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Prakriti-Based Medicine: Exploring the Genetic Foundations of Ayurvedic Principles

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Abstract
Ayurveda (the science of life) is an ancient system of medicine practised in India and works on the concept of *Prakriti*, a person's individual physical and psychological constitution influenced by three *Dosha* (*Vata*, *Pitta*, and *Kapha*). Ayurgenomics integration genomics and Ayurveda for the personalized medicine may provide new insights into *Tridosha* theory to personalize medicine. Scientific studies have begun to unravel the genetic basis of *Prakriti*, including correlations between individual constitution types and SNPs (single nucleotide polymorphisms), gene expression patterns, and physiological states. Domain 9 relates with relation of *Prakriti* with disease susceptibility, drug metabolism, drug efficacy. Epigenetics, the dynamic alteration in gene expression by lifestyle and environment is these days recognized as a foundation to Ayurvedic teachings. Ayurnutrigenomics is an emerging idea with the aim to develop personalized functional foods and nutraceuticals based on a person's genetic make-up, inspired by Ayurveda principles. From a *Prakriti* perspective, the three pillars of Ayurveda *Ahara* (diet), *Vihara* (activity or lifestyle), and *Aushadhi* (medicine) form a well-knitted method to provide personalized care for patients according to their *Prakriti* and preventive health promotion. Future implications The utilization of Ayurgenomics into modern medicine has tremendous life-changing possibilities and can really change the future of healthcare by delivering personalized, feasible means to address illness. However, more in-depth research is required for the complete understanding of molecular basis of *Prakriti* and for validation of Ayurvedic therapies with well-defined clinical trials.

Keywords: ayurgenomics, genomics, *Ayurveda*, diet, lifestyle, disease, pharmacogenomics, personalized medicine

Introduction

Ayurveda, a holistic system of health care which has its roots in India, is described as “the science of life” (from Ayus meaning lifespan and Veda meaning knowledge)[1]. Its fundamental principles are based on the theory of *Tridosha,* which maintains that all bodily and mental functions depend upon the balance of three basic physiological humours or vital energies–*Vata*, *Pitta* and *Kapha* [2]. *Vata* Dosha is related to anything in motion, such as nerve impulses, processes at the cellular level and the elimination of waste[3]. For example, digestion, metabolism, temperature control and transformation processes are all governed by *Pitta* Dosha[4]. *Kapha* Dosha is responsible for the body's structure, stability, growth and lubrication[5].

Prakriti also designates the (individual) specific equilibrium of the three *Dosha* as they are determined at birth, and it comprises an individual’s phenome[6]. There are seven predominant *Prakriti* types, upon which people are grouped according to the majority of *Dosha*(s): *Vata*, *Pitta*, *Kapha* and their composite *Dwandaj* pattern[7]. This is the constitution, determined genetically and by the prenatal environment, that in most cases remains stable throughout life[8]. *Prakriti* is an intrinsic factor; it makes one susceptible or resilient to diseases and prescribes methods of their treatment as well as on the mode of life including diet[9]. Disease, or *Aushadhi* is viewed as a change from this natural *Prakriti* balance[10].

Although with the development of modern genomics (the science of studying genomes) there are tools to understand individual differences at the molecular level[11]. Ayurgenomics integrates these two by use of modern molecular technologies to explore the genetic basis for *Prakriti* and its implications on stratified medicine[12]. This integration is congruent with the modern concept of P4 medicine (Predictive, Preventive, Personalized and Participatory) that Ayurveda has followed for millennia[13].

Table 1. Distinguishing features of three contrasting *Prakriti* types[14].

Feature	*Vata* Type	*Pitta* Type	*Kapha* Type
Body Frame	Thin, light	Moderate, well-proportioned	Large, sturdy
Skin	Dry, cool, rough	Warm, oily, sensitive	Cool, soft, oily
Hair	Dry, curly	Fine, oily, early graying	Thick, oily, wavy
Appetite	Irregular, variable	Strong, intense	Slow, steady

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Digestion	Variable, prone to gas	Sharp, prone to acidity	Slow, steady
Energy Levels	Variable, bursts of energy	Sustained, medium	Steady, high endurance
Mental Activity	Quick, imaginative	Sharp, focused	Calm, steady
Sleep	Light, interrupted	Moderate, sound	Deep, prolonged
Climate Preference	Prefers warm, humid	Prefers cool, ventilated	Prefers warm, dry
Common Traits	Creative, enthusiastic	Intelligent, leadership	Calm, compassionate

Epigenetics in Ayurveda

Epigenetics studies the changes in gene expression that do not involve changes to the DNA sequence, and it is closely still continues according to Ayurvedic views[15]. Ayurveda illustrates how the genetic constitution or the Janma *Prakriti* and Deha *Prakriti* can be influenced by factors such as food (Ahara), behavior and activity (*Vihara*), stress, place and climatic changes[16]. It is in keeping with the epigenetic theory of modifiability by environmental factors that may induce alterations in gene expression and possibly convey consequences for health of offspring[17]. – Therefore, Ayurveda can be viewed as one of the ancient forms of epigenetics and a model for interventions that could be modified to enhance health and halt disease by modulating gene expression in favorable way[18].

Ayurnutrigenomics

Ayurnutrigenomics is a new field integrating Ayurveda with nutrigenomics[19]. It is based on the Ayurvedic concept that food and drugs are inextricably linked[20]. This technique aims at developing personalised dietary recommendations and nutraceuticals based on a person's *Prakriti* and genetic information[21]. These three tenets of Ayurvedic health care can be applied toward the individualised prescription for prevention, improving quality of life and enhancing one's health[22].

Research on *Prakriti*'s Genetic Foundation

Significant research has been conducted to establish a genetic correlate for *Prakriti*:

- A pilot study conducted in 2005 identified a link between *Prakriti* types and polymorphisms in the HLA-DRB1 gene.[23].
- A pivotal study conducted in 2008 revealed unique genome-wide expression patterns across the three main *Prakriti* types, associating them with particular biochemical parameters.[14].
- Research on the EGLN1 gene (crucial for high-altitude adaptation) in 2010 found specific genotypes were overrepresented in *Pitta* types, suggesting a genetic basis for their adaptation[24].
- Studies have shown *Prakriti*-specific differences in drug-metabolizing enzymes like CYP2C19, indicating a foundation for pharmacogenomics[25].
- A comprehensive 2015 genome-wide analysis identified 52 SNPs significantly associated with the three major *Prakriti* types[26].
- Further studies have also identified *Prakriti*-specific DNA methylation markers and immunophenotypic differences[27, 28].

Studies on Physiology, Disease and *Prakriti*

Physiological studies corroborate *Prakriti*-based differences:

- Biochemical studies show variations in free radical generation, neurotransmitter metabolites, and hormone levels across *Prakriti* types[29].
- Cardiovascular reactivity studies indicate *Kapha* types have higher parasympathetic tone, while *Vata* types show higher sympathetic activity[30].
- *Prakriti* has been linked to lipid profiles, with certain types showing predisposition to higher LDL and triglycerides[31].
- Disease susceptibility studies associate *Vata Prakriti* with a higher risk for Parkinson's disease and specific subtypes of Irritable Bowel Syndrome (IBS)[32, 33].
- Research is also exploring the correlation between *Prakriti* and the human gut microbiome composition.

Large-scale initiatives like the CSIR's TRISUTRA project are employing community-based participation to recruit diverse Indian cohorts for robust Ayurgenomics research[34].

Contemporary Healthcare and Ayurgenomics

Modern medicine's reductionist approach, focusing on molecular pathways, is complemented by Ayurveda's holistic framework[35]. Ayurgenomics helps validate Ayurveda by providing a scientific language for its ancient concepts, facilitating its integration into modern healthcare[13]. By leveraging big data analytics and machine learning, Ayurgenomics can stratify populations for personalized preventive and therapeutic interventions, embodying the principles of P4 medicine[36]. This synergy can make personalized, preventive healthcare more accessible and affordable[37].

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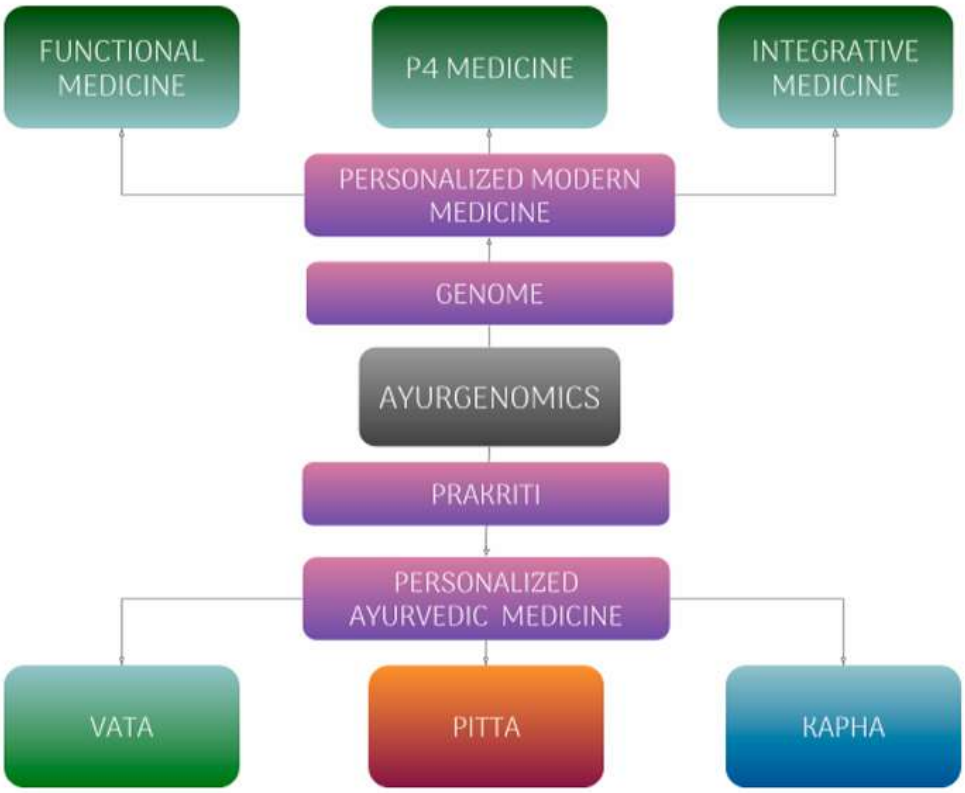
Figure 1. Ayurgenomics and its Relationship to Modern Medicine[38].



Conclusion and Future Perspectives

Ayurgenomics represents a transformative approach to healthcare by marrying the personalized, preventive wisdom of Ayurveda with the analytical power of modern genomics[12]. Evidence suggests that *Prakriti* has a measurable genetic and biochemical basis, influencing disease risk and treatment response[26, 14]. Future work should focus on:

1. Large-scale genomic and epigenomic studies to solidify the molecular basis of *Prakriti*.
2. Well-designed clinical trials to validate *Prakriti*-based interventions.
3. Developing affordable *Prakriti*-screening tools for community health programs.
4. Identifying biomarkers for monitoring Ayurvedic treatment outcomes.
5. Integrating Ayurgenomics data into AI-driven platforms for personalized health predictions.

Success in these areas will enable a shift from a disease-centric to a patient-centric model of health, offering affordable, personalized solutions for global health challenges[37].

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