NATIONAL ACADEMY OF SCIENCES

EDWIN BRET HART

1874—1953

A Biographical Memoir by

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E B Hall

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In a short obituary of Dr. S. M. Babcock, Professor E. B. Hart started with these words, "To have enjoyed for a quarter of a century the intimate and steadfast friendship of a professional associate and a truly great man is, indeed, a rare privilege, and yet such has been my good fortune in my association with Stephen Moulton Babcock." Similarly, I have had the good fortune of knowing Professor Hart for a period of 32 years. I first met him as a student in an elementary course in agricultural chemistry in 1921. In my senior year he called me to his office and told me to take over teaching duties in the laboratory immediately since one of the assistants was leaving for a new position. Many of his teaching and research assistants were appointed under similar circumstances. This was the beginning of my close association and intimate friendship with this great teacher, research worker and advisor—an association which continued until the time of his death. During the past twenty-five years hardly a day passed that we did not meet for a conference or just a chat.

Edwin Bret Hart was born near Sandusky, Ohio, on December 25, 1874, the son of William and Mary Hess Hart, and the youngest of their family of 14. He was raised by his older brothers and sisters because his mother died in his infancy. As a student in Sandusky High School from which he graduated in 1892, he came in contact with Dr. E. L. Moseley, a teacher of physics and biology who first interested him in science. In the words of Professor Hart, "Professor Moseley not only interested us in science, but his fine character was a glorious example of decent manhood for young men. . .". After high school Hart proceeded to the University of Michigan where he studied chemistry and medicine.

While at Michigan he was an assistant to a distinguished professor of analytical chemistry, Dr. E. D. Campbell, who had lost his sight due to an explosion in the laboratory. His

association with Professor Campbell not only gave him early experience in teaching, but also placed him in close contact with an investigator who emphasized precision in experimental work. He often told of his relationship with Professor Campbell and frequently referred to the bicycle trips they took together. They used the then common tandem bicycle which required the same team work which they enjoyed in the laboratory. This ride was a daily occurrence and after a hard day in the laboratory Hart admitted that Campbell often supplied most of the power. His first scientific publication was with Professor Campbell entitled "On the Quantitative Determination of Hydrogen by Means of Palladous Chloride."

In 1897 he went to the New York State Experiment Station at Geneva, where he worked with Dr. W. H. Jordan. This gave him a new approach to experimental work. It was undoubtedly his experience at Geneva that encouraged him to go to Germany for advanced study in the field of chemistry and biochemistry. So—at the very beginning of the century he set out for Germany to study under the famous biochemist, Albrecht Kossel, who was then at Marburg. After a year Professor Kossel moved to Heidelberg and Hart accompanied him. Because of this transfer he was prevented from obtaining a higher degree. However, Professor Hart always felt that the right kind of training and experience were as valuable as degrees. He thoroughly enjoyed the student life in Heidelberg and often indulged in reminiscences of his experiences at that institution. He paid all his own expenses and purchased with his own money most of the supplies which he used in the laboratory. In later years when graduate students were dissatisfied with the small stipend which they received he would refer to his early experiences when he had to borrow money for advanced work. He published one paper as a result of his work in Kossel's laboratory but this experience introduced him to studies on proteins and all the intricacies of protein chemistry.

After two years in Germany, he returned to Geneva where he remained for a period of four years. In 1906 Dean W. A.

Henry of the College of Agriculture invited him to come to the University of Wisconsin as Head of the Department of Agricultural Chemistry and Chemist in the Experiment Station. Undoubtedly one important factor which attracted him to Wisconsin was that Dr. Stephen M. Babcock had been at the Geneva Experiment Station from 1882 to 1888 and Hart had become acquainted with his work. In his own words "I have profited enormously by going to Wisconsin and coming in contact with such men as Henry, Babcock, Russell, King, and Van Hise."

At the New York Experiment Station Hart became interested in two areas of research: the study of chemical changes in cheese during ripening and the importance of phosphorus compounds in plants and animals. With L. L. Van Slyke he published a number of papers dealing with enzymes in cheese, proteolytic compounds formed during the ripening of cheese and the relation of gases and salts to chemical changes taking place in the ripening process.

This early work brought him in contact with milk and dairy products and he continued his interest in this subject during his entire life. Shortly after coming to Wisconsin he published a simple method for the estimation of casein in cow's milk and studied the variations in the amount of casein in milks. His interest in this test was undoubtedly dependent on the fact that fifteen years earlier Dr. Babcock had developed a method for the estimation of fat in milk. In fact, the same centrifuge which Dr. Babcock had developed was used in the casein determination. Hart believed that the market price of milk should be based on the protein content as well as the percentage of fat. It is interesting to reflect that if as much attention had been given to the Hart casein test as was given to the Babcock fat test the dairy industry would today encounter less difficulty in coping with the surplus butterfat and the high price of butterfat as compared to the other constituents of the milk. In other words, in those early days greater emphasis might have been placed on the nutritional value of milk below the cream line.

With his interest in dairy products, Professor Hart de-

veloped a course in dairy chemistry which came to be recognized as a basic training for students in dairy and food technology. When Professor Hart retired no one in his department was capable of continuing this course but it was fortunate that one of his early students, Dr. Hugo H. Sommer, was on the staff of the Department of Dairy Industry and continued to give this course until his untimely death in 1953.

In 1903 Professor Hart published, with W. H. Andrews of the Geneva Experiment Station, a classical bulletin dealing with the status of phosphorus in food materials. This work clearly differentiated between the so-called bound or organic phosphorus and free or inorganic phosphorus. The following year Patten and Hart studied the principal phosphorus compounds in wheat bran and established the importance of what we know today as phytin. His interest in phosphorus continued after coming to Wisconsin and one of his first contributions from the Agricultural Chemistry Laboratory at Wisconsin was a paper by McCollum and Hart on "The Occurrence of a Phytin-Splitting Enzyme in Animal Tissues." In 1909 Hart and McCollum, in cooperation with Professor J. G. Fuller, established the role of inorganic phosphorus in the nutrition of animals. As a result of these studies McCollum concluded in 1910 that all of the phosphorus needed by an animal for skeleton, nuclein or phosphatide formation can be drawn from inorganic phosphate. This early work is especially significant in light of the tremendous developments that have taken place during the past forty years relating to phosphorylated organic compounds. In the summary of the Symposium on Phosphorus Metabolism held at Johns Hopkins University in 1951, the following statement was made: "Without question the exploration of the role of phosphorus in organisms has integrated and illuminated our understanding of the chemical nature of life processes beyond compare." Professor Hart pioneered in these early studies.

Since he had worked on proteins, especially casein, he was well aware that phosphorus was an important constituent of these molecules. He was also aware that proteins were rich in sulfur and that certain proteins contained as much as 2 per

cent on the dry weight basis. In 1909 Professor W. H. Peterson joined the department and Hart and Peterson published several papers on sulfur requirements of plants and animals. It is interesting to point out that in addition to McCollum and Peterson, Professor W. E. Tottingham had also become a member of the department and on the basis of these four men the department expanded into three areas—namely, the chemistry of animal metabolism, the chemistry of plant metabolism, and the chemistry of bacterial metabolism, with Professor Tottingham leading the work in plant chemistry and Professor Peterson developing the work in bacterial metabolism, or fermentation. A little later Dr. Steenbock joined the department and helped expand the work in the animal field.

Up until this time no specific emphasis had been placed on nutrition as such. Professor Hart had been interested in analytical chemistry, dairy chemistry, in proteins, enzymes and mineral elements, but he was now to pioneer in the new field of nutrition. A few years before Hart came to Wisconsin Dr. Babcock had initiated an experiment with growing heifers on restricted rations. The results of these experiments had not been conclusive and when Hart arrived in 1906 Dr. Babcock presented the results of his preliminary work and suggested to Dean Henry that a more comprehensive experimental plan should be inaugurated. The results of these studies with rations from single plant sources led to the publication of Research Bulletin No. 17 which has become a classical report since it laid the foundation for most of the modern research in nutrition.

It was about this time that limited federal funds were being made available for the support of research in Agricultural Experiment Stations. To be sure, the workers in those days were plagued with requests for reports of experimental results as are our modern workers. In order to be able to show progress in these reports Hart outlined two projects, namely, Adams No. 8, which dealt with mineral metabolism and mineral requirements of animals, and Adams No. 10, which dealt with vitamins and other organic nutrients in animal nutrition. This approach was typical of Hart's

philosophy—namely, to have a broad research program, one which was not confining but which allowed the investigator to modify his plan as new ideas became available. These two projects are still active in the Department of Biochemistry and modern investigators might well take cognizance of this type of philosophy. Practically all of Hart's work could be classified in these two categories.

No one individual has contributed more to research on minerals and vitamins in nutrition than Professor Hart. He was instrumental in the discovery that iodine is important in preventing goiter in animals and as a result of this discovery the livestock industry has been saved millions of dollars. He was an enthusiastic advocate of iodized salt for humans in order to prevent simple goiter in children, and served on committees which attempted to promote legislation which would make the iodization of salt compulsory. Later he and associates developed a method for the stabilization of iodine in salt which would insure the maintenance of a standard iodine content of salt.

In 1923 he initiated a comprehensive study on the relation of iron to nutrition and in cooperation with other members of the department clearly demonstrated, in 1928, that iron cannot be utilized for building hemoglobin unless it is accompanied by a small amount of copper. This discovery was presented by Professor Hart at the Federation Meetings in Ann Arbor, Michigan, in the spring of 1928. After his presentation he was given a standing ovation by the members. Such recognition has been given to only a few members of the American Society for Biological Chemists.

The demonstration that inorganic iron can be used for hemoglobin production only when it is accompanied by small amounts of copper was not only of importance in human nutrition but had real value in the prevention of anemia in farm animals, especially pigs. While Hart was pleased to see another discovery made in his laboratory put to immediate practical use, he was also interested in the basic aspects of this discovery and gave much attention to the mechanism by which copper functions in the living cell. Further studies on copper led

him into studies on other trace elements such as manganese, zinc, cobalt and boron. He and his coworkers demonstrated that both manganese and zinc have important functions in the animal body. Extensive attempts were made to demonstrate that boron was essential in animal nutrition, but it was impossible to produce a diet low enough in boron to produce any ill effect in the animal. It was recognized, of course, that boron is an important element in plant nutrition. He also studied the importance of cobalt in preventing anemia in cows and sheep before its relationship to vitamin B_{12} was demonstrated.

He was one of the first workers to show the toxic effect of fluorine in farm animals and these early results impressed him with the deleterious effects of this element even when used in small amounts as a therapeutic agent. Extended investigations were undertaken under his direction in 1928 to study the physiological effects of fluorine at various levels upon farm and laboratory animals. This study was brought about because rock phosphate was being introduced as an economical source of calcium and phosphorus in practical animal feeding. This rock phosphate contained appreciable amounts of fluorine and, when fed at levels high enough to supply calcium and phosphorus, also supplied toxic levels of fluorine. It is interesting that these studies were made possible by a grant from the Ruhm Phosphate and Chemical Company of Mt. Pleasant, Tennessee, which was promoting the use of rock phosphate for animal feeding. These studies showed that rock phosphate was highly unsatisfactory as a mineral supplement because of the harmful effects of the fluorine present. As a result of these studies improvements were made in the production of rock phosphate so that a large portion of the fluorine was eliminated. Thus the original findings which appeared detrimental to the industry were used to develop procedures which were later of real benefit to the entire industry.

Professor Hart had the ability to convince industry that the facts must be obtained and their procedures modified to fit the facts.

Later when the use of fluorine in drinking water was suggested as a means of controlling dental caries, Professor Hart was frequently called upon as an advisor and consultant in this program. As late as January, 1952 he testified before the House Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics (82nd Congress) on the possible deleterious effects of fluorine. His advice at this time was typical, namely, that more extensive studies should be carried out before far-reaching conclusions could be made. Perhaps he was overly cautious in opposing the rapid application of this procedure but his opposition was based on sound knowledge of the dangers inherent in such a program. In fact the very day before his death he was called upon for advice regarding the addition of fluorine to the drinking water in the city of Milwaukee.

He was frequently called upon for advice, but his response was always the same—secure the needed facts through research. In fact it was a question of this kind which led him to demonstrate that urea could be used as a source of nitrogen in ruminants. An industrial concern came to him with experimental data that had been reported in Germany indicating that simple forms of nitrogen might be used as a replacement for part of the protein in the diet. He searched the literature and found that every bit of evidence indicated that this was not true. However, he was not satisfied with the available facts and went to the dairy barns to get a few cows in order to set up an experiment on urea. He soon demonstrated that under proper conditions, urea can be used by ruminants and as a result of these studies urea is used in a practical way today. After this discovery he willingly gave his time to answer problems arising as a result of adding urea to animal feeds, whether the inquiry came from an industrial company manufacturing urea or from individual farmers who might have difficulties.

Professor Hart's interest in minerals and their relation to nutrition also led him into the field of food technology. In the manufacture of condensed milk, the sterilization process involves heating the milk at a fairly high temperature for a considerable length of time. During this sterilization process

the milk often coagulates and even if the coagulum is broken up by shaking, the product is not accepted by the consuming public. Hart, together with Dr. H. H. Sommer, showed that the main factor in the heat coagulation of milk is dependent upon the composition of milk salts. They showed that this difficulty could be remedied on a commercial scale by the addition of the proper amount of sodium citrate or disodium phosphate. This observation eliminated the difficulty of coagulation and the industry still uses this procedure.

Although Hart worked in the vitamin field most of his life his achievements present a peculiar anomaly. It is doubtful that we can associate Hart's name with the discovery of a specific vitamin or the isolation of a new vitamin. In this respect his experiences paralleled those of Sir Jack Drummond who though active in the vitamin field for more than a quarter of a century has no vitamin linked to his name. Such are the unpredictable rewards of fickle fortune. However, he had a hand in studies on every one of the known vitamins. It is told that he was instrumental in helping Dr. McCollum differentiate vitamin A from vitamin B, because he felt that McCollum was spending too much money for the purchase of the sugar—lactose. In the early studies McCollum used as part of the ration for his experimental animals the milk sugar lactose, but it was rather expensive and Professor Hart suggested that he use a cheaper form of carbohydrate. When this was done the ration was not only deficient in vitamin A, but also deficient in the water soluble vitamin complex. The reason for this was the fact that lactose as manufactured in those early days carried with it considerable quantities of B vitamins which were present in the original milk. Hart was associated with Steenbock and others in studies on the chemical properties of the antiscorbutic vitamin or vitamin C. He was associated with Steenbock in the early work on vitamin A and especially on the antirachitic vitamin which Dr. Steenbock later showed could be produced by exposure of foods to ultraviolet light. His interest in vitamin D was stimulated largely by the difficulty which poultry raisers were encountering in attempting to produce chicks for broilers through indoor feed-

ing. When they were reared indoors the chicks did not grow and their legs became deformed. The condition was known as leg weakness. This deficiency was shown to be due to a lack of Vitamin D and as a result of this work the broiler industry was saved.

He was associated with many of the studies dealing with the B vitamins. In many cases other members of his staff took the initiative in these studies, but he was genuinely interested in the progress of each study. Nothing thrilled him more than to see a new fact thoroughly established and he was pleased when a member of his staff made these new and fundamental discoveries. Frequently he was critical of new techniques, especially if they required elaborate equipment, but as soon as he saw results from these new techniques he was as enthusiastic over the new procedure as any one else. He was always helpful to the many students who frequently came to him for advice. Often he went to the literature to find helpful hints for investigators regardless of whether they were working directly with him or with some of his colleagues. A total of 46 students received their Ph.D. degrees under Professor Hart, but he was helpful to at least three times this number of students. The following acknowledgment in a Ph.D. thesis presented shortly after Hart's death is typical of the high regard which all the students had for him. "His very presence in the laboratory and the inspiration of his personality, no less than the positive encouragement he was ever ready to supply, have been the writer's most richly rewarding experience of the years during which the work reported here was in progress." He recognized the importance of cooperation in research work and he not only carried out this cooperation personally but encouraged other members of his staff to do likewise.

Professor Hart's pleasing voice and affable manner made him an effective public speaker both to scientific and lay audiences. He was frequently called upon to give public addresses but he turned down a very large percentage of the invitations. He realized that he could not give a good lecture without proper preparation and he never failed to take the

necessary time for such preparation. Whenever he did accept a speaking engagement he would immediately proceed to work on his manuscript. Often he would have his paper ready months before the time of delivery.

He had great personal charm and a keen sense of humor which made him a delightful companion. He belonged to a dinner club in Madison for many years; he always presented his latest research findings to this group but he was equally interested in reports made by other members of the club. He had the ability to present the most difficult results in simple and understandable words. He tried to instill this ability in his students and was often critical when students handed him reports which were poorly prepared.

He was a member of the American Society of Biological Chemists and a charter member of the American Institute of Nutrition. He also held membership in the American Association for the Advancement of Science, the American Chemical Society, the Society for Animal Production, and the American Dairy Association. He was a member of Alpha Chi Sigma, Alpha Zeta, Phi Lambda Upsilon, Sigma Xi, Phi Kappa Phi and an honorary member of Phi Beta Kappa.

He received several professional awards and honors, among which were the Borden award from the American Dairy Association in 1941 and the honorary degree of Doctor of Science from the University of Wisconsin in 1949. He was elected to the National Academy of Sciences in 1944, an honor which he highly treasured but unfortunately he never attended a meeting of the Academy. He did not enjoy meetings and when he did go to the national meetings one or two baseball games were usually included in the itinerary. His failure to attend scientific meetings was unfortunate because he had much to contribute and many would have liked to become better acquainted with him.

On May 15, 1931 the members of his department gave a dinner in his honor and presented him with bound volumes of his papers. This was given in commemoration of his 25 years of service as leader in research and as chairman of the Department of Agricultural Chemistry. At the time of his

official retirement in 1945 his friends and colleagues gave him another dinner which was attended by several hundred people. At this time a portrait painted by Mr. C. W. Thwaites was unveiled and has been hung in the library of the Department of Biochemistry.

It took persuasion by several members of his department before he agreed to a dinner in his honor. However, he thoroughly enjoyed the experience and his comments at the end of the program were the highlight of the evening. His final words included the following: "Science and research thus breathe the very air of freedom and offer in a day of peril and confusion, a mighty reinforcement to the free spirit of man. By bitter trial we have learned at last that this free spirit is no natural gift but must be nourished and defended or it will be lost."

While Professor Hart did not like honors or special recognition it is interesting that he went out of his way to pay special tribute to Dr. Babcock, who preceded him. A few years ago when the Babcock award was given by the food technologists in Chicago he had agreed to talk on the life of Dr. Babcock. A few weeks before the scheduled program he was stricken with a very severe case of arthritis. In spite of this great physical handicap he was determined to proceed to Chicago to give his paper. It was only after much persuasion that he agreed to have someone else present the paper which he had written.

At this point it is interesting to relate the final outcome of this attack of arthritis. It was in May, 1950, that Hart began to suffer from sciatica. He consulted orthopedic surgeons, physical therapists and many others, but there was no improvement during a period of three months. X-rays indicated the presence of lime deposits in the lower lumbar region as the cause of the severe pain. Hart, therefore, went back to his early experiments with animals and wondered if it would be possible to remove the calcium deposits by producing an acidosis. In other words he made himself an experimental guinea pig. Instead of using hydrochloric acid, he decided to

use ammonium chloride because a larger quantity of chlorine could be ingested through the use of this compound. He took four grams of the ammonium chloride daily, two after the morning meal and two after the evening meal. He followed this treatment for three weeks and at the end of this period he found that the pain had left, he could walk normally and there was no reoccurrence of the trouble. He realized that his own case was complicated by the use of diathermy and massage during the period that he took ammonium chloride. However his improvement was much greater during the period of ammonium chloride treatment than at any other stage. This stimulated his interest in the entire field of arthritis and during the last few years he gave much of his time to study and research on this problem. Many of his friends and total strangers wrote to him for the procedure which he used. Several individuals who tried his treatment encountered distinct improvement while others, of course, failed to find much relief.

When students returned to the Wisconsin campus, they went directly to Professor Hart's office for a visit. He was anxious to see every one of them and ask after their progress, and often gave them helpful advice that they could use when they went back to their own laboratories. After his retirement he had even more time to give to visitors whether they were his students or distinguished scientists from other parts of the world. During his active career he was more abrupt and often would tell the student or visitor that he had no more time to give at present but that they could come back at some later time. This was especially true if you came to his office shortly before a scheduled lecture. When you sat in his lecture it would appear that he was so thoroughly familiar with his subject that he needed no notes or no frequent consultation of the literature. However, he rarely gave a lecture without reviewing his notes and developing the proper mood for a stimulating talk.

He was an outstanding teacher. As a lecturer he was pleasing, clear, and stimulating. He was a skillful and search-

ing quiz master, immediately detecting superficial knowledge and impatient of it. In addition to the course in dairy chemistry mentioned earlier, he gave the general or elementary course in agricultural chemistry, later biochemistry. In this course he had sophomores, juniors, seniors, and often graduate students. His questions would be tempered to the level of training of the student. Nothing would please him more than to find a graduate student in his elementary course who could not answer a simple question readily answered by a sophomore. His evaluation of a student was based largely on personal contact with the student. He usually went through the formal action of giving examinations but often he would use the same questions year after year. He would diligently read the examination papers but often the grades would not necessarily depend upon the results of the examination.

Usually he had another member of the staff in charge of the laboratory part of his course but he visited the laboratory section daily. In fact, he often visited the laboratory sections in courses with which he had no connection. For many years Professor W. H. Peterson gave the other elementary course in the department which was given largely for home economics girls. Hart would delight in visiting the laboratory in this course and asking the girls what they were doing. Usually he received intelligent answers but one day one of the girls turned to him and said "I don't have to answer questions asked by the janitor." The reason for this reaction was undoubtedly due to the fact that he seldom wore a laboratory jacket in the laboratory but would generally take his coat off and use a small piece of toweling or cheese cloth as an apron. This apron was not changed too frequently and often he did look like a janitor. No one enjoyed this reply more than Professor Hart and he frequently told the story on himself. When a younger member of the staff took over his elementary course Professor Hart agreed, after many requests, to give an advanced course in nutrition. Students from all over the campus took this course and the discussions included many areas outside the field of nutrition. He would completely lose

himself during the discussions and often the class would not be dismissed until 30 or 45 minutes after the scheduled time for the class to close. In addition to his formal teaching he also conducted a general seminar which was equally stimulating to everyone who sat in it.

In addition to his research and teaching he was a successful administrator. He took over as chairman of the department when he arrived in 1906 and continued until 1944. In the early days his department was small, for many years not more than 4 members, there were no staff meetings and usually he made the necessary decisions with little consultation with the staff. However, as the department grew larger he reluctantly accepted the procedure of having staff meetings although they were held as infrequently as possible and usually they were dismissed as rapidly as possible. He recognized that administrative procedure was necessary but that it took time from both teaching and research. He rebelled against unnecessary reports but agreed to do those which were absolutely necessary and prepared them in concise form and always had them ready on time. He was impatient when special problems and issues arose and he would try to settle them as rapidly as possible. In doing so he would often act without making the necessary inquiries and he would not hesitate to make arbitrary decisions which might be distasteful to his colleagues. When he first gave the elementary course in agricultural chemistry he included material dealing with soils and bacteriology. When the professors giving related courses questioned the wisdom of this he immediately replied that he was teaching agricultural chemistry and it was none of their business what he included in the course.

During his early years at Wisconsin and shortly after Dr. McCollum came to the department from Yale University, Dr. L. B. Mendel expressed some annoyance over the fact that the nutritional studies at Wisconsin were being conducted along somewhat similar lines to those being carried on at Yale. Hart took little time in answering this criticism in direct fashion and pointed out that there was no economic waste for

two laboratories to engage in similar lines of work since thereby the viewpoints are widened and the conclusions strengthened. While these curt answers often irritated his colleagues, those who knew him well realized that these rapid actions were made so that he would have more freedom for research work.

As an administrator he worked hard to keep his staff intact. There were few losses of personnel from his department over the 38 years that he served as its head. He expected much from his associates but he never attempted to direct their work or to indicate what problems they should study. He was anxious to cooperate with workers in other departments and encouraged his staff to do the same. In fact, it was his successful cooperation with the workers in many departments that has done much to break down the departmental barriers at the University of Wisconsin.

Professor Hart served on relatively few University committees although he was an efficient committee member and worked very hard on the appointments which he accepted. One of his most enjoyable and fruitful activities was his service on the Research Committee of the Graduate School. This committee was organized in 1919 to help stimulate research in the University and later this committee served to make grants to faculty members for research. He was an original member of this committee and served on the committee for a period of 19 years. He was greatly disappointed when President Glenn Frank came to the University of Wisconsin and failed to appoint him to this committee. However, he was reappointed in later years and during the year 1944-45 he served as its chairman. He maintained high standards in research and was not afraid to tell his colleagues that projects which they submitted did not appear to be of the quality necessary for support from the Research Committee. However, he was equally enthusiastic about good projects and would go out of his way to compliment faculty members or students who had shown real progress in their work. Some of the money dispensed by the Research Committee became

available through the Wisconsin Alumni Research Foundation. This was established to develop the discovery made by Dr. Steenbock that ultraviolet light would produce vitamin D. Professor Hart believed that income from research findings should if possible be used to support further research. He turned several of his discoveries over to the Wisconsin Alumni Research Foundation for development and he was enthusiastic about using the income from these findings for further support of research.

In 1903 Professor Hart married Annie Virginia DeMille. For many years the Harts together with their one daughter, Margaret, lived within two blocks of the laboratory. This location was very convenient since he visited the laboratory on Sundays as well as on week days. The family did not take part in many social activities but it was a privilege to visit in their home and to be included in their small dinner parties. For many summers the Hart family proceeded to the tip of Door County in Wisconsin where they had a cottage on Green Bay just outside the village of Ellison Bay. There were few conveniences in the cottage and during the summer they lived a primitive life. Professor Hart enjoyed sailing on the bay and swimming, as well as playing tennis on the court adjacent to his cabin. Mrs. Hart died June 28, 1936, but Margaret, together with her husband, Professor Russell Larson, lived with him in the family home. During the more recent years he and his daughter and son-in-law enjoyed Christmas trips to Mexico, Central America, South America and Hawaii. He was fond of sports both as a spectator and as a participator. He skated and played tennis even in the later years of life, but made his sports recreation and not work.

On March 11, 1953 Professor Hart came to the laboratory as usual. Although he had been officially retired for almost 8 years he visited the laboratory daily and continued his interest in all activities in the department. He left the laboratory about 4 o'clock in the afternoon and spent an unusually pleasant evening with his family at home. During the night he was stricken with a coronary attack and died on March 12, 1953.

If one were to write a complete story of Professor Hart's life it would involve writing a complete history of nutrition during the first 50 years of this century. However, much of his work can be traced in the publications listed in the bibliography which follows. His life was exceptionally rich in outstanding achievements and great leadership and in kindly inspiration to those who had the good fortune of knowing him.

KEY TO ABBREVIATIONS USED IN BIBLIOGRAPHY

Amer. Chem. Jour. = American Chemical Journal
Amer. Jour. Physiol. = American Journal of Physiology
Amer. Jour. Pub. Health = American Journal of Public Health
Ann. Rev. Biochem. = Annual Review of Biochemistry
Arch. Biochem. = Archives of Biochemistry
Biochem. Jour. = Biochemical Journal
Jour. Agr. Res. = Journal of Agricultural Research
Jour. Amer. Chem. Soc. = Journal of the American Chemical Society
Jour. Amer. Diet. Assoc. = Journal of the American Dietetic Association
Jour. Amer. Vet. Med. Assoc. = Journal of the American Veterinary Medical Association
Jour. Assoc. Off. Agri. Chem. = Journal of the Association of Official Agricultural Chemists
Jour. Biol. Chem. = Journal of Biological Chemistry
Jour. Dairy Sci. = Journal of Dairy Science
Jour. Exp. Med. = Journal of Experimental Medicine
Jour. Nutr. = Journal of Nutrition
Jour. Ped. = Journal of Pediatrics
N. Y. Agri. Exp. Sta. Bull. = New York Agricultural Experiment Station Bulletin
Poultry Sci. = Poultry Science
Proc. Amer. Soc. Animal Prod. = Proceedings of the American Society of Animal Production
Proc. Soc. Exp. Biol. Med. = Proceedings of the Society for Experimental Biology and Medicine
Soil Sci. = Soil Science
U.S. Dept. Agri. Bur. An. Ind. Bull. = United States Department of Agriculture, Bureau of Animal Industry Bulletin
Univ. Wis. Agri. Exp. Sta. Res. Bull. = The University of Wisconsin Agricultural Experiment Station Research Bulletin
Univ. Wis. Agri. Exp. Sta. Cir. Inform. = The University of Wisconsin Agricultural Experiment Station Circular of Information
Wis. Agri. Exp. Sta. Bull. = Wisconsin Agricultural Experiment Station Bulletin
Zeit. f. physiol. Chem. = Zeitschrift für physiologische Chemie

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