

# Agni–Sharir Interface with Cellular Bioenergetics: An Integrative Scientific Review

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## ABSTRACT

*Sharir Rachana* in *Ayurveda* provides a structural–functional framework to understand life processes, among which *Agni* occupies a central position. *Agni* is responsible for digestion, metabolism, transformation, and energy production at both systemic and cellular levels. Classical Ayurvedic texts describe different forms of *Agni*, such as *Jatharagni*, *Dhatvagni*, and *Bhutagni*, which collectively govern nourishment, tissue formation, and vitality. *Acharya Charaka* emphasizes that balanced *Agni* sustains life, while deranged *Agni* is the root cause of disease. In modern biomedical science, similar roles are attributed to cellular bioenergetics, involving mitochondrial function, enzymatic metabolism, ATP production, and metabolic signalling pathways. Mitochondria are now recognized as central regulators of energy homeostasis, apoptosis, and redox balance. This review aims to explore the interface between the Ayurvedic concept of *Agni* and modern cellular bioenergetics from a *Sharir Rachana* perspective. Understanding *Agni* as a functional correlate of cellular energy metabolism is a current need to explain the pathogenesis of metabolic disorders, degenerative diseases, and lifestyle-related conditions. An integrative interpretation of *Agni–Sharir* may contribute to personalized medicine, preventive healthcare, and holistic metabolic regulation.

**Keywords:** *Agni*, *Sharir Rachana*, Cellular bioenergetics, Mitochondria, Metabolism, Integrative medicine

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## INTRODUCTION

*Sharir Rachana* does not restrict itself to gross anatomical structures but also includes functional entities responsible for maintaining life. Among these, *Agni* is described as the fundamental principle governing digestion, metabolism, growth, strength, immunity, and longevity. *Acharya Charaka* states “*Agnimandya* is the root cause of all diseases” and maintenance of *Agni* is the prime therapeutic goal [1]. Similarly, *Vagbhata* describes *Agni* as the basis of life, complexion, strength, enthusiasm, immunity, and longevity [2].

Modern medicine identifies energy metabolism as the cornerstone of cellular and systemic health. Cellular bioenergetics, primarily regulated by mitochondria and metabolic enzymes, is essential for tissue function, repair, and survival. Dysregulation of these processes is central to disorders such as diabetes, obesity, neurodegeneration, cardiovascular diseases, and chronic inflammation [4–6].

In this context, revisiting *Agni* as a functional anatomical concept interfacing with cellular bioenergetics represents a significant and timely need in *Sharir Rachana*. This integrative approach enables understanding metabolism beyond biochemical reactions, linking it with constitutional, dietary, and lifestyle factors described in *Ayurveda*.

### Aim and Objectives

#### Aim

To review the Ayurvedic concept of *Agni* and correlate it with modern cellular bioenergetics from a *Sharir Rachana* perspective.

#### Objectives

1. To analyze classical descriptions of *Agni* in *Ayurveda*
2. To understand the structural–functional basis of *Agni* in *Sharir Rachana*
3. To correlate *Agni* with modern cellular energy metabolism
4. To highlight the clinical relevance of *Agni* dysfunction in metabolic diseases
5. To explore the integrative significance of *Agni–Sharir* in contemporary medicine

### Concept of Agni in Ayurveda

The term *Agni* literally means fire and represents the principle of transformation. *Ayurveda* describes **13 types of Agni**:

- **Jatharagni (1)** – Governs digestion and assimilation of food at the gastrointestinal level
- **Bhutagni (5)** – Responsible for elemental transformation of food substances
- **Dhatvagni (7)** – Responsible for tissue-level metabolism and nourishment

*Acharya Vagbhata* states that “All metabolic activities in the body depend upon Agni” [2]. Proper functioning of *Agni* ensures formation of healthy *Rasa* and subsequent *Dhatus*. Impaired *Agni* leads to formation of *Ama* (toxic metabolites), which acts as the root of systemic diseases [1,2].

*Agni* operates at both gross (systemic) and subtle (cellular) levels, making it a functional component of *Sharir Rachana*. Thus, *Agni* is not merely digestive fire but a comprehensive metabolic principle.

### Agni and Structural Basis in Sharir Rachana

Although *Agni* is not a visible anatomical structure, it is functionally associated with the following:

- **Koshta** – Gastrointestinal tract responsible for digestion
- **Grahani** – Functional unit regulating digestion and absorption
- **Yakrit (Liver)** – Central metabolic organ involved in biotransformation
- **Pleeha (Spleen)** – Involved in metabolism and immunity
- **Dhatus** – Tissue systems where *Dhatvagni* acts

These structures serve as anatomical substrates where metabolic transformation occurs. From a modern perspective, this corresponds to organs rich in mitochondria and metabolic enzymes such as liver, intestine, muscles, and endocrine glands.

### Concept of Cellular Bioenergetics

Cellular bioenergetics refers to the processes by which cells:

- Convert nutrients into usable energy
- Produce ATP through oxidative phosphorylation
- Maintain redox balance
- Regulate metabolic signalling pathways

Mitochondria are the central organelles responsible for ATP production via the electron transport chain [4]. Enzymatic reactions within cytoplasm and mitochondria regulate carbohydrate, lipid, and protein metabolism. Disturbance in mitochondrial function results in decreased ATP, increased oxidative stress, and cellular damage [6].

### Correlation Between Agni and Cellular Bioenergetics

Ayurvedic Concept	Functional Role	Modern Correlation
<i>Jatharagni</i>	Digestion of food	Digestive enzymes, gut metabolism
<i>Bhutagni</i>	Elemental conversion	Nutrient absorption and assimilation
<i>Dhatvagni</i>	Tissue nourishment	Cellular metabolism, mitochondrial activity
<i>Agni Bala</i>	Strength and vitality	ATP availability, metabolic efficiency
<i>Agnimandya</i>	Impaired metabolism	Mitochondrial dysfunction, metabolic syndrome

Thus, *Agni* may be understood as the **sum total of metabolic and bioenergetic activities** within the body. This shows striking similarity with modern concepts of cellular energy homeostasis.

### Agni Dushti and Metabolic Disorders

*Ayurveda* describes four functional states of *Agni*

1. **Samagni** – Balanced metabolism
2. **Vishamagni** – Irregular metabolism
3. **Tikshnagni** – Hypermetabolism
4. **Mandagni** – Hypometabolism

These states closely resemble modern metabolic conditions:

- Insulin resistance
- Hyperthyroidism and hypothyroidism
- Obesity and dyslipidaemia
- Chronic fatigue syndrome
- Neurodegenerative disorders

*Agnimandya* leads to *Ama* formation, which blocks microchannels (*Srotorodha*) causing systemic inflammation and metabolic disorders [1,3].

### Clinical Significance of *Agni–Sharir* Interface

#### 1. Metabolic Diseases

Most lifestyle disorders originate from impaired *Agni* and defective cellular energy production. *Ayurveda* describes *Agnimandya* as the primary cause of *Prameha* (diabetes), *Sthaulya* (obesity), and *Medoroga* [1]. Modern studies also confirm that mitochondrial dysfunction and impaired oxidative phosphorylation are central to insulin resistance and metabolic syndrome [7,8].

#### 2. Aging and Degeneration

Classical texts describe decline of *Agni* with advancing age leading to *Dhatu kshaya* and *Ojas* depletion [2]. Similarly, modern research shows age-related decline in mitochondrial function, reduced ATP production, and increased oxidative stress contributing to neurodegeneration and sarcopenia [6,9].

#### 3. Immunity and Tissue Repair

Balanced *Agni* ensures proper *Dhatu* formation and optimal *Ojas*, the essence of immunity [1,3]. Cellular studies reveal that adequate ATP production is essential for immune cell activation, wound healing, and tissue regeneration [10,11].

#### 4. Preventive and Personalized Medicine

*Ayurveda* emphasizes assessment of *Agni* and *Prakriti* for personalized diet and lifestyle planning [2]. This aligns with modern personalized medicine approaches based on metabolic profiling and mitochondrial function assessment [12].

### Relevance in Contemporary Medical Science

- Explains metabolic disorders holistically
- Supports mitochondrial medicine and systems biology
- Bridges *Ayurveda* with cellular physiology
- Strengthens preventive and integrative healthcare

## DISCUSSION

The *Agni* concept reflects a profound understanding of biological energy transformation. Modern science now recognizes that mitochondrial dysfunction lies at the root of many chronic diseases [6]. This validates the Ayurvedic emphasis on *Agni* as the foundation of health. Integrating *Agni–Sharir* principles with cellular bioenergetics provides a comprehensive framework for understanding metabolism beyond isolated biochemical pathways. Such integration also supports individualized treatment based on *Prakriti* and *Agni* status.

## CONCLUSION

*Agni* represents the functional core of *Sharir Rachana* and can be scientifically correlated with cellular bioenergetics and metabolic regulation. Understanding the *Agni–Sharir* interface offers valuable insights into disease prevention, metabolic health, and personalized medicine. Further experimental and clinical research is essential to validate *Agni*-based interventions using modern bioenergetic markers.

### Future Scope

- Research on *Agni* assessment and mitochondrial biomarkers
- Clinical trials on *Agni*-modulating therapies
- Integration with metabolic and lifestyle medicine
- Development of *Agni*-based preventive healthcare models

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