A look at how the body produces energy to support the processes of life and maintain good health. Topics include the fundamentals of energy production; metabolic regulation of energy; the roles of the adrenal and thyroid glands in this process; glucose metabolism; and nutrients needed by the body’s organs and systems in sustaining healthy energy levels.

**WHAT IS ENERGY?**
Funk & Wagnall’s New International Dictionary defines energy as the “power by which anything acts effectively to move or change other things or accomplish any result.” Put another way, it is the ability to do work or to move mass. It’s an interesting observation that energy and mass can neither be destroyed nor created, but each can be converted into the other.

**Energy takes** many forms: potential, kinetic, radiant, physical or chemical, to name a few. Energy production in the body is a chemical process that occurs in every single cell, generated by a structure called the mitochondria. Think of it as “the little engine that could.”

**To accomplish this task,** the cells need fuel to produce a lively and energetic feeling in the body. That fuel is glucose, a sugar extracted from foods through a chemical process called metabolism.

**THAT “LOW” FEELING**

Nutritional and naturopathic counselors often hear complaints from their clients about low energy levels. Clients report that their normal daily routines have become “chores,” and some chores are simply avoided because they require too much effort. Yet, those very projects and deeds may be vital to that person’s life or lifestyle. That’s why it’s important to look at energy and its role in the body.

**There are, of course,** many reasons why a person would experience low energy levels. Examples include physically or mentally stressful situations, poor dietary habits (like eating only fast-foods) and missing meals altogether.

**Low food-intake,** combined with poor nutritional habits, may deprive the body of adequate amounts of nutrients essential for energy production.

**In addition,** some physical actions and stressful situations create conditions within the body that may require greater than normal amounts of nutrients. For this reason, it is essential that each of us regularly consume all the nutrients known to participate in energy production.

**METABOLISM & NUTRITION**

The energy-production process requires specific nutrients. One of the most crucial is pantothenic acid, because it is one of the catalysts of energy creation. Pantothenic acid is an element in the formation of acetyl coenzyme-A, which is a carrier molecule in the Krebs cycle. The Krebs cycle is the series of enzyme reactions that yield energy through the utilization of carbohydrates, fats and proteins to fuel cellular functions.1 It is involved in releasing energy from carbohydrates and in gluconeogenesis, the formation of glycogen from non-carbohydrate sources such as amino acids or fatty acids.2

Pantothenic acid also helps boost red blood cell production, which provides more oxygen for “fuel burning” and enhances the body’s coenzyme-A activity for increased ATP production, essential to maintaining the body’s energy levels.3

Several of the B-complex vitamins are essential for the energy production process: B1, B2 and B12 help vital amino acids enter the Krebs cycle; Vitamin B12 also helps the body metabolize fats, carbohydrates and proteins, and interacts in the metabolic process with folic acid, required for all cell growth and reproduction.4

**GLANDS & ENERGY**

Two key glands involved in energy’s production and regulation in the body are the **adrenals** and the **thyroid.** Both are part of the endocrine system, the body’s ductless glands that produce and secrete hormones directly into the blood or lymph, which circulates the substances to all parts of the body.3

**THE ADRENALS**

Adrenal glands consist of an inner section, the medulla, plus an outer portion, the cortex. Each part produces secretions that affect energy production in the body.

**Responding to impulses** originating in the brain and traveling through the sympathetic nervous system, the medulla produces the hormones universally associated with the “fright, fight or flight” alarm reaction. These hormones, adrenaline and noradrenaline, are secreted directly into the blood and carried to virtually all tissues of the body.

Circulating **noradrenaline** causes constriction of virtually all the body’s blood vessels. Other responses include increases in heart activity, inhibition of the gastrointestinal tract, dilation of the pupils and decreases in nonessential activities.

**Adrenaline’s effects** are similar, although epinephrine causes greater impact on cardiac activity and less constriction of the blood vessels. Adrenaline’s impact on tissue metabolism is also several times greater.

**The adrenal cortex** produces a trio of life-essential substances, called glucocorticoids, that, together with other hormones, regulate metabolism and also the body’s resistance to stress. They are cortisol (hydrocortisone), corticosterone and cortisone. Cortisol is the most abundant and is responsible for about 95% of glucocorticoid activity.7

Glucocorticoids’ role is to make sure the body has enough ATP available. ATP, or adenosine triphosphate, is the principal energy-storing molecule in the body.8

Glucocorticoids increase the rate at which proteins are broken down and amino acids are removed from cells, primarily muscle fibers, and transported to the liver. Amino acids can be synthesized into new proteins, such as the enzymes needed for metabolic reactions. If the body’s reserves of glycogen and fat are low, the liver may convert lactic acid or amino acids into glucose (gluconeogenesis). Glucocorticoids also stimulate lipolysis, the breakdown of triglycerides into fatty acids and glycerol, plus the release of fatty acids from adipose tissue.9

**THE THYROID**

Thyroid hormones regulate the body’s oxygen use, cellular metabolism and basal metabolic rate, as well as growth and development. In regulating metabolism, the hormones stimulate protein synthesis, enhance cholesterol excretion in bile (which aids in fat digestion, thus reducing cholesterol levels), and increases the use of glucose in the production of ATP, the main energy-producing chemical in cells.10
**ADRENAL FACTORS STRESS SUPPORT™** contains vitamins C and B12 along with pantothenic acid, complemented by the herbs eleuthero root and licorice root, known for their energizing properties. **Adrenal Xtra Energy Support”** is formulated to enhance the body's endurance and speed its return to normal energy levels. **Adrenal Xtra Energy Support”** derives its name and potency from the addition of three times the amount of energy-enhancing pantothenic acid found in **Adrenal Factors Stress Support™** and also from Rhodiola rosea, used for centuries to combat fatigue, support physical strength and enhance mental stamina. **Thyroid Factors™** contains iodine, manganese and tyrosine, complemented with the herbs Irish moss and gentian root.

**ESSENTIAL NUTRIENTS FOR ENERGY PRODUCTION**

Glands synthesize and secrete certain fluids for use in the body. The production of such substances, like the important adrenal and thyroid hormones, always requires active work by the cells and results in an expenditure of energy. Nutrients required for proper functioning of the adrenal and thyroid glands include these substances:

**ADRENALS**

Pantothenic acid. Plays a key role in releasing energy from carbohydrates; in gluconeogenesis; in synthesis and degradation of fatty acids; and in the synthesis of such vital compounds as sterols and steroid hormones.15 Helps to boost red blood cell production providing more oxygen for "fuel burning" and enhances the body’s coenzyme-A activity for increased ATP production, essential to maintaining the body’s energy levels.


Vitamin C. Occurs in large concentrations in both parts of the adrenal gland: the outer cortex and the inner medulla.16 Essential in the adrenal medulla’s production of adrenalin and noradrenaline. Although adrenals are rich in vitamin C, large amounts are lost with secretion of corticosteroids.16

**THYROID**

Manganese. A mineral necessary for production of thyroxine, one of the thyroid hormones that must be present for the regulation of basal metabolism.

Chromium. A mineral involved in metabolism of carbohydrates, lipids (fats) and nucleic acids.

Tyrosine. An amino acid necessary to the manufacturing of the thyroid hormones, as well as to the adrenal glands and pituitary.


**REFERENCES**

2. Tabers, 811.
5. Tabers, 638.
8. Tortora, 545, 546.
10. Tortora, 538.
12. RDA, 169.
15. "Let's get social" /michaelshealth

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MICHAEL'S®
PRODUCT FORMULAS

**ADRENAL FACTORS**

**Stress Support™**

**Supplement Facts**

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<th>Amount Per Serving</th>
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**OTHER INGREDIENTS:** Dicalcium Phosphate, Stearic Acid, Microcrystalline Cellulose, Vegetable Magnesium Stearate, Modified Cellulose Gum, Silicon Dioxide and Pharmaceutical Glaze (Shellac, Povidone).

**Thyroid Factors™**

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**OTHER INGREDIENTS:** Dicalcium Phosphate, Stearic Acid, Microcrystalline Cellulose, Modified Cellulose Gum, Vegetable Magnesium Stearate, Silicon Dioxide and Pharmaceutical Glaze (Shellac, Povidone).

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**OTHER INGREDIENTS:** Rosemary, Hypromellose (Capsule) and Leucine.

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