

## MYER E. JAFFA: PIONEERING CHEMIST IN THE FOOD AND NUTRITION SCIENCES

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### Introduction

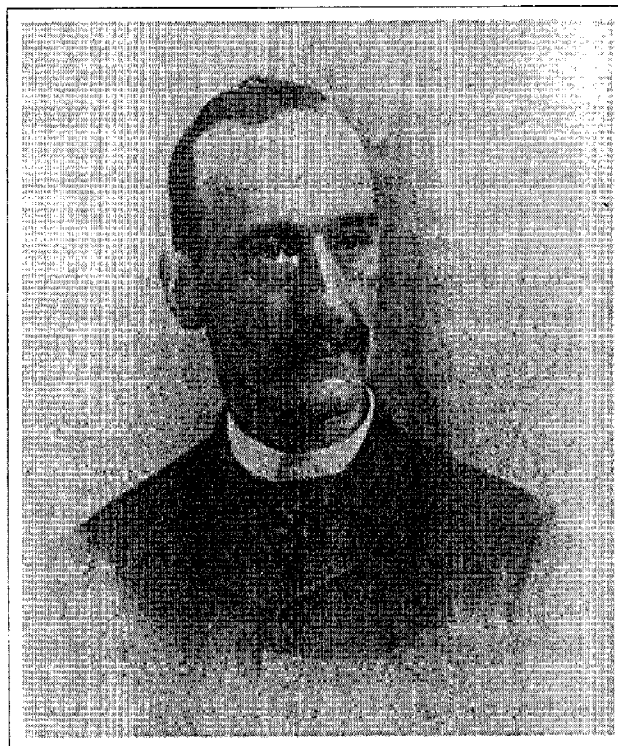
During the 19th century, many Americans whose professional training had been in chemistry pioneered the development of new disciplines, including those related to agriculture and health such as nutrition and food science. Notable examples were Wilbur O. Atwater, Professor of Chemistry at Wesleyan University and the first director of the Office of Experiment Stations in the U.S. Department of Agriculture, and Harvey Wiley, Professor at Purdue University and later head of chemistry at the U.S. Department of Agriculture (USDA). Under the organizational guidance of Atwater, chemists employed in state agricultural experiment stations undertook analyses of foods and studies of food intake and digestion in the first nationally coordinated program of human nutritional studies. Under the leadership and encouragement of Wiley and the guidance of the Association of Official Agricultural Chemists, the state experiment station chemists also undertook analyses of adulterants in foods. Collectively, the work of these chemists led to the first systematic tables of food composition data as well as to the guidelines that were used in the enforcement of the first federal pure food and drug legislation passed in 1906.

The career of a California chemist, Myer Edward Jaffa (1857-1931), illustrates some ways in which chemists contributed to the development of food and nutrition sciences. Jaffa, a long-time member of the University of California faculty and the agricultural experiment station staff, was the first in the United States to hold the title "Professor of Nutrition(1)." He was also the

first director of the State of California's Food and Drug Laboratory.

### Early History

In 1866, at the age of 9, Jaffa was brought by his parents to San Francisco from Sydney, Australia. The family, including a brother and two sisters, arrived at a time



Myer E. Jaffa, courtesy Bancroft Library

when San Francisco was a bustling seaport that had grown rapidly during the gold rush days of the previous two decades. The University of California, however, was not formed until two years after the Jaffa family arrived. By the time Jaffa was 16, he was able to enter the university as a member of the first class to take instruction at the present Berkeley location. He majored in the Mining Department, which had a curriculum rich in chemistry, and in 1877 was granted the Ph.B. degree, writing his senior paper on "The Analysis of Auriferous Pyrites in the Grass Valley Region."

In 1879 Jaffa obtained employment on the Berkeley campus as an analytical chemist in the agricultural experiment station. For two years he worked on the study of soils in California, as a part of the 1880 Census and Transcontinental Survey, and then was given responsibilities in the Viticulture Laboratory, a legislatively funded and important program in the early years of the California station. Under the direction of the well-known soil scientist, E. W. Hilgard (1833-1916), the station took on increased responsibilities for providing technical information to the state's farmers, and Jaffa was put in charge of the agricultural chemistry laboratory. There he analyzed crops as well as the soils on which they were grown, publishing a well-received bulletin on cattle foods (2). His first analysis of human foods was to settle a dispute among producers as to whether brown-shelled eggs were more nutritious than white ones. He could find no difference (3). In 1896 he received an M.S. degree from Berkeley for a thesis entitled "Investigations of Food Materials, Animal and Human," and published the California Agricultural Experiment Station Bulletin 110, "The Study of Human Foods and Practical Dietetics" (4).

### Nutrition Investigations

In 1895 Jaffa married Adele R. Solomons, a San Francisco physician. In the following year he became a father and at the university was given the title of assistant professor of agriculture. In that year, also, he joined the USDA's national nutrition study under the direction of Atwater. Not surprisingly, one of his first studies was a 10-month record and analysis of the food intake of his own infant son begun in July 1896. He also made a 17-day food intake study of the university football team as they undertook training for the 1896 season. In December, he recorded and measured the composition of the overall food consumption of the seven adults in his own household for three weeks. The following year he conducted a second study with his son as a subject and a

digestion study and two food intake studies with his second-born, a daughter. The nutrition investigations conducted from 1896-98 were published along with the extensive food composition analyses as a single bulletin from the USDA (5). Jaffa's son, at age 4-7 months, averaged an intake of 643 Calories, and by the end of the study his intake was 785 Calories and 23 g protein per day. These values are below the current norms, but during the 10-month study, his food intake was said to have been adversely affected by the family's relocation from San Francisco to Berkeley, which entailed a change in the source of milk, and by his teething.

From his records, Jaffa calculated a 4,185 per man (or 3,700 per head) Calorie intake for the adult individuals in his household. This was larger than expected and was equivalent to the standard of Atwater and others for "men at hard muscular work." Even though the chemist's household members were classed as sedentary workers, the amount of physical activity they had during a normal day, including walking to and from work and manual household chores, was considerably more than is typical of a sedentary worker today. However, this still does not seem to explain fully the high values recorded. His own explanation was that the family "having recently moved to Berkeley they were all stimulated by the change, and craved and ate larger quantities of meat than they had done before, or have done since. The large quantity of fat in the dietary (195 g/head/day) was supplied in part by the meat, and in part by the unusual quantity of pancakes and fritters used, these being fried in butter or fat (6)." At that time there was, of course, no knowledge of a relation between heart disease, cholesterol, and dietary fat.

The intake of the California football team as estimated by the disappearance of food from their training table was over 7700 Calories per head per day. Jaffa suggested that this very large value was due to their being in the early and active part of their training period and still "building up" their muscles, and indulging in the novelty of unlimited free eating. It may also have been that more people than just the football team were taking food from the training table. In any case, all the intakes that Jaffa estimated for adult subjects in his early studies were excessive by today's standards.

The Bay Area was unique in having a considerable Chinese community. Its members were regarded as being capable of hard work under adverse conditions, even though they were, it was thought, living on little but rice. This was an apparent paradox since at that time it was the orthodox view that people who did physical work needed a great deal of protein (and that generally meant

large amounts of meat), if they were to maintain their strength. Jaffa was the first to make a quantitative investigation of their diets (7). His most extensive study was carried out for 18 days with a group of 12 Chinese men working on a truck farm (or "vegetable garden") in Berkeley. They performed severe outdoor work from 6 AM to 7 PM, with a one-hour break for dinner. They lived in a bunk house on the farm and their meals were supplied by the manager. People familiar with life in China told Jaffa that these men's diet was very close to that of their home country. It was true that rice formed a very large part of the diet with the men using 1 lb 13 ounces of rice (weighed before cooking) per head per day, and this alone provided nearly 3,000 Calories. However, they also obtained another 1,100 Calories from animal products (mostly pork and fish) and ate a variety of vegetables, especially cabbage and radishes. Their total protein intake was 145 g per day. They therefore just met the high protein standard of the day for men at active work, which is almost double the present standard. Their diet included no milk, butter, eggs or sugar. It was a low-fat diet, with 21% of the energy coming from fat, as contrasted to the current national average intake of about 40%.

Another unusual group in California, this time of Caucasians, were fruitarians - that is to say vegetarians who also did not believe in eating any kind of cooked food and restricted themselves to fruits, nuts, and a small amount of cereals. Such diets were of double interest to Jaffa; first because they went against the orthodox belief in the special value of meat; second because of the special importance of fruits and nuts in California farm production, any indications of their nutritional value might help to upgrade these products in consumers' minds from being just afterthoughts to a real meal. The vitamins and their contribution from fruit were, of course, still to be discovered. Among fruitarians Jaffa studied the diets of two men in their 60's, two women in their 30's, and three children aged 6, 9, and 13 (8). They all had surprisingly low calculated protein and energy intakes about one half the standards of the day. A large proportion of their Calories came from the fat in the almonds and other nuts in their diet. Jaffa was clearly most surprised by the results but wrote of one group, "We hesitate to pronounce judgment. The adults have lived like this for 7 years, and the children, though below average in height and weight, have the appearance of health and strength, and run and jump and play all day... and were said to be unusually free from colds and other complaints common to childhood (9)."

Jaffa must have wondered whether one needed time to adapt to a fruitarian diet, because he asked an athletic

student volunteer to try its effect. For a week the student ate his usual diet, in which 40% of the Calories came from animal products. For a second week he made a partial change, and then for a final 8 days went all the way, eating mostly nuts (particularly walnuts), oranges, bananas, and dried fruits. In this period he consumed nearly 3,000 Calories per day, and felt fully able to continue all his usual term-time activities (10).

After Atwater's disabling stroke in 1904, federal support of dietary studies lapsed. In the 1904 report of the California Agricultural Experiment Station we read that (11):

Professor Jaffa's nutrition investigations have received high commendations both at home and abroad.... His continued participation in this work will greatly redound to the credit of the University; but it is much regretted that the means and appliances for this purpose are very inadequate.... lack of room has compelled Professor Jaffa to locate his operations. . . apart from the main laboratory, in the old boiler-house, . . . and in a corner of the attic provisionally partitioned off and lighted by a small skylight. [where] he is at least enabled to work undisturbed.

In July 1906, Jaffa was named Assistant Professor of Nutrition, and in 1907 Professor of Nutrition.

### Pure Food and Drug Laboratory

In 1907 Jaffa was made founding director of the State Food and Drug Laboratory, which was housed on campus, and his \$4,000 salary was divided equally between the State Board of Health and the University. State law charged the laboratory with preventing the manufacture, sale, or transportation of adulterated, mislabeled or misbranded foods, liquors, and drugs. In the first seven months of the laboratory's operation, it received 1400 samples of foods and food materials for analyses; laboratory chemists actually analyzed 989 of these. For most foods, the major problems were in misbranding (misleading as to product origin) or mislabeling (failure to note additives on the label). Some products labeled as olive oil contained a portion of cotton seed oil. For meat products, preservatives such as boric acid were frequently found and, under the law, were considered adulterants. In the case of confectioneries and spices, analyses revealed a variety of adulterants, such as charcoal added to black pepper or talc to candy. Only 57 % of all samples met the requirements of the law (12).

In the second and third years the analytical activity remained high. While there was some decrease in the amount of adulteration, mislabeling increased and the percentage of samples meeting the state requirements

did not change. By the year ending in 1912, however, more than two-thirds of the samples fully complied with the law, and less than 5% were adulterated, a situation that Jaffa described as "certainly very encouraging and indicates that beneficial results are being obtained (13)."

During this period of time, Jaffa concluded each of his reports with a plea for more funds, more personnel, and better quarters for the work. He also emphasized the need for additional work on nutrition. In his report for 1910-12 he commented: "It does not appear that a laboratory operated under the auspices of the State Board of Health, and located in the Department of Nutrition of the University, is doing its best work if original investigations in nutrition are not being conducted (14)."

In July 1915 one of Jaffa's colleagues, E. J. Lea, took over the directorship of the laboratory and Jaffa became a "consulting nutrition expert" to the laboratory, now renamed the Bureau of Foods and Drugs. In this role he provided education and information and investigated food problems in state-owned hospitals and asylums. He made two or more trips to each institution to study dietary and food conditions and make recommendations for change. He was encouraged by the cooperative attitude of those who were responsible for feeding individuals in these institutions and urged that this advisory role be maintained to provide an incentive to the institutions to continue to make progress toward routinely providing high quality diets.

Jaffa resumed the directorship of the Bureau of Foods and Drugs in 1924 and in the first biennial report during this period the secretary of the State Board of Health noted that the bureau had turned its attention from food as sold in the marketplace to "the improvement of food supplies at their sources." The bureau also had additional responsibilities for monitoring feeds under the California Feeding Stuffs Act (15). In the report for 1928, Jaffa placed emphasis on the condition of the hamburger samples tested. Ninety-four percent "were found to be in violation of the law, in that there was added to the meats a forbidden preservative—some compound of sulphurous acid" (16). In the two years ending in July 1930, the bureau's inspectors "destroyed or condemned as undesirable for human consumption" over 1.6 million pounds of food, most of which was walnut meats. They also destroyed "181,500 assorted labels and 8,000 booklets which contained misleading or false statements concerning the respective food product." In that period they analyzed over 5,000 samples and found 17% in violation of the law (17).

In June, 1931, upon Jaffa's death, the chief of the Bacteriological Laboratory took over the Bureau of Food

and Drugs and, later, these two laboratories were merged. The value of chemistry in improving the quality of the food supply was noted by the new director in his 1932 report (18):

These methods are founded on the development within the last thirty years of laboratory technique which is competent to disclose the fitness for human consumption of many finished products, also their quality and pertinent information concerning the circumstances of their production. Knowledge of the existence of such laboratory facilities in the hands of the enforcement organization furnishes an incentive for production and distribution within the requirements of the law which is quite as effective in most instances as a complete system of personal inspection

### Jaffa as Educator

As an assistant professor, Jaffa taught courses in human and animal nutrition, adulteration of human and animal foods, and the detection of adulterants, and was responsible for supervision of graduate research in agricultural chemistry. In 1908, as professor of nutrition, he also lectured specifically on dairy chemistry, poultry husbandry, and the marketing of poultry products.

The surviving outline of a lecture that Jaffa gave to an undergraduate general science class provides evidence of the way in which he was able to gain the interests of the audience, convey some basic scientific principles, and draw practical conclusions that could be used by the listeners in their everyday lives (19). He focused his lecture on the respiration calorimeter, the leading-edge technology in nutrition science of the time. The students must have been intrigued by the idea of a human subject living in an enclosed chamber and carrying out various activities so that the caloric output of that subject could be measured with amazing accuracy. An important question of the time was whether the Law of the Conservation of Energy held for the human body, and experiments in the calorimeter showed that it did. Jaffa discussed the composition of food and the evidence that protein, fat, carbohydrate, and minerals, the known nutrients, each played a special role in the body. Finally, he described how results obtained with the respiration calorimeter would allow nutrition scientists to describe more precisely how much of each of the nutrients was required for various activities and physicians to prescribe for the dietary needs of their patients.

By 1910 the University of California was responding to local and national demands for domestic science

or home economics curricula for women students. At the same time the USDA was helping to promulgate national guidelines that would ensure a satisfactory science basis for these curricula. Jaffa took responsibility for communication between the university curriculum committee, of which he was a member, and the Department of Agriculture to assure that the university curriculum met the highest standards. For this curriculum he taught courses in pure food laws, food and household chemistry, human and animal nutrition, composition of human foods, and dietary standards.

In 1915, Agnes Faye Morgan (1884-1968) joined the faculty and began her outstanding career as the developer of home economics and nutritional sciences at Berkeley. Applied dietetics and infant nutrition courses were added to the curriculum. Within a year, however, the household science program was moved from agriculture to another college; but Jaffa continued to be heavily involved in instruction until 1924, when he took leave to direct once again the state's food and drug laboratory on a full-time basis. The following year he retired from the university, holding the record for the longest period of service among the faculty at that time.

### Nutrition Education for the Public

In addition to university teaching, Jaffa was interested in the education of the lay public or consumers so that they would make healthful food choices. In the first human nutrition bulletin written by Jaffa for the agricultural experiment station, he provided extensive information about the composition of human foods, especially California foods, and gave advice about the application of scientific principles to diet (20). He lectured widely to a variety of lay audiences about the application of science, especially chemistry, to the practical problems of choosing an economical, nutritious and safe diet. His topics ranged from the value of basic foods such as milk, to the value of foods important to California's agriculture such as fruits, and the nature of the newly discovered vitamins.

Jaffa's views of the importance of education for consumers were stated in his report for the work of the state laboratory from 1910-1912 (21):

The Director of the laboratory has delivered a large number of lectures during the past two years before women's clubs, schools, farmers' institutes, etc. The purpose of these talks is to indicate to the consumers the fact that there are certain responsibilities which they must assume if they expect to receive the greatest benefit from the [pure food] law. The State is doing a great deal toward safeguarding the food of

the people, but it can not accomplish all, and in order that the best results be obtained it is necessary that there should be earnest activity and intelligent cooperation between those who purchase food and those engaged in the enforcement of the law.

### Personal Characteristics

In carrying out his work, Jaffa encountered adversities that sometimes resulted in major set-backs. In 1897, when he was in the midst of the work for the national nutrition study, a fire destroyed most of the station's building and a large portion of their records was burned. In 1906, as he was beginning work with a bomb calorimeter to improve his measurements of the energy value of foods, the San Francisco earthquake and subsequent fire eliminated his source of compressed oxygen for the calorimeter and the studies had to be postponed. The final, and perhaps most distressful, event was the complete destruction of his home by the devastating Berkeley fire in September, 1923.

Upon Jaffa's retirement a former student wrote (22):

(Jaffa) has a remarkable way of seeing the bright side of life. During the fire in the fall of 1923, which wiped out in a few hours many blocks of Berkeley's fine homes, Professor Jaffa lost his home and all but a few of his personal effects. His home was the last of eleven hundred to burn. I came upon him in his office in the evening after the fire and found him nervously playing with a pencil. He looked more tired than usual, but otherwise appeared just the same as ever. He said "It feels mighty queer not to have any place to go home to tonight—well, anyway Mrs. Jaffa won't have to climb the hill anymore."

Jaffa and his wife were Jewish, so that he was part of a small minority in the university at that time. It is not evident that this affected his career, however, as he played leadership roles in at least two organizations. One was the faculty club at UC-Berkeley, where he was a founder and a director for many years. The other was the Association of Official Agricultural Chemists. Jaffa hosted this group for a national meeting in San Francisco and a tour of parts of California in 1899. In 1904 he served as national president of the Association, but was prevented from attending the annual meeting that year by "severe family illness (23)."

As a physician, Jaffa's wife must have been understanding and helpful with the studies of their infants' food intake. She also lectured in the university for a period on infant nutrition, worked in the university's Institute for Child Welfare and, after her husband's death,

reissued some of his recommendations for healthy, economical diets (24).

### In Retrospect

Jaffa's career was characterized by several "firsts" as the first US faculty member to hold the title "Professor of Nutrition," and the first director of California's Food and Drug Laboratory. Trained at the university as a mining chemist, Jaffa successfully applied his knowledge of analytical techniques to problems of soil composition, as well as food and feeds composition and adulteration. Moreover, he applied chemistry to studies of energy and protein intake by animals and human and to food composition and safety.

August Glaive, one of Jaffa's proteges and later director of the California Food and Drug Laboratory, wrote of his mentor (25):

Dr. Jaffa was one of the pioneers in the field, a patient researcher, ...also a teacher par excellence, a great chemist, a humanitarian with an exceptional understanding of human nature as well as a keen sense of responsibility for the well-being of his community.

As early as 1911, there was a published tribute headed: "The Man Behind the Food Law." In part it said (26):

While many men play some part in the enforcement of the pure food laws, it is practically certain, wherever these laws are being operated actively and to the satisfaction of both consumer and producer, that one will find a good chemist behind the law. Food and drug analysis ranks among the most difficult and technical of the divisions of chemistry...It is a tribute to the accuracy of work done by Professor M. E. Jaffa, director of the Food and Drug Laboratory, and his competent staff, that in none of these cases [found in violation of the law] have the chemical findings been questioned in court.

Upon Jaffa's death, after a very brief illness in 1931, A. F. Morgan, his successor at the university wrote (27):

He was appreciated by state officials, food manufacturers and distributors as honest, courageous and just, qualities indispensable in the important position which he occupied. The state of California has benefited in many ways from this man's services.

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# AMERICAN CHEMICAL SOCIETY

## Coming Events

### NATIONAL MEETINGS, 1998

March 29 – April 2  
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August 23 - 27  
BOSTON

### 15<sup>th</sup> BICENTENNIAL CONFERENCE ON CHEMICAL EDUCATION

August 9 – 13, 1998  
WATERLOO, ONTARIO  
Symposium: "History of Chemistry: Our Scientific Heritage"  
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