

a history of medicine in pictures

by George A. Bender

painting by Robert A. Thom

Goldberger: Dietary Deficiency and Disease

THE TALL, slim doctor with the piercing eyes was making rounds of the orphanage with his young assistant. In orderly lines of twos, children were marching by. Suddenly, a small boy broke from the line, ran to the tall doctor and grabbed him about the legs. Looking up from a face shining with shy admiration, the boy said: "Are you the man giving us all the good things to eat?"

"Yes," said the doctor, a rare smile illuminating his face, "do you like them?"

"Oh, indeed we do. I hope you won't stop!"

The smile lingered briefly as an attendant shooed the small boy back into line. Then the customary seriousness returned, and the flashing eyes continued their rapid, restless survey of the surroundings. Particularly, Dr. Goldberger studied the faces of the little folk. Why must they suffer these unsightly pellagrous lesions, and all the accompanying discomforts? Why had pellagra visited over half the children in the orphanage, year after year, during the seventeen years the institution had been in existence? Would the new diets he had prescribed cure the afflicted? Would they prevent a recurrence of pellagra next spring?

Dr. Goldberger's mind impatiently demanded answers, but his scientific training warned that only time would tell. Meantime, there were so many things to



attend to. Dr. Waring could manage studies at the orphanages; he'd have to see how Dr. Willets was getting along at the State Sanitarium. Then, there was the appointment with the Governor...

That was the way Dr. Joseph Goldberger, surgeon in the United States Public Health Service, went about his work. By this time, 1914, Dr. Goldberger was a veteran; his record as an investigator in matters of health and sanitation was well established. When a particularly knotty problem demanding immediate action faced the Surgeon General, it was likely that Dr. Goldberger would be hurried on the mission. Now, there was the problem of pellagra. If anybody could find the answers, Goldberger could.

Dr. Goldberger did find the answers to the causes and cure for pellagra; proved them beyond doubt in the face of powerful opposition from some of his medical colleagues; and thereby he helped put on solid footing the foundations for scientific study of vitamins and nutrition.

Diseases which are now known to have been caused by nutritional deficiencies were observed and described in the writings of Hippocrates and of Pliny. Beriberi has been known in the Orient for three thousand years. James Lind, in 1757, recognized that scurvy could be cured or prevented by juices of citrus fruits. Pellagra had first been studied comprehensively in 1730 by Gaspar Casal, physician of Oviedo, Spain; and its name, first used by Frapolli, in 1771, derived from the Italian words, *pelle agra*, meaning "rough skin." It came to notice in Spain and in Italy after introduction of corn from the New World as a food product. Pellagra was first described in North America in 1864, although undoubtedly it had been widespread long before. By the first decades of the twentieth century, it had become a serious and baffling problem in southern United States. Did it arise, as some physicians believed, from a powerful, unknown toxin, perhaps in corn? Or, was it caused by infectious microorganisms, as other physicians believed? The affliction defied the usual patterns of infections: it was a disease commonly associated with poverty; unlike infections, it struck more often in rural regions than in crowded cities; it was particularly serious among inmates of institutions, such as orphanages, prisons, or asylums—yet it never was noted among attendants or administrative staffs, even though their work brought them in close contact with patients.

Modern knowledge of the entire field of nutritional deficiencies stems from the work of Casimir Funk, who, in 1911, described the isolation from rice polishings of an active substance that would cure beriberi. His work was preceded by that of a group of Dutch medical officers in the East Indies: Eijkman, in 1897, established that beriberi among prisoners could be cured and prevented by adding rice polishings to their diet; his successor, Grijns, postulated the then revolutionary idea that the disease was due to a nutritional deficiency, and not to toxicity or infection. Funk, believing the substance he had isolated had characteristics of the chemical family known as amines suggested the term, "vitamine," and went on to develop the theory of deficiency diseases, and of existence of dietary factors specific for the cure of each: the "antiberiberi vitamine," the "antiscorvy vitamine," and the like.

Meantime, pellagra had become so widespread in the cotton-growing areas in southern United States that it was seriously affecting the economy. Cotton producers put pressure upon Senators and Congressmen from the South; and they, in turn, put pressure on the United States Public Health Service to do something about pellagra. Although an able staff from the Public Health Service already had spent five years studying the disease, and every conceivable clue had been traced down—none had led to a satisfactory answer. So, early in 1914, Surgeon General Rupert Blue ordered Dr. Goldberger to leave Detroit's diphtheria problems in the hands of an assistant and take over investigations of pellagra in the cotton country.

Indeed, Dr. Goldberger was well fitted for his new assignment. He had already proved to be an able clinician, a good bacteriologist, an epidemiologist, and a parasitologist, as well as an excellent investigator.

Joseph Goldberger was born July 16, 1874, on a peasant tenant farm near Giralt, Austria-Hungary (now a part of Czechoslovakia). Crop failures plagued the peasants, and fascinating tales came back from relatives in the New World. In 1881, when Joseph was seven, father Samuel and mother Sarah Goldberger decided to make the break: they converted all their resources to cash and sailed for New York. They settled on the lower East side, and the family's eight children were sent to school. Samuel peddled on the Bowery until they could open a little grocery store. Joseph and his brothers were delivery boys; but Joseph usually had a book under his coat. He haunted libraries and second-hand book stalls. At home, his upbringing was strictly Jewish orthodox; at school, his companions were of every race and creed.

At sixteen, Joseph entered the course of civil engineering at New York City College, standing fifth in his class of six hundred at the end of his second year. However, his friend, Pat Murray, who had entered Bellevue Hospital Medical College, persuaded Joseph to accompany him to hear Dr. Austin Flint, Jr., deliver a medical lecture. To the consternation of his family, Joseph transferred to medicine, entering the Bellevue school. In 1895, he graduated second in his class, and stood at the top of the list for appointment as an intern at Bellevue Hospital. There he demonstrated a remarkable aptitude for precise, accurate detail in reports.

The lower East side offered little opportunity for a young physician, so Dr. Goldberger entered practice in Wilkes Barre, Pennsylvania. Two years there convinced him that private practice was not his field. There was money to be made—but no adventure. To Joseph, money without adventure had no appeal. Dr. Goldberger was never to be entirely free of petty financial worries—but adventure he found indeed.

After unsuccessfully trying to join the Navy as the Spanish American War began, Dr. Goldberger entered the Public Health Service in 1899, as an assistant surgeon. His first assignment at Reedy Island, Delaware, brought him under the influence of Farrar Richardson, who gave Goldberger sound instruction and free rein to improve on routine inspection methods then in use. In 1902, Surgeon General Walter Wyman sent Dr. Goldberger to Tampico, Mexico, to study yellow fever. Within five years, spent in Tampico and in New Orleans, Dr. Goldberger became one of the world's authorities on yellow fever—a disease of which he himself nearly died.

In 1906, Dr. Goldberger dealt his family another shock: he announced his intent to marry a pretty Gentile girl—Mary Farrar, daughter of a prominent New Orleans family and niece of Farrar Richardson. The Farrar family, no less than the Goldbergers, had serious misgivings—but neither the stubborn doctor nor his equally determined fiancée would be swayed. They were

the picture When Dr. Joseph Goldberger, Surgeon, United States Public Health Service, and his assistant, Dr. C. H. Waring, began studies of pellagra at the Baptist Orphanage near Jackson, Mississippi, in 1914, they faced puzzling questions: why were adults, older children, and the very young, free of the disease? Why, every year, did it strike children aged three to twelve? Dr. Goldberger ruled out infection or toxic foods as causes. With cooperation of Director J. R. Carter and House Mother "Miss Ida," the doctors added fresh meat, eggs, and milk to diets. Pellagra disappeared. By bold experiments, Dr. Goldberger proved dietary deficiency the cause of pellagra; pointed other researchers toward discovery of essential nutrients, now called vitamins, required to maintain health.

married April 19, 1906. Mary's life was to be no bed of roses, for Dr. Goldberger's protracted assignments away from home, his constant exposure to danger, and his poor scale of pay, gave rise to many anxieties. His first son was but thirty-six hours old when Dr. Goldberger was assigned to Brownsville, Texas, to study dengue fever—and he suffered a severe attack of the disease before his work there was finished. Apart from these problems, theirs was a happy marriage, blessed by three sons and a daughter.

Dr. Goldberger was to spend several years in laboratories in Washington, D. C., and at Woods Hole, Massachusetts, becoming an expert on helminthology. In 1909, his acute powers as a "health detective" were spectacularly demonstrated. A disease, first described by Schamberg in 1901, had appeared in epidemic form every spring in Philadelphia, manifesting itself as a temporarily disfiguring and acutely itching skin disease. Assigned to try to track down the responsible agent, Dr. Goldberger went to Philadelphia. Within forty-eight hours, he had eliminated the possibility of germ infection; had determined that the disease was caused by vermin; and had isolated specimens of the villain—the tiny acarine mite (*Pediculoides ventricosus*) which was carried to its victims in mattresses filled with fresh wheat straw. Sterilization of mattresses ended this source of human discomfort.

At Woods Hole, Dr. Goldberger formed a friendship with Dr. H. T. Ricketts, of the University of Chicago, who had done work on Rocky Mountain spotted fever. Later, in 1909, the two were to meet again in Mexico City, working on typhus. Dr. C. J. H. Nicolle, a French physician working in Tunis, had been first to describe transmission of typhus by the body louse. Dr. Goldberger's work confirmed this; and further, he demonstrated that the head louse could transmit typhus. His work also proved that typhus and Rocky Mountain spotted fever, both insect-borne, were separate diseases. Dr. Goldberger nearly paid for his knowledge with his life, in 1910, but he recovered from a typhus infection resulting from a laboratory accident. A few months later, Dr. Ricketts was not so fortunate: he died of typhus.

Dr. Goldberger was involved in a number of other assignments, including research on measles, in 1910. He was first to demonstrate that monkeys could be infected with measles, opening the way to new knowledge of infectious diseases. In 1913, he was sent to Detroit, Michigan, to study a diphtheria epidemic that was seemingly out of control. Despite serious political opposition, the stern and courageous Public Health Surgeon soon got to the bottom of a problem of official neglect, demonstrated the danger of diphtheria carriers, and instituted methods for their detection and control. It was from this triumph that Dr. Goldberger, with considerable personal misgivings, headed south to the cotton fields and pellagra.

Knowing little about the disease he was to study, Dr. Goldberger set out to learn all he could. He went to cotton-mill towns; to the cotton fields; to the hills and valleys. He found hundreds of people afflicted with skin lesions, weakness, digestive upsets, diarrhea, and mental disturbances—typical signs of pellagra. Many insane patients had been sent to institutions by pellagra; others had contracted pellagra after institutionalization.

Of particular interest to Dr. Goldberger were two orphanages near Jackson, Mississippi. There, mass studies could be made. The Methodist and the Baptist orphanages were less than a mile apart. Despite good institutional care, reasonably

good buildings, and, by the day's standards, nutritious meals, more than half of the children could be expected to suffer one or more attacks of pellagra each year. The suffering on the little faces haunted the doctor, despite his steely outward demeanor.

In his characteristic way, Dr. Goldberger cut across the confusion of custom and of literature and arrived at basic conclusions quickly: it seemed unlikely that pellagra was infectious, because it did not afflict all persons in a group, even though they might live in intimate association, as did orphanage personnel and children; it did not appear to be a toxin, because adults and children ate many of the same foods. It was strange that it seldom afflicted adults at these institutions; stranger still, it seemed to be confined almost exclusively to one age group: those children between three and twelve years of age. In this group, the percentage of pellagra was extremely high.

With his assistant, Dr. C. H. Waring, Dr. Goldberger studied the orphanage, the orphans, the management, the buildings, the sanitary facilities, the soil, the surroundings, the diets, and the habits of all persons associated with the institutions.

It was not long before the inquiring mind of the medical detective began to visualize patterns in the puzzle. Although the children's diet was adequate caloriewise, adults received considerably more meat and protein foods. The little children, during their first two years, received plenty of milk; but after that age, the children's diet was largely carbohydrate: corn bread, grits, cane syrup, and molasses. They received meat only once a week; and vegetables of high protein content, such as peas and beans, were seldom served, especially in the early spring.

Dr. Goldberger's sharp eyes detected another interesting thing: the children over twelve, who went "outside" to school, to work, or to do errands, frequently supplemented their institutional diet by buying, begging, or sometimes stealing extra foods which they craved. Among this age group, pellagra was less common. But the group between infancy and puberty had to live on the food they were served; they suffered most.

The Public Health doctors conferred with administrations and boards. These were sympathetic, but felt that they could not afford to meet Dr. Goldberger's suggestions for supplementary foods. Not to be thwarted, Goldberger turned to the Public Health Service: would it grant an appropriation to provide the foods needed for the test? He received an affirmative answer from Washington about the middle of September. The superintendent of the orphanage, Dr. J. R. Carter, and "Miss Ida," the House Mother (who later became Mrs. Carter), were very cooperative. The children began to get meat four times a week; eggs daily; milk regularly; and the corn foods, while not eliminated, were reduced and supplemented by oatmeal, peas, beans, and other vegetables.

Soon, Drs. Goldberger and Waring noticed, signs of pellagra on little faces and bodies began to disappear. Apparently they were winning against pellagra. But could they prevent recurrence the following spring, 1915? Only time would tell.

Meantime, with the aid of another assistant, Dr. David G. Willets, Dr. Goldberger launched another study—this time with a control group—at the Georgia State Sanitarium at Milledgeville. At this asylum, two wards, one of colored women, and one of white women, were turned over to the

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Public Health officers for their test. Apart from the change in diet and increased watchfulness over individual feeding, no change in habitual routine was made. Of the seventy-two patients, equally divided among Negro and white, eighteen had previous histories of at least two attacks of pellagra.

During the period of observation—December 31, 1914, to October 1, 1915, none of the group receiving special diets presented recognizable evidence of a recurrence of pellagra.

Of the control group (the other inmates of the asylum) who received the customary institutional diet—about the usual number, or forty-seven per cent, experienced recurrence of pellagra!

Dr. Goldberger was sure, now, that he could cure pellagra, and that he could prevent it. But he was equally certain that many of his colleagues—those championing the infection or the toxin theory—would remain unconvinced. Now, he wanted to see if he could produce pellagra by dietary control, as well as prevent it. But, who would be so courageous as to risk such a test? Dr. Goldberger had a bold idea.

Dr. E. H. Galloway, head of the State Board of Health in Mississippi, had been very sympathetic and helpful to Dr. Goldberger. Dr. Galloway also was a close friend of Governor Earl Brewer. Dr. Goldberger asked permission to lay his plan before the Governor. It was startling—but, having satisfied himself as to the legal aspects and as to the medical safety of the plan, the Governor gave it his stamp of approval.

At the Mississippi State Penitentiary, eight miles from Jackson, Dr. Goldberger and his assistant, Dr. G. A. Wheeler, presented their plan: they wanted twelve healthy, white, adult male volunteers for a six-month restricted diet test. (These men, it was felt, would be least likely to be susceptible to pellagra under normal conditions.) The volunteers would be segregated as to quarters and meals, but otherwise would be treated substantially as were other prisoners. If they became ill, they would receive the best of care. At the end of the test period, each would receive a pardon from the Governor.

There were plenty of volunteers, and a dozen men soon were selected. From February 4 to April 19, 1915, the men were kept under observation without any change in diet. None showed evidence of pellagra. Then, the diet was changed. The volunteers were fed biscuits, mush, grits, gravy, syrup, sweet potatoes, rice, collards—all items common to the diet of the region—but no meat, milk, beans, or peas. The rest of the prison population, receiving normal diet, were the "controls."

One volunteer had to be released for medical reasons in July; but eleven finished the test. Little of note occurred for five long, agonizing months—April 19 to September 12—but then, pellagrous dermatitis began to show up. By October 1, 1915—the end of the test period—six of the eleven volunteers exhibited pellagrous lesions. The diagnoses were confirmed by Dr. Galloway and by several other expert physicians. Dr. Goldberger was elated. He had proved not only that pellagra could be prevented or cured by diet, but also that it could be produced by dietary deficiency.

The balance of Dr. Goldberger's life was devoted to study of pellagra, the foods that were somehow deficient, and the relative values of those foods that would prevent the disease. He was quick to point out that poverty was one of the greatest factors contributing to pellagra—impoverished persons oftentimes could not afford to buy the foods needed to protect them against the ailment. Other persons, out of habit, chose to avoid foods that would have protected them.

Some medical men, however, still took issue with Dr. Goldberger and the Public Health Service. They clung to the infection theory. So, Dr. Goldberger, to leave no stone unturned, launched another series of experiments—drastic, revolting,

use none the less conclusive. Using a group of sixteen volunteers, including himself and his wife, he set out to try to pass pellagra from one person to another. He injected blood of pellagra patients into the volunteers; he introduced nose and throat swabbings from pellagrins into the orifices of volunteers. He collected urine and feces from pellagrous patients, and scales from their skins, and rolled these with bread dough into pills which the stouthearted volunteers swallowed. Though the experiments were repeated time and again, not a one of the sixteen volunteers developed the slightest symptom of pellagra. The published results of these tests quieted all but diehard opposition.

Dr. Goldberger found that brewer's yeast, of all foodstuffs, contained the highest percentage of pellagra-preventive substance, which he called the P-P factor. With more time, likely Goldberger would have discovered the chemical nature of the P-P factor—but time was not allotted him. It remained for other men to discover what came to be called vitamin B; and still others to discover vitamin B to be a complex; and in the course of the next three decades, to break the vitamin B complex down into at least eleven different substances—including B₁, or thiamin, the antiberiberi vitamin; B₂, or riboflavin; niacin, or niacinamide, the antipellagra factor; B₆, or pyridoxine; B₁₂, or cyanocobalamin, the antipernicious anemia vitamin; and folic acid, biotin, pantothenic acid, as well as other factors thus far less understood. The list of names of researchers who have contributed to Medicine's knowledge of vitamins—those compounds which the human body cannot synthesize for itself but which are vitally essential to body well-being and to life—would fill a directory of distinguished scientists.

A rare form of cancer finally began to slow down Dr. Goldberger's work. He had to give up his beloved research, and he died January 17, 1929.

Dr. Goldberger's ashes were taken to Haines Point, above the Potomac River. After a simple ceremony conducted by Rabbi Abram Simon, Dr. McCoy, carrying out Dr. Goldberger's wishes, strewed the ashes to winds that swept them over the surface of the river he had loved.

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