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QUESTION

Ten Important Scientists who have made significant contributions to the field of nutrition and state out their discoveries.

ANSWER

1. Antoine-Laurent de Lavoisier (1743 – 1794)

He showed that oxygen consumption increased during work, exposure to cold and during digestion (specific dynamic effect) and was lower during fasting (basal metabolism). He was the father of calorimetry. To Lavoisier, the principle of balanced sheet was very important, so he was meticulous in his accounting for where substances and calories went. He was dubbed the Father of nutrition. Lavoisier theorized that nutrients play a part in metabolism and respiration. Antoine-Laurent Lavoisier is considered the father of modern chemistry, and he was among the first to relate this science to physiology by exploring the ideas of metabolism and respiration. Lavoisier placed a guinea pig into an ice calorimeter – a container inside another insulated container filled with ice. The amount of ice that melted would be a measure of the heat given off by the guinea pig. Through this experiment, Lavoisier was able to demonstrate that respiration was a form of slow combustion. He began to investigate how the body converts food into tissues before his death in 1794. Nevertheless, Lavoisier's work laid the foundation for later investigations of the role of food in the human body.

2. Agnes Fay Morgan (1884 – 1968)

Dr. Morgan conducted research on “women's issues,” i.e., human nutrient requirements and foods. Her early work focused on the vitamin content of processed foods. She was the first to demonstrate that a commonly used food preservative, sulfur dioxide, had a protective effect on vitamin C and a damaging effect on thiamin. She also studied the vitamin content of many important California-grown foods, i.e., wheat, almonds and walnuts, and the effects of processing on them. She was interested in defining the cause of low weight in children, and she showed that small supplementary feedings with fruits, milk and wheat germ improved the growth of school children. Using various animal models, rats, guinea pigs, hamsters and cocker spaniels, she analyzed the relationships between vitamins and hormones. Her studies of dietary calcium, phosphorus, vitamin D and parathyroid hormone demonstrated that an over dosage of vitamin D produced brittle bones and calcification of soft tissues. She also investigated interactions between vitamin A, carotene and thyroid secretion, and between riboflavin, panthothenic acid and adrenal gland secretions.

3. James Lind (1716 – 1794)

James Lind, a British naval surgeon, is credited with discovering the cure for scurvy, a disease that results from Vitamin C deficiency. Sufferers endure bleeding under the skin, softening of the muscles, digestive problems, and rotting gums. Scurvy attacked prisoners, sailors, soldiers, and children, all of whom had limited access to fresh fruits and vegetables. During the eighteenth century, it is estimated that more British sailors died of scurvy than in battle. Prior to Lind's work, medical opinion held that scurvy was caused by exposure to "bad air," putrefaction, and dampness. Lind's major contribution to science was the first controlled clinical trial. In 1747, aboard the HMS Salisbury, Lind took twelve sailors suffering from scurvy and divided them into six pairs. Each pair received a different scurvy treatment. The two men who were given citrus fruit became well within six days and even helped to care for the other sailors. All of the other men remained ill. Lind published the results of the trial in his *Treatise on the Scurvy* in 1753, but the book received very little attention. Lind himself never accepted the results of his own experiments and continued to believe the disease was caused by an infection.

4. Justus Freiherr von Liebig (1803 – 1873)

He was a German scientist interested primarily in the link between chemistry and physiology, Liebig thought he could infer the biological processes of living organisms from knowledge of the chemical properties of elements. Liebig theorized that the chemical components of the body were all derived from vegetable protein, either consumed directly from plants or indirectly from meat. He thought the body converted this protein into all of the substances needed for regeneration and growth. Additional substances were needed only to supply energy for digestion. Accordingly, Liebig held that proteins, carbohydrates, and fats, the “dietetic trinity” provided all of the nutrition needed by the human body.

5. Sir Frederick Gowland Hopkins (1861 – 1947)

Frederick Gowland Hopkins was the first scientist to elucidate the “accessory food factor,” the idea that food contains trace amounts of substances essential for nutrition. Accessory food factors later came to be called vitamins. Hopkins discovered tryptophan, an essential amino acid, as early as 1901. He demonstrated that tryptophan was necessary for life and that it must be supplied through diet. Hopkins read the results of these experiments at a meeting of the Society of Public Analysts in 1906, noting, “no animal can live upon a mixture of pure protein, fat and carbohydrates.” Despite discoveries that backed up his claims, skepticism about the existence of vitamins lingered among the medical community into the 1920s. Hopkins’ work in nutrition earned him the Nobel Prize for Medicine or Physiology in 1929, an honor he shared with Christiaan Eijkman, the physician whose research resulted in a cure for beriberi.

6. Casimir Funk (1884 – 1967)

He was a Polish biochemist, generally credited with being among the first to formulate in 1912, the concept of vitamins, which he called "vital amines" or "vitamines". After reading an article

by the Dutchman Christiaan Eijkman that indicated that persons who ate brown rice were less vulnerable to beri-beri than those who ate only the fully milled product, Funk tried to isolate the substance responsible, and he succeeded. Because that substance contained an amine group, he called it "vitamine". It was later to be known as vitamin B₃ (niacin), though he thought that it would be thiamine (vitamin B₁) and described it as "anti-beri-beri-factor". In 1911 he published his first paper in English, on dihydroxyphenylalanine. Funk was sure that more than one substance like Vitamin B₁ existed, and in his 1912 article for the Journal of State Medicine, he proposed the existence of at least four vitamins: one preventing beriberi "antiberiberi" one preventing scurvy "antiscorbutic" one preventing pellagra "antipellagic" and one preventing rickets "antirachitic". From there, Funk published a book, *The Vitamines*, in 1912, and later that year received a Beit Fellowship to continue his research. Funk proposed the hypothesis that other diseases, such as rickets, pellagra, coeliac disease, and scurvy could also be cured by vitamins. Funk was an early investigator of the problem of pellagra. He suggested that a change in the method of milling corn was responsible for the outbreak of pellagra, but no attention was paid to his article on this subject. The "e" at the end of "vitamine" was later removed, when it was realized that vitamins need not be nitrogen-containing amines. He postulated the existence of other essential nutrients, which became known as vitamins B₁, B₂, C, and D. In 1936 he determined the molecular structure of thiamine, though he was not the first to isolate it. Funk also conducted research into hormones, diabetes, peptic ulcers, and the biochemistry of cancer.

7. Christiaan Eijkman (1858 – 1930)

He was a Dutch physician and professor of physiology whose demonstration that beriberi is caused by poor diet led to the discovery of antineuritic vitamins (thiamine). Together with Sir Frederick Hopkins, he received the Nobel Prize for Physiology or Medicine in 1929 for the discovery of vitamins. Eijkman had been sent to the Dutch East Indies to study beriberi, a disease of the peripheral nerves, but his discovery of the cause was accidental. He noticed the symptoms of beriberi in some chickens used in his laboratory when their feed had been altered for a few months. During that time, chickens in the laboratory had been fed leftover rice from military rations, until a new cook refused to

allow military rice to be fed to civilian animals. Rice was then purchased from another source, and the birds soon recovered. During the months that the chickens developed beriberi, the feed had been polished rice, and when the birds' diet was switched back to unpolished rice, the birds recovered in a few days. Eijkman surmised that polished rice lacked a dietary component found in unpolished rice, and that beriberi was caused by depriving the body of this component, which he called "the anti-beriberi factor". Subsequently, Eijkman was able to prove that the disease was not caused by blood contamination, respiratory metabolism, perspiration, or seasonal or temperature variation. He suspected the disease was caused by an unknown bacteria. Eijkman was unable to continue his research due to ill health, but a study by his friend Adolphe Vorderman confirmed the link between polished rice and the disease. Eventually it was determined the missing compound that was causing beriberi was vitamin B₁, thiamine. Chemist Casimir Funk shortened the term "vital amine" to coin a new word, vitamin. For his contributions to the discovery of antineuritic vitamins, Eijkman won the 1929 Nobel Prize for Medicine, sharing the prize with Sir Frederick Hopkins. Funk, perhaps unfairly, was never given full credit for his work.

8. Elmer Verner McCollum (1879 – 1967)

In 1907, Elmer McCollum, a biochemist at the University of Wisconsin, was assigned to research the chemical components of cow dung. Instead, he established the nation's first scientific rat colony in the basement of his laboratory building in secret, because the dean of his college thought rats were useless for research. McCollum was interested in the relationship between fats and health. He gave some rats a fat-free diet and noticed that they developed sore eyes and infections. Other rats given plenty of fats were healthy. By 1914, McCollum had identified the substance lacking from the rats' diet. He called it Fat Soluble Factor A: the first known vitamin. Living at a time when vitamins were unknown, he asked and tried to answer the questions, "How many dietary essentials are there, and what are they?" McCollum also helped to discover vitamin B and vitamin D and worked out the effect of trace elements in the diet. McCollum went on to publish scientific studies on a host of other vitamins and minerals. He

also wrote over 100 articles for McCall's, a women's magazine, and published numerous popular books on nutrition. Interestingly, he argued against the use of vitamin pills and supplements, instead advising varied diets of whole foods.

9. Wilbur Olin Atwater (1844 – 1907)

He was an American chemist known for his studies of human nutrition and metabolism. He is credited with developing the Atwater system, laying the groundwork, in the 19th century, for the science of nutrition in the United States and inspiring modern Olympic nutrition. Atwater is best known for his studies of human nutrition. He invented and used the respiration calorimeter, with the help of fellow Wesleyan scientists Edward Bennett Rosa and Francis Gano Benedict, to measure precisely the energy provided by food and created a system to measure that energy in units, known as food calories as developed in the Atwater system. He studied respiration and metabolism in animals and in humans. The calorimeter aided studies in food analysis, dietary evolution, work energy consumption, and digestible foods. It measured the human metabolism balance by analyzing the heat produced and metabolic rate by a person performing certain physical activities. With this machine, the dynamics of metabolism could be quantified and the balance between food intake and energy output could be measured were unique. Atwater demonstrated that whatever amount of consumed energy humans cannot use is left over and stored in the body. His findings thus established that the first law applied to humans as well as animals. Atwater's research and conclusions in this regard changed both how people thought about science and about humans. Most importantly, the calorimeter was a great influence to the growing awareness of the food calorie as a unit of measure both in terms of consumption and metabolism. Atwater reported on the weight of the calorie as a means to measure the efficiency of a diet. He stated different types of food produced different amounts of energy. He stressed the importance of an inexpensive and efficient diet that included more proteins, beans, and vegetables in place of carbohydrates.

10. Doris Howes Calloway (1923 – 2001)

Dr. Calloway conducted research on a broad spectrum of human nutrition and food science, most of which was completed using the metabolic facilities in the “Penthouse” at Berkeley. Her work focused on gut microflora and intestinal gas, metabolism of nitrogen and amino acids in humans, human energy requirements and the functional consequences of marginal nutrition. Like other women nutrition scientists, much of her research focused on issues about women, i.e., the menstrual cycle, pregnancy and lactation, and energy needs for women's work.