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A REVIEW ON AYURVEDA AND GENOMICS: CONCEPTUAL BASIS OF AYURGENOMICS IN SAMHITA TEXTS

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ABSTRACT

The science of Ayurveda emphasizes the uniqueness of every individual through the doctrines of Prakruti (constitution), Doṣha predominance, and Beeja (genetic determinants), which govern physical, physiological, and psychological attributes. These foundational concepts, described in detail in the Samhita texts such as Charaka Samhita, Sushruta Samhita, and Ashtang Hridaya, provide insight into heredity, variability, disease susceptibility, and the influence of maternal diet and lifestyle. Modern genomics explores similar domains by studying genetic variation, gene expression, and the role of environment in health and disease. The integration of these two perspectives has given rise to the emerging discipline of Ayurgenomics, which offers a scientific basis for the age-old Ayurvedic principle of personalized medicine. This article presents a literary review of classical references related to Prakruti, Beeja, Beejabhaga, Guna and Samhanana, analyzing them in the context of contemporary genomic understanding.

Keywords: Ayurveda, Genomics, Ayurgenomics, Prakruti, Beeja, Dosh, Samhita.

INTRODUCTION

Understanding human individuality has always been a central pursuit of both ancient wisdom and modern science. Ayurveda emphasizes that no two individuals are identical, and therefore, health, disease prevention, and treatment must be tailored according to one's unique constitution. This uniqueness is explained through the concepts of Constitution (Prakruti), Dosha predominance, Heredity, and Qualities (Gunas), which together provide a framework for personalized care.

Modern Genomics, on the other hand, explores how genes and their variations shape diversity, susceptibility to diseases, and therapeutic responses. Yet, despite its technological advancements, it often struggles with effectively classifying populations for precision medicine. Ayurveda's constitution-based model offers a complementary perspective, and the emerging field of Ayurgenomics seeks to bridge these two systems.

Ayurgenomics highlights how ancient concepts of Constitution, Heredity, and Maternal influences parallel modern ideas of Genotype, Phenotype, and Epigenetic regulation. A literary exploration of these concepts shows that Ayurveda anticipated many of the principles that Genomics is only beginning to unravel, making it highly relevant to the foundations of personalized medicine today.³

Concept of Prakruti

The concept of Prakruti is a cornerstone of Ayurved Shastra and clinical practice. Prakruti refers to the unique constitutional makeup of an individual, determined at the time of conception and remaining stable throughout life. It governs not only physical characteristics, but also psychological tendencies, disease

susceptibility, and therapeutic responses. In this sense, Prakruti serves as the constitutional blueprint of an individual, analogous to the genetic and epigenetic constitution in modern science.

Prakruti Determination At the Time of Conception

As explained Sushrut Samhita Sharir Sthana 04/63, Depending on the predominance of Vata, Pitta or Kapha in the beej at the time of conception, the offspring develops that respective constitution, which is termed the natural prakruti of the individual. This highlights that Prakruti is pre-determined at conception by the status of the doshas in the reproductive material, similar to how allelic combinations and gene expression patterns at fertilization decide the constitutional traits of the offspring.⁴

Types of Prakruti and Its Lakshan: (Charaka Samhita Vimana Sthana 08/96-98)

As per Charak Samhita Vimana Sthana 08/96-98, The Samhita granthas classify prakruti into three basic types — Vata, Pitta, and Kapha — along with their dual combinations and the rare balanced type (sama prakruti). Each constitution has distinct anatomical, physiological, and psychological attributes.⁵

Vata Prakruti: Individuals are lean, energetic, and prone to anxiety and degenerative disorders.

Pitta Prakruti: Individuals are sharp, ambitious, and prone to inflammatory and metabolic disorders.

Kapha Prakruti: Individuals are strong, calm, and prone to obesity and respiratory disorders.

This constitutional profiling bears striking similarity to modern genotype-phenotype mapping, where genetic variations influence metabolism, temperament, and disease predisposition.

Prakruti and Disease Susceptibility

As explained in Charaka Vimana Sthana 08/95, Prakruti forms the basis of predisposition to certain diseases. The strength and susceptibility to disease are influenced by one's constitution and the predominance of Doshas and other factors.

This echoes the genomic observation that genetic variations (SNPs, polymorphisms) predispose individuals to particular diseases, such as Asthma, Diabetes, or Autoimmune conditions.

Prakruti as the Ayurvedic Parallel of Genomic:

Prakruti = Genetic & Epigenetic Blueprint (fixed constitution + environmental modulation).

Dosha predominance = Gene expression signatures that determine phenotype.

Individual susceptibility in Ayurveda = Genetic predisposition in genomics.

Indeed, recent Ayurgenomics studies have validated this conceptual link. For example, transcriptomic profiling of healthy individuals stratified by prakruti revealed distinct gene expression patterns correlating with Vata, Pitta, and Kapha types. Similarly, studies on EGLN1 gene variation linked high-altitude adaptation specifically to Pitta Prakruti individuals, supporting the genomic relevance of prakruti classification.

Panchmahabhoot Siddhant In Ayurveda

The Panchmahabhut Siddhant explains that all living bodies are constituted from five elemental (Panchtanmatra), and that variability in their proportion gives rise to individual diversity. In the light of Ayurgenomics, this can be understood as an ancient model of genomic and molecular complexity. Just as the five elements combine infinite permutations to create diverse forms, genes and their regulatory networks interact in countless ways to produce phenotypic variation. For instance, individuals with dominance of Pruthvi and Jala Mahabhutas are described as stable, well-built, and enduring, reflecting a genetic tendency toward anabolic metabolism. On the other hand, predominance of Vayu and Agni Mahabhutas manifests as agility, restlessness, and high metabolic rate, comparable to gene clusters involved in energy metabolism and neuro-regulation. Thus, the Panchmahabhut framework may be interpreted as a metaphorical genomic code, wherein elemental balance represents the orchestration of genetic expression that underlies constitution (Prakruti) and individuality

Tridosha Siddhant In View Of Ayurgenomics

The Tridosha Siddhanta embodies Ayurveda's vision of human individuality as the result of a dynamic interplay of three regulatory principles—Vāta, Pitta, and Kapha. While classically described in terms of movement, transformation, and stability, these Doshas may also be interpreted as ancient representations of biological regulation and systemic balance. In the perspective of Ayurgenomics, the Tridosha model resonates with the modern understanding that no single gene or pathway defines health or disease, but rather a complex network of genetic expressions, their regulatory interactions, and environmental influences together determine the phenotype. Just as Doshas are said to remain in equilibrium in health (Sama Dosha) and produce disease when disturbed (Vikrut Dosha), genomic science reveals that health is maintained when gene expression and regulatory networks are balanced, while disturbances lead to pathology. For instance, Vata's variability mirrors the unpredictability of gene-gene interactions, Pitta's precision reflects metabolic gene regulation, and Kapha's stability symbolizes genetic conservation across generations. In this way, the Tridosha framework can be seen as a holistic Genomic philosophy, where the balance of

regulatory forces within the body anticipates the modern concept of systems biology and precision medicine.

Concept Of Beej

The concept of Beej (seed) occupies a central place in Ayurvedic Embryology and Heredity. The term Beej in classical texts refers to the reproductive element that serves as the primary determinant of the individual's physical and psychological constitution. Both Shukra (male gamete) and Artava (female gamete) are collectively considered as Beej. The Charaka Samhita explains that the normal development of the embryo depends upon the integrity of the Beej and its subdivisions, and any defect in these may lead to congenital deformities.

When a portion (Beejbhag) of the reproductive seed is absent or defective, the embryo develops abnormally, either partially or in its entirety.

This passage clearly shows that specific defects in reproductive material led to specific deformities, while generalized defects affect the entire organism. Conceptually, this is very close to the modern understanding of gene mutations and chromosomal aberrations that may affect single organs or the whole system. Due to the presence of defects in the parts (beejbhag) of the reproductive element, diseases manifest in the offspring.

This highlights an Ayurvedic recognition of hereditary transmission of disorders, which in modern Genomics corresponds to monogenic and polygenic diseases resulting from gene-level abnormalities.

Charaka further subdivides Beej into Beejbhaga (part of the seed responsible for organogenesis) and Beejbhagavyav (subdivisions of the Beejbhaga responsible for finer structures). For example, when the Beejbhag of the eye is defective, congenital blindness arises; when the beejbhag of the ear is defective, congenital deafness occurs. This is explained in Charak Samhita Sharir Sthana 3/17, which forms the textual foundation for understanding organ-specific inheritance.⁶

From a Genomic perspective, this stratification of beej can be compared as follows:

Beej → Genome or gamete (the total hereditary material),

Beejbhaga → Gene or group of genes (segments responsible for organ development),

Beejbhagavyav → DNA substructures/codons / base sequences (determinants of fine structural traits).

The classical texts also recognize Beej Dosha (defective seed) as the root cause of certain incurable or hereditary diseases. Sushrut Samhita Sutra Sthana 24/05 categorizes such disorders under Adibala Pravrutta Vyadhi — diseases originating from defects in the seed itself. This correlates well with the modern concept of genetically determined disorders that are transmitted across generations and often lack a complete cure.⁷

Thus, the Ayurvedic doctrine of Beej, as detailed in the Samhitas, is not merely a metaphoric description but a sophisticated framework that anticipates modern concepts of genome, genes, gene segments, mutations, hereditary transmission, and organ-specific genetic expression. When viewed through the lens of genomics, these insights establish Ayurveda as a profound precursor to the science of heredity and personalized medicine.

Beej And Heredity

Ayurveda provides one of the earliest systematic frameworks for understanding heredity through the concept of Beej (seed). The reproductive elements – Shukra (sperm) and Artava (ovum) – are

collectively termed beej, serving as the carriers of parental traits into the offspring. The health, integrity, and quality of the beej determine not only the viability of conception but also the constitution, strength, and susceptibility of the child. This correlates with the modern scientific understanding of gametes as vehicles of genetic material, transmitting hereditary information across generations.

Beej and Genetic Continuity

The Charak Samhita emphasizes the importance of Beej as the foundational determinant of hereditary transmission. (Charak Sutra 21/4 Chakrapani)

In Charak Sharir Sthana 3/17, It is said, If a specific part of the Beej (Beejbhaga) is absent or defective, the embryo develops abnormally in that part or, if entirely defective, the whole organism is affected.

This indicates an Ayurvedic awareness of hereditary transmission of traits and congenital anomalies. In genomic terms, this corresponds to the role of gene segments in organogenesis and the occurrence of mutations or deletions that manifest as congenital disorders

Sushrut classifies certain diseases as Adibala Pravṛtta Vyadhi—originating due to defects in the beej. In Sushrut Sutra Sthana 24/05, Sushrut states that Diseases arising from defects in the seed (Beej dosha) are considered hereditary disorders.

This highlights a clear recognition of hereditary disease transmission in Ayurveda. Conditions such as congenital blindness, deafness, dwarfism, or disorders seen in successive generations were explained through the framework of Beej Dosha. Modern parallels include genetically inherited conditions such as hemophilia, sickle cell anemia, and cystic fibrosis.

Beejabhaga and Organ-Specific Heredity

Ayurveda further subdivides beej into beejbhag (a portion of the seed responsible for organ formation) and beejbhagavyava (subdivisions of the beejbhag that govern finer structural details).

As per Charak Samhita Sharir Sthana 4/30, When the part of the seed responsible for a specific organ is defective, deformity arises in that specific organ.⁸

This division can be compared with the modern concept of genes (beejbhag) and nucleotides/codons (beejbhagavyava), where alterations at different levels of the genetic material produce defects of varying magnitude—ranging from single-organ defects to systemic anomalies.

Beej and Precision Medicine

Importantly, the Samhitas also link Beej with the determination of Prakriti at conception. Depending upon the doshic predominance in the Beej, the offspring inherits a particular constitution, as described in Ashtang Hridaya Sharir Sthana 3/82. This aligns closely with the concept of genetic predisposition and personalized traits, providing Ayurveda's foundational framework for precision medicine.

Role Of Other Factors (In Dosha Predominance)

Charaka also emphasizes the role of maternal influences, particularly diet and lifestyle, in shaping the Prakriti through modulation of Doshas: (Charak Samhita Vimana Sthana 08/95 Chakrapani) .This reflects the recognition of maternal nutrition and lifestyle as determinants of prakriti, much like modern observations that maternal malnutrition, obesity, or stress can predispose the offspring to metabolic syndrome, cardiovascular

diseases, or psychological disorders through epigenetic mechanisms.

Influence of Season and Environment

As explained In Charaka Sharir Sthana 02/29 - Kala (season), Desha (geographical region), and Jataprasakta nidana (environmental factors) as influential in shaping constitution and health. The qualities of Desha, Kala (Season) also manifest in the development of the fetus.

This corresponds to the concept of gene-environment interaction in modern biology, where environmental factors such as climate, altitude, or exposure to toxins influence genomic function and adaptation. For example, populations in high-altitude regions develop genetic adaptations (like EGLN1 variation) for hypoxia tolerance—an observation validated by Ayurgenomics through prakriti-based stratification.

Dietary Influence on Phenotype

Charaka further elaborates in (Sharir Sthana 02/29-30) , The body develops in accordance with the type of diet and lifestyle practiced. This shows the Ayurvedic acknowledgment of diet as a phenotype-modifying factor, similar to modern nutrigenomics, where dietary components influence gene expression and metabolic outcomes. For instance, excess of Guru (heavy) and Snigdha (unctuous) foods can upregulate pathways associated with obesity and insulin resistance, while Laghu (light) and Ushna (hot) foods enhance metabolism.⁸

Psychological Influence:

The Samhitas also suggest that maternal psychological state affects the fetus. Charak Samhita Sharir Sthana 4/27 notes: The mental condition of the mother influences the fetus.⁹

This resonates with research in psychoneuroimmunology and fetal programming, where maternal stress hormones can cross the placenta, altering gene expression in the developing brain and predisposing the child to anxiety, depression, or behavioral issues.

DISCUSSION

The conceptual foundations of Ayurveda, as elaborated in the Samhita texts, provide a unique and comprehensive understanding of individuality, heredity, and environment, which, when examined through the lens of modern genomics, reveal a striking degree of convergence. The Ayurvedic doctrine of Beej (seed), Beejbhaga (sub-unit), and Beejbhagavyava (sub-sub-unit), anticipates the modern genetic model of genes, alleles, and sub-genetic structures. The classical explanation that defects in these units result in congenital anomalies reflects an early awareness of hereditary transmission and genetic mutations. Equally significant is the concept of prakriti, the constitutional type determined by dosha predominance at the time of conception. The descriptions of vata, pitta, and kapha prakriti with their distinct anatomical, physiological, and psychological attributes closely parallel the modern genotype-phenotype relationship. This ancient constitutional classification has been validated by Ayurgenomics research, which demonstrates associations between prakriti types and genetic markers, such as HLA polymorphisms, cytokine profiles, and variations in the EGLN1 gene, confirming the scientific validity of Ayurvedic observations.

More importantly, Ayurveda emphasizes the significance of maternal, dietary, and environmental influences in shaping constitution. asserts that maternal diet and regimen influence the fetus, acknowledges the impact of maternal mental state, and

highlights the influence of region and season. These references not only indicate Ayurveda's awareness of non-genetic determinants of individuality but also correspond directly with the modern concept of epigenetics, where Maternal nutrition, psychological status, and environmental factors alter gene expression without changing the DNA sequence. The holistic Ayurvedic model, therefore, integrates hereditary determinants with external influences to explain the development of constitution and disease susceptibility.

Together, these literary insights reveal that the Ayurvedic triad of Beej (genetics), Prakruti (constitution), and Aahar-Vihara (environmental and lifestyle influences) anticipates the principles of modern genomics and epigenetics. The Ayurvedic approach not only provides a framework for understanding human diversity but also extends beyond genomics by incorporating the psychological and spiritual dimensions of individuality. In this way, Ayurveda offers a uniquely holistic perspective that aligns with and enriches modern precision medicine.

CONCLUSION

The review of classical Samhita references establishes that Ayurveda embodies a remarkably advanced understanding of heredity, constitution, and environmental influences. The doctrines of beej, prakriti, dosha predominance, and guna, along with the emphasis on maternal, dietary, and environmental factors, illustrate that ancient Ayurvedic physicians had recognized the principles of individuality and variability that resonate closely with genomics and epigenetics. Modern Ayurgenomics has further validated these concepts by demonstrating molecular and genetic correlations with prakriti-based classifications. This convergence underscores that Ayurveda is not only a system of traditional knowledge but also a timeless science of individuality that anticipated many discoveries of modern biology. The synthesis of Ayurveda and genomics through Ayurgenomics provides a powerful platform for developing truly personalized and integrative healthcare. Thus, the literary evidence from Samhita establishes a strong conceptual basis for Ayurgenomics and highlights the continued relevance of Ayurveda in advancing the vision of holistic and precision medicine in the twenty-first century.

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