Ancient Hindu Science: Its Impact on the Ancient and Modern Worlds

Alok Kumar

'The first nation (to have cultivated science) is Hind. This is a powerful nation having a large population, and a rich kingdom (possession). Hind is known for the wisdom of its people. Over many centuries, all the kings of the past have recognized the ability of the Hindus in all the branches of knowledge.' This is how Sayid al-Andalusi (1029 – 1070), a noted eleventh century natural philosopher from the Muslim Spain, described Bharat in his book, *Tabaqat al Umam* (*Book of the Categories of Nations*). This book is perhaps the first book ever written on the global history of science.

Sayid was a Muslim who served as the chief judge (*Qādi* or *Kāzi*) in Toledo and resolved conflicts among Muslims using Sharia's laws—obviously an influential position. In his book, Sayid analyzed the scholarly contributions of various nations and divided them in two categories: nations that made significant contributions to science and the nations that did not contribute much to science. In his list of nations who contributed to science, he chose eight nations: the Hindus, the Persians, the Chaldeans, the Greeks, the Romans, the Egyptians, the Arabs and the Hebrews.

According to Sayid, '[t]he Hindus, as known to all nations for many centuries, are the metal (essence) of wisdom, the source of fairness and objectivity. They are peoples of sublime pensiveness, universal apologues, and useful and rare inventions.' Why Sayid assigns 'useful and rare inventions' as a contribution of the Hindus? What are these inventions? In support of his statement, Sayid cited the disciplines of Mathematics, Astronomy, and Medicine, where the Hindus made seminal contributions.

Science provides materialistic benefits to humanity. Nations leading in science generally have better economies. How was the economy of Bharat during the ancient period? Dr Angus Maddison (1926–2010), a distinguished British economist who taught at the University of Groningen, the Netherlands, wrote a book, *Contours of the World Economy: 1–2030*, in which he compiled the Gross Domestic Products (GDP) of various nations during the past two millennia. Following were his results for the GDP of Bharat:

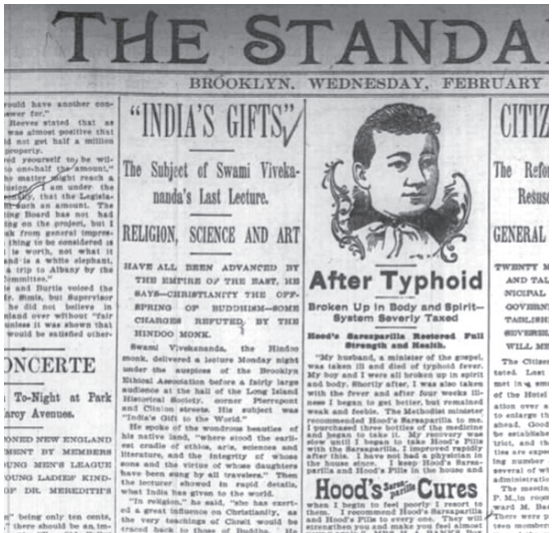
Year (AD)	Bharat's GDP as Percentage of World Economy
Beginning of the Christian era	32.0
1000	28.1
1500	24.4
1600	22.4
1700	24.4
1820	16.0
1913	7.5
2003	5.5

The above table tells us that the Bharat's economy was close to one-third of the world's economy at the beginning of the Christian era. The only other nation which was comparable to Bharat was China. All other nations, particularly the European nations, were much behind Bharat in

economic prosperity. No wonder, Bharat was popularly labeled as *sone ki chideya* (golden sparrow).

One can see the downward trend of Bharat's GDP for several centuries. Fortunately, the trend is currently reversing and Bharat's share of Global GDP in 2023 was 9.4%. Due to colonization and subjugation of Bharat for about a millennium, such awareness was restricted to small number of scholars at the end of the nineteenth century. At that time, Bharat was synonymous with poverty and illiteracy. In such literary environment, Swami Vivekananda first visited America in 1893 and gave his iconic speech at The Parliament of Religions in Chicago on September 11, 1893. His speech caught the attention of the Western world, catapulted him to a much wider audience, and he lectured extensively in America. One such speech was covered by the *Brooklyn Standard Union* newspaper, New York, on February 27, 1895. The title of the article was, *India's Gift to the World*, and had the following information:

> Swami Vivekananda, the Hindoo monk, delivered a lecture Monday night under the auspices of the Brooklyn Ethical Association before a fairly large audience at the hall of the Long Island Historical Society, corner Pierrepont and Clinton streets. His subject was 'India's Gift to the World'. He spoke of the wondrous beauties of his native land. ... Then the lecturer showed in rapid details, what India has given to the world. ... India has given to antiquity the earliest scientifical physicians, and, according to Sir William Hunter, she has even contributed to modern medical science by the discovery of various chemicals and by teaching you how to reform misshapen ears and noses (so-called plastic surgery). Even more it has done in mathematics, for algebra, geometry, astronomy, and the triumph of modern science—mixed mathematics—were all invented in India, just so much as the ten numerals, the very cornerstone of all present civilization, were discovered in India, and are in reality, Sanskrit words.



THE STANDA

BROOKLYN, WEDNESDAY, FEBRUARY

"INDIA'S GIFTS."

The Subject of Swami Vivekananda's Last Lecture.

RELIGION, SCIENCE AND ART

HAVE ALL BEEN ADVANCED BY THE EMPIRE OF THE EAST, HE SAYS—CHRISTIANITY THE OFFSPRING OF BUDDHISM—SOME CHARGES REFUTED BY THE HINDOO MONK.

Swami Vivekananda, the Hindoo monk, delivered a lecture Monday night under the auspices of the Brooklyn Ethical Association before a fairly large audience at the hall of the Long Island Historical Society, corner Pierrepont and Clinton streets. His subject was "India's Gift to the World."

He spoke of the wondrous beauties of his native land, "where stood the earliest cradle of ethics, arts, sciences and literature, and the integrity of whose sons and the virtue of whose daughters have been sung by all travelers." Then the lecturer showed in rapid details, what India has given to the world.

"In religion," he said, "she has exerted a great influence on Christianity, as the very teachings of Christ would be traced back to those of Buddha. He showed by quotations from the works of European and American scientists the many points of similarity between Buddha and Christ. The latter's birth, his exclusion from the world, the number of his apostles, and the very ethics of his teachings are the same as those of Buddha, living many hundred years before him.

"Is it mere chance," the lecturer asked, "or was Buddha's religion but the foreshadowing of that of Christ? The majority of your thinkers seems to be inclined in the latter explanation, but there are some bold enough to say that Christianity is the direct offspring of Buddhism just as the earliest heresy in the Christian religion—the Monecian heresy—is now universally regarded as the teaching of a sect of Buddhists. But there is more evidence that Christianity is founded in Buddhism. We find it in recently discovered inscriptions from the reign of Emperor Oshoka of India, about 200 B. C., who made treaties with all the Grecian kings, and whose missionaries disseminated in those very parts where, centuries after, Christianity flourished the principles of the Buddhistic religion. Thus it is explained, why you have our doctrine of trinity, of incarnation of God, and of our ethics, and why the service in our temples is so much alike to that in your present Catholic churches, from the mass to the chant and benedictus. Buddhism had all these long before you. Now use your own judgment on these premises—we Hindoos stand ready to be convinced that yours is the earlier religion, although we had ours some three hundred years before the dawn of the Christian era.

"The same holds good with respect to sciences. India has given to antiquity the earliest scientified physicians, and, according to Sir William Hunter, she has even contributed to modern medical science by the discovery of various chemicals and by teaching you how to reform misshapen ears and noses. Even more it has done in mathematics, for algebra, geometry, astronomy, and the triumph of modern science—mixed mathematics—were all invented in India, just so much as the ten numerals, the very cornerstone of all present civilization, were discovered in India, and are in reality, Sanskrit words.

"In philosophy we are even now head and shoulders above any other nation, as Schoppenhauer, the great German philosopher, has confessed. So much India gave to the world her system of nota-

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THE ART ROOMS CROWDED.

MR. FERREE AND MRS. DELLENBAUGH ATTRACT VERY LARGE AUDIENCES.

Not long ago a member of the Brooklyn Institute of scientific habit and inclination complained that the Institute was devoting too much time its current season to art, and too little to science. If there was any cause whatever for this allegation, and certainly the scientific meetings are on a steady increase rather than the reverse, the reason of it is not far to seek.

The large crowds that attended the Browning reading by Mrs. Dellenbaugh and the French architecture lecture by Mr. Ferree yesterday furnished pretty clear proofs of the kind of instruction and entertainment Brooklyn audiences like. At both events women were compelled to stand up, and every available seat in the rooms of hall had its occupant. A week previous Stewart Culin's informing, not to say speechmaking, lecture on the ethnology of games attracted but two or three dozen listeners.

Mrs. Dellenbaugh's interpretation of Browning's, "In a Balcony," would perhaps possess more interest for the followers of a literary cult than the average theatregoing, drama-craving public. Mrs. Dellenbaugh might be the first to admit this, and to point out that it is just because Brooklyn boasts such a class that her readings are so largely patronized. Her methods are quiet, but do not fail by reason of that quality. Perhaps her chief defect lies in want of imaginative interpretation, the quality which makes Bidder so interesting a breadth of vision and a varied intellectual sympathy are required by a dramatic reader, which even a knowledge of the laws of stagecraft cannot supply. It would be ungracious, however, to criticise Mrs. Dellenbaugh, whose work fulfills its purpose, and without doubt affords enjoyment to many cultured people. That a woman should essay, and essay successfully, this province of mimic art, of itself thousands praise.

Mr. Ferree's account of French cathedrals and shrines interested all who have ever made a European trip or have the

A page of the Standard Union documenting Swami Vivekananda's speech

Let us explore further the above statement of Swami Vivekananda that was published in a newspaper in New York. Bharat's main contribution is in the invention of the numeral system, the Hindu numerals, where there are ten symbols (from one to zero, the last numeral invented was zero) and the location of these numbers define their magnitudes. In a base-10 positional- or

place-value system, a number, represented as $x_4 x_3 x_2 x_1$ can be constructed as follows:

$x_1 + (x_2 \times 10^1) + (x_3 \times 10^2) + (x_4 \times 10^3)$

Where x_4, x_3, x_2, and x_1 are nonnegative integers that have magnitudes less than the chosen base (ten in our case). As you may have noticed, the magnitude of a number increases from right to left. For example, the number 1234 will be written as $4 + (3 \times 10^1) + (2 \times 10^2) + (1 \times 10^3)$.

After this numeral system became prevalent in Bharat, it spread to nearby regions. Soon, these numerals were commonly used in Persia and the Middle East. The medieval Islamic natural philosophers were quite truthful in giving credit to other civilizations. Owing their gratitude to the Hindus, numerals were always called *arqam hindiya* in Arabic, literally meaning the Hindu identity. Al-Biruni (973-1051), Al-Khwarizmi (9th cent.), Ibn Labban (ca. 971-1029), and Al-Uqlidisi (920-980) were some of the leading mathematicians of the medieval Islamic period. These natural philosophers are known as much for preserving and transmitting Hindu knowledge of mathematics in the Middle East, that was later passed to the Europeans, as they are known for their own creative work.

In some regions of the world, a few local patriots did not like this foreign Hindu system as it was indicative of Hindu dominance. Severus Sebokht (died, 662 CE), a Syrian natural philosopher mentions of such a rivalry between the Greek and Hindu numerals. He writes:

> I will omit all discussion of the science of the Hindus, a people not the same as Syrians, their subtle discoveries in the science of astronomy, discoveries which are more ingenious than those of the Greeks and the Babylonians; their valuable method of calculation; their computing that surpasses description. I wish only to say that this computation is done by means of nine signs. If those who believe, because they speak Greek, that they have reached the limits of science, should know these things, they would be convinced that there are also others [Hindu] who know something.

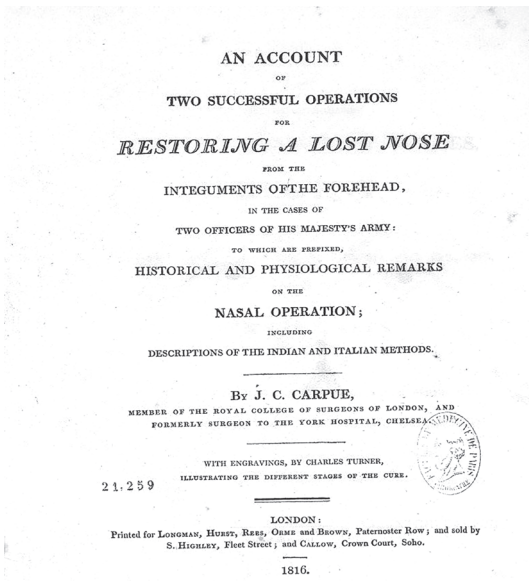
This quotation is a proof that the Hindu numerals were in practice in Arabia by the seventh century. Also, Sebokht considered Hindu astronomy and mathematics at par with the Greek astronomy and mathematics.

At the end of the second millennium, in year 2000, The American Association for the Advancement of Science (AAAS) compiled a list of the top 100 scientific findings that made significant impacts on the world and published in *Science* journal on January 14, 2000. Only two discoveries were chosen from the non-Western world: (1) invention of zero and (2) the astronomical observations of the Hindu and Mayan sky-watchers for agricultural and religious purposes. Both non-Western contributions involved the works of the ancient Hindus. Why Hindu contributions to astronomy were considered so important in human history? Do we teach Hindu contributions to astronomy in school curricula in Bharat?

In astronomy, the spherical shape of the earth was recognized by the ancient Hindus. Aryabhata (476 - 550 CE) used an analogy of a *kadamba* flower to demonstrate the distribution of various life forms on the Earth:

> Half of the sphere of the Earth, the planets, and the asterisms is darkened by their shadows, and half, being turned toward the sun, is lighted according to their size. The sphere of the earth, being quite round, situated in the center of space, in the middle of the circle of asterisms [constellations or stars], surrounded by the orbits of the planets, consists of water, Earth, fire, and air. Just as the ball formed by a *kadamba* flower is surrounded on all sides by blossoms just so the Earth is surrounded on all sides by all creatures terrestrial and aquatic (*Aryabhatiya*, Gola, 5-7).

Kadamba flower



AN ACCOUNT
OF
TWO SUCCESSFUL OPERATIONS
FOR
RESTORING A LOST NOSE
FROM THE
INTEGUMENTS OF THE FOREHEAD,
IN THE CASES OF
TWO OFFICERS OF HIS MAJESTY'S ARMY:
TO WHICH ARE PREFIXED,
HISTORICAL AND PHYSIOLOGICAL REMARKS
ON THE
NASAL OPERATION;
INCLUDING
DESCRIPTIONS OF THE INDIAN AND ITALIAN METHODS.

By J. C. CARPUE,
MEMBER OF THE ROYAL COLLEGE OF SURGEONS OF LONDON, AND
FORMERLY SURGEON TO THE YORK HOSPITAL, CHELSEA.

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1816.

Title page of J C Carpue's book

Aryabhata assigned diurnal motion to the Earth and kept the sun stationary in his astronomical scheme. According to Aryabhata, the motion of the stars that we observe in the sky is an illusion. To explain the apparent motion of the sun, he used an analogy of a boat in a river: 'As a man in a boat going forward sees a stationary object moving backward just so in Sri-Lanka a man sees the stationary asterisms moving backward exactly toward the West.'

The interpretation is that a person standing on the equator of Earth, that rotates from the West to the East, would see the asterisms (constellations or stars) moving in the westward motion. The clear grasp of Aryabhata about Earth's motion and relative motion are splendidly explained in the analogy of a boat man given above. Clearly, Aryabhata's earth was not stationary; it certainly had diurnal motion.

With respect to the field of medicine, Swami Vivekananda mentioned about Hindu physicians and the so-called plastic surgery. Perhaps, he was alluding to the works of Charaka, Sushruta, and Vagbhata. Ayurveda is the Hindu science of healing and rejuvenation. It is a holistic system of medicine, which is curative as well as preventive. It is a holistic approach which focuses on both mind and body. Dietary measures and lifestyle changes are recommended to delay the aging process at the cellular level and to improve the functional efficiency of body and mind. The basic idea is to create a balance in the body that will allow the body to cure itself.

In ancient India, earlobes or nose were chopped as a punishment for some crimes. For example, in *Ramayaṇa*, Shurpanakha, sister of Ravana, was punished by Lakshmana and lost her nose and earlobes. In Bharat, repair of such body parts was possible using a surgical process that was made famous by Sushruta. Nasal amputation has also worked its way into the Hindi metaphors and the Hindi term *nāk kat gai* (nose is chopped) implies that a person is insulted. Also, 'saving nose' (*nāk bachā lī*) is a colloquial term implying to go through difficult circumstances without any embarrassment.

Sushruta described the technique to graft skin, popularly known as 'plastic surgery' these days as a general umbrella term. He is considered as the father of plastic surgery, and the Western world gives credit to Bharat for the method of rhinoplasty surgery. Sushruta repaired noses or

earlobes by using an adjacent skin flap. This procedure is popularly called as 'the Indian method of rhinoplasty.' Live skin from the thigh, cheek, abdomen, or the forehead was used to make the new artificial body parts.

In England, the first article on the subject appeared in the *Gentleman's Magazine* in 1794 by Colly Lyon Lucas, a British surgeon and member of the Medical Board at Madras, India. He explained the process in his letter to the Editor, describing the process as 'long known in India' and not known to the British. Colly Lyon Lucas witnessed a case where a local person serving the British army, in the war of 1792 CE, was captured by King Tipu Sultan. Unable to defeat the British outright, the sultan tried to starve his enemies by ambushing the local bullock drivers who transported grain to the British. Tipu decided to humiliate the bullock drivers by mutilating their noses and ears. Lucas discusses the case of one such victim of this practice, the Mahratta bullock driver Cowasjee, who, on his capture, had his nose and one of his hands amputated by Sultan. After one year, this man decided to get his nose repaired. An operation was performed by the Ayurvedic surgeons. In this operation, skin was taken from the forehead, molded, and placed as a nose. The whole process took about 25 days. The artificial nose looked 'as well as the natural one' and the scar on the forehead was not very observable after a 'length of time.'

In the United Kingdom, the first operation of rhinoplasty was performed by Joseph Constantine Carpue on October 23, 1814, in front of a large group of surgical colleagues and his students. Carpue performed the second operation on an army officer who lost his nose during the Peninsular War against Napoleon, and later wrote a book about it in 1816. In this book, Carpue attributes this procedure to Bharat from time immemorial: 'Assuredly, the Hindoos owe no part of their skill in this operation, either to Europe. ... all the names I have cited concur in deriving the Indian practice to time immemorial' (Carpue, 1816, 42). An interesting fact is that the surgery was mostly performed by the lower cast people like *Koomas* (*kumhār*) or potters and brickmakers, as shared by Carpue.

In this brief article, a glimpse of the prime past of the Hindus is provided in view of Swami Vivekananda's speech, India's Gift. To understand modern science as a coherent story, it is essential to recognize the accomplishments of the ancient Hindus. They invented our base ten number system and zero that are now used globally, carefully mapped the sky and assigned motion to the Earth in their astronomy, developed a sophisticated system of medicine with its mind-body approach known as Ayurveda, mastered metallurgical methods of extraction and purification of metals, including the so-called Damascus blade and the Iron Pillar of New Delhi, and developed the science of self-improvement that is popularly known as yoga. It would be nice if Bharat could attract the best brains to explore and document properly Bharat's prime past, fulfil the dream of Swami Vivekananda, and preserve the knowledge for the future generations.

Suggested Readings

1. Kumar, Alok, *Sciences of the Ancient Hindus: Unlocking Nature in the Pursuit of Salvation* (South Carolina: Create Space, 2014).
2. Kumar, Alok, *Ancient Hindu Science: Its Impact on the Ancient and Modern Worlds* (Mumbai: Jaico Publishing, 2020). This book is also published from Morgan & Claypool (2019) from USA and Springer (2019) from Switzerland.
3. Montgomery, Scott and Alok Kumar, *A History of Science in World Cultures: Voices of Knowledge* (London: Routledge, 2015).
4. Salem, S. I. and Alok Kumar, *Science in the Medieval World* (Austin: University of Texas, 1991).