WHAT DOES PROTEIN EVEN DO FOR US?

Well... you might regret asking after reading this!

- Regulation of gene expression, as well as micro-RNA biogenesis and levels
- Cell signaling via kinases (e.g., mammalian target of rapamycin, AMP-activated protein kinase, cGMPdependent kinase, cAMP-dependent kinase, and mitogen-activated protein kinase), G protein-coupled receptors, and gaseous molecules (e.g., NO, CO and H2S)
- Nutrient transport and metabolism
- Transport of water, other amino acids and proteins, glucose, fatty acids, vitamins, and minerals
- Major energy substrates for the small intestine (glutamine, glutamate, and aspartate) and immunocytes (glutamine)
- Substrates for, and activation of, protein synthesis ·
- Inhibition of autophagy (cellular waste removal and programmed self-destruction) and intracellular protein degradation
- Regulation of metabolism (activation of the oxidation of glucose and long-chain fatty acids to CO2 and water; inhibition of glucose and fatty acid synthesis)
- One-carbon unit metabolism and methylation of DNA and proteins
- RNA and DNA synthesis, as well as amino acid, heme, and carnitine synthesis
- Activation of lipolysis and fat oxidation, and reduction in white adipose (fat) tissue
- Stimulation of brown adipose tissue development and thermogenesis
- Appetite and body composition (e.g., skeletal muscle, fat, and bone masses)
- Modulation of immune responses (T cell receptor, lymphocyte proliferation, the production of cytokines and antibodies, macrophage polarization to affect the population of M1 and M2 cells, killing of pathogens by NO, O2 −, and H2O2) and prevention of infectious disease (including viral infections)
- Lactation (synthesis of amino acids, proteins, lipids, and carbohydrates by mammary glands)
- Reproduction (male and female fertility, fetal growth and development, and possibly fetal programming of postnatal metabolism and health)
- Hormone secretion and endocrine status
- Synthesis and secretion of hormones (e.g., thyroid hormones, insulin, glucagon, and glucocorticoids)
- Mediation of hormone actions
- Anti-oxidative defenses and removal of toxic substances
- Synthesis of glutathione, carnosine, creatine, and taurine
- Synthesis of antioxidative enzymes (e.g., glutathione peroxidase, superoxide dismutase and H2O2 peroxidase)
- Removal of ammonia and xenobiotics
- Anti-inflammation
- Regulation of apoptosis (programmed cell death) and aging
- Neurological function and behavior
- Synthesis of neurotransmitters (e.g., serotonin, γ-aminobutyrate, dopamine, and acetylcholine)
- Agonists and co-agonists of N-methyl-daspartic acid (e.g., glutamate, aspartate, glycine, d-aspartate, d-alanine, and d-serine)
- Neuroprotective reactions
- Digestive function
- Chemical sensing via the G proteincoupled receptors in the gastrointestinal tract and possibly in other tissues · Gastrointestinal emptying and the motility of the small intestine

- Conjugates with taurine and glycine to facilitate lipid digestion and absorption
- Modulation of the growth, metabolism, and population of the microbiota in the lumen of the small intestine
- Recovery from injury
- Enhancement of wound healing after surgery or injury (e.g., polyamine and NO synthesis)
- Synthesis of collagen and remodeling of extracellular matrix (e.g., glycine and proline)
- Regulation of blood flow and cardiovascular function (e.g., NO synthesis)
- Other physiological processes · Pigmentation (skin, hair, and eyes)
- Regulation of acid–base balance (e.g., renal ammoniagenesis from glutamine
- Osmoregulation (e.g., taurine and glutamine in skeletal muscle, heart, and fetal fluids)

- Source: Wu G. Functional amino acids in nutrition and health. Amino Acids. 2013. pp. 407–411. -