

PARADIGM SHIFTS LEADING TO ORIGINS OF NUTRITION SCIENCE

The origins of germ theory of disease are lost in the mists of history but it was certainly being discussed in the 1600s. The theory was rejected by the vast majority of medical practitioners and early scientists. However, in 1676 the Dutchman Antonie Van Leeuwenhoek developed the first microscope and was able to identify bacteria and many other microscopic structures. He corresponded with the Royal Society in London who initially doubted his scientific integrity but eventually accepted his findings. In 1857 the researches of Louis Pasteur finally replaced the theory of spontaneous generation and validated the germ theory of disease. Pasteur carried out a series of experiments that were similar to Redi's experiments that proved that maggots came from the eggs of flies (Figure 3). He proved that microscopic life-forms in the air are responsible for putrefaction and fermentation (bacteria and yeasts). Subsequently Louis Pasteur and the German physician-scientist Robert Koch were able to further develop the germ theory of disease. Koch laid down a set of criteria for establishing the link between a disease and microorganisms known as Koch's postulates:

1. The microorganism must be found in abundance in all organisms suffering from the disease, but should not be found in healthy organisms.
2. The microorganism must be isolated from a diseased organism and grown in pure culture.
3. The cultured microorganism should cause disease when introduced into a healthy organism.
4. The microorganism must be re-isolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent.

This theoretical framework (paradigm) was almost immediately used to determine the disease processes in anthrax, syphilis, tuberculosis, rabies and cholera. However, not all disease is due to pathogenic microorganisms and mistakes were made. In 1804, Japanese doctors gave the first detailed description of kakké which is better known as beriberi. The condition starts with creeping paralysis of the legs, then swelling of the lower extremities and finally heart failure and death and was particularly common in the Far East in institutionalised populations such as military and prisons. Beriberi was becoming a problem for the Dutch authorities in the Dutch East Indies. The important breakthrough came in 1890 with a young army surgeon, Christiaan Eijkman, who was researching beriberi in Java using various animal models. The research was based on Koch's postulates and involved injecting animals with bacterial cultures from the blood of human beriberi subjects. He found that the chicken was a good animal model for beriberi but that there was little difference in the severity of chicken beriberi between those injected with the bacterial culture and those who had not been injected. Then, to his amazement all his chickens suddenly recovered from the disease. However, the clue was a change to the chicken feed and this was something that Eijkman's assistant organised. Normally, the chickens were fed on a standard feed grade uncooked brown rice but unbeknown to Eijkman, the assistant had acquired leftover cooked white rice from the cook at a neighbouring military hospital for a period of five months. However, when a new cook took over, he refused to continue the arrangement. The miraculous return to good health of the chickens coincided with a return to standard brown rice chicken feed. Once Eijkman's assistant "came clean" and explained this, a new avenue of research opened up. After carrying out a series of experiments, Eijkman realised that there was a substance in the outer layer or "silverskin" of the rice grain that was "indispensable to life and health" but which would have been completely removed in the polishing process that is used to produce white rice.....