



## History of Animal Nutrition-Various Scientists

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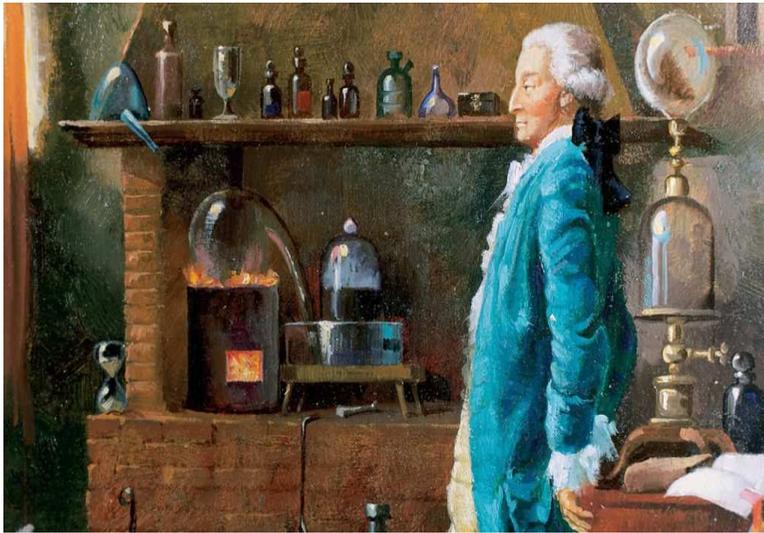
K.N.P. Veterinary College, Shirwal

•**Antoine Lavoisier (1743-1794)**: A French chemist, widely considered as the "**father of modern chemistry**". He was a self-promoter and noted for his discovery of the role oxygen plays in combustion. He introduced the **balance and thermometer** into nutrition studies. With Laplace, he designed a **calorimeter** by means of which it was demonstrated that respiration is essential source of body heat. He is acknowledged as the "**Father of Nutrition, Father of Modern Chemistry. Founder of the Science of Nutrition**".

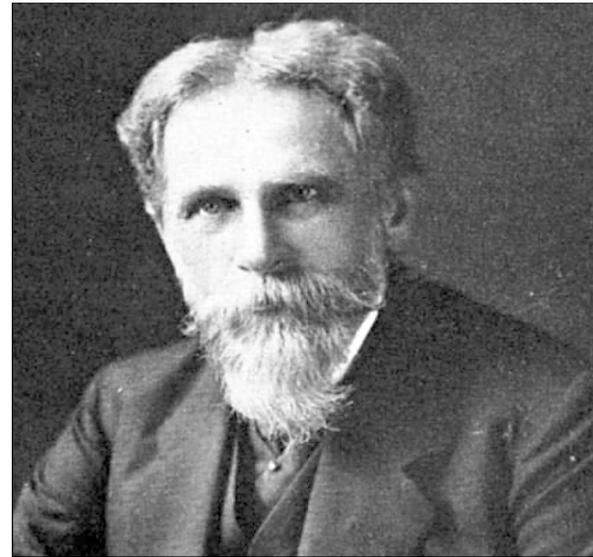
•**Santorio Sanctorius (1561-1636)**: He designed **instruments** to quantify pulse, temperature, and environmental humidity. Sanctorius clearly deserves the title of **founding father of metabolic balance studies**. He weighed himself on a balance before and after eating food, to find out what **happened to the food?**. This was the first experiment on **human metabolism**.

•**Max Rubner (1854-1932)**: Max Rubner was a German physiologist and hygienist. Max Rubner is remembered for his **research in metabolism, energy physiology, hygiene and dietary thermogenesis**. In 1883 Rubner introduced the 1. "**Surface hypothesis**", which stated that the metabolic rate of birds and mammals is roughly proportional to their body surface area (at constant temperature). Max Rubner is also known for his 2. "**Rate-of-living theory**", which proposed that a slow metabolism increases an animal's longevity. He showed that carbohydrate and fat were **interchangeable** in metabolism on the basis of energy equivalents.

•**G. J. Mulder**: He was from Netherlands and he gave the name "**Protein**" to the nitrogenous food. The term protein means "**to take first place**".



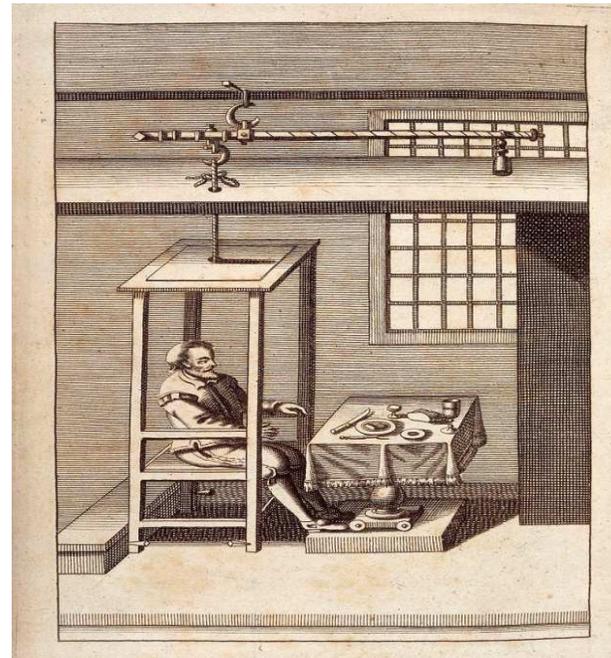
**Antoine Lavoisier**



**Max Rubner**



**G. J. Mulder**



**Santorio Sanctorius**

•**Francois Magendie**: The great French Physiologist. He is recognized as “**Founder of Modern Experimental Method in Animal Feed Experiments**”. He employed diets of **pure carbohydrates & fats** to prove that food **nitrogen is essential**. In 1816, he stated that Nitrogen present in body had its origin in Nitrogen compounds present in food.

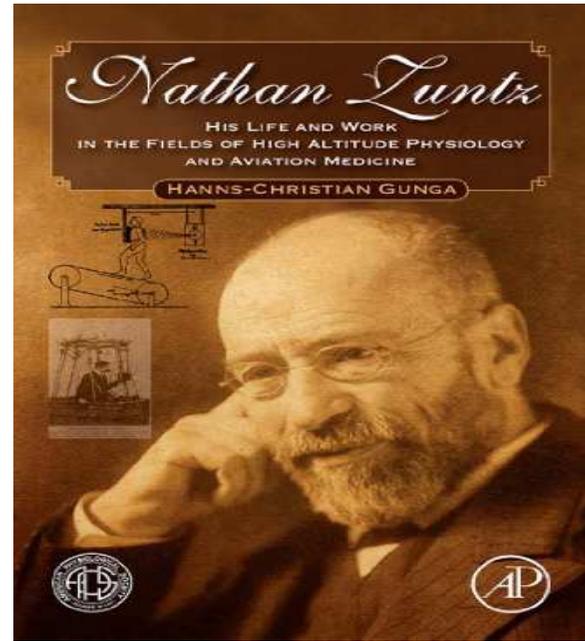
•**Nathan Zuntz (1847-1920)**: He was pioneer in **basal metabolism and in respiration studies** with farm animals. He developed the **first portable respiration apparatus**. He was first to formulate the “**Fermentation**” hypothesis to explain **mechanism of forage utilization by ruminant** animals in 1879.

•**Oskar Kellner (1851-1911)**: Oskar Kellner was a **German** agricultural scientist. His nutritional analysis of livestock feed was called the “**Kellner Standard**” and was subsequently adopted by the **Japanese livestock industry**. He contributed a **Starch Equivalent (SE) system of energy evaluation**.

•**F. B. Morrison**: Observed that stockmen are **spending large sums of money** for entirely unnecessary amounts **on protein supplement** (reducing profits). Therefore, endeavored to combine in one **set of standards / guidelines** which will be **best guide** available in **computation of rations** for various classes of livestock. These standards were first presented in the **15<sup>th</sup> edition of “Feeds and Feeding”** published in 1915 under the authorship of **Henry and Morrison**. They were then called “**Modified Wolff and Lehmann standard**”. They soon came to be known as the “**Morrison Feeding Standard**”. These standards were **expressed** in terms of DM, Digestible Protein (D.P.) and T.D.N. In the year 1956, Morrison has included the standard the **allowances** for Ca, P and Carotene besides digestible carbohydrates, digestible proteins and net energy. The average of Morrison standards has been **accepted for Indian livestock**.



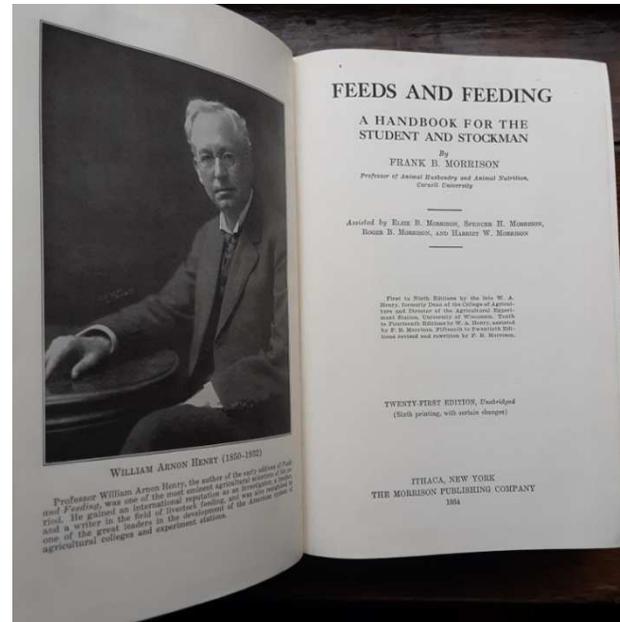
**Francois Magendie**



**Nathan Zuntz**



**Oskar Kellner**



**F. B. Morrison:**

•**Leonard Maynard (1887-1972)**: As a chairman of NRC (USA) committee on Animal Nutrition in 1942. He was **responsible to prepare the recommended Nutrients Allowances** for farm animals. His research includes studies on **requirements** of minerals, amino acids, vitamins, developments of purified diets, utilization and metabolism of protein, minerals and lipids in feed supplies for lactating animals.

•**Max Kleiber (1893-1976)**: He was from Switzerland and he developed the **use of weight to the 0.75 power ( $W^{0.75}$ )** instead of **surface area** to describe energy metabolism.

•**Franz Tappeiner**: A German scientist showed that **large quantities of VFA**, notable acetic acid, were produced from the *in-vitro* fermentation of cellulose by bacteria (Ox rumen).

•**Wilbur Atwater (1844-1907)**: Wilbur Atwater was an American chemist known for his studies of **human nutrition and metabolism**. He invented and used the **respiration calorimeter**, to measure precisely the energy provided by food. He **created a system** to measure that **energy in units**, known as **food calories** as developed in the **Atwater system**.

•**Van Soest**: Van Soest is remembered for developing **procedures to estimate the fibre** in feedstuffs. He developed the **detergent system of fractionation of forage carbohydrates** and few methods for lignin.

## Leonard Maynard

Leonard Maynard, 87, died Sept. 10, 2003.

Born in Logan, W. Va., he had been a resident of Akron for 62 years. Mr. Maynard retired from the National Standard Co. in 1980 with 38 years of service, and was a member of the Church of Jesus Christ of Latter Day Saints.



Preceded in death by first wife, Garnet, second wife, Joyce, two brothers, and a sister, he is survived by daughters, Gloria Poole and Priscilla MacBride (Fred) both of Akron; six grandchildren, 12 great-grandchildren, and three sisters.

Services will be held at 2 p.m. FRIDAY at the Billow FALLS Chapel, corner of 23rd and Falls Avenue, with Bishop James Juhasz officiating. Interment at Northlawn Memorial Gardens. Friends may call at the funeral home one hour before service time. In lieu of flowers, memorials may be made to the Church of Jesus Christ of Latter Day Saints, 106 E. Howe Ave., Tallmadge 44278, or to the Hospice Care Center, 3358 Ridgewood Rd., Akron 44333. (Billow FALLS Chapel, 330-867-4141.)

Please sign the guestbook at [www.ohio.com/obituaries](http://www.ohio.com/obituaries)

**Leonard Maynard**

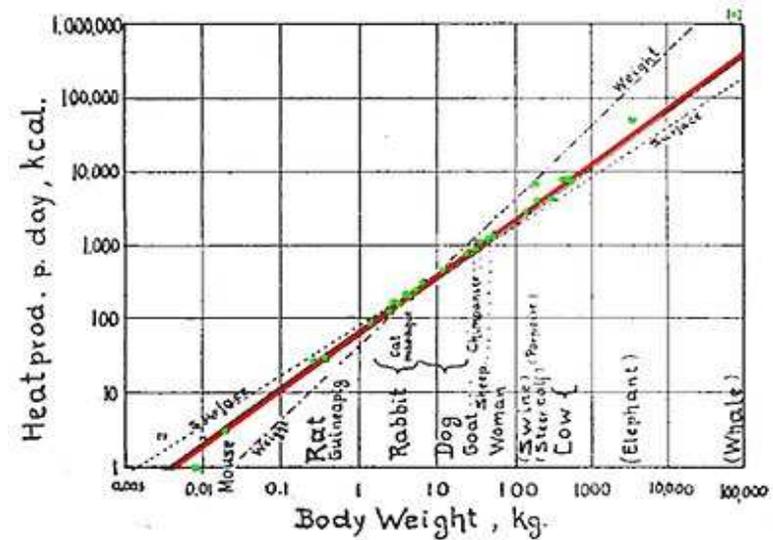
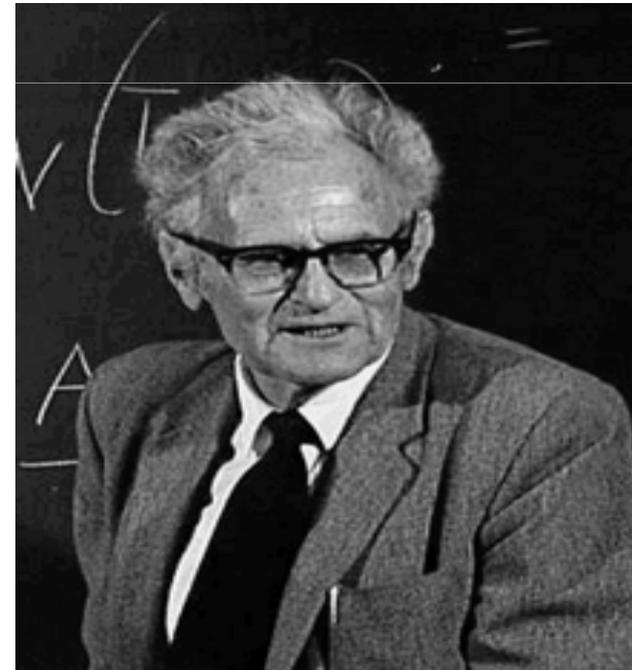


Fig. 1. Log. metabol. rate/log body weight.



**Max Kleiber**



**Franz Tappeiner**



**Wilbur Atwater**



**Van Soest**



Twenty-five years as a fireman ended on Friday for Mr. Terry Tilley, Russell Road, Mitcham. Here (centre) with his wife he receives a clock from Station Officer P. Dann, and an illuminated address signed by all members of the station. All his colleagues also subscribed towards the cost of the clock.

Mitcham News & Mercury, 12th February, 1965

**Tilley Terry**

•**Tilley-Terry:** Tilley-Terry have worked on the *in-vitro* method of fibre digestibility in ruminants. *In-vitro* methods for laboratory estimations of degraded feeds are important for ruminant nutritionists. *In-vitro* methods have advantage not only of being **less expensive and less time-consuming**. Three major biological digestion techniques are currently available to determine nutritive value of ruminant feeds:

- Digestion with rumen microorganisms as in Tilley-Terry (1963) or using a gas method
- In-situ* incubation of samples in nylon bags in the rumen
- Cell-free fungal cellulose

These biological methods are more meaningful since microorganisms and enzymes are more sensitive to factors influencing the rate and extent of digestion than are chemical methods (Van Soest, 1994). The nylon bag technique has been used for many years to provide estimates of both the rate and extent of disappearance of feed constituents. This technique provides a useful means to estimate rates of disappearance and potential ruminal degradability of feedstuffs and feed constituents whilst incorporating effects of particulate passage rate from the rumen. The Tilley and Terry (1963) technique is used widely because of its **convenience, particularly when large-scale testing of feedstuffs is required**. This method is employed in many **forage evaluation laboratories** and involves **two stages** in which forages are subjected to **48 hrs fermentation** in a buffer solution containing rumen fluid, followed by **48 hrs of digestion with pepsin in an acid solution**. Both Tilley and Terry and nylon bag methods are based on residue determinations and may result in over-estimation of DM digestibility's for tannin-rich feeds, since tannins are solubilised in both these systems but might be indigestible and do not contribute to nutrient supply to animals.

•**Johan Kjeldahl (1849-1900):** Johan Kjeldahl was a Danish chemist who developed a method for **determining the amount of nitrogen** in certain organic compounds using a laboratory technique which was named the Kjeldahl method after him.

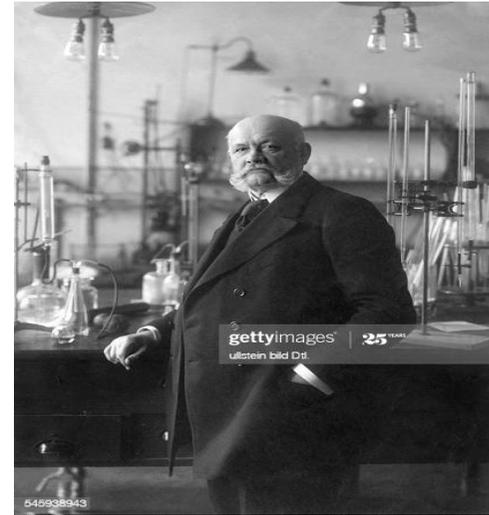
•**Franz Soxhlet:** A **Soxhlet extractor** is a piece of laboratory apparatus invented in 1879 by Franz Soxhlet. It was originally designed for the **extraction of a lipid** from a solid material. Typically, a Soxhlet extraction is used when the desired compound has a limited solubility in a solvent, and the impurity is insoluble in that solvent. A Soxhlet Extractor has three main sections i.e A percolator (boiler and reflux) which circulates the solvent, a thimble (usually made of thick filter paper) which retains the solid to be laved, and a siphon mechanism, which periodically empties the thimble.

•**Stephen Babcock (1843-1931):** Babcock was a U.S. agricultural chemist. He is best known for his **Babcock test** in determining **dairy butter fat in milk** processing, for cheese processing. He determine **proper feed ratios** of carbohydrate, fat, and protein using chemical analysis of cow excrement. He determined that excrement's chemical composition was similar to that of feed, only major exception was the ash content. This led Babcock to wonder what would happen if cattle were fed a single grain (barley, corn, wheat).

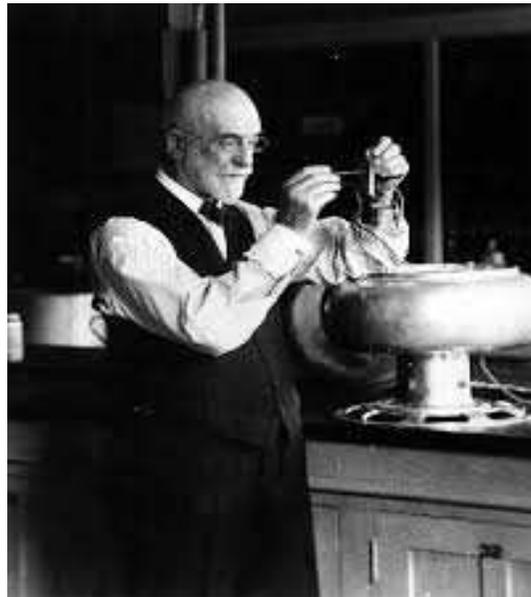
•**Henry Armsby:** Henry Armsby performed experiments on the **energy metabolism of cattle**. He invented **the respiration calorimeter** in 1902. He **recognized the importance of heat loss** as a waste of feed energy, which had got little attention in the past, and was determined to gather the data that would enable publication of net energy value of all the feedstuffs **used in formulating livestock rations**. Net energy is that feed energy remaining after subtracting that lost in feces, urine, combustible gases, and that used in metabolizing the feed itself (heat increment)-in other words-that energy available for animal production.



**Johan Kjeldahl**



**Franz Soxhlet**



**Stephen Babcock**



**Henry Armsby**

•**Elmer McCollum (1879-1967):** McCollum was an American biochemist known for his work on **influence of diet on health**. McCollum first proposed that **nutritive failure of certain diets** was due to a lack of "**palatability**." He proposed that if a diet could be made to taste good, and animals ate larger quantities of food, diets would be adequate. This hypothesis, and supporting data, were **criticized by scientists**. McCollum acknowledged this error & rededicated himself to more careful analyses including an analysis of growth-promoting factors in protein-free milk, which then led to isolation of **first known fat-soluble vitamin which he later called Vitamin A**. His experiments with diets of small animals led to discovery of **water-soluble vitamin B**. He later showed that B is not a single compound, but a **complex**. He showed that **vitamin D** prevents rickets, a bone disease.

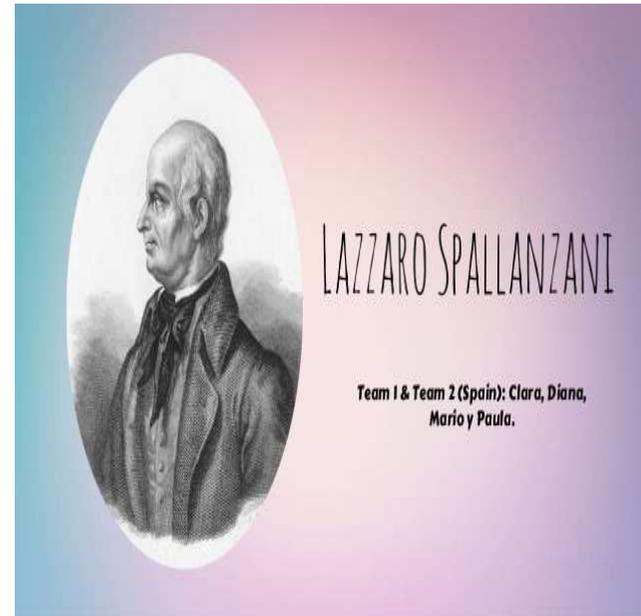
•**Lazzaro Spallanzani (1729-1799):** Spallanzani was an Italian biologist & physiologist who made important contributions to **study of bodily functions, animal reproduction**. **His great work however is the process of digestion**. He first interpreted the process of digestion. He swallowed linen **bags containing meat and bread** and retrieved it by strings attached to them periodically and found some chemical changes that took place in meat and bread.

•**Benedict Mendel (1872-1935):** Mendel was an American biochemist known for **study of Vitamin A, Vitamin B, lysine and tryptophan**. Together with **Thomas Osborne** he established essential amino acids. As early as 1910 he found an important **growth factor** later to be known as **vitamin B**. They discovered Vitamin A in 1913 in butter fat (independently discovered by Elmer McCollum, as well as water-soluble vitamin B in milk. They showed, that a lack of Vitamin A in diet led to **Xerophthalmia**.

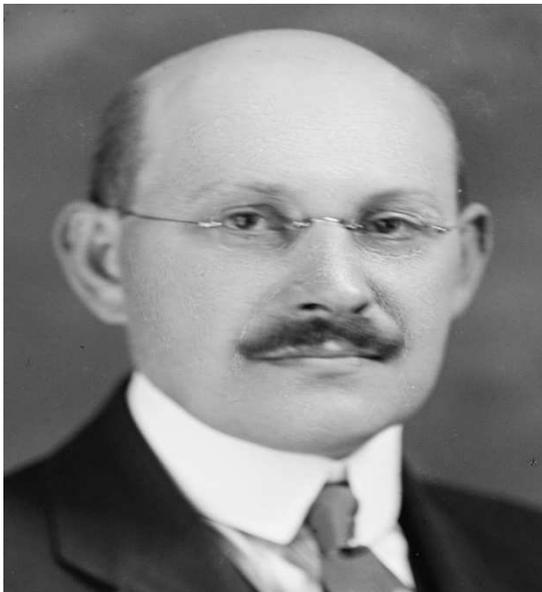
•**Henry A. Mattill:** The Discovery of the Antioxidant Function of Vitamin E is the main the contribution of Henry A. Mattill. The best-established biochemical function of vitamin E is its action as a lipid antioxidant.



**Elmer McCollum**



**Lazzaro Spallanzani**



**Benedict Mendel**



**Henry A. Mattill**

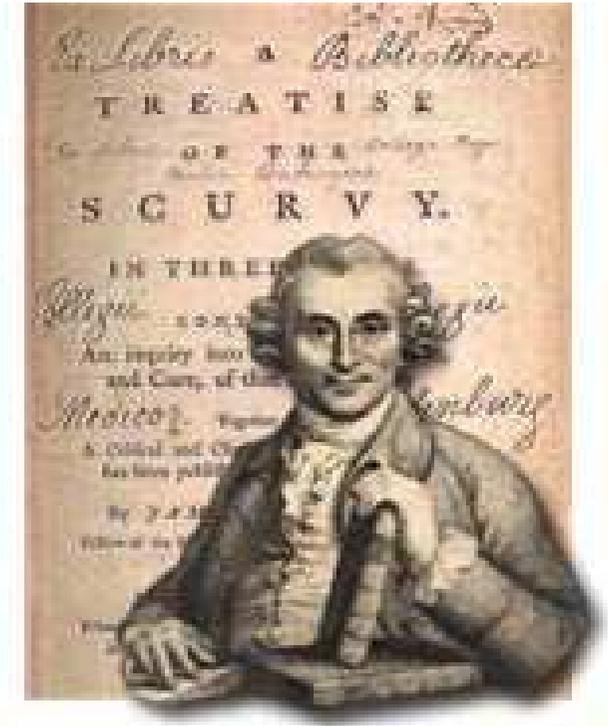
•**Robert Hungate:** Robert Hungate was a **pioneering microbial ecologist** who **developed the first techniques for the culturing of anaerobic microbes in the bovine rumen.** Hungate selected the **symbiotic bacteria of termites** as his thesis topic, investigating their role in cellulose digestion. Hungate first identified the **production of H<sub>2</sub> as a fermentation product** in worker termites, and undertook a study of **nitrogen fixation** in experimental termite colonies. He worked on Rumen microbiology, The "Hungate" method, while investigating the role of **cellulolytic protozoa, *Clostridium cellobioparum*.**

•**James Lind (1716-1794):** James Lind was a Scottish physician. He was a **pioneer of naval hygiene in the Royal Navy.** By conducting the **first ever clinical trial, he developed the theory that citrus fruits cured scurvy.** He argued for the health benefits of **better ventilation aboard naval ships,** the improved cleanliness of sailors' bodies, clothing and bedding, and below-deck fumigation with sulphur and arsenic. He also proposed that fresh water could be obtained by distilling sea water. His work advanced the practice of preventive medicine and improved nutrition. Scurvy is a disease now known to be caused by a **Vitamin C deficiency,** but in Lind's day, the concept of vitamins was unknown. Vitamin C is necessary for the maintenance of healthy connective tissue.

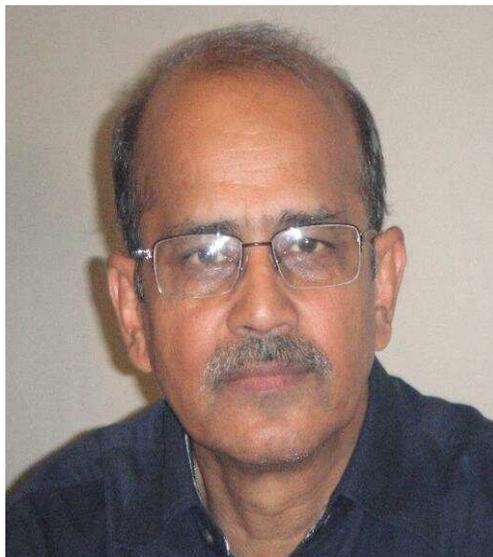
•**Talapatra S. K:** Talapatra conducted lot of work on **assaying the grasses for their nutritive** value at Veterinary College, **Mathura.** He is remembered for the development of methods to estimate the minerals especially **calcium & phosphorous** in feed and fodders.



**Robert Hungate**



**James Lind**



**Talapatra S. K**

### **Indian Animal Nutritionist**

- 1. S. K. Ranjhan**
- 2. S.K. Talpatra**
- 3. D. V. Reddy**
- 4. D. N. Kamra**
- 5. D. Narhari**

**Thank You**