

Clive McCay: A Man Before His Time

Hansel W*

Pennington Biomedical Research Center, Baton Rouge, LA, USA

*Corresponding author: William Hansel, Pennington Biomedical Research Center, Louisiana State University System, Baton Rouge, LA, USA; E-mail: William.Hansel@pbrc.edu

Received date: May 04, 2015; Accepted date: May 10, 2015; Published date: May 17, 2015

Copyright: © 2016 Hansel W. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Commentary

Clive McCay (1898-1967) is widely honored [1] for his discovery 76 years ago that caloric restriction prolongs the life span of rats [2,3]. Although this turned out to be one of the greatest discoveries ever made in biology and medicine, it was only one of the many important contributions that he made to our knowledge of nutritional physiology.

Clive grew up in Indiana and did his undergraduate work at the University of Illinois, majoring in chemistry and physics. He obtained the M.S. degree in 1923 at Iowa State University and the Ph.D. degree in Biochemistry from the University of California, Berkeley in 1925. He then completed a National Research Council Fellowship with L. B. Mendel at Yale. In 1927 he accepted an invitation to join the Department of Animal Science (then named Animal Husbandry) at Cornell University as an Assistant Professor. He remained at Cornell, as associate and full professor of nutrition until his retirement in 1962. He also held an appointment in the School of Nutrition at Cornell which he helped to establish.

In 1934 [2] McCay and Crowell published their first report indicating that caloric restriction prolongs the lifespan of the rat. In 1935, two landmark publications from Cornell by McCay, Crowell and Maynard [3] and Asdell and Crowell [4] established that both longevity and reproductive performance in rodents are primarily controlled by energy intake. After World War II, these findings were extended to dairy and beef cattle, where they had great influence on feeding and breeding practices [5,6]. Later the ability of caloric restriction to prolong life was extended to many species, including flies [7], worms [8], yeast [9], rodents [10], and monkeys [11].

These early studies of McCay and his collaborators laid the groundwork for the field of Gerontology. He was an organizer and President (1949) of the American Gerontological Society. More importantly, his findings stimulated thousands of research projects aimed at determining the mechanism(s) involved and in developing calorie restriction mimetic (CRM) drugs to prevent obesity, Type II diabetes and cancer [12,13].

In February, 1948, I enrolled as graduate student at Cornell University and was assigned space in the laboratory of my mentor, Dr. Sydney Asdell, in the Stocking Hall Annex. The laboratory next door was occupied by Dr. Clive McCay and his students.

J.B. Sumner, the Nobel Prize winner for his work in crystallizing the first enzyme, urease, and his old dog Hundin, occupied a third laboratory. As a graduate student, I took McCay's courses in Laboratory Methods in Nutrition and the History of Nutrition. The laboratory course was state of the art for its time, and included experiments involving use of ⁴⁵Ca, my first experience in handling radioactive compounds. During this period, I was occasionally co-opted to help Dr. McCay's staff and students necropsy rats at the end of

some of their experiments and I still have vivid recollections of the large number of cancers of all kinds seen in the old rats fed high energy diets. Later, as a junior faculty member, I came to know McCay well and to appreciate the significance of his many contributions to the field of nutrition.

McCay was always in a hurry. He moved at a rapid pace, literally, and figuratively. His self-discipline radiated to this students and staff. Clive exercised vigorously and was an avid skier. He controlled his diet, and was always lean and trim.

His interests were wide and included many areas of research that remain active to this day. He died in 1967 at 69.

The Cola Wars

McCay fired the first shots in the "Cola wars". He chose to focus his attack on the high phosphoric acid concentration of Coca-Cola, which caused etching of the teeth [14], rather than the more important effects of the high sugar contents of the colas and their effects on insulin sensitivity and the onset of type 2 diabetes, primarily because etching of the teeth is more likely to be understood by the average person. He was successful in bringing about a reduction of the high phosphoric acid content of Coca Cola, but the effect of high levels of sugar in the diet remains a serious problem [15].

At this time, rumors circulated that McCay's success might cost him his job, but the Cornell administration supported him and these rumors soon died down.

Calcium Metabolism in the Elderly

McCay and his co-workers were among the first to recognize that calcium absorption is less efficient in elderly animals [16] and men and women [17]. Some of the earliest data were collected in trout [18] and dogs [19], species that McCay studied extensively.

These findings led to the development by a large pharmaceutical company of a product consisting of estrogens (equalin and equalenin) extracted from mare's urine, that was successfully used for many years to maintain bone strength in post-menopausal women. Farmers in northern New York and southern Ontario and later, in Saskatchewan, Canada collected the urine using an effective collection harness, and were paid on the basis of units of estrogen produced.

Irradiated Foods

A current topic of great interest to researchers and consumers alike is the feasibility of preserving foods by irradiation. This work was pioneered by McCay [20] who found no ill effects of irradiated meat on growth and reproduction of dogs. Modern researchers seem to be reaching the same conclusions.

Our Preferences for Sugar

The first experiment performed in McCay's laboratory course was a striking demonstration of the preference of rats for a 10% sugar solution to tap water. Individually caged rats were given access to tap water or sugar water. In every case the tap water was untouched, while bottles containing 10% sugar were consumed. Subsequent tests show that the same preferences exist in other species, including man [15].

Protein Quality

Early in his career McCay recognized that the quality of proteins varies according to their assortment of essential amino acids [21]. A comparison of the quality of milk protein (casein) and soybean protein showed that soybean protein was nearly as effective in promoting growth as casein, which led to the widespread use of this protein in many foods, and to the explosion of soybean production throughout the world. Casein remains the highest quality protein and is the major ingredient of the widely consumed yogurt preparations.

The Cornell Formula Bread

McCay and his wife, Jeanette, recognized the problems associated with consumption of bread. Bread consumption declined in the 1930s, primarily because many nutritionists considered them as "empty calories", good only for filling stomachs. After the end of World War II, the McCays designed bread based on soybean flour and dried milk that solved these problems [22]. This bread became the Cornell Formula Bread and was sold by cooperative stores and other groceries [22] for many years. Neither the McCays, nor their assistants, received any financial reward for the development and marketing of the Cornell Formula Bread.

The History of Nutrition

McCay was an avid student of the history of nutrition, and I found his course on the subject extremely interesting. It made me realize the importance of the contributions of scientists such as Von Burger, Roger Bacon, Beaumont, Magendie and Chevrueil and to isolate and study important problems in my own field, Reproductive Physiology. McCay stated that the study of history allowed one to mature in wisdom, without the usual accompanying symptoms of aging.

Despite his lean body, maintained by control of his diet and exercise, McCay lived only 69 years. Few have accomplished so much for the benefit of mankind in so short a time.

References

- Verzan F (1967) In memoriam: Clive M. McCay. *Gerontologia* 13: 193.
- McCay CM, Crowell MF (1934) Prolonging the life span. *The Scientific Monthly* 39: 405-414.
- McCay CM, Crowell MF, Maynard LA (1935) The effect of retarded growth upon the length of lifespan and upon ultimate body size. *J Nutrition* 10: 63-79.
- Asdell SA, Crowell MF (1935) The effect of retarded growth upon sexual development of rats. *J Nutrition* 10:13-24.
- Sorenson AM, Hansel W, Hough WH, Armstrong DT, McEntee K, et al. (1959) Causes and prevention of reproduction failures in dairy cattle. I. Influence of underfeeding and overfeeding on growth and development of Holstein heifers. Ithaca: Cornell University Agricultural Experiment Station, Research Bulletin 936.
- Reid JT, Loosli JK, Trimmer GW, Turk KL, Asdell SA, et al. (1964) Causes and prevention of reproductive failures in dairy cattle. I. Birth to fifth calving. Ithaca: Cornell Agricultural Experiment Station, Research Bulletin 987
- Partridge L, Piper MD, Mair W (2005) Dietary restriction in *Drosophila*. *Mech Ageing Dev* 126:938-950.
- Houthoofd K, Vanfleteren JR (2006) The longevity effect of dietary restriction in *Caenorhabditis elegans*. *Exp Gerontol* 41:1026-1031.
- Guarente I (2005) Calorie restriction and SIR2 genes—toward a mechanism. *Mech Ageing Dev* 126: 923-928.
- Ramsey JJ, Harper ME, Weindruch R (2000) Restriction of energy intake, energy expenditure, and aging. *Free Radic Biol Med* 29: 946-968.
- Colman RJ, Anderson RM, Johnson SC, Kastman EK, Kosmatka KJ, et al. (2009) Caloric restriction delays onset and mortality in rhesus monkeys. *Science* 325:201-204.
- Park HW (2010) Longevity, aging and caloric restriction: Clive Maine McCay and the construction of a multidisciplinary research program. *Hist Stud Nat Sci* 40: 79-124.
- Fernandez G (2008) Progress in nutritional immunology. *Immunol Res* 40: 244-261.
- McCay CM, Will L (1949) Erosion of molar teeth by acid beverages. *J Nutr* 39: 313-324.
- Cohen R (2013) Sugar: Why we can't resist it. *Nat Geographic* August.
- Kane GG, McCay CM (1947) Calcium requirements in old and young hamsters and rats. *J Gerontol* 2: 244-248.
- McCay CM (1949) Older people need calcium in their diet. *Agric Leaders Dig* 30: 51-52.
- McCay CM, Titcomb JW, Cobb WE, Crowell MF (1928) Nutritional requirements and growth rates of brook trout. *Trans Am Fish Sci* 58:205-231
- McCay CM (1941) The nutritional requirements of dogs. *The Cornell Vet* 31:8.
- McCay CM, Rumsey GL (1960) Effect of irradiated meat upon growth and reproduction. *Fed Proc* 19:1027-1030.
- McCay, CM, Eaton E (1947) The quality of the diet and consumption of sucrose solutions. *J Nutr* 34:351-362.
- McCay JB (1994) Clive McCay: Nutrition pioneer. Biographical memoirs by his wife (1st edn.), Tabby House, Charlotte Harbor Florida, USA.