ANDRÉ MAYER
(1875–1956)
André Mayer

— A Biographical Sketch

(1875 – 1956)

André Mayer was born in Paris on November 9, 1875. His father, Myrtil, was a remarkable man. The son of a Vosges mountain woodcutter, he had been sent away by his father at the age of 12 with a silver five-franc piece to seek his fortune in the Alsatian Valley lest he, too, end up an illiterate lumberjack if he stayed in the hills. A resourceful boy, he decided not to become an apprentice but instead used his small capital to start in business buying and selling feathers for eiderdowns and pillows, while educating himself through books he bought or borrowed. Already prosperous at the age of twenty he switched to the textile industry, setting himself up as a draper. A gifted inventor, he successfully experimented with more and more complex machinery which could bind feathers to cloth to make “fur.” The feather boa, so popular in the second half of the nineteenth century, was his brainchild. He moved to Sedan, then to Paris, and married a young lady from a well-established family in Lille. He became active in liberal causes (he was one of the heads of the Masons, the main organized opposition to Napoléon III) and in social reform (he pioneered in medico-social services and better employment conditions). He founded a number of hospitals, clinics, and sanatoriums the largest of which, situated in the Vosges, bears his name.

André, an only child, was a brilliant student in the sciences as well as in the classics. He entered medical school at the age of 16 and toward the end of his medical studies started concurrently a science degree at the Sorbonne in the laboratory of Albert Dastre, Claude Bernard’s favorite student. Dastre’s laboratory was an extraordinarily live place intellectually and in the span of a few years André Mayer met there many of the most active physiologists of his time. He also spent a short period in Ostwald’s laboratory in Leipzig. At twenty-two he was, to all intents and purposes, an independent investigator. Within a year or two he had become the head of an active laboratory supported, first, largely by his father and after 1905 by his inheritance. His collaborators were attracted as much by his kindness, his generosity, his gaiety and his unfailing good manners as by the clarity of his intelligence, his disciplined imagination, his vigorous inductive powers and his encyclopedic scholarship. Until World War I he started his day by spending two hours operating a free clinic in a poor district of Paris.

When he was twenty-three he demonstrated the constancy of the osmotic pressure of the internal environment and showed that sudation, pulmonary evaporation and even fluid deprivation altered osmotic concentration only very slowly. The concept of osmotic constancy was so new that the Société de Biologie appointed a special commission to examine the implications of this finding. André Mayer went on to study the means by which osmotic homeostasis is maintained: reflex cardiovascular changes, use of subcutaneous and intramuscular water reserves. He examined the physical and chemical correlates of thirst, especially as related to changes in osmotic concentrations. His book “On Thirst,” which appeared in 1900, created a sensation among psychologists and philosophers as well as among physiologists; for the first time a basic psychological drive was related to measurable parameters in the body, and a physiological regulation entailing a specific behavior was clearly related to physico-chemical variations.

The study of changes in the viscosity of plasma led André Mayer to study the
colloidal state of protoplasm. He went on to discover the existence of complexes: glucoproteins and lipoproteins in particular. He studied the conditions in which such complexes were reversibly or irreversibly dissociated or were precipitated. He became deeply involved in the physical chemistry of colloids and founded the French Society of Physical Chemistry of which, at a very early age, he became President. One of the fellow charter members with whom he became friendly was Pierre Curie. This friendship led him to make the first observation of the effect of radiation on living organisms. Curie said, in the course of one of their conversations: "You are a physician, I wish you would look at a sore I have which does not heal." Mayer looked at the sore which resembled a burn and was situated just under Curie's right vest pocket. Mayer asked whether Curie carried in his pocket anything which might rub against his skin. Curie said no, all he carried in this pocket was a small tube with a little radium in it. Mayer tested the tube on a colloid preparation which collapsed, then taped it onto the skin of a mouse which developed a burn similar to that of Curie.

The demonstration with Victor Henri that cytoplasm is a colloidal gel, the physical properties of which could be modified by very small chemical changes, led Mayer, together with a small group of friends whom he attracted to his laboratory among them George Schaeffer, Emile Terroine, Emmanuel Fauré-Fremiet and F. Rathy — to investigate the difference in composition between tissues. This work led them to the concept of "cellular constants" (such as the lipoprotein ratio, cholesterol : fatty acids, which they correlated with the degree of hydration of cells, and the cholesterol : phospholipids ratio). It also led to Mayer's fundamental contribution establishing the existence of lipoproteins of various types. The demonstration that, contrary to the theories of Overton, lipoprotein complexes were present inside as well as at the periphery of cells led André Mayer and his collaborators to the discovery that lipoproteins were present in large amounts in mitochondria. They showed that mitochondria were also rich in unsaturated fatty acids and that they took an active part in the metabolism of cells. In 1913, Mayer undertook with Terroine a study of the mechanism of development of fatty livers. He also developed with Armand-Delille the first "synthetic" medium for the culture of bacteria, an achievement of major importance for both bacteriology and nutrition.

Then came World War I. André Mayer volunteered on the first day and became battalion surgeon at the First Marne, then at Verdun. When the German army attacked the Canadians with poison gas, he was called back to organize the biological component of the Allied Chemical Warfare Service. Given overriding authority to call back from the Army the personnel he required and to requisition laboratories, he showed himself a superb administrator of large-scale scientific, military and industrial programs, and within the span of a few months he had been given enormous executive powers and become a trusted major advisor to the Allied Commander-in-Chief and the Allied Governments.

The first reaction of many Allied scientists had been that it was folly to believe that France and the United Kingdom could win a "chemical" war against Germany and that the only course of action was immediate negotiation — in effect a capitulation. André Mayer and his British associate, Joseph Barcroft, convinced the doubters that the physiology, pharmacology, and biochemistry they could deploy were a match for "German" science and were the key to victory in "chemical" warfare. They conceived, manufactured, and distributed in record time millions of the first military gas masks so that the second German chemical attack — which occurred only a few weeks after the pilot experiment on the Canadian front — failed. Through the development of new compounds and techniques they went on to put the enemy on the defensive in this field. They were helped from 1917 on by their American colleagues, Walter Cannon and L. J. Henderson in particular. André Mayer's crucial contributions to the Allied victory were recognized by high decorations from almost all Allied armies: French, British, Rumanian, Greek, Yugoslav, Japanese, etc.
They also gave him a position of international leadership among physiologists which made it possible for him to exert a decisive influence in the creation of the first international organizations devoted to nutrition and to health (particularly, as we shall see, the United Nations Relief and Rehabilitation Administration and the Food and Agriculture Organization).

In spite of the formidable amount of activity which he had to expend in directing his laboratories, his pilot plants, and his front-line observations and experiments, André Mayer continued to have the serenity of mind necessary to permit the serendipity of the first-rate scientist. One example among many others will serve: when he was told in 1916 that a number of workers manufacturing picric acid died in extreme hyperthermia, he refused to accept the diagnosis that there must be an epidemic among them, because he was struck by the peculiar epidemiologic characteristics of these deaths: they occurred only among workers involved in the second nitration of phenol. Some experiments he conducted himself, during what little spare time he had, led him to discover the enormous increase in heat production due to dinitrophenol, a discovery which had immediate practical as well as theoretical implications.

In 1919 André Mayer married a physiologist who had been one of his prewar students and wartime assistants, Jeanne Eugénie, and he was named Professor of Physiology in the Medical School of the University of Strasbourg. He took a leading part in reorganizing the university and built an Institute which has been ever since extremely active. In 1922 he was elected Professor at the Collège de France in Paris and once again immediately attracted to his laboratory a number of the best French (and other European) scientists. In 1929 he became co-director of the Institute for Biophysics and Biochemistry with Jean Perrin, a physicist and Nobel laureate, and with the great chemist, George Urbain, the discoverer of eleven new (rare earth) elements and the theoretician of inorganic complexes. He continued concurrently to direct his laboratory at the Collège de France, of which he became Vice President for Sciences in 1930. He was also to be elected in that period a member of the National Education Council, the National Research Council, and the National Defense Research Board, as well as of the French and Belgian Academies of Medicine and later of the French Academy of Sciences. He served at various times as President of the Biochemical, Physiological, and Psychological societies as well as of the French Society for the Advancement of Science and the Federated Biological Societies. While these appear to be and were formidable administrative tasks, he continued through this period to spend at least one-half of every day in the laboratory, and he repeatedly declined positions which would have taken him away permanently from the research he loved: he turned down the Presidency of the Collège de France, of the University of Paris, and ministerial positions.

It was in his laboratory at the Collège de France that pioneer work on the influence of oxygen and CO₂ pressure, of hydration and of toxicity, and ionic concentration on the respiration of animal and vegetable tissues—basic to the subsequent development of biochemistry—was undertaken in the early twenties in collaboration with L. Plantefol. André Mayer went back to the study of 1,2,4-dinitrophenol, the action of which he had discovered in 1916 in his famous toxicological investigation. He showed that its hyperthermic effect in the whole animal was due to a hypermetabolic effect in tissues. He concluded that there can be a purely chemical thermogenesis: heat production can be increased by methods other than shivering and exercise. Mayer's analysis of the mode of action of dinitrophenol through the use of methylene blue and other hydrogen acceptors, culminating in his demonstration in 1932 that the energy released by oxidative reactions is released in the presence of dinitrophenol as heat instead of being stored as high energy compounds, was a technical and intellectual tour de force considering the state of biochemistry at that period.

Mayer and his collaborators, Plantefol, Chevillard, and Gompel, among others,
studied the effect of decreasing oxygen pressure on body temperature, and of simultaneous decreases of environmental temperature and of oxygen pressure on oxidative reactions. He demonstrated for the first time that it was possible under certain conditions to bring down the body temperature of rats, dogs, and cats to 15 to 17° and to bring them back to normal temperature without any lasting damage, a discovery which was to have many important surgical and medical applications.

In the thirties, André Mayer went back to the study of regulatory mechanisms. Having studied both hyperthermia and hypothermia, it is not unexpected that he started with the examination of the regulation of body temperature, and in particular the role of evaporation in this regulation. Of more immediate interest to nutritionists was his series of basic papers on the regulation of food intake, at a time when this basic area was almost completely neglected. He and Gasnier demonstrated that food intake was a regulated phenomenon in mammals, that the effectiveness of the regulatory mechanism could be quantitatively evaluated by defining its reliability, its accuracy, and its sensitivity, that these parameters varied independently under various conditions and that the results obtained supported an hypothesis of two related regulatory mechanisms, a short-term (daily) mechanism corrected by a long-term mechanism. André Mayer examined the effects of heat loss and of environmental temperature on the functioning of the regulation. His fundamental work was once again interrupted by war when, in September 1939, at the age of 64, he reported to Allied headquarters as a general officer.

To fully understand André Mayer’s major contribution to modern thought on human nutrition and his decisive contribution to the creation of the international institutions concerned with nutrition, we must look at his own history and at the history of ideas during his lifetime. As an ardent and resourceful mountain climber he became familiar early in life with people who are forced to extract a meager and precarious livelihood from a difficult environment, and developed profound sympathy and, indeed, great affection for them. As a very young man, in the year 1898 when he was 23, he took a long trip to Morocco, including long forays into areas generally forbidden to outsiders. He looked at “underdeveloped” areas with what would now be considered a “modern” view, but was then considered a revolutionary perspective. Through the exotic facade he saw millions of men, women and children, not as picturesque natives inhabiting a romantic land, but as fellow human beings who were sick and malnourished in a world where the means existed to bring scarcity and sickness to an end. Throughout his life, he never lost the ability to combine a clear appraisal of the technical aspects of a health or nutritional situation with a feeling of outrage that a preventable problem had lasted so long, and he maintained the fortitude, the patience and the organizational ability to bring about the necessary correction.

In the 1920’s he served as chairman of the Expert Committee of the International Red Cross on the Protection of the Civilian Populations. Both at the 1921 Washington Disarmament Conference and at numerous Geneva meetings, along with a few farsighted statesmen like young Anthony Eden, he fought for the banning of chemical and bacteriological warfare. In the early 1930’s he became active in the health and nutrition activities of the League of Nations, working with a group which included Rajchman, Burnet, Aykroyd, Bigwood, Melianby, Hazel Stiebeling, McDougall and John Boyd Orr. It is usually forgotten now (and, once again, those who forget history may repeat it) that economists of that period considered agricultural “overproduction” the main cause of the depression. In a world ravaged by hunger, and threatened even in its most industrialized and heretofore most prosperous areas, economists advocated further restriction in agricultural production. The small group of nutritionists, eventually helped by labor leaders, battled the economists to a standstill. At the International Labor Conference in 1935, they appealed for “the indispensable marriage of health and agriculture.” The pioneer French surveys, organized by André Mayer
and carried out in the thirties by his student and friend Lucie Randoin, and linking minimum salary, employment, nutrition and health, paralleled Orr's surveys in Britain and Stiebeling's surveys in the United States. These led to a recognition that maldistribution and the collapse of buying power had resulted in agricultural surpluses, rather than vice versa.

During World War II André Mayer had the opportunity to translate his ideas on nutrition into major institutions. After having, once again, served as the chief scientist for defense against chemical warfare for the Allies in 1939–1940, he had become the head of the Free French medical and scientific mission to the United States and from 1941 to 1944 commuted between Cambridge, Massachusetts, and Washington, D.C. In 1942, André Mayer and Frank McDougall approached Mrs. Roosevelt and, through her, President Roosevelt, with a view to implementing the “Freedom from Want” through the creation of an international organization devoted to food and agriculture. President Roosevelt was impressed by the arguments of the two Geneva veterans and agreed to call a preliminary conference—the first United Nations Meeting—in Hot Springs, Virginia, in May 1943. A decision was taken to appoint a commission to elaborate a constitution for food and agriculture; André Mayer took the leading part in this work and at the first meeting of the FAO Conference—in Quebec City in October 1945—was elected chairman of the Executive Committee of FAO. He declined to succeed Orr as Director General, but was twice President of the General FAO Conference, Chairman of the Council, and represented FAO at the United Nations on the Coordination Committee of the United Nations Agencies (the “seven wise men”), and at the Councils of UNRRA, UNESCO, and UNICEF. He was universally known as “Mr. FAO” within the organization and within the United Nations generally. The Food and Agriculture Organization has perpetuated his memory within the organization in a number of ways, the most meaningful being the establishment of the André Mayer Fellowships. Beneficiaries of these fellowships, who number many distinguished agricultural scientists and economists among them, have made important contributions toward the realization of his ideal of a world free from hunger.

In 1945 at the time of the Quebec Conference, André Mayer was 70. His work for FAO would have sufficed to fill the time of a younger man, but he resumed the direction of his laboratory and his teaching and administrative duties at the Collège de France. He was appointed chairman of the French Interministerial Committee on Food and Agriculture and served as chairman of the Social Affairs Committee of UNRRA (he had participated as the French representative in the creation of this international institution in 1943). He took an active part in establishing the International Council of Scientific Unions and was chairman of the Board of a number of institutes and foundations (some of the latter had been created by his father). He spent a great deal of his time helping to modernize the Cancer Institute in Lille, an excellent institute founded by Herbert Hoover, of which he had been since 1938 chairman of the Board and of the Executive Committee. His work was not confined to meetings and board rooms. He re-equipped his laboratory, staffed it and resumed his lectures. In the summer he continued to go to his beloved Alps and initiated his grandchildren, as he had his two children, in the beauties of nature and the joy of physical effort.

He wrote a great deal, not only about physiology but about science and its relation to society, about the history of ideas, about the state of underdeveloped countries and their future and about the role of international institutions. His style was simple but noble, often even poetic. Many of his articles, such as his introduction to the volume on Life of the French Encyclopedia, have become literary classics and American, British, and other European universities awarded him honorary degrees in literature and in law as well as in science.

1 A son, born in 1920, this writer; and a daughter, born in 1924, Geneviève Sylvie (Massé), a graduate of Radcliffe College and, after service in World War II, the University of Paris Medical School and the Harvard School of Public Health. Well known for her studies of the growth pattern of West African children and now Professor at the French School of Public Health, she is the wife of a distinguished epidemiologist who is also Professor there.
He traveled extensively, often to distant areas in which he organized and supervised nutritional surveys. After his wife died in early 1956, he departed for Senegal and Mali where, at the age of 81, he inspected survey teams in isolated villages hundreds of miles from the coast. He returned with jaundice, first diagnosed in Africa as due to infectious hepatitis, but which turned out to be due to a carcinoma of the head of the pancreas. After less than ten days of enforced inactivity, following an unsuccessful operation, he died on May 27, 1956, interested in everything but his own suffering. To the very end, when he was in great physical pain, he showed to his visitors and to the hospital staff, including its humblest members, the same innate courtesy and concern for their welfare that he had shown to every man, woman or child his life had touched.

All who saw him and heard him at international meetings remember him with the same mixture of affection and awe. He would wait while everyone else spoke at great length, defending a viewpoint, arguing for this or that advantage for his country, his institution or himself, straying from the point, forgetting the main issue, bargaining for quid pro quos. Finally, he would ask for the floor and stand, his neat, trim figure very erect. He would make kind reference to any well-intentioned or practical statement others had made. And then he would speak of people.

In rooms filled with diplomats representing governments, scientists emerging from their laboratories, scholars just out of their libraries, the miserable villages of Africa, the crowded cities of India, the suffering, uneducated, helpless children of the world would take shape. The whole tone of the meeting would change as the comfortable delegates were reminded of what really was at stake. André Mayer would recall to them their tradition of knowledge and of compassion. A few sentences from the great prophets of mankind or from the Greek philosophers or the great encyclopedists of the eighteenth century, a simple and masterly summary of the technical aspects of the problems and, finally, a lucid, precise and generous solution would usually win the day. And all would leave proud of themselves, pleased and somewhat astonished at all the good there was in them, friendly toward one another and delighted at the achievements of a conference which, a few hours before, had seemed doomed to hopeless deadlock.

André Mayer firmly believed that greater knowledge carries greater responsibility, and that physiologists have a special duty to defend Man as an organism, physicians to defend Man as a patient, and nutritionists to defend Man as a nutritional entity. Like Pericles and the ancient Athenians, he believed that men silent in the presence of injustice are useless; he would have little use for nutritionists silent as crops are being destroyed from the air, as the children of the poor remain underfed in their own rich countries or while a whole people, as we witness now in Biafra, is being exterminated by famine.

At a time when the young are avoiding the natural sciences because they are repelled by the moral neutrality of scientists we can turn back to the memory of André Mayer as that of a scholar who spoke and fought for Man, a great pioneer in science who was a great pioneer in the new humanism.

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