illustrate the interconnections and long history of microbiological research. Though streptomycin was discovered in 1943, the basic knowledge which lay behind its discovery had been accumulating in one laboratory alone for almost 30 years. And its foundation in turn dated back to Pasteur, Koch and even far beyond.

Streptomycin's Predecessors

A year after the work began in 1939, its first result evolved. It was actinomycin, derived from Dr. Waksman's old friends the actinomycetes. It had remarkable properties to destroy microbes, but was almost as efficient at destroying living animals. It could easily have been used as an animal poison. Soon after actinomycin came clavacin and fumigacin. These as well were either too toxic or not active enough.

Rapid progress was made in 1942 when the announcement was made of the discovery of a selective agent which killed many bacteria and slowed to a stop the growth and reproduction of others. Christened streptothricin, it was streptomycin's direct predecessor. Its importance lay in the fact that it showed a murderous preference for gram-negative microbes, thus supplementing the gram-positive killing power of penicillin and tyrothricin.

Streptothricin showed great promise in the animal body. It successfully attacked varieties of bacteria that had resisted other agents and seemed not too toxic. Its bright promise dimmed, however, when it was found to have a delayed toxic effect—it wiped out the disease infection, but, days or weeks later, the animal succumbed to streptothricin itself.

But the trail was growing hot.

Needle in a Haystack

It is worth delaying here for a moment to consider the mathematical odds against emerging with the substance desired. They are beyond calculation. To begin with, the variety of microorganisms is infinite. Every type has its own variants. And every variant in turn can be altered by the tiniest changes in diet, temperature, agitation, or even by the shape of the flask in which it is grown.

As an example, one group of bacteriologists worked without success to duplicate an experiment performed in another country. They followed all directions, with microscopic precision, but never secured the desired result. After numerous attempts, the reason emerged. Specifications had directed growth at "room temperatures." In the country where the experiment had originally been performed, room temperature was a few degrees lower. The characteristics of the bacteria produced were completely different when the temperature was changed by even a few degrees.

Such were the complications that were involved in the search for a strain of microbes which would perform the tasks desired.

Dr. Waksman set in motion two types of exploratory testing. One involved literally starving the bacteria in a sample of soil, then introducing a dangerous bacterial strain. The method, used by Dr. Dubos in "training" bacteria determined whether the soil microbes could learn to exist upon the dangerous strains as food. This is necessarily a slow method.

Simultaneously, he started testing work with agar plates. This involved growing cultures of pathogenic bacteria, then dropping other living organisms (from the soil, manure pile or peat bog) into the culture. If a clear patch developed around the second group, it showed that the newly-introduced microbes were wiping out the hosts in their cloudy culture.

Mathematically it was possible for the endless search and testing to go on for years. Using such methods, he and his student Albert Schatz succeeded in isolating two individual promising strains of *Streptomyces griseus*. One came from the throat of a chicken, the other from a heavily manured field.

Good Against TB

Even more miraculously, the strains were effective on both the problems being attacked—against the armored tuberculosis bacillus as well as the general group of gram-negative types. Amid growing excitement, the tests went from test-tube to laboratory animals—still with almost universal success.

Heavy-yielding, the strains aroused great hopes, but were abruptly checked as the strains became less vigorous and yielded increasingly less streptomycin.

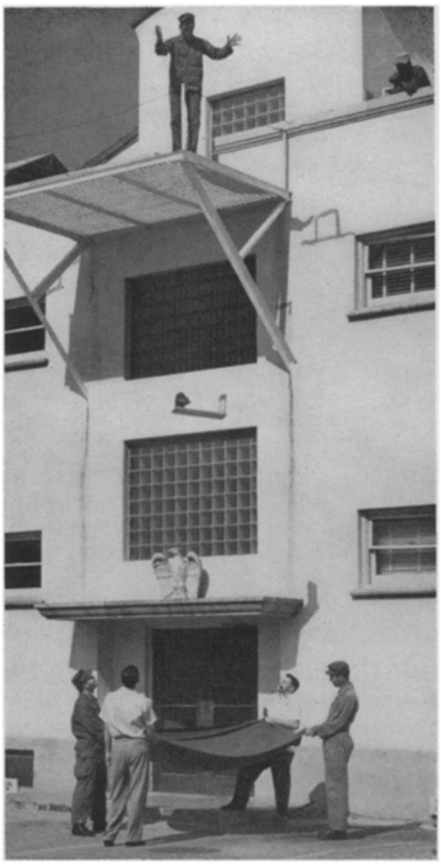
With intuition that came from recognition of the importance of the soil itself as the power plant of all life, Dr. Waksman finally planted these microbes in rich earth in the hope that new generations would regain their parents' strength. They did—and more. Showing their unpredictability, the microbes developed new strains, which were even more active.

But streptomycin was still months away from its first sensational conquests. Thousands of tests were still to be doggedly made. Endless searching went on for better ways to grow and purify and strengthen the product.

Finally tests were made upon live chick embryos and white mice—the Poultry and Animal Husbandy Departments laboratory nearby gave valuable assistance at this point since Dr. Waksman's laboratories did not have the necessary elaborate animal-testing facilities. The delicate embryos and small animals furnished ideal testing ground, both for the ability of the preparation to do its job and also to test toxicity.

Coming through with flying colors, the tests were expanded to baby chicks, guinea pigs, then finally, through commercial laboratories, such as Merck and Co., at Rahway, N. J., where many former Waksman students served, to the clinics.

Merck scientists improved the manufacturing processes still further, built a pilot plant for small-scale manufacture. Then finally, late in 1944, small quantities were released to the Mayo Clinic for tests. Later, as additional quantities from Merck's miniature factory became available, the Army joined the testing work. Other universities and hospitals began to amass test results.



FREE FALL—The man on the canopy has just dropped a tank with accompanying motion picture camera, shown half way down. During the fall pictures were taken, one of which is shown on the opposite page. The shots demonstrate that an object in free fall has no weight.

The secret of the miracle drug soon "leaked" out and the discovery of streptomycin and its medical miracles flashed around the world.

But streptomycin is not the end of the road. It has been followed by new antibiotics—grisein, streptocin, and finally neomycin. The potential of the latter has led to speculation that it may replace streptomycin—certainly it may prove to be an important supplement, since it is highly active against bacterial strains which seem to develop a resistance to streptomycin.

Science News Letter, November 1, 1952

Airplane engines today cost about $17 per horsepower.

Winter squash provides good amounts of calcium, iron and phosphorus in addition to several vitamins.

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AERONAUTICS

Self-Starter For Jet Engines

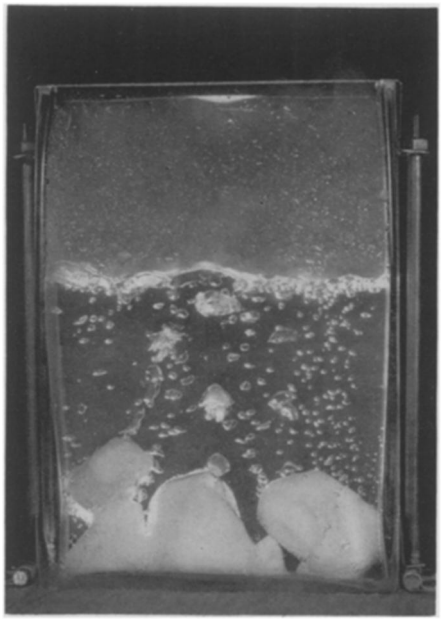
➤ OUTSIDE ELECTRIC power to start the engines of jet-propelled airplanes will not be needed with the use of a jet-engine self-starter announced by General Electric, Lynn, Mass.

It means that the field of usefulness of jet planes is greatly expanded. They will be able to land and take off at flying fields where the outside power is not available.

In this development, a small jet engine built into the plane is used to start the main power plant. Two types have been developed. One uses in the starter jet a combination of fuel and compressed air. The other is powered by hot gases resulting from the burning of a solid propellant in a replaceable cartridge.

Several types of self-starters for jet engines have been developed during the past few years, but none seem to be successful enough to warrant their general use. The type of self-starter used in conventional planes cannot be employed because of the large amount of power required.

In the solid propellant system, developed by G.E., the energy for the starter is provided by the burning of a solid fuel contained in a breech. A fast-burning charge, looking much like an artillery shell, is inserted in the breach and ignited electrically.



WEIGHTLESS — This tank photographed during a free fall was weightless as the shot was made. Bubbles from the dry ice at the bottom of the tank remain suspended in the water. The camera which took the photograph was fastened to the other end of the same board that carried this tank.

In the air-fuel system, pneumatic methods are employed. The pneumatic system can be charged on the ground from air bottles, and in flight from an engine-driven compressor. Approximately five pounds of high-pressure air is used per start. The air enters a combustion chamber through a valve. There it is mixed with jet fuel from a pressurized one-quart bottle. The mixture burns and operates the starter jet which in turn starts the main engine.

Science News Letter, November 1, 1952

PHYSICS

H-Bomb Already Tested?

American people have received only rumors, but hydrogen bomb broadcasts its own official report in the form of microscopic radioactive particles carried by winds.

➤ JOSEPH STALIN may already be studying a report on the first explosion of a hydrogen bomb at Eniwetok Atoll in the Pacific.

It is certain he will know about the first H-bomb explosion long before the American people will. All the American people now know is that there are rumors the first H-bomb will be tested at Eniwetok sometime this fall or winter. It might already have been set off.

Stalin will know about it not through any elaborate spy system, nor through agents who might have infiltrated the Joint Task Force conducting the Eniwetok tests. None of this cloak and dagger stuff is necessary. An H-bomb explosion sends thousands of microscopic radioactive particles high into the air. From there they are carried by the winds all around the world. Delicate instruments, sent up by high-flying balloons, or flown up in airplanes, can detect these particles. Detailed analysis of the particles can tell not only whether an A-bomb or an H-bomb has been exploded, but also something about the precise composition of the bomb.

For greater efficiency in the analysis, perhaps Stalin has a submarine stationed somewhere in the thousands of miles of empty Pacific ocean between Eniwetok and the west coast of the American hemisphere. Balloons which automatically send back reports of radioactivity in the sky could be launched from the submarine.

Of course, the reverse picture is true as well. American high government officials will have a report of the first Russian H-bomb explosion a few days after it happens. They have to wait only until the wind currents carry the radioactive particles to the nearest detecting stations in the free world.

Science News Letter, November 1, 1952

NUTRITION

Reducing Diet Dangers

➤ THE PSYCHOLOGICAL approach to weight reducing has some danger, Dr. Ruth M. Leverton of the University of Nebraska warned at the meeting of the American Dietetic Association in Minneapolis, Minn.

The danger is that it may help people diet too much.

Inability to stay on a reducing diet formerly safeguarded people from permanently injuring their health by long periods on grossly inadequate diets, Dr. Leverton pointed out.

"We can no longer depend on this safeguard," she stated. "By receiving help in understanding some of their emotional problems they may be able to stay on dangerously inadequate reducing diets until their health fails."

An outstanding requirement of a good reducing diet, she said, is that it will replace faulty food habits with good ones which will lead the patient to choose the kind and amount of food that will meet his nutritional needs.

Reducing diets, "generally speaking," are most likely to be deficient in calcium and riboflavin because they do not include enough milk, Dr. Leverton criticized.

Next most likely deficiencies are protein and vitamin B-1 because of too skimpy servings of meat and milk and enriched bread and cereals. Most reducing diets call for so much in vegetables and fruits that they usually supply plenty of vitamin A and vitamin C.

In general, she said, reducing diets come from one of four sources:

1. Figments of unbridled imaginations, untested and uninhibited by scientific knowledge.

2. Accumulations of both sound and "screw-ball" ideas which happened to produce the desired results and therefore are being promoted.

3. Sound ideas leading to careful and intelligent planning of diets.

4. The same as the third, but with one addition—organized scientific testing of the diet using as subjects a group of overweight people.

Science News Letter, November 1, 1952