Center for Advancing Pluralism
pluralist.org

# Dharmic Contributions to Global Knowledge

## Published by the Center for Advancing Pluralism

### Contents


- Introduction
- Trade
- The Spread of Āgama-Śiva-Buddha
- Universities
- Linguistics
- Health and Medicine
- Non-Harm Diets
- Mathematics
- Astronomy
- Wellbeing
- Psychology
- Martial Arts
- Games
- Other Contributions
- Summary


## Introduction

Dharmic peoples over millennia have contributed to important developments in information and methodologies that have helped to advance human societies the world over. As a result of colonial education and narratives about India and the Dharma traditions, many of these contributions are overlooked or misattributed to other cultures and civilizations. Slowly, however, as curricula address outdated biases, more and more institutions are endeavoring to present a more balanced, historically accurate picture and acknowledge those contributions.

> *"Indian learning, Indian religious insights and Indian ideas are among the crucial foundations of our world… In matters of science, astronomy and mathematics, India was to be a teacher of the Arab world, and hence Mediterranean Europe too."*[1]

## Trade

> *"The Hindus are, after all, one of the great merchant civilizations of the world…"*[2]

> *"Nearly every kind of manufacture or product known to the civilized world—nearly every kind of creation of man's brain and hand, existing anywhere, and prized either for its utility or beauty—had long been produced in India. India was a far greater industrial and manufacturing nation than any in Europe or any other in Asia. Her textile goods—the fine products of her looms, in cotton, wool, linen and silk—were famous over the civilized world; so were her exquisite jewellery and her precious stones cut in every lovely form; so were her pottery, porcelains, ceramics of every kind, quality, color and beautiful shape; so were her fine works in metal—iron, steel, silver and gold. She had great architecture — equal in beauty to any in the world. She had great engineering works. She had great merchants, great businessmen, great bankers and financiers. Not only was she the greatest shipbuilding nation, but she had great commerce and trade by land and sea which extended to all known civilized countries. Such was the India which the British found when they came."*[3]

In the most ancient times, Dharmic peoples generally produced and consumed goods locally. However, since before 7,000 BCE, known human migration routes in Ancient India served as corridors for sharing tools and knowledge. There is strong evidence that trade within Ancient India goes all the way back to stone tools in the Neolithic period. Trade between Ancient India and peoples beyond this region is documented from at least 7,000 BCE in the sense of exchange of tools and commodities. This developed and became more sophisticated as the world's earliest civilizations grew. Among them all, the Indus Valley Civilization was a crucial trading partner.

Indic artifacts and goods outside of Ancient India are found in the archaeological record from the Roman Empire, Ancient Greece, Ancient Persia, Ancient Bactria, Ancient Egypt, the Hittites, Mittani Kingdom, Byzantine Empire, the Caliphates, as well as Ancient Russia, Mongolia, China, Korea, Japan, the Southeast Asian Nations, Madagascar, the Indian Ocean Islands, Arabian Sea Islands, Arabia, and West Asia.[4]

The Indus Valley Civilization developed new techniques in metallurgy with copper, bronze, lead, and tin, and created the first known bronze statuary. They also produced and exported intricate handicrafts using carnelian, *lapis lazuli*, and finished ivory, including very fine drilling, and ornamental

---

[1] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 4

[2] Doniger, Wendy. *The Hindus: An Alternative History.* New York: Penguin Press, 2009, p. 31

[3] Tharoor, Shashi. *Inglorious Empire: What the British Did to India.* Brunswick, Australia: Scribe, 2017, p. 12

[4] Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 67-69, 73

shellworking. By c. 2500 BCE, Indian teak, red marble, and ivory were already being traded throughout Mesopotamia and the Persian Gulf region.[5]

Ancient India had a strong shipbuilding industry, with sturdy ocean-going vessels being constructed from at least as early as the 100s BCE, with two rudders and three square-rigged masts, each large enough to carry a thousand passengers or three thousand cargo containers, and could easily sail between India, the Red Sea, or the South China Sea and back.[6] Indian ships could, for example, sail either way between India and Roman Egypt in a mere six weeks.

Arabian, Turkic, Mongol, Egyptian, and European colonizers arrived in India first as traders. That led to an interest to raid India and take its treasures back home, or to an increased political interest in first controlling Indian trade, and then in fully controlling the regions and networks, which led to full-scale colonization. After the colonizers' arrivals, many Indian goods and textiles were overproduced for export across other lands they occupied. Just as in ancient, pre-colonial times, Indian goods joined the global market and created interesting fusions. Food, clothes, jewelry, and weaponry all saw valuable collaborations with Indian raw and processed goods and the cultures into which they were taken. Indigenous examples include: smelted iron, metal goods made from lost-wax casting, crucible steel (wootz steel for Damascus steel swords), diamonds and diamond drill bits, rubies, amethysts, onyx, banded black chalcedony, crimson sardonyx, ebony, teak, sandalwood, bloodred coral, ivory, saddles, drugs, incense,[7] zinc (first smelted in India), stoneware (predecessor of porcelain), tumble polishers for gems, indigo dye, tanned leather, buttons (2000 BCE), jute, silks, cottons, and sugar. Trade from these empires to other cultures meant that there were ancient Indian textiles found in Viking kingdoms, for example, as well as large finds of Indian gems, pearls, woven mats and baskets, teak, cotton weave, rice, lentils, coconuts, coriander, tamarind, and black pepper in Egypt,[8] while ancient Romans were heavy importers of Indian spices (pepper, nutmeg, cloves), aromatic nard and malabathrum (used in perfume manufacturing), tortoiseshell, and cotton.[9] Indeed India was the primary trading partner of the Roman Empire,[10] and the very stones of Egypt's pyramids were cut using Indian diamonds.[11]

---

[5] Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 58

[6] Prabha Ray, Himanshu. *Winds of Change: Buddhism and the Maritime Links of Early South Asia.* Delhi, 1994, p. 175; Ball, Warwick. *Rome in the East: The Transformation of an Empire.* 2nd ed. London: Routledge, 2016, p. 150; Cobb, Matthew A. *Rome and the Indian Ocean Trade from Augustus to the Early Third Century CE.* Mnemosyne Supplements, vol. 418. Leiden/Boston: Brill, 2018, p. 151.

[7] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 62-63

[8] Ibid, p. 54, 59

[9] Ibid, p. 63

[10] Ibid, p. 55-57

[11] Ibid, p. 59

The steel developed in India around the 5th century BCE[12] was known as the finest steel in the world, used for swords and other tools. Roman and Arabian trade indicates that in these Empires, it was widely known that the best swords and other weapons were made from Indian steel.[13] Indeed, Indian swords remained far superior to European ones well into the 1700s CE.[14]

Incidentally, although the use of coins for transactions was a global import into the Indosphere, the earliest use of banker's checks was found in the Maurya Empire in Ancient India (321-185 BCE). Additionally, standardization of measurements and weights was common in the Indus Valley Civilization from the 5th millennium BCE.[15]

Indic technical influence was present in Myanmar from at least as early as the 100s BCE, with hydraulic and irrigation systems, iron smelting, and standardized brick sizes.[16] Indic writing systems followed by the 200s CE.[17]

During the Chola period, South India exported vast quantities of textiles, spices, medicinal and recreational drugs, jewels, ivory, horn, ebony, and camphor both to China and to the west; to Siraf in Iraq they sent large cargoes of aloe wood, perfumes, sandalwood, and condiments.[18]

## The Spread of Āgama-Śiva-Buddha

The spread of Buddha Dharma occurred along trade routes that had existed for hundreds of years prior. Mīmāṃsaka and Smārta Dharma, and later Śaiva[19] and Vaiṣṇava Dharma traditions also

---

[12] Singh, Amit Kumar, Alok Kumar Kanungo, V. Selvakumar, and Amit Arora. "Ancient High-Carbon Steel from Southern Tamil Nadu, India: Microstructural and Elemental Analysis." Current Science 121, no. 2 (2021): 239–47.

[13] Sherby, Oleg D., and Jeffrey Wadsworth. "Damascus Steels." Scientific American 252, no. 2 (1985): 112–21; Schoff, Wilfred H. "The Eastern Iron Trade of the Roman Empire." *Journal of the American Oriental Society 35* (1915): p. 226.

[14] Tharoor, Shashi. *Inglorious Empire: What the British Did to India.* Brunswick, Australia: Scribe, 2017, p. 44-45

[15] Morley, Iain and Renfrew, Colin, *The Archaeology of Measurement: Comprehending Heaven, Earth and Time in Ancient Societies*, Cambridge University Press, 2010, p. 9.

[16] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 175

[17] Stargardt, Janice, "The Great Silver Reliquary from Sri Ksetra: Early Buddhist Art Meets Early Pali Inscriptions in the Pyu Culture of Burma (Myanmar)", in Janice Stargardt and Michael Willis (eds), *Relics and Relic Worship in Early Buddhism: India, Afghanistan, Sri Lanka and Burma*, London, 2018, pp. 89-105.

[18] Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 143

[19] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 82-83, 212-215

spread in these regions.[20] Artifacts, spiritualities, languages, and practices attest to the cultural interaction between clans, tribes and nations throughout this region, encompassing what are now India, Pakistan, Bangladesh, Sri Lanka, Afghanistan, Central Asia,[21] Bhutan, Tibet, China[22], Mongolia, Korea, Japan, Myanmar, Vietnam, Laos, Thailand, Cambodia, Indonesia, Malaysia, Singapore, Taiwan, Russia, Brunei, and parts of the Philippines.

Together with these spiritual traditions there spread many arts, such as temple architecture (including the largest-scale religious architecture in world history such as at Angkor Wat, originally constructed as a Hindu temple to Viṣṇu), numerous literary and theatrical versions of the *Rāmāyaṇa* and *Mahābhārata*, puppetry, dances, elaborate floral preparations used in spiritual ceremonies, and much more. Vāstu Śāstra architectural principles, originally developed for Hindu temples, have now spread all over the world with increasing popularity.

## Universities

Ancient Dharmic practitioners founded several famous international universities, such as at Takṣaśilā, Nālandā, Vikramaśilā, Śāradā Pīṭha, Nava-vihāra (a Dharmic university in what is now Afghanistan)[23], where students from across Eurasia and Africa (especially India, Tibet, China, Korea, Japan, Southeast Asia, Indonesia, Persia, Turkey, and Greece) studied everything from the Vedas to astronomy, mathematics, medicine, anatomy, philosophy, grammar, rhetoric, prose and verse composition, logic, metaphysics, and other disciplines.[24] Such universities were a major means of wide diffusion of ancient Dharmic contributions to global knowledge.

Another notable site was Udaygiri, the Mountain of the Sunrise, which in addition to a Hindu sacred site was a major center for ancient Dharmic science, located exactly where the Tropic of Cancer lay at the time.[25] It held a laboratory for astronomical observation, timekeeping, and calendar-making,

[20] "This free mixing of Hinduism and Buddhism is a striking feature of South-East Asian religion… As a Chinese report noted, 'The people all learn the Brahminical writings and greatly reverence the law of the Buddha.' The Buddha and the Hindu gods accommodated each other and often appear folded in with local religious practices including ancestor worship, fertility ceremonies, and naga and yakshi worship as well as other spirit cults." - Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 181

[21] Ibid, p. 83

[22] Ibid, p. 101-110, 115

[23] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 236

[24] Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 102

[25] Willis, Michael, *The Archaeology of Hindu Ritual: Temples and the Establishment of the Gods*, Cambridge, 2009, p. 18-30, 75.

with water clocks, sundials, solstice-marking sightlines, observation platforms, and other implements combining multiple different systems of knowledge.[26]

The Zoroastrian Academy of Gundeshapur, founded in Persia in the 3rd century CE, was an intellectual center of learning and is considered by some to be the world's first teaching hospital. It became a hub for translating and expanding knowledge in medicine, science, and philosophy from Greek, Indian, and Persian sources.

To take Nālandā University as another example: it was patronized by Hindu and Buddhist rulers alike.[27] Educational standards were very high, with stringent entrance examinations.[28] Some ten thousand scholars were housed there at a time,[29] coming from across India, China, Nepal, Tibet, Sri Lanka, Korea, Sumatra[30] and elsewhere in Indonesia. They studied the various schools of Mahāyāna and Nikāya Buddha Dharma, the Vedas, logic, Sanskrit grammar, philosophy, medicine, metaphysics, divination, mathematics, astronomy, literature, and mystical and esoteric techniques[31], diffusing this knowledge across much of Asia. The university library, probably the greatest library in the world at the time, was nine stories tall, and visitors could copy any text and take the copies with them when they left.[32] It held more than nine million unique manuscript pieces, averaging about 1,250 ślokas each in length. So vast was Nālandā's famed library that when it was destroyed by Bakhtiyar Khilji in 1193, Persian and Tibetan accounts record the library burning for three months. The early Dharmic scientific texts were of very high sophistication.[33] Sanskrit manuscripts were produced on subjects ranging from agriculture to astronomy to pharmacology to mathematics to medicine to architecture and more.

---

[26] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 240-241

[27] Bakker, Hans T. *The World of the Skandapurana: Northern India in the Sixth and Seventh Centuries.* Leiden, 2014, pp. 18, 124-5; Sen, Tansen. "Buddhism, Diplomacy, and Trade: The Realignment of Sino-Indian Relations, 600–1400." *Asian Interactions and Comparisons.* Honolulu: University of Hawai'i Press, 2003, p. 33

[28] Xuanzang. *The Great Tang Dynasty Record of the Western Regions.* Translated by Li Rongxi. Honolulu: University of Hawai'i Press, 2006, p. 250

[29] Fogelin, Lars. *An Archaeological History of Indian Buddhism.* New York and Oxford: Oxford University Press, 2015, p. 204-5.

[30] Sen, Tansen. "Buddhism, Diplomacy, and Trade: The Realignment of Sino-Indian Relations, 600–1400." *Asian Interactions and Comparisons.* Honolulu: University of Hawai'i Press, 2003, p. 117; Singh, Upinder, "Gifts from Other Lands: Southeast Asian Royal Religious Endowments in India", in Upinder Singh and Parul Pandya Dhar (eds), *Asian Encounters: Exploring Connected Histories*, New Delhi, 2014, p. 46.

[31] Basham, A. L. *The Wonder That Was India: A Survey of the History and Culture of the Indian Sub-Continent before the Coming of the Muslims*. New Delhi: Rupa & Co., 1967, p. 165

[32] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 126-127

[33] Ibid, p. 242

## Linguistics

There are many language families that developed in Ancient India, some of which still survive just as they were millennia ago; others have evolved and morphed over time, and a large number have become extinct. Languages like proto-Kiranti, Sentinelese, and others are millennia old, as are proto-Tamil, proto- and Vedic-Sanskrit, etc. Pāṇini (c. 6-4th c BCE) developed a metalanguage to formalize the grammar of the various dialects of Sanskrit into 'classical Sanskrit.'[34] His scientific classification of the parts of speech is the basis of modern linguistics, and William Jones (1746-1794) based his foundational work on comparative linguistics on the study of the relationship between Sanskrit and Latin, Greek, and other European languages.

As oral-tradition-based cultures, ancient Dharmic practitioners did not focus on writing, but on memorizing. Yet when, through trade, they adopted writing, the Brāhmī script developed into the precolonial writing scripts used throughout the Indosphere, from West Asia through to East Asia and the Philippines.[35] In Sanskrit, Dharmic books were read, copied, and recited all over the Indosphere and beyond, from Sri Lanka to Southeast Asia and Indonesia to Tibet to the Mongolian steppes to China.[36] Sanskrit, Pali, Prakrits, and Tamil were *lingua francas*, to so speak, from Kandahar in Afghanistan all the way to Bali in Indonesia.

Most English speakers may be surprised to learn how many common modern English words originated in India, such as: bandana, bandicoot, bangle, bungalow, calico, candy, cash, cashmere, catamaran, cheetah, chutney, coolie, cot, crimson, crocus, cumberband, curry, cushy, dinghy, ginger, guar, jackal, juggernaut, jungle, jute (the fiber), khaki, lacquer, lilac, loot, mango, mongoose, mugger, musk, orange, pajamas, pal (as in friend), palanquin, pepper, punch (the drink), pundit, rice, sandalwood, shampoo, shawl, sugar, tank, teak, thug, toddy (as in hot toddy), verandah.

## Health and Medicine

Dharmic practitioners are in thorough alignment with the scientific method, especially when it comes to refining and standardizing concepts and practices. However, some preferred not to standardize beyond their own group, and there was always space given for them. There were a number of healing practices of the ~4,400 tribes, the majority relying on the intervention of the medium/healer, as well as deriving medical treatments and therapies from herbs.

Several millennia before the invention of the microscope, Jain philosophy postulated the existence of minute, unseen living organisms (*nigoda*s). This early recognition of microbial life was a remarkably prescient insight based on principles of non-violence. This parallels mentions of microorganisms in the Vedas, most especially the *Atharvaveda*, which refers to *adṛṣṭa kṛmi* or "invisible worms/insects" entering the body as the cause of many diseases. The Vedas prescribed strict hygiene and

[34] Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 80

[35] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 179, 208

[36] Ibid, p. 168-69

sanitation practices, herbal medicine, and many various ceremonies, primarily revolving around the Sun and fire, and fumigation with smoke to manage and treat these diseases caused by microorganisms. Vedic *ṛṣi*s like Kaṇva, Atri, Yamadagni, and Agasti began to describe different morphologies of microbes that affect humans, plants, and other animals, and what ecotypes they are most commonly found in. They warned that if these microbes contaminate water or food, consuming it can then cause the associated disease. The Vedas also warned that hygiene must be applied not only to humans' bodies, but also to containers before reuse, since reusing unwashed containers caused illness among people. Ṛṣi Bādarāyaṇa made advances in the use of antimicrobial herbs. European scientists did not catch up to their level of microbiological knowledge until the late 1600s or early 1700s CE, arguably even the end of the 1800s.

Dharmic medical knowledge was known and being written about in some detail by Greek scholars by the 300s BCE.[37]

Examples of the healing practices that developed into pan-regional health sciences are:

- Āyurveda
- Siddham
- Kalari Cikitsā/Uzhichil
- Veterinary practices developed earlier, but the Śālihotra Saṁhitā (c. 300 BCE) is a detailed compendium on horse and elephant medicine.
- Vṛkṣāyurveda

Āyurveda literally means "the science of healthy living". It developed out of thought typified by the *Atharvaveda*. Āyurveda today is focused on the foundational thought of the *Suśruta Saṁhitā*, *Caraka Saṁhitā*, and the *Bhelā Saṁhitā* - all started before the 3rd century BCE and revised through c. 5th century CE, with underpinnings of thought going back at least to c. 1200-900 BCE. The medical works of Suśruta and his contemporaries were in many respects ahead of Galen and contemporary Chinese medical texts.[38] Āyurveda was adopted as the preferred medical system in 8th-century Baghdad, with an Āyurvedic hospital operated based on the *Caraka Saṁhitā*.[39] The World Health Organization has released three major publications: WHO Benchmarks for the Practice of Ayurveda (2022), WHO Benchmarks for the Training of Ayurveda (2022), and WHO International Standard Terminologies on Ayurveda (2023).[40] As Dharmic practitioners support empirical verification (*pratyakṣa-pramāṇa*, the most important epistemological principle in almost all schools of Dharmic philosophy), most prefer doctors to have both allopathic and Āyurvedic training, where Āyurveda is recognized as alternative and complementary medicine.

Siddham, literally meaning "perfected" or "healed", developed in the Śaiva Dharma traditions attributed to the great Siddha, Agastya Muni and formulated primarily in the Tamil language.

---

[37] Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 80

[38] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 239

[39] Ibid, p. 253

[40] https://iris.who.int/bitstream/handle/10665/365543/9789240064935-eng.pdf?sequence=1

Siddham, like Āyurveda, after Indian Independence is being brought back into global conversations on alternative and complementary therapies. Given the ethos on rigor and proof, practitioners of Siddham medicine have supported greater regulation and standardization of the practice through the WHO Global Traditional Medicine Center.

Kalari Cikitsā/Uzhichil literally means “medicine of the defense training hall”. Developed in Kerala, the medicinal practices stemmed from the needs of defense personnel trained in the martial arts of Kalaripayattu. Most of these treatments were preventative in nature and directed towards general wellbeing and chronic ailments, though they also include the treatment of wounds such as cuts and punctures from weapons training accidents, the proper setting of broken bones, etc. Kalari Chikitsā in this region first adopted refinements from Siddha and Āyurveda, and is currently verifying its practices with allopathic medicine.

Vṛkṣāyurveda is an ancient Dharmic system of agriculture and horticulture that focuses on the health and wellbeing of plants. It encompasses knowledge about various aspects of plant life, including cultivation, nourishment, disease prevention, sustainable practices, formulae for fertilizers, etc. Vṛkṣāyurveda aims to produce healthy plants that yield high-quality produce for both food and medicine.

Dentistry developed in the early phases of the Indus Valley Civilization, c.7000 BCE[41], and the use of shampoos were developed in the same civilization between 2750-2500 BCE. Description and cures for leprosy are discussed in the *Atharvaveda* and more fully in the *Suśruta Saṁhitā*. Suśruta also discusses angina, lithiasis treatment, Caesarean section, and many other medical procedures. Suśruta was a pioneer in reconstructive ear and nose surgeries, and other surgeries, and some of his surgical techniques and implements continue to inform modern surgery.[42]

Dharmic medical texts, drugs and drug prescriptions were imported into ancient China,[43] and also traveled westwards, being studied by doctors in western Asia. Among others, early Persian physicians even traveled to India to study Dharmic medicine.[44]

## Non-Harm Diets

Rooted in the principle of ahiṃsā, the Jain diet is strictly vegetarian and sometimes vegan. The other Dharma traditions either adopted this or had their own versions, but it is especially closely linked to

[41] https://www.adea.org/godental/discover-dentistry/history-and-data/history-of-dentistry

[42] Shaye, David, *The history of nasal reconstruction*, Curr Opin Otolaryngol Head Neck Surg. 2021 (https://pmc.ncbi.nlm.nih.gov/articles/PMC8270507/)

[43] Kieschnick, John and Shahar, Meir (eds), *India in the Chinese Imagination: Myth, Religion and Thought*, Philadelphia, 2014, p 1-2; Schafer, Edward H. *The Golden Peaches of Samarkand: A Study of T'ang Exotics.* Berkeley: University of California Press, 1963, p. 50-52; Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 192; Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 110

[44] Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 102

Jain Dharma. This practice has long-standing health benefits and offers a powerful model for animal welfare and environmental sustainability.

## Mathematics

The concept of zero as an actual integer was developed in ancient India, as well as its mathematical properties. The Hindu Number System, with the critical innovations of a decimal system based on zero plus nine numerals and place-value arithmetic (with separate columns for units, tens, hundreds, thousands, etc.), was developed between the 6th - 1st BCE in India, together with the idea of the algorithm.[45] This quickly spread throughout India and South-East Asia specifically through Hindu temples.[46] Algebra was also an Ancient Indian invention, and was learned from there by the rest of the world.[47] Ancient Dharmic practitioners developed the richest and most dazzling mathematical tradition in the pre-modern world, making huge strides in arithmetic, geometry, trigonometry, and particularly astronomy.[48]

A Hindu treatise written in 499 CE covers arithmetic, squares, cubes, square roots, cube roots, triangles, the properties of a circle, algebra, fractions, linear and quadratic equations, sines, the decimal system with place value, the value of pi to four decimal places[49], spherical trigonometry, the (so-called) Fibonacci Sequence[50], the perfected 'rule of three' still used to compute ratios, the size, shape, and movements of the Earth (including daily axial rotation)[51], the correct cause of and formulae for predicting eclipses[52], the exact length of the solar year to an accuracy of seven decimal places[53], the distance between the Earth and the sun and moon, an at least implicitly heliocentric model of the solar system, and an explicit description of the relativity of motion applied to the stars.[54]

Sign conventions like those used today for multiplication, division, fractions, addition, subtraction, brackets, etc. were developed before the 7th century CE in India. Combinatorics and Power lists also

---

[45] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 260

[46] Ibid, p. 242

[47] Ibid, p. 244, 260

[48] Plofker, Kim. *Mathematics in India.* Princeton, NJ: Princeton University Press, 2009, p. vii

[49] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 281; Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 103

[50] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 281

[51] Ibid, p. 283; Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 103

[52] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 283

[53] Ibid

[54] Ibid, p. 243

have significant origins or parallels in the work of ancient Dharmic thinkers. Ancient Dharmic mathematicians also developed the concept of negative numbers and their properties.[55]

Ancient Dharmic practitioners gifted a great deal of their discoveries about science, astronomy and its techniques and instruments, and mathematics to the Arab world, including the number zero, the concept of positional notation/decimal place value, trigonometry tables of sines and versines enabling accurate astronomical tables and the prediction of eclipses.[56] This knowledge was adopted by the Arabic mathematicians, through which it is the ancestor of the modern numeric system.[57] Ancient Dharmic mathematical innovations were also transmitted to Southeast Asia at an early date.[58]

## Astronomy

Ancient Dharmic practitioners observed the cosmos in order to further understand the environmental, agricultural, and other cycles on Earth. As a result, they developed many insights into space. Sophisticated techniques of geometry and mathematical astronomy were necessary to properly align Vedic ceremonies with the movements of the heavens, and stretch back many thousands of years in India.[59] Later, Indians engaged in discussion with their peers from ancient Greece and China in universities like Takṣaśilā and Nālandā, and further evolved these understandings. The foremost center for the study of the stars in Ancient India was a great astronomical observatory in the city of Ujjain.[60] In the 100s BCE, an author in Greece cited an Indian scholar as an authority on the movements of the stars.[61]

In 662 CE, a Syrian bishop wrote with great reverence of "the science of the Indians, including their subtle discoveries in astronomy, discoveries that were more ingenious than those of the Greeks and Babylonians, and of their valuable methods of calculation which surpass description… done by

[55] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 243-244

[56] Ibid, p. 234-235

[57] Ibid, p. 4, 230, 238; Aczel, Amir D, *Finding Zero: A Mathematician's Odyssey to Uncover the Origins of Numbers*, New York, 2016; Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 103

[58] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 204

[59] Ibid, p. 238

[60] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 235

[61] Lehoux, D. "The Parapegma Fragments from Miletus." *Zeitschrift für Papyrologie und Epigraphik* 152 (2005), p. 125-40

means of nine signs".[62] The specific concept of gravity as a force of attraction was described by Brahmagupta (598-668 CE). A very accurate length of the Earth's orbit (a sidereal year) was given in the Surya Siddhānta in c. 4-5th centuries CE. Dharmic discoveries in astronomy and calendrical computation were transmitted to China[63] and across Southeast Asia.[64] As of the 8th century CE, even in the Arab world an understanding of Sanskrit was considered a prerequisite for any who wished to understand the latest advances in the science of astronomy.[65] From the 1000s CE on, Indian astronomy became a major part of the basis of the astronomy of Western Europe, along with Euclid and the astronomy of Ancient Greece.[66]

## Wellbeing

Ancient Dharmic discussions on the intellect, mind, emotions, consciousness and their relationship to the physical body (before the 8th century BCE) are some of the most consequential Dharmic innovations; they were absorbed into modern psychology through Carl Jung. The Hindu philosophical traditions of Vedānta, Sāṅkhya, Yoga, and even Nyāya and Vaiśeṣika, as well as Buddha Dharma and Jain Dharma all provided exceedingly detailed discussions on the management of the mind to find grounding and equanimity, many centuries before the common era. Meditation is the most important method taught in these traditions, accompanied by breath modulation, Yoga, and other practices that have been wholesale adopted by the world for their numerous benefits.

Buddhist monks and pious Hindus frequented ancient Egypt, Palestine, and Libya. Some scholars have suggested that this movement could have influenced the Jewish Essenes in Judaea, and also Christian monks. Indeed Christian monasticism began in Egypt, where many Dharmic monastics already resided. Christian tradition records that the first Christian monk and the founder of Christian monasticism was Saint Antony, who was born in Alexandria, a city frequented by Dharmic monastics at the time, and he performed his first monastic retreat in a cave near the Red Sea, along which coast contemporary Dharmic temples appear in the archaeological record.[67]

In the 1950s and 60s, when Christians rediscovered the benefits of meditation through their modern contact with Hindus and Buddhists, they were able to look back in their own Christian history and find the writings of their ancient Desert Fathers referring to meditation, which many Christians used

[62] Plofker, Kim. *Mathematics in India.* Princeton, NJ: Princeton University Press, 2009, p. 255; Joseph, George Gheverghese. *The Crest of the Peacock: Non-European Roots of Mathematics.* 3rd ed. Princeton, NJ: Princeton University Press, 2011, p. 462.

[63] Schafer, Edward H. *The Golden Peaches of Samarkand: A Study in T'ang Exotics*. Berkeley, 1967, p. 276.; Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 110

[64] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 204

[65] Ibid, p. 236

[66] Ibid, p. 238

[67] Gregorios, Paul, 'The Monastic Tradition', in Sarayu Doshi (ed.), *India and Greece: Connections and Parallels*, Bombay, 1985, pp. 29-34; Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 69-70

as a justification to support them practicing meditation today, even though the Desert Fathers' historical practices were what would be more accurately termed contemplation (based on contemplating a particular verse of Scripture, etc.), whereas many modern Christians practice more and more Dharmic forms of meditation since these are ratified by medical science.

## Psychology

Ancient Hindu Dharma traditions discussed different facets of the mind: mind complex (*manas*), intellect (*buddhi*), consciousness (*citta*), and sense of self (*ahaṁkāra*). They also described that a person is comprised of distinct facets of self: physical (*annamaya*), life-functional/energetic (*prāṇamaya*), mental/emotional (*manomaya*), cognitive/intellectual (*vijñānamaya*), and essential/blissful (*ānandamāya*). These philosophical foundations were much broader than Greco-Roman archetypes in Imperialist Europe and gave greater grounding to the discipline of psychology than the Western framework that preceded it.

Between 1923 and 1936, Sigmund Freud and Romain Rolland wrote extensively on Ramakrishna Paramahamsa and Swami Vivekananda's approaches to the mind.[68] Then from 1936 to 1943, Carl Jung visited India and wrote many articles on psychology. He was especially intrigued with the psychological applications of the ideas of Varna. Most modern theoretical and therapeutic approaches in psychology are derived from Jung's theories or otherwise respond to them, including personality classifications like Myers-Briggs, which directly descended from theories that Jung conceived after his study of Varna or Hindu personality types.[69] Modern psychology prominently features many concepts developed in ancient India, such as epistemology, methods of subjective inquiry, theories of self and personality, emotions and triggers, and applied psychology (pathways for change) such as meditation (*dhyāna*) and controlled breathing techniques (*prāṇāyāma*). These and contributions from other Dharmic and other global indigenous traditions continue to be investigated or appropriated as part of developing modern psychology.[70]

Some preeminent modern trauma researchers, for example Bessel van der Kolk, MD, think that Yoga techniques such as *nāḍī śōdhana prāṇāyāma* can be an effective intervention for trauma and often refer their clients to Yoga teachers.[71]

---

[68] Maharaj, Ayon, *The challenge of the oceanic feeling: Romain Rolland's mystical critique of psychoanalysis and his call for a 'new science of the mind'*, "History of European Ideas", 2017 (https://philarchive.org/archive/MAHTCO-17)

[69] Coward, H. G., *Jung and Eastern Thought.* Albany, NY: State Univ. of New York Press, 1985

[70] Mayer, John, Ph.D. *Hindu Personality Types Travel West*, Psychology Today, 2009. (https://www.psychologytoday.com/us/blog/the-personality-analyst/200903/hindu-personality-types-travel-west)

[71] Parker, Stephen, Ph.D. *Clearing the Path: The Yoga Way to a Clear & Pleasant Mind: Patañjali, Neuroscience, and Emotion*. Minneapolis, MN: AHYMSA Publishers, 2017, chapter 7

## Martial Arts

Many types/schools of martial arts developed in ancient India, including, but far from limited to:

- Malla-yuddha: an art focusing primarily on wrestling, developed from prehistoric times, mentioned in the *Rāmāyaṇa* (c. 4th c BCE) and *Mahābhārata*. It is the ancestor of the Khmer (788CE), Burmese, Javanese, and other native wrestling styles. Modern Kuṣṭi was developed during the Mughal Empire (1526-1858) as a fusion between this and Persian Koṣṭhī-Pehelvāni. It grew in parallel with many healing and massage practices. It was a sport and an avenue for gentlemen's duels, and used for personal self-defense rather than warfare.
- Dhanurveda: Archery and martial sciences for warfare, codified from at least as early as 1100 BCE. It includes battle strategy, boxing, chariot driving, horse riding, spears, nooses, swords, shields, etc.
- Silambam: Ancient martial arts developed in the Tamil region as attested in the Saṅgam literature from 400 BCE. It primarily used a staff, as well as indigenous knuckle-dusters, whips, sickles, daggers, spears, flexible swords, and batons. It is perhaps a contributor to the development of Shaolin Kung Fu as Buddhabhadra (Chinese: 跋陀), a famed teacher at the Shaolin monastery, came from this area of Ancient India, and his two first disciples were experts in the regional Chinese martial arts.
- Muṣṭi-yuddha, an unarmed striking sport referenced at least as early as the *Rāmāyaṇa*, using punches, kicks, elbows, knees, and grabs. Headbutts and groin strikes were not allowed in competitions. Traditional training included conditioning the fists by punching coconuts and rocks with the bare knuckles. Matches were one-on-one, or one-vs-a-group, or group-vs-group. There were no timed rounds, and victory was only by knockout, ringout (these fights were on a raised platform), or submission. These fights actually continued at least into the 1890s.
- Kalaripayattu: Developed as a combination of Kerala clan and tribe martial arts and self defense techniques, Dhanurveda, and Silambam and formalized around the 12th century CE. Kalaripayattu focuses primarily on weapons combat, but also includes unarmed striking as well as wrestling.
- Kabaddi: a contact team sport which had become part of the Yādava tribal nation by at least as early as the 3rd century BCE. It is still played today recreationally and professionally in India, and internationally in the Asian Games. It was featured as an exhibition sport in the 1936 Olympics in Berlin.[72]
- Śastra-Vidyā, the science of weaponry. Sikhs developed this as the art of Śastar-Vidyā for their military purposes.
- Other native Dharmic martial arts include Adimurai, Huiyen Lallong, the Paika Akhāḍā arts from Oṛiśā, Chedi Talimkhana, Lathi Khela, Parikhanda, Sqay (the Káśmīri school of swordsmanship), Mardhani Khel, and more.

To go into one particular Dharmic martial art in more detail, let us take Malla-yuddha. An unarmed fighting sport, it incorporated grappling (mostly wrestling-style), joint-breaks, punches, biting, chokes,

[72] https://www.olympics.com/en/news/kabaddi-in-olympics-berlin-1936-exhibition-sport

and pressure point strikes. Matches were traditionally codified into four types, from purely sportive contests of strength without striking, to trying to lift each other off the ground for three seconds, up to actual full-contact fights. There were four traditional styles of Malla-yuddha: Hanumanti, concentrating on overall technical skill; Jāmbavānti, focusing on submitting the opponent with locks and holds; Jarāsandhi, concentrating on joint breaks; and Bhīmaseni, focusing on sheer strength training to overpower the opponent.

Malla-yuddha training began between the ages of ten to twelve, and took place mainly in a traditional arena called an *akhāḍā* (academy), a clay pit about thirty feet across, either square or circular. The soil of the floor was mixed with various ingredients including ghee (clarified butter). Before each training session, the floor was raked of any pebbles or stones. Water was added approximately every three days to keep it at the right consistency, soft enough to avoid injury but hard enough not to impede the practitioners' movements. Practitioners began each training session by flattening the soil, both as endurance training and for discipline. Then they threw a few handfuls of soil onto their own and each other's bodies as a form of blessing, and also to improve their grips on each other (training was always done in loincloths only). Then they would offer veneration at a small shrine to the gym's patron deity, most commonly Hanumān. They would light incense and offer a small yellow flower garland. Then they would touch their head to their instructor's feet as a sign of gratitude.

The training proper consisted of eight types:

- Bodyweight exercises without equipment, such as squats and pushups. This was the first type of training introduced to young children, before any of the others.
- Complex exercises that use a variety of special pillars and hanging ropes.
- Fitness training consisting of rope-climbing, log-pulling, running, and swimming.
- Unarmed combat itself, including wrestling, locks, submission holds, takedowns, and strikes. This training category included both learning techniques from the instructor, and actually wrestling/sparring with each other.
- Exercises done with a large stone ring that was swung like a kettlebell, lifted like a weight, or worn around the neck during pushups and squats.
- Exercises performed with a meter-long bamboo stick with a heavy round stone attached to the end.
- When they were exhausted, intense physical training would cease for the day, followed by discussion of unarmed combat tactics and strategies with the experienced instructor.
- Massage. The practitioners were all taught how to massage, and every training session ended with them massaging each other to promote blood circulation, the endocrine system, and therefore, healing and quicker recovery.

Many of these training methods were adopted by European health sciences during the colonial period, and their influence remains significant in modern fitness methods and equipment.

## Games

Indus Valley-style gaming boards and dice had reached Mesopotamia by c. 2500 BCE.[73]

- Chess: the ancestor Caturaṅga is attested from the Indus Valley Civilization and is the ancestor for most Asian and European versions of the game.[74]
- Ludo: the ancestor Catuṣpāda/Chaupar is attested from 1100-800 BCE. Branded as Parcheesi in modern America.
- Tag: Āṭā-pāṭyā is mentioned as early as 400 BCE.
- Hopscotch: Nondi and Pāndi are two early Pandya Empire (400BCE-1616 CE) versions of the common game.
- Snakes and Ladders: Mokṣapaṭam, from 2nd century CE.
- Seven Stones: found in Indus Valley Civilization

## Other Contributions

Ancient Dharmic peoples made various other technological and scientific advances which contributed significantly to global knowledge and development, such as:

- The world's first known urban sanitation systems were developed in Ancient India, with elaborate, advanced, well-ordered wastewater/sewage drainage systems. In the Indus Valley Civilization all urban homes, even the smallest homes on city outskirts, were connected to the sewage system.
- The Indus Valley Civilization developed the world's first public baths and swimming pools.
- Dharmic ideas and models of urban planning were adopted very early by the rulers of Southeast Asia.[75]
- The big-toe stirrup, a major technological innovation enabling easier horse-riding, was an ancient Dharmic invention which spread to the rest of the world.[76]
- The technology for making sugar from sugarcane developed in Ancient India and was transmitted to China and other cultures.[77]

---

[73] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 58-59

[74] Ibid, p. 255; Thapar, Romila. *A History of India: Volume 1.* Reprint edition. London: Penguin Books, 1990, p. 77

[75] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 177

[76] White, Lynn. "Tibet, India, and Malaya as Sources of Western Medieval Technology." The American Historical Review 65, no. 3 (1960): p. 516; Penn, Tim, B. Russell, and A. I. Wilson, 2021.""On the Roman-Byzantine Adoption of the Stirrup Once More: A New Find from Seventh-Century Aphrodisias." *Anatolian Studies* 71: 129–39.

[77] Sen, Tansen. *India, China, and the World: A Connected History*. New Delhi: Oxford University Press, 2018, p. 59-60; Gordon, Stewart. *When Asia Was the World: Traveling Merchants, Scholars, Warriors, and Monks Who Created the Riches of the East*. Cambridge, MA: Da Capo Press, 2007, p. 19

- Some Ārya clans went to the Levant and mixed with local Hurrian clans to form the Mittani Kingdom (1550-1260 BCE) in modern-day northern Syria. Mittani people were Vedic Āryas[78] that fused their traditions with other clans in their lands (equivalent to parts of modern Syria and Turkey). In the Mittani kingdoms, the rulers were descended from Ārya tribes, but they were administering an area populated by locally indigenous tribes. They approached this by acculturating themselves to the local tribes with a Dharmic pluralistic understanding based on collaboration and synthesis rather than exploitation. There is a demonstrable difference in the way that they approached social organization: rather than trying to eradicate or subjugate (such as with exorbitant taxes) other cultures, they practiced a cooperative, equitable pluralism, treating tribes as equals and finding ways to integrate and coexist; and a non-exploitative, mutually beneficial economic model based on trade and shoring up domestic production for export. Later, this similar Dharmic ethos is observed in Thailand and elsewhere in Southeast Asia. Dharmic civilization is one of the only major global civilizations in which that ethos survives. Over the course of history, nearly the whole of Asia is witness to this.
- Many ancient Dharmic fables were transmitted throughout ancient Western cultures, especially the Hindu *Pañcatantra* and the Buddhist *Jātaka* tales, which appear in demotic Egyptian stories, Aesop's Fables, and popular early Christian works.[79]
- In the 100s BCE, an author in Greece cited an Indian scholar as an authority on meteorology.[80]
- Blowguns to shoot darts or pellets originated from ancient India.[81] This was not their only point of origin; they independently originated among South American and Australian native peoples, but it was Indian blowguns which spread to the medieval European world.
- The Zoroastrians, a Dharmic people, developed the *qanat*, an ingenious underground water management system, over 3,000 years ago. By tapping into groundwater sources and using gravity-fed tunnels, *qanat*s efficiently transported water to arid areas, enabling large-scale agriculture and sustaining populations.
- Ancient Zoroastrians also invented the *yakhchal*, or "ice pit," an egg-shaped dome with a subterranean storage space that functioned as an evaporative cooler. These structures were used to store ice and food year-round, even in the desert heat.
- Elements of Ancient Indic cuisines, music, dance forms, arts, clothing fashion, and weaves have become highly popular worldwide.

---

[78] Beckman, Gary M. *Hittite Diplomatic Texts.* 2nd ed. Atlanta: Scholars Press, 1999, p. 47

[79] Dalrymple, William. *The Golden Road: How Ancient India Transformed the World.* London: Bloomsbury Publishing, 2024, p. 69

[80] Lehoux, D. "The Parapegma Fragments from Miletus." *Zeitschrift für Papyrologie und Epigraphik* 152 (2005), p. 125-40

[81] White, Lynn. "Tibet, India, and Malaya as Sources of Western Medieval Technology." The American Historical Review 65, no. 3 (1960): p. 521

## Summary

Dharmic civilizations have had profound global influence, but their contributions have long been minimized by colonial narratives. Ancient India was a hub of trade and manufacturing, producing textiles, gems, metals, ships, and financial innovations such as banker's checks. Its goods reached Rome, Egypt, Southeast Asia, and beyond, while its shipbuilding and metallurgy, including the invention of crucible steel, set global standards.

Alongside commerce, India was a center of learning and spirituality. Universities like Nālandā attracted international scholars and housed vast libraries, spreading knowledge of mathematics, astronomy, medicine, and philosophy. Dharmic thinkers developed zero, the decimal system, algebra, advanced trigonometry, and sophisticated astronomical models, many centuries ahead of Europe. Medical systems such as Ayurveda and Siddham pioneered surgery, pharmacology, and holistic health, influencing traditions from China to the Middle East.

Dharmic spiritual traditions and practices traveled with trade, shaping Southeast Asian culture, art, and architecture, while ancient Indian languages became lingua francas across Asia. Dharmic concepts of the mind, meditation, and yoga later informed Western psychology and modern wellness practices. Martial arts, games like chess, and innovations in urban planning and technology further demonstrate Dharmic cultures' wide-ranging impact.

Overall, Dharmic civilizations advanced human society in science, medicine, trade, philosophy, and culture – a legacy now being rediscovered beyond colonial biases.