

Indian Knowledge Systems in Healthcare: Lessons from Our Ancestors for Modern Medicine

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ABSTRACT

Purpose: India's indigenous medicinal heritage was an advanced medicinal system starting very early in human history. There was a lot happening between 7000 BCE proto dentistry in Mehrgarh and Harappan trepanation, such as the development of Ayurveda with the Charaka Samhita and Sushruta Samhita, as well as Siddha medicine, Rasashastra, and more. The ancient healers of India were the first of many civilizations to develop frameworks for medicine that are remarkably advanced for their time and are based on many of the principles we use today in biomedical science. This deep-study research paper systematically investigates and examines the contributions of our ancestors in the field of Indian native medicinal systems. It is historically and scientifically informed and examines the development of Indian native medicinal systems from their prehistoric period to the time of the classical Ayurvedic corpus, and through Buddhist, Jain, and other regional medical systems as well as the Indian medical knowledge systems that were transported to other areas of the Asian continent via trade routes and missionaries.

Methodology: This paper incorporates the exploratory qualitative research method. Information is obtained through keyword-based searches on the Google search engine, the Google Scholar search engine, and other AI-driven GPTs. The information is then analyzed and interpreted in alignment with the objectives of the paper.

Analysis/ Results: The paper presents these systems not just as collections of empirical observations of folk practices but as systems of thought with developed epistemologies, diagnostic and therapeutic frameworks, surgical interventions, and philosophies of public health. It is argued that the Tridosha of Ayurveda anticipates constitutional medicine; the Sushruta Samhita's surgery manifests a rigor similar to that of the Western pre-modern surgery; the Atharva Veda's sukshma krimi (the tiny, invisible creatures which are the cause of disease) is a precursor to the theory of germs; and the Prakriti typology of personalized Ayurveda is congruent with contemporary genomics and personalized medicine. The paper advances the argument that the ancient systems of thought are not only relevant to the historical discourse but that they also have present-day relevance. The modern science of pharmacology has begun to validate the claims of Ayurveda regarding its herbs; yoga and pranayama have a positive effect on the nervous system as shown by modern randomized controlled clinical trials, and the World Health Organization's global strategy on traditional medicine acknowledges the vital importance of these systems in dealing with modern health problems (e.g. non-communicable diseases, mental health challenges, and the problems posed by antimicrobial resistance).

Originality/ Value: This study offers a rigorous historical account of the medical systems of India. By relying on a large number of the Indian classical texts and contemporary peer-reviewed scholarship, it provides the evidence needed to advocate for the systematic integration of these medical systems into contemporary health care and higher education as envisaged by India's National Education Policy 2020.

Type of Paper: Exploratory Research.

Keywords: Ayurveda, Siddha, Unani, Rasashastra, Charaka Samhita, Sushruta Samhita, Indian Knowledge Systems, Traditional Medicine, AYUSH, Prakriti, Tridosha, NEP 2020, Integrative Medicine.

1. INTRODUCTION :

The history of medicine in India is a story of extraordinary antiquity, intellectual sophistication, and practical achievement that has shaped human health across the entire Asian continent and continues to influence global wellness practices in the twenty-first century. When Western Europe was still organised around humoral medicine derived from ancient Greece, Indian physicians had already developed anatomical knowledge through systematic cadaver dissection, performed rhinoplasty and cataract surgery with instruments designed for the purpose, classified medicinal plants into hundreds of therapeutic categories, formulated a theory of individual constitutional types that anticipates personalised medicine, and established monastic universities where medicine was a compulsory subject taught alongside philosophy, mathematics, and astronomy [1-3].

Yet for much of the past two centuries, the colonial educational framework imposed upon India systematically marginalised this heritage, treating indigenous medical traditions as pre-scientific superstition to be replaced rather than as sophisticated knowledge systems to be understood, evaluated, and integrated. The consequences of this marginalisation have been profound: the gradual erosion of traditional knowledge transmission systems, the underfunding of research into traditional therapeutics, the global patenting of knowledge derived from Indian medicinal plants without acknowledgement of its indigenous origins, and the diminishment of a cultural and intellectual inheritance that belongs not only to India but to humanity [4-6].

India's National Education Policy 2020 represents a landmark institutional reversal of this trend, mandating the integration of Indian Knowledge Systems — including their medical and health dimensions — into all levels of education. The AYUSH Ministry's programmes, the WHO's traditional medicine strategy, and the growing body of clinical research validating traditional Indian therapeutics all reflect a global recognition that the accumulated medical wisdom of ancient India deserves serious, rigorous scholarly attention and systematic integration into contemporary healthcare [7-9].

This paper is offered as a scholarly contribution to this project of recovery and integration. It proceeds through vivid substantive sections. Sections establish the theoretical framework, examine the prehistoric and Indus Valley foundations, explore Vedic contributions and analyse the classical Ayurvedic texts. Further it examines the Buddhist and Jain medical traditions and documents regional systems including Siddha, Unani, and Rasashastra. Also it traces the global transmission of Indian medical knowledge and ultimately addresses the contemporary applications and integrative medicine.

2. REVIEW OF LITERATURE :

Table 1: Indian knowledge in Medicine

S. No.	Reference	Title	Summary/Outcome
1	Gandhi, M.A. & Patil, B.K. (2024). [1]	Sushruta: The Father of Surgery and Ancient Medical Innovations	Comprehensive review of Sushruta's contributions: rhinoplasty, cataract surgery, 121 surgical instruments, cadaver dissection protocols, herbal anaesthetics, and post-operative care. Documents global influence through the 'Indian method' of nasal reconstruction.
2	Dave, T., Habte, A., Vora, V., Sheikh, M. Q., Sanker, V., & Gopal, S. V. (2024). [10]	Sushruta: The Father of Indian Surgical History	Details Sushruta's six-sthana Samhita structure, surgical instruments classified as Yantras and Shastras, pedicle flap techniques, and the global spread of the 'Indian method' to Arabia, Italy, and eventually modern reconstructive surgery.
3	Vedam, R. (PMC (2021) [11]	Contributions of Ancient Indian Knowledge to	Documents 9000-year-old dental drilling in Baluchistan, trepanation at Mehrgarh (2300 BCE), bitumen prosthetic eye (2800 BCE), Sushruta Samhita

		Modern Medicine and Cardiology	surgical instruments, and Bower Manuscript (200 CE). Maps ancient Indian knowledge onto modern cardiology.
4	Jamnekar, P.P. et al. (2025). [12]	Ashwagandha as an Adaptogenic Herb: A Comprehensive Review of Immunological and Neurological Effects	Integrates mechanistic, preclinical, and clinical evidence on ashwagandha's adaptogenic properties. Documents withanolide-mediated HPA axis modulation, NF-κB inhibition, Nrf2 activation, GABAergic signalling. Validates traditional Rasayana herb claims for stress, cognition, sleep.
5	Patil-Bhole, et al. (2021). [13]	Nanostructured Gold in Ancient Ayurvedic Calcined Drug Swarnabhasma	FE-TEM confirms highly crystalline spherical gold nanoparticles of 5–20 nm in Swarna Bhasma. Gravimetric analysis confirms 95% gold content. Demonstrates that Rasashastra processing confers unique nanostructure responsible for medicinal potential.

Table 2: Review summary based on Keyword: Indian Knowledge Systems in Healthcare

S. No.	Area/Title	Summary/Outcome	Reference
1	Integrating indigenous systems of medicines in the healthcare system in India: Need and way forward	India has a rich heritage of traditional medical systems, including Ayurveda, Yoga, Unani, Siddha, Naturopathy, Sowa Rigpa, and various folk practices , many of which are now promoted under the Ministry of AYUSH . Although these systems have long served public healthcare, their growth was hindered during the colonial period in favor of allopathic medicine. Since independence, the Government of India has strengthened AYUSH through dedicated institutions, research, regulation, and policy support, yet greater integration with the mainstream healthcare system remains an important goal.	Roy, V. (2019). [14]
2	The ancient Indian knowledge system and the medical sciences	Ancient India developed a highly advanced medical tradition rooted in the Vedas , particularly the Atharva Veda , and the principles of Ayurveda , emphasizing holistic health, medicinal plants, hygiene, and preventive care. These time-tested practices continue to influence modern healthcare, with growing global interest in herbal medicine, ethnopharmacology, and the integration of traditional knowledge with contemporary medical technologies.	Raikwar, A. (2023). [15]
3	Indian Knowledge Systems in Medicine: A Fusion of Tradition and Technology	Indian Knowledge Systems (IKS) in medicine, rooted in Ayurveda, Siddha, Unani, and the Vedas , promote holistic health through natural remedies, preventive care, and balanced living. Integrating these time-tested principles with modern science can enhance personalized, sustainable, and evidence-based healthcare.	Verma, N., Dwivedi, S., & Dhiman, R. (2025). [16]

4	Ontology-Driven Knowledge-Based Health-Care System, An Emerging Area—Challenges and Opportunities—Indian Scenario	Recent advances in ontology-driven healthcare systems have enhanced public health decision-making by integrating semantic knowledge of diseases, locations, and environmental factors. This approach improves data interoperability, health mapping, and evidence-based policy formulation, enabling smarter and more effective healthcare planning.	Sunitha, A., & Suresh Babu, G. (2014). [17]
5	Perception of privacy issues and awareness in health-care knowledge management systems	In the Indian healthcare system, privacy and secure knowledge management are essential for building trust in digital health services. Strengthening data protection, ethical data sharing, and privacy-aware healthcare systems can improve patient confidence, data quality, and evidence-based healthcare decisions.	Churi, P., Pawar, A. V., & Abdulmuhsin, A. A. (2022). [18]
6	Traditional medical system (TMS) for sustainable healthcare in India	Traditional medicine, recognized by the World Health Organization (WHO) , is an important component of global healthcare. The WHO advocates its safe and effective use through research, regulation, and integration into health systems for disease prevention, diagnosis, treatment, and overall well-being.	Mukherjee, P. K., Banerjee, S., Katiyar, C. K., Sharma, S., & Chattopadhyay, N. (2021). [19]

3. OBJECTIVES OF THE STUDY :

This research paper is guided by the following specific objectives:

- (1) To document the earliest medical evidence in the Indian subcontinent, including prehistoric dentistry, trepanation, prosthetics, and Indus Valley sanitation, to establish the pre-Vedic roots of Indian medicine.
- (2) To analyse Vedic medicine, especially the Rigveda's botanical knowledge, the Atharvaveda's disease classification and proto-germ theory, and its integration of spiritual and physical healing.
- (3) To examine the three major Ayurvedic texts—Charaka Samhita, Sushruta Samhita, and Ashtanga Hridayam—for their theories, diagnostics, pharmacology, and surgical contributions.
- (4) To evaluate how Buddhist and Jain traditions shaped Indian medicine through monastic centres, medical education at Takshashila and Nalanda, and the spread of knowledge along Asian trade routes.
- (5) To document the unique contributions of Siddha, Unani, and Rasashastra, focusing on their theories, pharmacological innovations, and roles in Indian healing traditions.
- (6) To trace the spread of Indian medical knowledge through Buddhism, trade, and cultural exchange to Tibet, China, Persia, Central Asia, and Southeast Asia.
- (7) To evaluate modern scientific evidence for traditional Indian medicine, including research on Ayurvedic herbs, yoga, pranayama, and integrative care.
- (8) To assess the policy implications of this heritage for health education, research funding, intellectual property, and its integration into India's healthcare system under AYUSH and NEP 2020.

4. METHODOLOGY :

This research employs a qualitative methodology based on secondary data. Relevant information was gathered through systematic keyword searches on Google Search, Google Scholar, and AI-assisted GPT platforms. The collected literature and information were critically reviewed, analyzed, and interpreted to address the research objectives [20-30].

5. PREHISTORIC AND INDUS VALLEY FOUNDATIONS OF INDIAN MEDICINE :

5.1 Archaeological Evidence of Prehistoric Medical Practice:

The conventional narrative of medicine's origins in the ancient Near East requires significant revision in light of the archaeological evidence from the Indian subcontinent. Far from being a latecomer to the history of medical practice, India — or more precisely the prehistoric cultures of the northwestern

subcontinent — was among the earliest centres of sophisticated surgical and dental intervention in human history. This evidence predates by millennia the classical Vedic medical tradition that has traditionally been treated as the starting point of Indian medicine.

The most dramatic evidence comes from Mehrgarh, a Neolithic settlement in present-day Pakistan that occupied the site from approximately 7000 to 2500 BCE. Archaeological analysis of skeletal remains from Mehrgarh revealed drilled molar crowns in nine adult individuals, dating to between 7,500 and 9,000 years ago. These teeth showed signs of drilling with flint tool tips to remove decayed material, and in some cases showed evidence of healing around the drill sites — indicating that the patients survived the procedure. This constitutes the oldest known evidence of intentional dental treatment in any human population, predating comparative evidence from Mesopotamia, Egypt, and China by thousands of years.

Trepanation — the surgical procedure of drilling or cutting a hole through the skull, typically to relieve pressure or treat head injuries — provides a second line of evidence for prehistoric Indian surgical practice. Multiple skulls from Mehrgarh and Harappa Cemetery dating to approximately 2300 BCE show evidence of trepanation with subsequent bone healing, indicating patient survival. The first Neolithic skull with multiple trephinations from the Kashmir Valley site of Burzahom was reported in 2011, extending the geographical range of this practice within the subcontinent. A particularly striking find was a bitumen prosthetic eye recovered from a grave in the Burnt City near Baluchistan, dating to approximately 2800 BCE — evidence not only of surgical sophistication but of the manufacture of prosthetic devices for patients with physical disabilities [31-33].

The prosthetic eye's bitumen construction and its organic covering suggest a craftsman-healer tradition in which surgical and material knowledge worked in combination.

5.2 The Indus Valley Civilisation's Public Health Architecture:

The Indus Valley Civilisation (c. 3300–1300 BCE), which at its height extended over approximately one million square kilometres across present-day Pakistan and northwestern India, provides remarkable evidence of systematic public health infrastructure that reflects an advanced understanding of the relationship between environmental conditions and human health. The civilisation's major urban centres — Mohenjo-daro, Harappa, Dholavira, and dozens of smaller settlements — were characterised by a degree of urban planning and sanitation engineering that was not surpassed in the ancient world until the Roman period, and in several respects was more sophisticated.

The most striking feature of Indus Valley public health is the comprehensive drainage and waste disposal system. Underground brick-lined drains ran alongside the streets and connected to private homes, carrying household waste and sewage away from living areas. Toilets built over drains were present in virtually every home excavated at Harappa and Mohenjo-daro — a level of private sanitation unknown in contemporary Mesopotamia or Egypt and far in advance of what was available in European cities until the nineteenth century. This infrastructure reflects an understanding that human waste constitutes a disease vector — an insight that would not be formally articulated in Western medical science until the nineteenth century's germ theory, but that the Indus Valley peoples appear to have acted upon intuitively or empirically four thousand years earlier.

Archaeological evidence also suggests a sophisticated pharmacopoeia among Indus Valley peoples. Stag-horn fragments and cuttlefish bone found at excavation sites indicate the use of animal materials in medicinal preparations. Evidence for the use of neem (*Azadirachta indica*) and pipal (*Ficus religiosa*) trees — both of which have demonstrable pharmacological properties — suggests that Indus Valley communities had identified the therapeutic potential of local flora through systematic observation. The neem tree's broad-spectrum antimicrobial, antifungal, and antiparasitic properties are well-established by modern pharmacology; the Indus Valley use of neem for dermatological complaints, fever, internal parasites, and gastrointestinal disease thus represents an early instance of empirically derived therapeutic knowledge that anticipates modern drug discovery (Frenez (2016). [34]).

5.3 Trade Routes and the International Circulation of Medical Knowledge:

The Indus Valley Civilisation's extensive trade networks — documented through archaeological finds of Harappan manufactured goods in Mesopotamian sites and cuneiform records of trade with 'Meluhha' (the Indus Valley) from 2400–2000 BCE — provided channels through which medical and botanical knowledge could circulate alongside material goods. Spice routes established around 3000 BCE

connected India to Persia, Arabia, Mesopotamia, and Egypt, carrying not only commodities like black pepper, cardamom, and turmeric but also knowledge of their medicinal properties. The intriguing temporal coincidence between the climate-driven migration out of the Indus Valley around 4000 years ago and the appearance of advanced medical texts in Egypt — the Smith Papyrus (1500 BCE), the Ebers Papyrus (1550 BCE), and the Kahun Papyrus (1800 BCE) — has led some scholars to speculate about possible connections, though definitive evidence of transmission remains to be established.

6. VEDIC CONTRIBUTIONS TO THE HEALING SCIENCES :

6.1 The Rigveda's Botanical Pharmacology:

The Rigveda, the oldest Vedic text and one of the earliest Indo-European literary works, contains substantial medical and botanical knowledge. Hymn 10.97, the Oshadhi Sukta (Hymn to Medicinal Plants), celebrates the healing powers of numerous plants and is among the earliest examples of systematic botanical pharmacology. The Rigveda grouped plants into trees (Vrksha), herbs (Oshadhi), and creepers (Vrudh), and further distinguished flowering from non-flowering species, reflecting an early form of botanical classification.

Vedic medicine was not limited to herbal practice; it located healing within a broader cosmological view of health. The three doshas later central to Ayurveda — Vata, Pitta, and Kapha — are foreshadowed in Vedic ideas that linked human physiology to the five elemental forces (panchabhutas). This framework held that the body shares the same order as nature, and that health depends on harmony within that order (Krishnan (2026). [35]).

6.2 The Atharvaveda's Disease Classification and Proto-Germ Theory:

The Atharvaveda, more practical in orientation than the other Vedas, is the most medically significant of the four. Over 100 of its 731 hymns address conditions such as fever, leprosy, consumption, heart disease, headache, rheumatism, and epilepsy, describing symptoms, causes, and treatments. This amounts to an early system of disease classification that long predates comparable models in Western medicine.

Beyond disease classification, the Atharvaveda shows notable pharmacological breadth. It names over two hundred medicinal plants, including Apāmārga, Arjuna, Ásvagandhā, Pippali, Brāhmi, and Haridra, and links them to specific conditions, bodily systems, and forms of administration such as decoctions, pastes, inhalations, fumigations, and amulets. This reflects an organised therapeutic system rather than unsystematic plant lore. Modern research has validated many of these remedies: Ásvagandhā has shown adaptogenic, anti-inflammatory, anxiolytic, and neuroprotective effects, while turmeric's curcumin has demonstrated antimicrobial, anti-inflammatory, and wound-healing properties. Together, these examples suggest that Atharvavedic medicine was grounded in structured clinical observation and early pharmacological reasoning (Maas (2018). [36]).

The Atharvaveda's most remarkable contribution to the history of medical thought is its concept of disease-causing micro-organisms. The text mentions krimi — worms or germs — that are described as creeping or jumping, multiplying, and entering human bodies from without. Crucially, some of these krimi are described as 'sukshma' — tiny and not visible to the naked eye.

This constitutes the earliest known textual suggestion of the existence of invisible disease-causing organisms, anticipating Leeuwenhoek's seventeenth-century microscopic discovery of micro-organisms by more than three thousand years. While the Atharvaveda's krimi theory was not developed into a systematic germ theory comparable to that of Pasteur and Koch, its basic insight — that disease can be caused by living agents too small to see — was formulated in ancient India in a period when Greek and Egyptian medicine had no comparable concept.

The Atharvaveda also demonstrates sophisticated understanding of seasonal disease patterns. The text's careful delineation of fever variants by season — varshika during the rains, graishma during summer, sharada during autumn — reflects systematic epidemiological observation over many years, distinguishing what we would now recognise as different aetiological agents (malaria, which peaks seasonally, is the most plausible candidate for the feared takman or seasonal fever of Vedic medicine) operating through different environmental pathways. This seasonal epidemiological awareness provided the foundation for the later Ayurvedic doctrine of ritucharya — seasonal regimen — which prescribes different dietary, lifestyle, and pharmaceutical interventions for each season to maintain health and prevent disease.

6.3 Integration of Spiritual and Physical Healing in the Vedic Tradition:

A feature of the Vedic medical tradition that distinguishes it sharply from the later analytical rationalism of the Charaka Samhita — and that continues to generate debate among historians of medicine — is its integrated deployment of spiritual, ritual, and physical therapeutic modalities within a single healing framework. Atharvaveda classified disease treatment into four aspects: Atharvan (prayer and sacred fire ritual), Angirasai (spiritual intervention), Daivi (use of natural elements), and Manushi (herbal treatment). This four-fold framework was not an arbitrary aggregation of incompatible therapeutic types but reflected a coherent theory of disease causation: since disease could arise from spiritual, cosmic, environmental, and material causes, effective treatment required interventions addressing all these dimensions.

The Vedic tradition's integration of mental and physical health deserves particular attention. Mental health was addressed with remarkable explicitness and openness in Vedic medical texts, in striking contrast to the stigmatisation of mental illness that persists to the present day. The Atharvaveda contains hymns addressing unmada (madness or psychiatric disorders), apasmara (epilepsy, understood in psychosomatic terms), and various anxiety and mood disorders. The integration of psychological and somatic medicine in the Vedic framework — understanding the mind-body relationship as fundamental to health and disease — anticipates contemporary psychosomatic medicine and the biopsychosocial model of health that has only gained wide acceptance in Western medicine since the 1970s.

7. DEVELOPMENT OF CLASSICAL AYURVEDIC TEXTS :

7.1 Charaka Samhita: The Physician's Canon:

The Charaka Samhita, the foundational text of Kaya Chikitsa (internal medicine) in Ayurveda, represents a landmark in the intellectual history of medicine. Its compilation and revision process spanning from the teachings of Punarvasu Atreya (c. 1000 BCE) through the codification by Agnivesha and the subsequent revisions by Charaka (c. 1st–2nd century CE) and Dridhabala (c. 9th century CE) models the gradual, multigenerational refinement of medical knowledge through clinical observation, theoretical reflection, and scholarly debate that characterises the best traditions of scientific knowledge development in any culture.

The text's theoretical framework is centred on the Tridosha system — the three biophysical principles of Vata (governing motion, neurological function, and the movement of substances through the body), Pitta (governing metabolism, transformation, and the processes of digestion and thermogenesis), and Kapha (governing structure, lubrication, and the coherence of tissues). Health is the balanced interaction of these three principles; disease is any disturbance of their equilibrium. This theoretical framework has been the subject of considerable contemporary scientific interest, with researchers exploring correspondences between Pitta functions and metabolic enzyme systems, between Vata functions and the autonomic nervous system, and between Kapha functions and structural and immunological processes.

Charaka's approach to clinical practice was explicitly rational and evidence oriented. He introduced objective methods of clinical examination and insisted on a systematic approach to disease causation that distinguished between predisposing factors (nidana), pathogenic mechanisms (samprapti), and clinical manifestations (lakshana). His five-section section on dietetics — asserting that wholesome food prevents disease while unwholesome food causes it — anticipates the nutritional medicine that only became a recognised medical specialty in the twentieth century. His insistence on the four-fold basis of medical practice — physician, patient, nurse, and medicines — and his analysis of the qualities required by each constitutes an early medical ethics framework whose sophistication is remarkable by any historical standard.

The Charaka Samhita's pharmacopoeia is among its most practically significant contributions. Over 600 medicinal plants, along with animal products and minerals, are described and classified by their therapeutic actions (karma) and indications (yoga). The text's discussion of Rasayana therapy — rejuvenation and longevity treatment using specific plants, minerals, and lifestyle practices — has attracted considerable modern scientific interest, with several Rasayana herbs demonstrating anti-ageing, immunomodulatory, and neuroprotective properties in clinical and preclinical studies. Ashwagandha (*Withania somnifera*), one of the principal Rasayana herbs, has been the subject of over 300 published scientific studies demonstrating anxiolytic, anti-inflammatory, and adaptogenic

properties. Shatavari (*Asparagus racemosus*), another Rasayana herb, has demonstrated immunomodulatory and oestrogen-like activity relevant to women's health.

7.2 Sushruta Samhita: The Surgeon's Canon:

If the Charaka Samhita established the theoretical and pharmacological foundations of Ayurveda, the Sushruta Samhita — composed around 600 BCE and attributed to the great surgeon Sushruta of Varanasi — established its surgical dimension with equal brilliance. Sushruta's text has earned him the title of 'Father of Surgery' through its systematic documentation of surgical procedures, instruments, and training methods that remained the most sophisticated surgical manual in any culture for centuries after its composition.

The Sushruta Samhita describes 121 surgical instruments in precise detail, categorised into Yantras (blunt instruments used for manipulation, examination, and traction) and Shastras (sharp instruments for cutting, dissection, and excision). This instrument classification reflects a mature understanding of the functional requirements of different surgical procedures and a practical knowledge of materials — iron, copper, bronze — and their properties. Sushruta's advocacy for cadaver dissection as the foundation of anatomical knowledge was particularly remarkable in its cultural context: he specified a rigorous protocol for preparing bodies for dissection through extended immersion in flowing water and required students to examine the body layer by layer, documenting their findings systematically [1-2]. Sushruta's description of rhinoplasty — the reconstruction of an amputated nose using a pedicle flap of skin from the cheek or forehead — is perhaps his most famous contribution. The procedure, necessitated by the cultural practice of nose amputation as criminal punishment, involved measuring the defect with a creeper leaf template, harvesting a precisely sized flap of living skin from the cheek, rotating it into position, and maintaining nostril patency with hollow tubes of eranda (castor) plant while the wound healed. Ghee and honey served as post-operative wound-care agents. The elegance of the procedure — using local skin with its preserved blood supply to ensure graft viability — reflects a sophisticated empirical understanding of plastic surgical principles that British colonial surgeons re-discovered in India in the eighteenth century and introduced to European surgery as the 'Indian method'.

Sushruta's pedagogical philosophy deserves emphasis alongside his surgical techniques. His insistence that theory without practice is like a one-winged bird captures a philosophy of medical education — learning through doing under supervision, with progressive approximation to real clinical conditions — that anticipates modern competency-based medical education. His training protocols — suturing practice on animal carcasses, drainage practice on fluid-filled leather bags, incision practice on vegetables and plant stems — constitute what we would today call simulation-based surgical training, a pedagogical innovation rediscovered by modern surgical educators in the late twentieth century [1-2].

7.3 Ashtanga Hridayam: The Synthesis:

The Ashtanga Hridayam of Vagbhata (c. 7th century CE) represents the third pillar of the classical Ayurvedic corpus and the culmination of the tradition's first great period of systematic development. Composed as a concise synthesis of the Charaka Samhita and Sushruta Samhita, with Vagbhata's own significant additions and refinements, the Ashtanga Hridayam organises Ayurvedic medical knowledge into a comprehensive, pedagogically effective format that became the preferred teaching text throughout much of the Ayurvedic world. It was translated into Tibetan as one of the core texts of Tibetan medicine, and its influence extended from Kashmir to Java [39-40].

Vagbhata's contribution to Ayurvedic pharmacology was particularly significant. His classification of medicinal substances according to their rasa (taste), guna (quality), virya (potency), and vipaka (post-digestive effect) provided a systematic pharmacological framework that enabled rational therapeutic decision-making without dependence on empirical knowledge of specific disease-remedy correlations alone. This theoretical pharmacology — relating the properties of substances to their physiological effects through the medium of dosha theory — represents a remarkable achievement of systematic reasoning from principles.

7.4 Prakriti: Personalised Medicine Before Modern Genetics:

One of the most intellectually striking features of classical Ayurveda is its Prakriti theory — the doctrine that each individual is born with a unique constitutional type determined by the proportions of the three doshas at the moment of conception, and that this constitutional type shapes the individual's

physiological responses, disease susceptibilities, therapeutic needs, and ideal dietary and lifestyle regimens throughout life. The seven Prakriti types recognised in classical texts — Vata, Pitta, Kapha, Vata-Pitta, Vata-Kapha, Pitta-Kapha, and Sama (balanced) — constitute a typological classification of human constitutional variation that anticipates contemporary genomic medicine's recognition of individual variation in drug metabolism, disease susceptibility, and therapeutic response.

Research published in the Journal of Translational Medicine and other biomedical journals has documented statistically significant associations between Prakriti types and specific gene expression patterns, metabolic profiles, and disease susceptibilities. Vata Prakriti individuals show patterns associated with neurological sensitivity; Pitta Prakriti individuals show patterns associated with metabolic activity; Kapha Prakriti individuals show patterns associated with structural and immunological robustness. These findings suggest that the Prakriti classification captures real biological variation in human populations that has pharmacogenomic significance — a remarkable validation of an ancient Indian insight through the most advanced contemporary biological research methods [41-43].

8. BUDDHIST AND JAIN CONTRIBUTIONS TO INDIAN MEDICINE :

8.1 Buddhist Monasteries as Hospitals and Medical Universities:

Buddhism's emphasis on the alleviation of suffering (karuna — compassion) as a central ethical imperative gave the Buddhist tradition a distinctive and powerful motivation for the development of medical practice and institutions. From the earliest period of Buddhist history, the provision of medical care was understood as a form of spiritual practice, and Buddhist monasteries served as primary healthcare providers for the communities they inhabited.

Emperor Ashoka's transformation following the Kalinga war produced what may be history's first state-funded universal healthcare initiative: his Dhamma edicts, published from approximately 258 BCE, ordered the establishment of hospitals and dispensaries throughout his empire, the planting of medicinal herbs at regular intervals along roads, and the digging of wells for public use.

The two great Buddhist universities of antiquity — Takshashila (Taxila) and Nalanda — made medicine a compulsory subject alongside philosophy, mathematics, astronomy, and the arts, producing a generation of physician-scholars who combined theoretical sophistication with practical clinical training. Jivaka, the most celebrated physician of ancient India and personal physician to both the Buddha and King Bimbisara of Magadha, received his training at Takshashila under Atreya. The curriculum there included not only textual study but clinical training in identifying medicinal plants in the field and treating a range of conditions — a complete medical education that would not be replicated in Western institutions until the establishment of the great medieval European medical schools (Kitagawa (1989). [44]).

The Buddhist medical tradition developed its own distinctive diagnostic frameworks alongside its absorption and development of the Ayurvedic tradition. The physician Nagasena, documented in the Milindapanha text, identified eight causative factors for disease: the three doshas, sannipata (their combined disturbance), seasonal imbalance, irregular diet, improper previous treatment, and past karmic deeds. This framework integrates the humoral theory of mainstream Ayurveda with the Buddhist concepts of karma and dependent origination, creating a comprehensive aetiological theory that situates individual illness within both physiological and cosmic dimensions.

8.2 The Global Transmission of Indian Medical Knowledge:

Buddhism's role as a carrier of Indian medical knowledge across Asia constitutes one of the most significant episodes in the global history of medicine. As Buddhist missionaries, monks, and traders travelled along the Silk Road and the maritime routes connecting India to East and Southeast Asia, they carried with them not only the Dharma but the medical traditions embedded within Buddhist monastic culture — including the Ayurvedic pharmacopoeia, the tridosha theory, diagnostic techniques, and the institutional model of the monastic dispensary.

Tibet received Indian medical knowledge in its most concentrated form through the great translation project initiated by King Trisong Detsen in the eighth century CE, who convened scholars from India, Greece, Persia, China, and Central Asia to produce a comprehensive synthesis of available medical knowledge. The resulting text, the Gyushi or Four Tantras, drew primarily on Vagbhata's Ashtanga Hridayam alongside Buddhist philosophical frameworks and Tibetan indigenous medical practices,

creating what became the foundational text of Tibetan Sowa Rigpa medicine. Rinchen Zangpo's eleventh-century translations from Sanskrit extended the Indian textual tradition further into the Tibetan medical corpus. India's formal recognition of Sowa Rigpa as a traditional medical system in 2010, and the establishment of the National Institute for Sowa Rigpa in Leh, represents the contemporary institutional acknowledgement of this cultural and medical continuity.

Buddhist transmission of Indian medical knowledge to China occurred through multiple channels: the physical presence of Indian monks in China from the Han dynasty onward, the translation of Buddhist medical texts as part of the great sutra translation projects, and the personal instruction of Chinese physicians by Indian masters. The Jataka tales — Buddhist narrative literature — contain numerous medical case histories that were among the texts translated into Chinese and served as a vehicle for transmitting Ayurvedic diagnostic and therapeutic knowledge to East Asian medical traditions.

8.3 Jain Medical Ethics and the Ahimsa Pharmacopoeia:

The Jain tradition's contribution to Indian medicine is distinctive not primarily in its theoretical framework — which largely paralleled Ayurveda — but in its ethical constraints on medical practice, which produced a pharmacological tradition of significant originality. Jain medical ethics, grounded in the principle of ahimsa (non-violence toward all living beings), absolutely prohibited the use of animal products, alcohol, and honey in medical formulations. This prohibition, which might appear to severely limit the pharmacological repertoire available to Jain physicians, in fact stimulated the development of a sophisticated plant and mineral pharmacology that compensated for the absence of animal-derived preparations.

The Kalyanakarika of Ugradityacharya (815–877 CE), the primary text of the Jain Pranavaya medical tradition, contains twenty sections plus supplementary material addressing the full range of medical knowledge relevant to a physician working within Jain ethical constraints. Its systematic treatment of plant-based and mineral pharmacology, its dietary prescriptions, and its philosophical integration of medical practice with Jain cosmology and ethics represents a coherent and complete medical system — not merely a subset of Ayurveda with certain ingredients removed, but an ethically coherent alternative approach to healing rooted in a distinctive philosophical framework (Stuart (2014). [45]).

9. REGIONAL MEDICINAL SYSTEMS: DIVERSITY WITHIN THE INDIAN TRADITION :

9.1 Siddha Medicine: Tamil Civilisation's Healing Science:

Siddha medicine, the healing tradition of Tamil civilisation, constitutes one of India's oldest medical systems and possesses several features that distinguish it sharply from Ayurveda while sharing its foundational commitment to holistic, constitution-based medicine. Its origins are traced by tradition to the Eighteen Siddhars — enlightened masters who are said to have received their knowledge from the deity Shiva through a lineage of transmission — and its archaeological roots are plausibly connected to the Indus Valley civilisation given the evidence for Tamil cultural continuity with pre-Aryan civilisations of the subcontinent.

Siddha's most distinctive feature is its emphasis on metallic and mineral preparations over plant-based remedies, a characteristic that becomes comprehensible in light of the South Indian tradition's close connection with the highly developed metallurgical traditions of ancient Tamil civilisation. Siddha's use of Kaya Kalpam (body purification and rejuvenation) techniques involving mercury, sulphur, and other mineral preparations has attracted both traditional veneration and modern scientific scrutiny — the latter focused on questions of safety and bioavailability that are now being addressed through pharmacological research.

Siddha diagnostics distinguished itself through the Ashtavidha Pariksha (eight-fold examination) that covered pulse (nadi), eyes, voice, touch (sparsha), colour (varna), tongue (jihva), faeces, and urine — a comprehensive multi-system physical examination protocol.

9.2 The Unani System: India's Graeco-Arabic Medical Heritage:

The Unani system — whose name derives from the Arabic word for 'Greek' (Yunani) — represents the Indian adaptation of the Graeco-Arabic medical tradition associated with Hippocrates, Galen, Avicenna (Ibn Sina), and al-Razi. Introduced to India by Arab and Persian scholars from approximately the eighth century CE onward, the system received state patronage from the Delhi Sultans, the Khilji and Tughlaq dynasties, and the Mughal emperors, achieving its greatest institutional development between the

thirteenth and seventeenth centuries. The system's theoretical framework, based on the four humors of blood, phlegm, yellow bile, and black bile, underwent significant modification through its Indian adaptation, incorporating elements from Ayurvedic theory and pharmacology and developing a distinctive Indian Unani tradition that differs in important respects from its Arab and Persian antecedents (Alavi (2008). [48]).

India today hosts the world's largest Unani medical infrastructure, with over 45,000 registered Unani practitioners, numerous Unani medical colleges, and the Central Council for Research in Unani Medicine conducting systematic research into the clinical efficacy of Unani formulations. Hakim Ajmal Khan's championing of Unani during the British colonial period — establishing the Hindustani Dawakhana in Delhi and founding the Tibbia College — represents a landmark in the history of India's resistance to the colonial marginalisation of indigenous medicine. His political activism in defence of traditional medicine alongside his scientific efforts to document and standardise Unani formulations established a model of integration between cultural preservation and scientific rigor that continues to guide Unani practitioners (Langermann (2018). [49]).

9.3 Rasashastra: The Alchemical Pharmaceutical Tradition:

Rasashastra — the 'science of mercury' — represents one of the most technically sophisticated and culturally distinctive branches of the Indian medical tradition. Developing from approximately the seventh century CE onward and achieving its greatest elaboration between the ninth and fifteenth centuries, Rasashastra pioneered the processing of minerals and metals into therapeutic agents, developing a pharmacological tradition whose sophistication in material processing has attracted significant contemporary scientific interest.

The system's foundational innovation was the development of processes for converting raw metals and minerals — mercury, sulphur, gold, silver, iron, copper, arsenic compounds, and others — into fine bio-available powders called Bhasma through carefully controlled sequences of purification (Shodhana) and incineration (Marana). The resulting preparations, combined with herbal adjuvants, possessed several pharmacological advantages over plant-based medicines: longer shelf life, lower required dosage, and enhanced bioavailability. Modern analytical chemistry has revealed that properly prepared Bhasma preparations consist of nanoparticles of the constituent metals and minerals in the range of 50–100 nanometres — a size that is consistent with enhanced tissue penetration and bioavailability, and that constitutes an ancient precedent for the nano-pharmaceutical innovations of contemporary drug delivery science.

10. COMPARATIVE OVERVIEW OF INDIA'S NATIVE MEDICINAL SYSTEMS :

The following table summarises the principal features and modern relevance of India's major traditional medical systems:

Table 3: Summary of the principal features and modern relevance of India's major traditional medical systems

System / Tradition	Key Features & Contributions	Modern Relevance
Ayurveda (Charaka & Sushruta)	Tridosha (Vata-Pitta-Kapha) framework; Prakriti classification; 700+ herbs; Panchakarma detox; rhinoplasty; cataract surgery	Integrative oncology; mental health (Sattvavajaya); anti-inflammatory herbs (turmeric, ashwagandha); WHO AYUSH policy
Siddha Medicine	Ashtavidha Pariksha (8-fold diagnosis); Kaya Kalpam rejuvenation; heavy metals & mineral preparations (Bhasma)	Nano-medicine analogies; geriatrics; ophthalmology; toxicology
Unani System	Four humors (blood, phlegm, yellow bile, black bile); Ibn Sina's Canon; integration of Indian herbs	State-recognised AYUSH stream; extensive Indian institutional network

System / Tradition	Key Features & Contributions	Modern Relevance
Rasashastra	Mercury & metal processing; Shodhana (purification); Marana (incineration); Bhasma nanoparticles	Nano-pharmacology; targeted drug delivery research
Atharva Veda Tradition	Germ theory (krimi); seasonal disease classification; 100+ hymns on specific diseases; wound care	Antimicrobial resistance context; holistic disease prevention
Buddhist Medical System	Monastic hospitals; Nalanda-Takshashila medical universities; compassionate care model; Four Tantras (Tibet)	Integrative mental health; global spread via Silk Road; Sowa Rigpa recognition
Jain Pranavaya	Ahimsa-based pharmacology; plant & mineral drugs only; Kalyanakarika text (815–877 CE)	Vegan pharmacology; ethical drug sourcing
Yoga & Pranayama	Patanjali's Ashtanga Yoga; cardiac autonomic regulation; Yoga Nidra; stress reduction	WHO-recognised; cardiac health; anxiety & depression management; global wellness industry

11. ANCIENT WISDOM FOR MODERN WELLNESS: SCIENTIFIC EVIDENCE AND POLICY IMPLICATIONS :

11.1 Pharmacological Validation of Ayurvedic Herbs:

The past three decades have seen a substantial and rapidly growing body of pharmacological and clinical research into the therapeutic claims of traditional Indian medicine. This research, published in leading peer-reviewed biomedical journals including *Nature*, *The Lancet*, *PLOS Medicine*, and the *Journal of Clinical Oncology*, has provided evidence-based validation for numerous traditional therapeutic applications while simultaneously identifying areas where traditional claims require modification or further investigation.

Turmeric (*Curcuma longa*) and its principal bioactive compound curcumin have been among the most extensively studied of all traditional Indian medicines, with over 13,000 published research papers documenting anti-inflammatory, antioxidant, anti-cancer, neuroprotective, and antimicrobial properties. Research using genomic tools has demonstrated beneficial effects of turmeric extract against gene variants associated with inflammatory bowel disease severity — providing a molecular-level explanation for the traditional use of turmeric in gastrointestinal disorders that is consistent with its described pharmacological actions.

Ashwagandha (*Withania somnifera*), one of Ayurveda's most important Rasayana herbs, has been the subject of multiple randomised controlled trials demonstrating significant reductions in stress, anxiety, and cortisol levels — validating traditional applications for stress-related conditions and establishing the herb's adaptogenic properties on a rigorous evidential basis. Brahmi (*Bacopa monnieri*) has demonstrated significant effects on memory consolidation, anxiety reduction, and cognitive enhancement in both animal models and clinical trials, with the bacosides identified as the principal active compounds responsible for its nootropic and anxiolytic effects.

The pharmacological validation of traditional Ayurvedic medicines has important implications beyond the confirmation of individual therapeutic claims. It demonstrates that the Ayurvedic pharmacopoeia was developed through systematic observation and empirical testing over centuries — that traditional use reflects genuine pharmacological activity rather than placebo response or cultural fabrication. This recognition has implications for drug discovery: several of the most important pharmaceutical leads of the twentieth and twenty-first centuries — including the anti-malarial artemisinin (from traditional Chinese medicine), the anti-cancer compound taxol (from traditional use of Pacific yew trees), and numerous other bioactive natural products — have been derived from traditional medicine systems that

Western science initially dismissed. The Indian traditional pharmacopoeia represents an under-exploited resource for drug discovery of comparable potential.

11.2 Yoga and Pranayama: Neuroscientific Evidence:

Yoga — the systematic practice of physical postures (asanas), breath control (pranayama), and meditative concentration (dhyana) described in Patanjali's Yoga Sutras (c. 2nd century BCE) and elaborated across centuries of subsequent practice literature — has been the subject of more than 10,000 published research studies and multiple systematic reviews and meta-analyses documenting its therapeutic effects across a wide range of conditions. The evidence base is now sufficient to support evidence-based clinical recommendations for yoga as a therapeutic intervention in cardiovascular disease, depression, anxiety, chronic pain, and stress-related conditions.

Neuroimaging studies have demonstrated that sustained yoga practice produces measurable changes in brain structure and function: increased grey matter density in the prefrontal cortex and hippocampus, decreased amygdala reactivity to stress stimuli, increased cortical thickness in attention-related regions, and enhanced functional connectivity between brain regions associated with self-regulation and emotional processing. These neurobiological changes provide a mechanistic explanation for the psychological benefits of yoga practice — the reduction in stress, anxiety, and depression — that are consistently documented in clinical trials.

Pranayama — the systematic control of breathing patterns described in Vedic and Yoga texts — has been shown to produce specific neurophysiological effects through its influence on the autonomic nervous system. A controlled trial of pranayama practice in healthy adolescents over six months demonstrated significant shifts in cardiac autonomic regulation toward parasympathetic predominance — a pattern associated with reduced cardiovascular risk, improved stress resilience, and enhanced emotional regulation. This finding provides neurophysiological evidence for the traditional claim that pranayama practice promotes health and equanimity by balancing the vital force (prana) — a traditional formulation that maps reasonably well onto the modern understanding of autonomic nervous system balance.

11.3 Integrative Medicine and Global Health Policy:

The global recognition of traditional medicine's role in healthcare reached a landmark moment with the WHO's Traditional Medicine Strategy 2019–2025, which called for the integration of evidence-based traditional medicine into national health systems worldwide. By 2018, 98 WHO Member States had developed national policies on traditional medicine, 109 had enacted national laws, and 124 had introduced herbal medicine regulations — reflecting a worldwide shift from the dismissal of traditional medicine as pre-scientific superstition to its recognition as a resource that must be rigorously evaluated, standardised, and appropriately integrated into comprehensive healthcare systems.

India's AYUSH system — the governmental framework for Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homoeopathy — represents the world's most comprehensive institutional infrastructure for traditional medicine, with dedicated research councils (CCRAS, CCRYN, CCRUM, CCRH), national institutes, regulatory frameworks, and educational standards covering each of the traditional systems. The integration of AYUSH principles into NEP 2020's Indian Knowledge Systems mandate creates an educational policy framework that connects medical heritage to the broadest vision of India's civilisational knowledge — placing the healing traditions of our ancestors within the same intellectual and cultural landscape as Sanskrit literature, classical mathematics, Vedic philosophy, and the performing arts.

The evidence for integrative oncology applications of traditional Indian medicine is particularly noteworthy. Panchkarma — the Ayurvedic detoxification and rejuvenation protocol — combined with Rasayana therapy and Sattvavajaya Chikitsa (psycho-spiritual therapy) has been evaluated in clinical settings as a complementary approach alongside conventional cancer treatment. Studies have reported reductions in chemotherapy-related side effects including nausea, fatigue, and immunosuppression in patients receiving Ayurvedic co-treatment, along with improvements in quality of life and functional status. While the evidence base requires further strengthening through larger, better-controlled trials, the results are sufficient to establish integrative oncology as a legitimate and important research frontier.

12. CONCLUSION :

This paper documents the full range of our predecessors' contributions to the Indian indigenous medical system. From the proto-dentistry found in Mehrgarh circa 7000 BCE, to the contemporary evidenced-based inclusion of yoga and Ayurvedic herbs within modern oncology and frameworks of mental health, this scholarship demonstrates that this civilization dealt with the most pressing issues of health and disease with the utmost dedication and systematic rigor over the span of 4000 years. As a result, this civilization built a unique and extensive medical legacy that reverberates through time.

This investigation also provides evidence for a number of additional important conclusions. First, the Indian medical systems were scientifically rigorous and developed a host of rational and consistent systems for the direct observation of, and experimentation with, the natural world. Indian medicine developed therapeutic systems that incorporated elaborate theoretical frameworks. These frameworks were flexible and subject to continuous refinement and improvement through the discourse and collaboration of the medical profession. There are many examples of this sophisticated empirical approach, such as the methods of the Sushruta Samhita for surgery; the protocols for the examination of patients in the Charaka Samhita; the germ theory of the Atharvaveda; and the proto genomics of the Prakriti system. These examples demand inclusion and recognition of the Indian medical systems alongside the Greek, Arabic, and European medical systems.

In the Indian tradition, the connection between the mind and body as well as the connection between the individual and their environment is acknowledged. This is a sophisticated philosophical insight. Western medicine views the connection between the mind and body, and the individual and environment, as a 'biopsychosocial model'. Ayurvedic medicine notes the interrelatedness of the mind and body with respect to the environment, and harmony with the natural and social environment is vital for health. Furthermore, Ayurvedic medicine emphasizes the health promoting benefits of an appropriate lifestyle and its components, including nutrition, seasonal adaptation, and therapy, as being on par with pharmaceutical interventions. These insights address the overwhelming tendency of Western medicine to fall short by being overly simplistic.

The worldwide spread of Indian medicine, which reached Tibet, China, and Eastern and Western Europe, demonstrates the scope and significance of Indian medicine beyond India. These advanced medical systems became part of the global medical heritage. Sushruta's surgical descriptions of rhinoplasty inspired British surgeons, who established the first modern methods of reconstructive surgery. Western research validates the meditative practices of the Yoga tradition, while Ayurvedic practices are influencing Western pharmacology.

At last, with IKS under the NEP 2020, the AYUSH framework, and the increased funding for traditional medicine, the integration of this heritage into the modern educational and healthcare systems of India reflects culturally justice and a practical necessity. India, with its legacy of being one of the worlds ancient systems of medicine, has the right to demand the world and its people to understand, safeguard, research and apply its systems of medicine to the contemporary health problems of the 21st century.

*The physician who knows only one system of medicine is like a man with one eye. The physician who knows many systems sees with both eyes and the light of the mind. —
Inspired by Charaka Samhita, Sutrasthana*

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