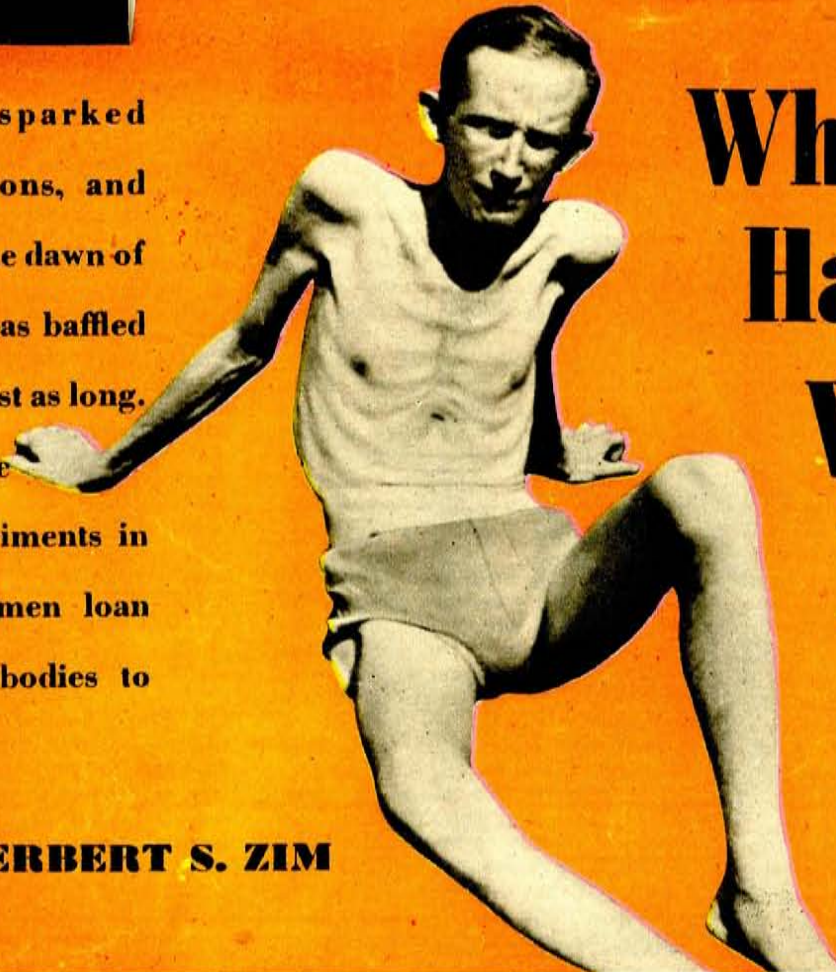


1946

Hunger has sparked wars, revolutions, and politics since the dawn of history—and has baffled scientists for just as long.

Now come some amazing experiments in which brave men loan doctors their bodies to reveal



# What Happens When People Starve

**BY HERBERT S. ZIM**

Live for twenty-four weeks on half the food you need, and you look like this. Bob McCurragh was one of thirty-six men who tried it.

**T**HE gaunt specter of starvation has haunted mankind since the dawn of history, yet doctors have studied it even less than rare diseases. For ages they have wanted the answers to such questions as: What does starvation do to the heart and lungs? How does it affect muscular strength, endurance, intelligence, emotions, and behavior? Without the answers we cannot intelligently combat the ravages of hunger, particularly in Europe and Asia, where the problem is almost beyond conception.

Until three dozen men voluntarily offered to starve for science in Minneapolis, doctors had never been able to get the essential facts on starvation. This may seem odd, but during famines there is rarely time for clinical notes—much less experiment. Three factors make the Minneapolis experiment a scientific opportunity that may never occur again: the co-operation of the volunteers; the availability of elaborate equipment; the presence of a unique, scientific team that used men of diverse training in a co-operative attack on the problem.

Ironically, the elaborate laboratory used in the tests is beneath the University of Minnesota stadium seats.

Few in the football crowds knew of it, though the laboratory included a diet kitchen, a food-analysis room, a statistical department, and three temperature-controlled rooms for producing arctic or tropic climate at will.

This Laboratory for Physiological Hygiene is directed by Dr. Ancel Keys, energetic physiologist of the university Medical School. The idea for the starvation project originated with a group of conscientious objectors who were serving as subjects for nutritional and psychological experiments at the university in 1943, according to Paul Bowman, director of relief training. These men were set to go abroad on a European relief project when an amendment to an Army appropriation bill, forbidding foreign service, left them stranded.

Dejected, they sought a way to help in foreign relief without leaving this country. The starvation experiment was their solution.

Dr. Keys and his staff saw the significance of the idea, and with their leadership the starvation experiment took shape. Harold Row, representing the Brethern Service Committee, actively promoted the project and announced it to all Civilian Public Service Camps. Applications from volunteers poured in. The requirements were strict because the experiment involved strain, confinement and physical suffering. The possibility of family complications ruled out married men.

Each of the thirty-six volunteers was pledged for a year's service under complete control of the scientists. It meant no trips home; eating every-

thing prescribed in the meager diet—and nothing more; working day after day and co-operating in an endless program of tests. In return, each man received lodging, medical care, a chance to continue his relief training, and a wage of five dollars monthly—later raised to fifteen, when the Office of Scientific Research and Development put the experiments under its Committee on Medical Research.

As guinea pigs, the objectors proved conscientious indeed.

W. J. HARKEY PHOTO





Moreover, the United States now has a great opportunity to help China with its democratic influence. This can be done in the same way that a banker would help a manufacturer rehabilitate his business by making a loan conditional on wise reorganization of the firm. For the future of Generalissimo Chiang Kai-shek's Central Government is now entirely dependent upon American support. Without military, economic, and financial assistance from the United States, it has little chance to recover from its deep crisis.

In Chungking, American business men will hear not only Nationalist generals and government officials who maintain that their conflict with the Communists is one between good and evil, in which all the Chinese people are on the side of the lawful government. They will hear a different story from the progressive Chinese inside and outside the Nationalist Party, from bankers, manufacturers, merchants, intellectuals, and politicians, and this is what they will be told:

**F**IRST, the vast majority of the Chinese people desire quicker and more genuinely democratic reforms than they have been promised or given by Chiang Kai-shek's Nationalist Party. They are fundamentally in unison with the demand of the Communists and the middle-of-the-road parties of the Democratic League for replacing the dictatorship of the right wing of the Nationalist Party with a coalition government that embraces all political groups. They insist that civil war can and must be avoided in this way and that a coalition government will lead to national unity.

Second, the Yen-an regime is by no means Communist in the Russian sense. Its so-called New Democracy proves the Yen-an leaders to be agrarian reformers whose Communist aims lie in the distant future. It has brought about great administrative, economic, and educational achievements in the areas which the peasants, together with the Communists, have liberated from the Japanese during eight years of war. The policies of the New Democracy give the answer to most Chinese problems and can be made the foundation of a Chinese revival that will permit a sound and steady development of China's international trade.

Third, the Communists would want to compete with the Nationalists for supremacy all over the country if the Nationalist Party does not yield to the demand of the people for a coalition government; and they may become more radical in the process, especially in case continued American support for the Chungking armies were to lead to Russian support for the Communist armies. But there is nothing in the present program and practices of the Chinese Communists that should make it impossible for the Nationalist Party to

co-operate with them in a coalition government if Chiang Kai-shek followed the wish of the people and granted them democracy.

If the American business men could visit Yen-an, as groups of U. S. Army observers and foreign correspondents did last year, they would find confirmation for these liberal Chinese views about the Communists.

In Yen-an they would find the farmer in a new role, as one of the creators and enthusiastic pioneers of what the people in those areas—Communists, liberal members of the Nationalist Party, and the vast majority of non-party men and women—proudly call "their" New Democracy.

They would meet labor hero Wu Men-yu, who was once so poor he had to sell his young daughters into bondage. Now he is the richest man in his village and one of the most famous persons in the Communist-controlled areas.

That man Wu has taken the lead in showing the people how to improve agricultural methods, even before American supplies could be obtained, mainly through the organization of co-operative efforts. The result was that the agricultural production around Yen-an was doubled during the last five years.

Like many other ordinary peasants whom the educational campaigns of the Communists awakened to social activity, Wu has helped the people to make self-government in the villages a success and to enlist the full co-operation of landlords, merchants, and old-time county officials.

These groups have come to realize that all classes benefit from land reform and village democracy and from the economic progress that results from the abandonment of old-age feudalism.

For example, a modern application of economics would enable the average Chinese to buy five dollars' worth of American-made goods each year—as much as the average American buys in two or three days. With such buying, you would have created 1,000,000 additional jobs in the United States, one for every tenth war veteran.

**S**END an annual two billion dollars' worth of American materials essential for improving their primitive production to the 450,000,000 industrious Chinese, and you will soon have changed their way of life beyond recognition.

Synthetic fertilizers, so far almost unused in China, could easily in-

*(Continued on page 79)*

Even in modern Shanghai, toilers like these prove the need of modern transport.

FRITZ HENLE PHOTO FROM MONKMEYER





## WHAT HAPPENS WHEN PEOPLE STARVE

Continued from Page 17

something should have happened to the food! Men had to try consciously to keep from being irritable, and sometimes they didn't succeed. Social graces and table manners disappeared. When a man spilled a drop of soup on his tray, he mopped it up with a bit of bread.

Loss of weight came quickly with the new diet. The body began to use its own fat. Muscles shrank.

By April, the men had already begun to assume the typical starved look.

The two bottles of soft drinks permitted weekly were heaven-sent, and so was the unlimited supply of black coffee. Some volunteers drank as many as twenty cups daily. Chewing gum was available and a craze developed for it. Some men spent all their spare time and most of their spare money on gum. The technical staff grew suspicious and found a trace of sugar gave each stick a food value of about two calories—an insignificant amount, but thenceforth gum was limited to two packs daily. Men even licked the inside of the wrapper for any trace of sugar.

By the mid-point of the experiment in May the men had lost an average of 27 pounds and the scales no longer provided an accurate measure of starvation. A man might not lose weight for a week, then suddenly drop 3 or 4 pounds. Dr. Keys attributed such irregularities wholly to variations in the water content of the subject's body. In starvation, it is typical for fluids to seep into the abdomen, ankles, and under the eyes—a condition known as edema or dropsy. These fluids made the real weight of the subject a matter of

guesswork. At any rate, loss of weight slowed down and so did energy output. The men began to reach a physiological equilibrium at a 1,750-calories level.

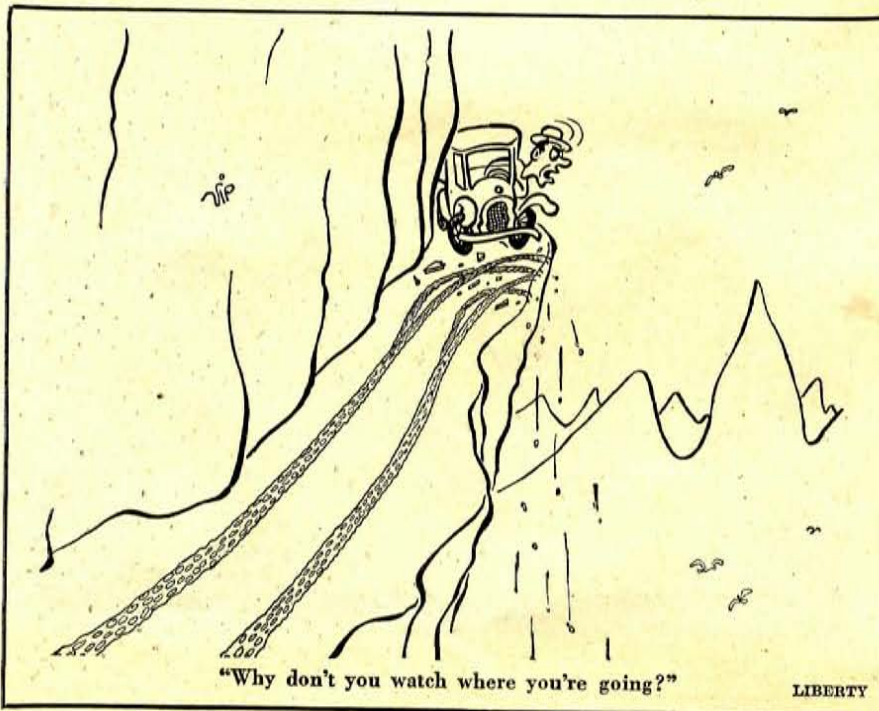
Even before the experiment was half over, the hunger strain made special precautions essential. One subject, in a pre-experimental state of mind, fainted while sprinting for a streetcar. Such faintings became common. So a "buddy system" was organized which provided a constant companion for every man leaving the laboratory. The buddy system also was a morale builder for starving men living in a well-fed community.

AS the experiment moved into its final months, it was astonishing to see the way the human body adjusts itself to adverse conditions. Under the impact of starvation the body can develop adequate ways of protecting itself and maintaining life at a low functional level. Tests and measurements bear this out.

The semistarved body is like a car running on three cylinders. It lacks power, pick-up, smoothness—but it runs. All essential organs make a new adjustment. Temperature drops from a normal of 98.6 to an average of 95.8, like a thermostat set lower to conserve fuel. Oxygen consumption drops a third, since there is less fuel to be converted into energy. The sugar content of the blood is lower, as if the body were reluctant to diminish its low reserves by making a normal supply available for immediate use.

X-ray measurements showed that the men's hearts actually shrank in size, and the pulse, normally about 72, dropped to half normal or less. Yet circulation remained adequate to meet the lowered energy requirements.

Naturally, the men were not as fit



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as before. The standardized work tests became intolerably difficult. Simple strength declined only about 10 per cent, but endurance on short heavy tasks dropped 50 per cent or more. No one lasted even a minute on the treadmill. Dr. Keys adds the significant statement that men who were most fit initially showed the greatest deterioration during starvation.

Speed reactions were affected little by starvation. And even muscular co-ordination did not suffer much. In short, the body held its own as long as there were no demands for heavy work output. That, the weakened body just couldn't take.

Intelligence—the kind measured by intelligence tests—seems unaffected by starvation. Both Dr. Brozek and Dr. Guetzkow, staff psychologists, were quick to add an important qualification: the tests measure intellectual capacity, and while this capacity seemed unimpaired, its voluntary use in prolonged mental work was another matter.

This qualification on the use of intelligence is the clue to a second series of experimental results. Starvation alters personality. It produces marked changes in behavior, emotions, initiative, and social concern. Intelligence may be unaffected by starvation, but if loss of initiative, interest, and awareness isolates the subject from the world around him, the effect is as devastating as if the mental faculties were themselves impaired. The best mind in a starved body isn't worth a nickel.

Apathy and depression came with bodily weakness. Men felt old in body and mind. They dropped all social activity. Just the task of being polite and attentive seemed "too much work." Food became the sole interest and preoccupation. No pin-up girl could compete with a dish of plain macaroni.

Diaries reveal voluptuous gastronomic dreams, and nightmares in which the volunteer is tempted by delicious pastries and desserts. Just as he is about to succumb, he awakens in a sweat, realizing with a grateful prayer that he has not betrayed his responsibility after all.

And so, even though vital organs and processes were unimpaired, six months of semistarvation reduced normally healthy men to weak, irritable, lean creatures, socially and economically ineffective. Their persistent hunger denied them all the constructive activities and pleasures of living except that of their morning and evening meals.

LOOKING back over the experiment, Dr. Keys thought it fortunate that the dietary level had been established at 1,750 calories. "A few hundred calories less," he said, "and we might have had serious health complications with permanent after-effects." Thousands in Europe cannot even hope for 1,750 calories this winter.

During the experiment, all the subjects received practically the same food. When starvation ended, last July 30, the men were shifted to four different recovery diets to test the relative effectiveness of each. All continued to receive the basic 1,750-calorie ration of bread, turnips, macaroni, and a suggestion of meat. Supplements were added. A minimum group received an additional 400 calories daily; other groups received multiples of that amount. The extra food was of the same type as the basic diet. Some in each group received pills of concentrated proteins and vitamins, while the rest received identical pills—but these were nutritional duds.

The thought of increased rations carried the men through the final starvation testing. This psychological



LIBERTY

LIBERTY



uplift kept them going even after the new diets were introduced, but both the men and the staff soon realized that the increased food was not going to produce miracles. Some gained a few pounds; most merely held their own. The surplus fluids were being replaced by body tissue and recovery was probably more rapid than the scales indicated. Six weeks on the new diets made it clear that recovery from starvation by adding small supplements to meager diets was no easy matter. *The chances that a diet of 2,000 or 2,400 calories would rehabilitate even a healthy adult seem slim indeed.*

These significant facts were communicated to FERA, OSRD, UNRRA, and the Army, even though the experiment still had six weeks to go. Dr. Keys pointed out that for effective rehabilitation it was imperative to raise calories well above the 2,500 level and to increase the proportion of protein in the diet. As the experiment drew to a close and the data were more certain, Dr. Keys re-emphasized that in an adult male no appreciable rehabilitation can take place on a diet of 2,000 calories a day. "The proper level is more like 4,000 daily for some months. The character of the rehabilitation diet is important, but unless calories are abundant, extra proteins, vitamins, and minerals are of little value," he said.

**I**N October, after three months of rehabilitation diet, none of the men had regained his former weight, physical capacity, or fitness. Even in December none was fully restored to performance capacity. Some of the men had received diets of definitely higher caloric value than the average American diet, but even this did not bring health back rapidly.

The experiment at Minneapolis suggests a number of things about the kind of starvation that is typical of Europe. Luckily, the human body's automatic protective measures ensure, to some degree, that the starved person *can* be rehabilitated, because vital organs and processes are relatively unimpaired. But the young and the old face more difficult problems, and children may bear the scars of hunger for life. Because hunger in Europe is coupled with cold, disease, and personal frustration, rehabilitation will be much slower than it was in the experiment.

It's clear that rehabilitation from hunger is a task where aid cannot be too little and too late. Herbert Lehman, director of UNRRA, says there are 180,000,000 in Europe "on the border line of starvation," and conditions in Asia are much worse. The starved body has such low reserves that it cannot stand any protracted hardships. The rising curve of deaths in Europe this winter needs no further explanation.

To talk elections, peace, and democracy to hungry people is talking to a blank wall. "The mental attitude

of starved persons cannot be changed for the better until they have been physically rehabilitated," Dr. Keys asserted. "Starved people cannot be taught democracy. To talk about the will of the people when you aren't feeding them is perfect hogwash." We cannot win the peace until all men and women are restored to a nutritional level where they are once again concerned with a better social and political life and in planning farther ahead than their next meal.

Perhaps one should differentiate between hunger and starvation. Both are found in Europe. Hunger does not involve the gross physical effects of starvation, but the pain, emptiness, and persistent desire for food are there. The irritation and griping so common during the last weeks of the Minneapolis experiment, when energy outstripped social control, is typical of hunger. Anything that weakens our essential social inhibitions is dangerous. Hunger may bring revolution, and starvation will certainly bring chaos to Europe.

The experiment points out another important thing for us at home. Nutrition is not concerned with the stomach alone. Mental effects of

hunger and starvation are more critical than physical, as far as this country goes. The body protects itself, but adjustment to normal social living goes by the board. Just as the human guinea pigs dropped their table manners, their interest in people, and their concern about others, so victims of hunger, to varying degrees, become less than normally useful citizens. Children are even less fortunate, because learning and habit formation are the core of education. Adjustments that are conditioned by an unsatisfied stomach may always be unsatisfactory adjustments. The experiment suggests—and educational statistics seem to bear out—the close relationship between family income, adequate nutrition, and advancement in school.

**T**HE experiment over, I talked with a volunteer about to go on a thirty-day leave to round out his own rehabilitation. "Would you sign up for another experiment if there were the need?" I asked. "Certainly, if there were the need," he said. "But do you think we have any need for starvation?"

THE END

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