Connecting the Modern Potential of AI-Driven Gene Sequencing with the Ancient Indian Healthcare Knowledge of Suśruta

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Abstract. This study examined the possibility of connecting the sage Suśruta's surgical expertise to contemporary AI-integrated drug development, gene sequencing, and biomedical healthcare systems. The ancient Indian surgical systems, healthcare systems, disease diagnostic systems, cure systems, healthy living systems, drug design systems, and many more biomedical systems are provided in Suśruta Saṅhitā. These days, AI models such as deep learning and machine learning are incredibly effective in drug discovery, gene sequencing, and disease diagnosis, among other areas. By looking for commonalities in observation, classification, and evidence-based reasoning among different systems, this study aims to establish a link. *Yantras, Shatras, and Dhātu*-s mimic tissue-specific expression, while Srotas align with biological signaling pathways and *Tridoṣa* reflects regulation. Information regarding disease susceptibility is provided by *Prakṛti*. With important ramifications for bioethics and global health justice, this interdisciplinary approach expands our knowledge of medical evolution and promotes culturally grounded genetic innovation.

Keywords: Artificial intelligence, Biomedical, Healthcare, Suśruta, Drug discovery

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1 Introduction

In the recent past, a number of pandemics, including COVID-19, OMICCON, H1N1, influenza, chicken pox, and others, have been occurring so often that people are constantly afraid. In order to combat these kinds of unidentified pandemics, contemporary research in DNA sequencing, disease tracking, treatment creation, etc., has become extremely important [1]. Genomics studies how DNA encodes biological function. It is based on Francis Crick's 1957 central dogma of molecular biology, which describes the flow of genetic information from DNA to RNA to protein (see Fig. 1) [2]. Large-scale, quick genetic material exploration is now possible thanks to developments in next-generation sequencing (NGS), such as whole genome sequencing (WGS), whole exome sequencing (WES), and transcriptomics [3].

The field of personalized medicine has changed as a result of the convergence of AI and genomic technologies. Faster disease characterization and risk prediction are made possible by machine learning algorithms' effective analysis of complex genomic data [4].

Genomic with AI are increasingly explored recent days but can be bridged from the ancient concept called “prakriti” by Suśruta, that include nature humankind and their constitutional traits. This helps to identifies the concept of modern biomedical genomics. Our study is going to analyse and finding the relation from ancient to today’s AI driven sequencing strategies.

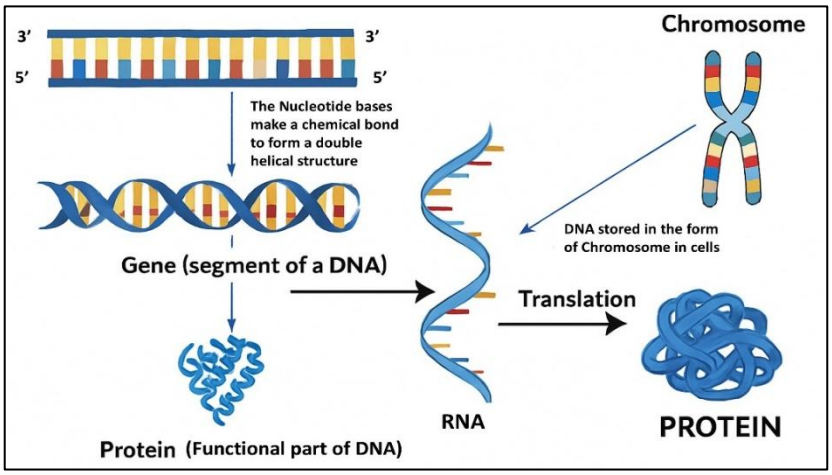

Fig. 1. The central dogma of molecular biology

According to the Suśruta Saṅhitā, Ayurveda is dedicated to preserving health and promoting a long, meaningful life in addition to treating illness. Surgery is given a special place in the text, which describes it as one of the first medical specialties capable of providing prompt and efficient treatments, even though it enhances general well-being [5]. In Suśruta Saṅhitā he introduced concepts of ancient medical systems, surgical mechanisms, and drugs which are still relevant to modern gene sequencing concepts. Suśrut's discoveries can be incorporated into current medical research, such as artificial intelligence in drug development and genome sequencing [6]. As Rigveda, 10.191.4 remind us

samānī va ākūtiḥ samānā hṛdayāni vaḥ
samānam astu vo mano yathā vaḥ susahāsati [7]

This means Human beings should have the same sense of humility; their intentions and behavior should be aligned; their minds should be united. This not only fosters natural cooperation but also fosters the concept of social living, which has inspired humankind to live well. It also aids in identifying contemporary technical ethics, legal requirements, and

social responsibility in the context of the contemporary healthcare system, the global field of medical research, and human science.

Starting with Suśruta: The Ancient Health Care System, this study focuses on the relationship between ancient wishdom and gene sequencing, current research in artificial intelligence (AI) and AI-driven disease diagnostics and biomedical research, drug design, ethical, legal, and social responsibility integration from ancient Indian wishdom, and the connection between ancient and modern systems.

2 Ancient Indian Understanding of Health and Heredity

2.1 Suśruta: The Ancient Health Care System

Suśruta's name is most prominent in ancient Indian medicine and surgery. Born in the city of Varanasi (Kashi) in approximately the 6th century BC, the contribution of this great physician has given birth to a unique chapter not only in India but also in the history of world medical science. His book 'Suśruta Saṃhitā' is one of the fundamental and scientific documents of Ayurveda, which contains various branches of medical science, principles and detailed principles of disease prevention along with surgery. The book 'Suśruta Saṃhitā' is divided into 186 chapters; it describes 1,120 diseases, 700 medicinal plants, 64 medicines prepared from minerals and 57 medicines prepared from animal sources [8]. These are divided into sections called Sutrasthan, Nidan, Sharisthan, Dhansthan, Kalpasthan and Uttartantra - which are the basis of Ayurveda of the later era.

Fig. 2. *Yantras* used in ancient Indian healthcare systems [9]

Suśruta uses more than 100 blunt and 20 sharp weapons, whose unique scientific design is amazing. These images show various surgical instruments (yantras and shastras) as described in the Sushruta Samhita. Each instrument had specialized uses for cutting, grasping, extracting, or probing during surgical procedures. 'Yantras' are mechanical or hand-held instruments mainly used for grasping, holding, clamping, or extracting (Fig. 2 and Fig. 3). 'Shastras' are cutting or sharp-edged tools, essentially ancient surgical blades and

knives. Each plate shows different types and shapes of these instruments; each tailored for a specific medical or surgical procedure (Fig. 4). These tools highlight the advanced knowledge of surgery and instrument design in ancient India, with each shape serving a practical surgical role like excising tissue, removing foreign bodies, or managing wounds. For that also he is called the title of 'Father of Surgery' for his excellence in surgery [9].

Suśruta's chirurgic skills first emerged in successful surgeries related to nose, ear, lip and skin grafting. All these operations symbolize the advancement of 'plastic surgery'. This book contains detailed descriptions of "surgery", "traumatology", "eye and dental treatment", "bone-fracture and fixation", identification of veins and arteries, and even "cataract surgery". And, the instructions he gave for the preparation and cleanliness of the operation are a practical prediction of modern antiseptic and sterilization methods.

Suśruta laid down strict ethical principles for doctors and surgeons—mainly: giving priority to patient confidentiality, practice, purity and humanity. He also instructed the apprentices to practice dissecting animals or vegetables enough so that there would be no mistakes during the actual operation. He emphasized the use of the five senses—sight, smell, touch, hearing, and taste—in diagnosing diseases, which is the basis of modern indications and diagnosis.

Suśruta set unprecedented examples in identifying the hereditary component of diseases, maternal health in childbearing, and the source of infectious diseases.

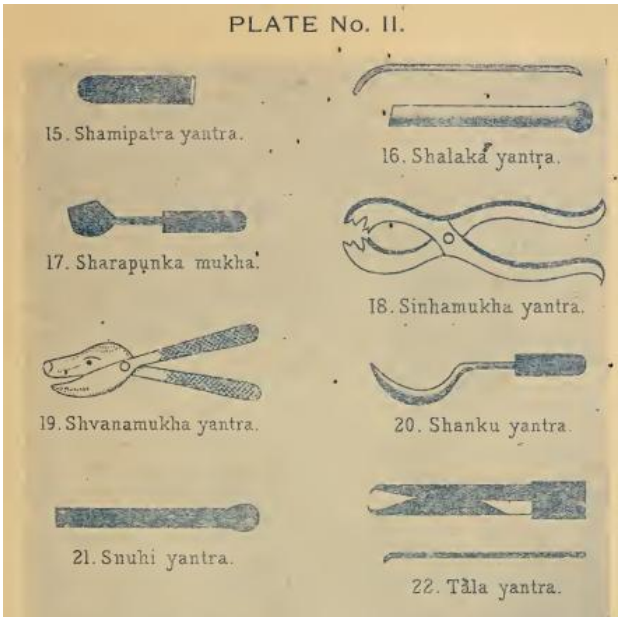

Fig. 3. More *Yantras* used in ancient Indian healthcare systems [9]

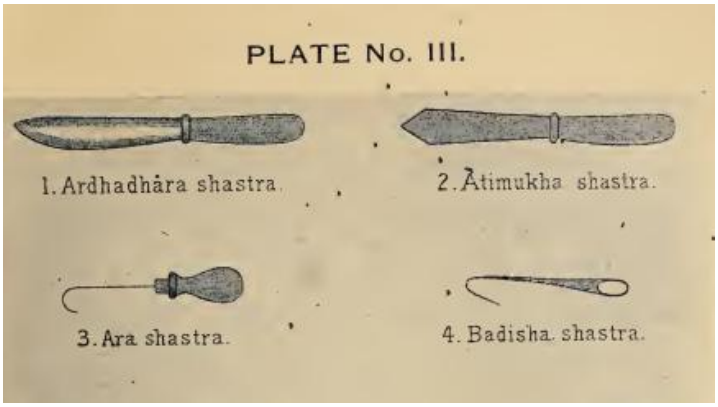

Fig. 4: *Shastras* used in ancient Indian healthcare systems [9].

The main philosophy of Suśruta Saṃhitā is—prevention of disease first, cure later. In preventing disease, healthy food and lifestyle are given priority, and maintaining a balance of physical and mental health is of utmost importance. Relevant and very important verses from Indian scripture remind us śarīram ādyaṁ khalu dharmasādhanam, means the body is the main means of performing all actions and duties [9].

In the age of genetics and cutting-edge biomedical research, Suśruta's meticulous observations and analytical methodology are still applicable. His teachings, ideas, and insights continue to influence our understanding of human well-being and provide a solid basis for contemporary health science.

2.2 Gene Sequencing in Suśruta Saṃhitā

The Suśruta Saṃhitā describes how the qualities of the parents' sperm and ovum are passed on to their offspring through the concepts of "Beeja," "Beejabhaga," and "Beejabhagavayava." In modern terms, these are chromosomes and gene fragments—which are used to explain inheritance, congenital, and genetic diseases. Suśruta Saṃhitā specifically identifies "inherited" diseases such as leprosy, gonorrhea, blindness, etc., which are caused by abnormalities of the vulva or ovary.

Modern scientific research has shown that there is a strong correlation between the Ayurvedic "Prakriti" classification and single nucleotide polymorphisms (SNPs) [10]. They analyzed 262 out of 3,416 people and showed that 52 gene markers (SNPs) can clearly distinguish the Prakriti categories (Bhat, Pitta, Kapha). In particular, the 'PGM1' gene was found to be strongly associated with the 'Pitta' Prakriti, which in Ayurveda is associated with the responsibility of metabolism and energy production. This study suggests that the basis of Ayurvedic "nature" is indeed genetic, and has the potential for personalized and future-oriented medicine.

Moreover, several studies [4,6] have found the validity of the concept of nature with reciprocal genetic, transcriptomic, and epigenetic changes. For example, researchers have been able to identify individual natures based on DNA methylation (epigenetic markers), which supports the "self-based" approach to medicine in the ancient Ayurvedic system.

Suśruta Saṃhitā and Ayurveda can determine the nature, disease susceptibility, and response of an individual not only socially, psychologically, or environmentally, but also genetically—and modern gene sequencing and ayurgenomics research has proven its scientific basis.

3 From Ancient Heredity Concepts to AI-Driven Genomics

3.1 Advances in Gene Sequencing and AI Technologies

The Human Genome Project (HGP), completed in 2001, provided the first comprehensive map of the human genome, revealing 99.9% genetic similarity among individuals, with only 0.01% variation accounting for differences in traits, disease susceptibility, and drug response [11]. Advances in long-read sequencing have recently filled the remaining 8% of the genome, enhancing understanding of intra-individual genetic variation. Genome-wide association studies (GWAS) help identify disease-linked mutations, though many variants—such as synonymous SNPs or small indels—are not pathogenic [4].

Recent days AI model has been developed for advance healthcare systems. Advanced AI techniques—such as natural language processing, convolutional neural networks, transformer models, and graph neural networks—are increasingly being used to interpret gene sequences and understand complex gene networks [6]. AI-driven drug discovery has also benefited from synthetically generated historical DNA sequencing data, enabling researchers to model biological processes more accurately and explore treatments for previously unknown diseases [6,12]. By managing the patient's genomic data, a number of technologies, such as IBM Watson for Oncology, have been developed for direct disease therapy [4,6,12].

But these developments also bring up issues with data privacy, ethical supervision, and the improper use of private genetic data. Strong, open policy frameworks will be necessary to address these problems.

3.2 Mapping Suśruta’s Medical Concepts to Modern Genetic Frameworks

The Suśruta Saṃhitā mentions about personalized medicine, concentrating on the physical nature, disease vulnerability, and lifestyle of the human. Similarly, modern gene technology also analyzes the genetic nature of the human, parental factors, and the effects of light and heavy food, and provides specific, tailored treatment directions. Today’s genomics and AI technology determines disease risk, drug sensitivity, etc. through the analysis of an individual’s DNA; which is exactly the modern scientific transformation of that ancient meticulous observation [6].

Research has shown that Suśruta’s “prakriti” or physical constitution is almost as important as a modern genetic fingerprint. Just as today’s AI and machine learning-based algorithms analyze large amounts of data to guide individual treatment, Suśruta also placed the three doshas (vata, pitta, kapha) and their balance at the center of disease diagnosis [8].

Simultaneously, Suśruta's principles of specimen education, preservation, and documentation served as the foundation for contemporary technology, including "biobanking"—that is, the preservation of biological samples, data analytics, etc.

In the era of AI and genetics, each patient carries a unique genetic profile; as a result, treatment becomes more subtle, precise and individualized. The Suśruta Saṃhitā is example of exercise brings health benefits, longevity, strength, and happiness; good health is the greatest good fortune, because with it all the purposes of life are achieved.

Suśruta’s tradition of personalized medicine, combined with modern gene and data-based technology, proves that in health science, it is not ‘old vs. new’ - but ‘coexistence and hybridization’ - that is the ultimate stage of human service. Modern AI and genetics have transformed Suśruta’s wisdom into scientific reality, which is a sign of the highest sophistication, ethics and effectiveness in the health sector.

4 Ethical and Social Implication

Suśruta's practice of dissection and anatomy had a significant moral and social impact on Indian medicine. He overcame religious and social barriers and scientifically acquired knowledge of physiology through dissection of corpses. At that time, dissection of corpses was considered taboo and impure in society, but Suśruta showed his moral courage to gain an accurate and detailed understanding of the human body. This led to the spread of truth-seeking, human welfare and scientific attitude in medicine. Socially, his initiative opened the way for future medical education to practical practice and brought dignity to medicine in society. Suśruta's proper acquisition of knowledge, prioritizing the welfare of the patient and innovative teaching methods prove that moral courage and social awareness are the basis for the long-term development of mankind.
The moral and social structure of ancient India was significantly impacted by Suśruta's work in neurosurgery. Many of his theories are in line with contemporary notions like biobanking, which places a strong emphasis on the meticulous documentation and storage of biological samples. His teachings continuously placed a high priority on patient safety, good hygiene, and therapeutic dignity—values that are still fundamental to moral medical practice today [13].

4.1 Ethical

Maintaining ethical standards should be crucial in the rapidly expanding usage of patient data in the AI-based development future. According to the Suśruta Saṅhitā, patients should be handled with love and honesty, while bad behaviors should be avoided. Most importantly, performing a surge without the patient's consent—is unethical [9, 14]. In the current period, patient identity safety has been given top attention. Data from AI models should be stored anonymously. Patients' private information must not be disclosed.

4.2 Legal

Suśruta argued that each patient should be treated fairly and given equal opportunities. He advises prospective physicians to respectfully learn from more experienced mentors. Doctors should continue to treat a patient until they are certain that they are healing and have found a way to make things better. There are a number of laws that support our beliefs in kindness, equality of opportunity, and patient care.

4.3 Social

Suśruta's Saṃhitā shaped not only medical practice but also the way society understood healing. His famous "forehead flap" surgery for nose reconstruction helped people regain their social identity at a time when losing the nose was seen as a deep humiliation. This view of physical healing as a pathway to emotional well-being and social acceptance still holds true today. Suśruta also showed a remarkably progressive concern for maternal health, fetal development, pregnancy care, women's rights, and child welfare—values that closely align with modern human rights principles [5].

5 Key Finding and Discussion

Through the prediction of physiologically active compounds and the simulation of molecular interactions, artificial intelligence has played a significant role in accelerating drug discovery.

AI's role in suggesting tailored treatments is demonstrated by platforms like IBM Watson for Oncology, which match patient genomic profiles with clinical recommendations. Furthermore, more personalized drug response predictions are being made possible by developments in AI-driven pharmacogenomic modeling, which reduces adverse reactions. Nonetheless, these technological advances necessitate careful consideration of ethical concerns, especially regarding genetic data security and patient confidentiality.

This paper also provides a conceptual link between the core principles of molecular biology and Suśruta's ancient Ayurvedic teachings. It is possible to loosely interpret the tridoshic model—Vata, Pitta, and Kapha—as reflecting dynamic regulatory processes at all levels of genetic expression, including DNA, RNA, and proteins. Through the alignment of genomic profiles with the age-old principles of individual constitution (also known as "Prakriti"), a more profound and culturally relevant approach to personalized healthcare is revealed. The potential for integrative frameworks that respect both conventional knowledge systems and scientific rigor is revealed by this interdisciplinary synthesis.

Suśruta's ideas are still relevant today because of their similarities to personalized medicine and genomics. The side-by-side comparison of Suśruta's medical concepts with contemporary genetic frameworks is shown in Table 1.

Table 1. Mapping Suśruta's Concepts to Modern Genetic Frameworks

Suśruta Concept	**Modern Genomics Analogy**	**Explanation / Parallel**
Tridoṣa (Vāta, Pitta, Kapha)	Gene regulatory networks / Epigenetic balance	Doshas govern physiological balance; similarly, gene regulatory networks maintain cellular homeostasis. [15]
Dhatus (Rasa, Rakta, Mamsa, Meda, Asthi, Majja, Shukra)	Tissue-specific gene expression / Proteome	Each dhatu corresponds to a functional tissue; modern genomics maps gene expression to tissue formation and function [9].
Srotas (body channels)	Metabolic and signaling pathways	Srotas transport nutrients, waste, and signals, akin to metabolic and cellular signaling pathways in molecular biology [9].
Ojas (vital essence / immunity)	Immune system and systemic resilience	Ojas represents vitality and resistance; genomics tracks immune function and genetic factors influencing health. [9]
Prakriti (body constitution)	Genetic predisposition / Genotype-phenotype correlation	Prakriti determines susceptibility and response to disease, similar to how genotypes influence phenotype and disease risk. [10]
Roga (disease)	Genetic mutations / Pathogenic variants	Diseases are caused by dosha imbalance; genomics identifies specific mutations or dysregulations causing pathology. [15]
Shalya (surgical intervention)	Targeted gene therapy / CRISPR-based correction	Surgery removes or corrects physical pathology; modern gene-editing can precisely correct genetic defects. [13]

Ayurgenomics can benefit from the comparative benchmarks offered by contemporary genomic governance frameworks. Genetic data must be treated as "sensitive personal data" under the EU's GDPR, which calls for explicit consent, purpose limitation, and protections like data minimization and pseudonymization. Genetic and health data are classified under sensitive categories in India under the Digital Personal Data Protection Act, 2023 (DPDP

Act) and previous drafts of the Personal Data Protection Bill, which emphasize consent, data fiduciary responsibilities, and localization of critical personal data. These frameworks provide potential models for culturally sensitive yet globally compatible genomic ethics, echoing Ayurvedic values regarding individual constitution (Prakṛti), confidentiality, and the necessity of continuous consent.

6 Conclusion and Future Work

Long prior to these developments became known elsewhere, Sage Suśruta's extraordinary vision in organizing surgical techniques, particularly in ophthalmology, is demonstrated by the works and methods attributed to him. Similar to early astronomers who promoted celestial understanding without the use of modern instruments, Suśruta elevated medicine by converting theoretical insights into clinical practice. He did this by exhibiting a scientific temperament based on observation, experimentation and documentation. Suśruta's contributions deserve equal scholarly attention and recognition, even though Hippocrates and other figures have been institutionalized in Western medicine. Bridging the Suśruta's concepts with modern genetic framework, AI based diagnosis, and drug design, surgical technology offers a great chance in scientific research.

Numerous other ancient wisdoms, such as Suśruta, who articulated their ideas in various Sanghitas, are also helpful in modern molecular biology, artificial intelligence, and genomics. These are the study's future directions, which can aid in enhancing human welfare, digital technology, and the healthcare system.

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