ing is much more pronounced for some perishables than for others. Furthermore, the colloidal composition of some products is such that even slow freezing affects the structure but slightly.

With most foods that are to be cooked as soon as defrosted, slow freezing is as satisfactory as quick freezing. In the case of meats, slow freezing may even have a tenderizing effect. Furthermore, any leakage of the meat subsequent to defrosting merely results in increased pan juices.

Vegetables with a high starch content display a much different response to the freezing treatment from leafy types that may exceed 90 per cent. of water by actual weight. Well-ripened berries and fruits with a high sugar content present a very different problem from acid and near-ripe fruit products.

Controlled supercooling and favorable colloidal action are utilized in the polyphase freezing process developed by Mr. Luis Bartlett and the author to flash-freeze foodstuffs. Unusually fast heat transfer is secured by direct contact of food with a chilled medium of high viscosity which is composed of three phases: Solid, liquid and vapor, hence the term "polyphase." A typical medium is composed of dextrose, sucrose and water. It is chilled and slowly agitated until a solid phase of finely divided ice particles has formed and is dispersed throughout the liquid. This composition is satisfactorily operated over the range −2F to −10F and is metastable at these temperatures.

Articles of food are floated in the cold medium and the slow agitation moves the articles with respect to the fluid and also to each other so the individual pieces are prevented from freezing together. Freezing is so fast that washwater or juices adhering to the food surfaces are at once frozen in place and do not dilute the polyphase medium. This film of ice is proof that diffusion of soluble constituents does not occur, solute is not transferred from the freezing medium to the food, nor does the food lose dissolved solids.

The high rate of heat transfer is due to three factors: (1) The extremely high thermal capacity of the polyphase state. (2) Increase in the thermal conductivity of the fluid film by the suspended ice particles. (3) Almost complete elimination of food supercooling by the "seeding" effect.

The polyphase medium removes heat approximately twice as fast as a liquid medium under identical operating conditions. Polyphase media, composed of water and sugars, may be operated in the metastable state at temperatures as low as −10F, while syrups employed in food freezing are seldom operated below +3F. Thus it is possible by employing the polyphase media to chill foods in a fraction of the time required by liquid media under ordinary operating conditions.

An important advantage of heat-transfer fluids which can be operated at subzero temperatures is that freezing is completed in one operation and no heat is removed in the storage room. By eliminating this period of exceedingly slow cooling, less irreversible damage to the colloidal structure occurs. Furthermore a more immediately practical result is that the food does not freeze into a solid mass in the container. Each piece retains its individual character so that it may be removed without disturbing the remainder and repackaging in smaller packages is easily accomplished.

Summation: The engineering profession of the world can be expected to give more attention to the animal-plant food cycles in the years ahead and to determine new methods of preserving for complete utilization the critical and exhaustible supplies of plant foods for the generations yet to live. Coincidentally with this obligation which the engineer must assume, there is the romantic but very real task ahead of applying the same intensive interest in the ultimate preservation of foods as the agriculturists have displayed in producing them.

The food preservation arts and sciences have now progressed forward far enough that the engineering profession can well assure the world that diets can henceforth be determined on the basis of what is good for man. With the coordination of our implements of electrical power, internal-combustion engine, propelled transportation, excellent network of roadways and mechanical inventions, and with the competent support of the food technologists, the bacteriologists and the chemists, the engineering profession should be able to assure the multitudes that the world's ability to preserve is now prepared to equal the world's capacity to produce food. When complete coordination is effected, and production, preservation and distribution become daily realities, then the profession will have reached new heights in engineering, achievement, statesmanship and service.

PUBLIC HEALTH IN THE U.S.S.R.[1]

By Dr. C.-E. A. WINSLOW

YALE UNIVERSITY

DURING a period of rapid demolition and rebuilding of Yale University a student was showing his father about the campus and the father said, "What is that building?"

[1] Address at the Science Panel of the Congress Celebrating the Tenth Anniversary of American-Soviet Relations, New York, November 9, 1943. The complete proceedings of the Science Congress including the Medical Session will be published at a later date by the National Council of American-Soviet Friendship.

"Which building?" asked the boy.

"Oh," said his father, "you didn't look quick enough. It's gone."

Russia, since the October Revolution, has been like that; and I can, unfortunately, bring you no up-to-date picture of its kaleidoscopic changes. My last visit to the Soviet Union was in the summer of 1936 as a member of a mission of health experts from the Health Organization of the League of Nations, which was invited to study the health program of the Union and which traveled from Leningrad to Batum, from Kiev to Gorki, with that purpose in mind. During the past seven years, the opportunities for intimate scientific contact have been limited, so that I can only report on one passing phase of a panorama of progress. My picture of 1936 has, however, the advantage of earlier knowledge, since I spent the summer of 1917 in Russia as a member of a Red Cross Mission and left Leningrad on the night that the sailors moved in from Kronstadt to inaugurate the October revolution, whose anniversary is celebrated to-day.

To take one concrete illustration. In 1917, the sewage of the city of Moscow was disposed of by irrigation on vast sewage farms, one of the most ancient methods of sewage treatment, and one which—to the best of my knowledge—is still in use at Paris and Berlin. In 1936, this procedure had been replaced by an activated sludge process—one of the most modern and scientific in the world.

By 1935, the death rate from diphtheria in the larger Russian cities had been reduced to one fifth of what it was in 1913; and the incidence of syphilis, as measured by a greatly improved machinery for reporting, had declined to a similar extent. The infant mortality rate and the total death rate from all causes had fallen to about one half of the figure for 1913.

During the three years ending in 1935, 170 million vaccinations for smallpox had been reported for the Soviet Union. Typhus and cholera, which had spread disastrously during the terrible phase of civil wars, had been brought under control. We saw a well-equipped Anti-Plague Institute at Rostov, where comprehensive plans were being made for combating the wild rodent carriers of plague which threaten the Volga region and the Caucasus as they threaten our own West Coast states. At Novorrossisk, we visited an excellent quarantine station for protection against the importation of disease. Malaria and dysentery remained a major menace—as they remain to-day over a major portion of the earth's surface; but substantial progress had been made—particularly in Georgia and the Crimea—in control of malaria through anti-mosquito measures and local centers for treatment with atabrine.

The most outstanding feature of the whole public health program was perhaps its provision for the care of maternity and infancy. The Soviet Union was keenly interested in its mothers and children. Research and general planning was carried out by the Clara Zetkin Central Institute for Maternity and Infancy at Leningrad where the latest advances were being studied in control of communicable diseases (the use of BCG vaccine, for example) in nutrition; in child psychology and kindergarten technique. Well-equipped hospitals and infant welfare stations had been established in the cities, and smaller centers were being developed throughout the rural areas, so far as limitations of personnel and equipment would permit. To facilitate the rapid increase in industrial employment of women, welfare stations and day nurseries had been established in the factories, in the Parks of Culture and Rest and in the railroad stations on a scale which we should do well to emulate in this country in the present war emergency. All in all, I am inclined to think that the Maternity and Infancy Program of the Soviet Union in 1936 was the most intelligent and far-reaching program of its kind in the world.

A second major emphasis of the Union health campaign was on the health of the industrial worker. Here, the center of research was an Institute of Industrial Diseases in Moscow with hospital and out-patient services of its own and where scientific investigations of the first order were carried out on mercury and other occupational hazards. In the factories, themselves, as, for instance, in the Molotov automobile factory at Gorki, we saw excellent hospitals and polyclinics and day nurseries for the workers —an exceptional model plant, to be sure, but one which would be hard to match in the model plants of other lands. Of particular interest was the provision of rest houses and sanatoria where the worker could spend his holidays or where the tuberculosis case or convalescent could be sent for longer periods. Nearly all the luxurious villas of the ancient aristocracy—in the Crimea, for example—were in use for this purpose; and many larger new institutions had been built, such as the magnificent sanitarium for the Red Army at Sochi. Some of these institutions were for children; and one of my most unforgettable memories of the summer of 1936 is the Young Pioneer Camp on the Crimea near Yalta, a vacation camp for children from all over the Union who had distinguished themselves by some distinguished service to the state. After a brief ceremony on the playing field (in the nature of a Boy Scouts' Parade) the formation broke up and the boys rushed up to our seats to make friends. With one of them firmly attached to each hand, we went up the hill to supper; and I discovered that one of my new-found friends' good deed had been the prevention of a train wreck by giving warning of an accident to the line.

The scope of the health program of the Soviet Union is, of course, a broad one, since it recognizes no artificial boundary between prevention and cure and provides medical care to all the people as a right of citizenship—just as we provide education in the United States. As rapidly as circumstances would permit, hospitals, polyclinics (industrial and regional) and the services of regional physicians and nurses had been provided, organized to provide routine preventive service, prophylaxis and medical care. Medical education—as in all continental European countries—was conducted by the state but with the interesting provision—without cost—of refresher courses for physicians every three years. Vigorous efforts were being made to increase the meager supply of hospitals and physicians available during the pre-revolutionary period. In Georgia, for example, the hospital beds had been multiplied fourfold and the number of physicians, tenfold, since 1913. Five hundred and seventy-seven primary medical centers had been established in the rural areas of that province alone.

The Soviet Union fully recognized the importance of scientific research, as the basis for progress in medicine and public health. I have mentioned several of the lavishly equipped institutions which guide progress in the fields of maternity and infancy and in industrial hygiene. I can not omit reference to the Central Institute for Nutrition in Moscow with its three divisions for physiology of nutrition, food sanitation and food technology; the institute directed by Dr. Lena Stern at Moscow; and that mecca for physiologists, the Pavlov Institute outside of Leningrad. A monograph by A. D. Speransky on "A Basis for the Theory of Medicine," published shortly before our visit, is one of the most challenging approaches to the basic physiological problems of disease which has appeared in any country in the present century.

Seven years in the history of Soviet Russia is a long time as measured by the slow-motion progress of less dynamic lands. The one thing which the Commissar for Public Health emphasized to us was "We are never satisfied." What new progress was made between 1936 and 1941 we do not know. How the terrific sufferings of the past two years have set back that progress, we do not know. But of some things we may be sure. The Soviet Union is dedicated to the physical and emotional and social health of its people, with an unusually vivid consciousness of that aim. It has advanced on the road to that ideal at an almost unparalleled rate. It will go forward on the road after the war is won and the threat of Nazidom lifted from the world. We want to share with the health leaders of the Soviet Union in their glorious tasks. We want to help them—if in any way we can. We want to learn from them as they go forward in their future advance. We are comrades together, not only in the war for the four freedoms but in the longer even more fundamental war for the health and welfare of the human race.

OBITUARY

RUSSELL HENRY CHITTENDEN

WITH the passing of Russell Henry Chittenden on December 26, 1943, an era in physiological chemistry in the United States may be said to have come to a close. "The first definitive laboratory of physiological chemistry in America for the instruction of students was established in the Sheffield Scientific School at Yale University in 1874";[1] the direction of it was placed in the hands of Chittenden, a young man eighteen years of age, who at that time was a candidate for the bachelor of science degree in the Sheffield Scientific School. This young man was born in New Haven, Conn., on February 18, 1856, the son of Horace Horatio and Emily Eliza Doane Chittenden; his family traced back to William Chittenden, who came to this country from the parish of Cranbrook, Kent, England, in 1639. The young man was educated in the public schools of New Haven and prepared for Yale in the French Private School there. At first he intended to study the classics, but a growing interest in natural science turned him toward the study of medicine and therefore matriculation with the Sheffield Scientific School. At the age of nineteen Russell Chittenden received his B.S. degree, having offered a thesis entitled "Glycogen and Glycocoll in the Muscular Tissue of Pecten irradians," which was published in the *American Journal of Science and Arts*. Its translation into German and subsequent publication in Liebig's *Annalen der Chemie* was destined to be the open sesame for the young man's acceptance as a student in 1878 in Kühne's laboratory at the University of Heidelberg. The young man had made his plans to enter Hoppe-Seyler's Institute of Physiological Chemistry at Strassburg but was disappointed by what he saw when he arrived; neither the city nor the laboratory made a favorable impression on him. To use his own words, "Intuition is not to be wholly ignored, and I went on to Heidelberg

[1] R. H. Chittenden, "The Development of Physiological Chemistry in the United States," p. 33, American Chemical Society Monograph Series. Chemical Catalogue Co., New York, 1930.