architecture of South India. Ancient bricks found at the excavation sites have dimensions that correspond to the units on these rulers.

- One of the notable scientists of the ancient India was Kanad who is said to have devised the atomic theory centuries before John Dalton was born. He speculated the existence of anu or a small indestructible particles, much like an atom. He also stated that anu can have two states — absolute rest and a state of motion.
- Mathematicians of ancient India often applied their mathematical knowledge to make accurate astronomical predictions. The most significant among them was Aryabhatta whose book, Aryabhatiya, represented the pinnacle of astronomical knowledge at the time. He correctly propounded that the Earth is round, rotates on its own axis and revolves around the Sun i.e the heliocentric theory. He also made predictions about the solar and lunar eclipses, duration of the day as well as the distance between the Earth and the Moon.
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- A pioneering steel alloy matrix developed in India, Wootz steel is a crucible steel characterized by a pattern of bands that was known in the ancient world by many different names such as Ukku, Hindwani and Seric Iron. Produced by the Tamils of the Chera Dynasty, the finest steel of the ancient world was made by heating black magnetite ore in the presence of carbon in a sealed clay crucible kept inside a charcoal furnace.
- India was the first to smelt zinc by the distillation process, an advanced technique derived from a long experience of ancient alchemy. Zawar in the Tiri valley of Rajasthan is the world's first known ancient zinc smelting site. The distillation technique of zinc production goes back to the 12th Century AD and is an important contribution of India to the world of science

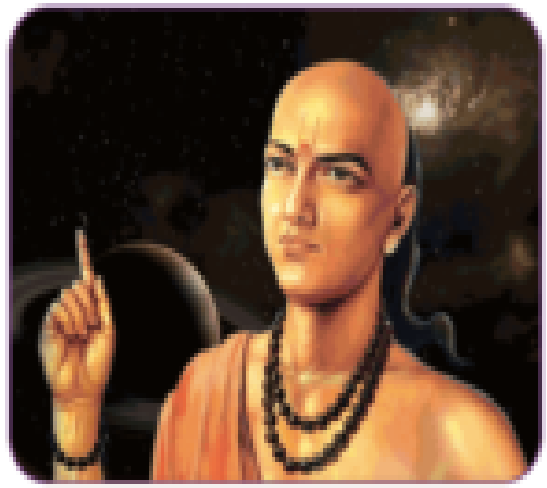
- Written by Sushruta in 6th Century BC, Sushruta Samhita is considered to be one of the most comprehensive textbooks on ancient surgery. The text mentions various illnesses, plants, preparations and cures along with complex techniques of plastic surgery. The Sushruta Samhita's most well-known contribution to plastic surgery is the reconstruction of the nose, known also as rhinoplasty.
- Long before the birth of Hippocrates, Charaka authored a foundational text, Charakasamhita, on the ancient science of Ayurveda. Referred to as the Father of Indian Medicine, Charaka was the first physician to present the concept of digestion, metabolism and immunity in his book. Charaka's ancient manual on preventive medicine remained a standard work on the subject for two millennia and was translated into many foreign languages, including Arabic and Latin.

- The first iron-cased rockets were developed in the 1780s by Tipu Sultan of Mysore who successfully used these rockets against the larger forces of the British East India Company during the Anglo-Mysore Wars. He crafted long iron tubes, filled them with gunpowder and fastened them to bamboo poles to create the predecessor of the modern rocket. With a range of about 2 km, these rockets were the best in the world at that time and caused as much fear and confusion as damage. Due to them, the British suffered one of their worst-ever defeats in India at the hands of Tipu.

Famous Indian Mathematicians and their Contributions

ARYABHATA

- He was born in 476 CE at Kusumapura.
- He was regarded as the first of the major mathematician-astronomers from the classical age.
- He worked on the ‘place value system’ using letters to signify numbers and stating qualities.
- He also described the number of days in a year to be 365.



- **Some key contributions and insights associated with Aryabhata include**:
- **Trigonometry:** Aryabhata made pioneering contributions to trigonometry. He introduced the concepts of sine (jya), cosine (kojya), and the formulae for calculating their values.
- **Pi (π) Approximation:** Aryabhata provided an approximation of the value of pi (π) as 3.1416, which is remarkably close to the modern value.
- **Place-Value System:** He used a place-value system for writing numbers, similar to the modern decimal system. Aryabhata's work helped lay the foundation for the development of the Hindu-Arabic numeral system.

- **Solving Equations:** Aryabhata addressed problems related to indeterminate equations and quadratic equations, providing methods for their solutions.
- **Astronomy:** In addition to mathematics, Aryabhata made significant contributions to astronomy. He explained the causes of eclipses and the motion of planets, among other celestial phenomena.
- Aryabhata's work had a lasting impact on Indian mathematics and astronomy and also influenced later scholars. His insights and mathematical techniques were transmitted to the Arab world and eventually to Europe, contributing to the development of mathematics and science in various parts of the world. Aryabhata's legacy continues to be celebrated in the fields of mathematics and astronomy, and he is remembered as one of India's greatest ancient mathematicians and astronomers.

SHAKUNTALA DEVI

- Shakuntala Devi, often referred to as the "Human Computer," was an Indian mathematician and mental calculator known for her exceptional mathematical abilities. Although she did not make groundbreaking mathematical discoveries like some of the earlier mathematicians, her contributions to mathematics lie in her remarkable talent, popularization of mathematics, and advocacy for mental math skills.

Here are some aspects of Shakuntala Devi's contributions to mathematics:

- **Mental Calculation Skills:** Shakuntala Devi's extraordinary mental calculation abilities were her most significant contribution to mathematics. She could perform complex mathematical calculations mentally and rapidly, often faster than electronic calculators. Her calculations included tasks like finding the cube root of large numbers, multiplying long sequences of numbers, and solving intricate mathematical puzzles.
- **Mathematical World Records:** Throughout her life, Shakuntala Devi set several world records for her mathematical feats. One of her most notable achievements was the calculation of the 23rd root of a 201-digit number, which she completed correctly in just 50 seconds in 1977. This accomplishment earned her a place in the Guinness Book of World Records.

- **Books and Publications:** Shakuntala Devi authored numerous books on mathematics, puzzles, and mental calculations. Her books were aimed at popularizing mathematics and making it more accessible and enjoyable for the general public. Some of her well-known books include "Figuring: The Joy of Numbers" and "Puzzles to Puzzle You.“
- **Recognition and Awards:** Shakuntala Devi received recognition for her contributions to mathematics and her efforts to promote mathematical thinking. She received awards and honors from various institutions and governments, acknowledging her exceptional mathematical talents and her role in mathematics outreach. Awards such as **Ramanujan Mathematical Genius Award, Lifetime Achievement Award**.

Bhaskaracharya

- Bhaskara, also known as Bhaskaracharya or Bhaskara II, was an Indian mathematician and astronomer who lived in the 12th century. He made significant contributions to various areas of mathematics, including algebra, arithmetic, and trigonometry. Here are some of Bhaskara's notable contributions to mathematics:
- **Bijaganita (Algebra):** Bhaskara's most famous work is "Bijaganita" (The Algebra), which is one of the most important treatises on algebra in Indian mathematics.

- In this work, Bhaskara presented solutions to a wide range of algebraic problems, including quadratic, cubic, quartic, and higher-order polynomial equations. He also developed methods for solving indeterminate equations and provided rules for dealing with zero and negative numbers.
- **Astronomy:** Bhaskara was not only a mathematician but also an accomplished astronomer. He wrote "Siddhanta Shiromani," a comprehensive treatise on astronomy that covered topics such as planetary motion, eclipses, and the calculation of celestial positions.
- **Calendar Calculations:** Bhaskara developed methods for calendar calculations, including determining the positions of celestial bodies and the timing of eclipses. These calculations were essential for both astronomical and astrological purposes.
- https://youtu.be/gNJNmPJqXJc?si=aB76t4ZgJakMq1_u