

Accident in a PETRI DISH

From the time of its unusual origin Penicillin has been developed in glass, and CGW ware has aided in increasing its production a thousandfold



Growing mold for Penicillin in Pyrex Fernbach flasks

THE story of a shining beacon of progress in medicine and public health that has emerged out of the destruction and death of World War Two — the story of the wonder drug Penicillin — is one of the most amazing and interesting of the great conflict. Many aspects of this story have been told, but little has been told about the glass products that have made possible the rapid development of Penicillin.

Many of the thousands of CGW men and women in factory and laboratory and office who turn out these glass products in their daily routine jobs may not realize the importance of their contribution to the story of Penicillin.

Some idea of the value of this contribution of CGW employees is seen in the fact that in the development of

Penicillin many of the essential laboratory control test and production techniques depend upon the satisfactory daily performance of glassware made by the men and women of several CGW plants. Throughout the entire process, from the growth of the original mold cultures in Fernbach flasks to the final packaging of the finished Penicillin in small rubber-stopped bottles, Pyrex brand chemical glassware serves important functions. Penicillin manufacturers know that they can depend upon this glassware to stand up under rugged handling, to take repeated steam sterilization without fogging or cracking, and yet not contaminate any of the delicate solutions. Even the slightest degree of contamination could cause poor yield or unstable product.

The urgent need by our armed forces for a medicant to successfully combat disease associated with warfare—pneumonia, gangrene, gonorrhea, staphylococcal and streptococcal infections—brought about within a few short months an amazing development and production of this drug that would ordinarily require many years of painstaking medical research. The growth of Penicillin production is nothing short of spectacular.

A Thousandfold Increase

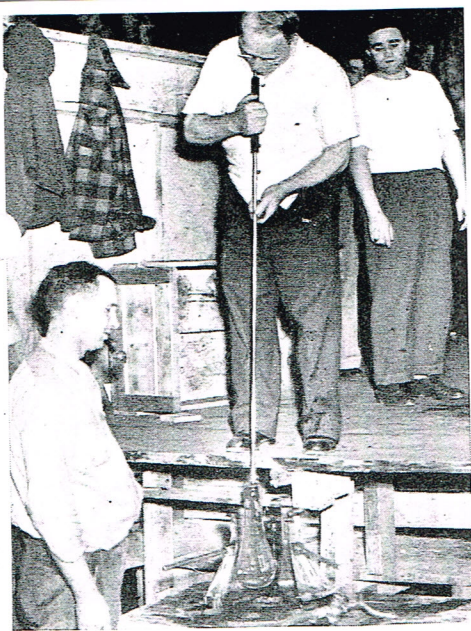
From a mere 4,000 packages per month in May 1943, at a price of \$20 each—the production of Penicillin increased a thousandfold to May 1945 or four million packages per month, at a price of less than \$1 each.

The story of Penicillin is a lesson in cooperation between medical researchers, workers, our Army, Navy, the War Production Board, the Department of Agriculture, and many leading drug and fine chemical manufacturers—even between the governments of Great Britain and the United States of America.

Oddly enough, Penicillin was first discovered by accident back in 1928 at the University of London. Dr. Alexander Fleming noticed that a petri dish containing a culture of bacteria was contaminated by a blue mold spore which drifted in from somewhere. Dr.



Final inspection and packing of Penicillin dispensing bottles is done in Pyrex finishing by Elizabeth Teets and Martha Bohart



Joe Fuchs blows molten glass into approximate shape of Fernbach flask as he is about to insert it in mold where it is blown into final shape. The mold holder at left is Ed Losey, and the shop helper in background is Myron Giambrone

it gave off yellow droplets of Penicillin. This Penicillin had to be recovered by separating it from the liquid culture medium, a very exacting and tedious process considering that the entire contents of the flask might contain only a few hundred units of Penicillin.

From flasks, the process went into bottles, and a special flat CGW culture bottle was used by some of the producers. But the problem of handling thousands of culture bottles each day and the low yield of Penicillin per culture bottle led to the development of a large-scale production method. Now this mold is grown in huge tanks holding thousands of gallons of culture liquor, and instead of forming a thick mat on the top of the tank the mold grows all through the liquor and is kept agitated and fed with air bubbling up through the liquor. By such a method the concentration of Penicillin in the liquid can be greatly stepped up so that final yields are enormously greater.

Deep Tanks Used

Regardless of the fact that most Penicillin is now produced in deep tanks, Pyrex glassware plays a very important part in the process. The original mold cultures are propagated and nursed along in Pyrex flasks.

These large tanks must be constantly sampled during the growing cycle and tests made to determine the strength of Penicillin in the liquor. Pyrex sampling bottles, Erlenmeyer flasks, culture tubes, and the serological pipettes for



Amelia Maio inserts a specified amount of liquid into pipette in CGW apparatus department to determine accurately the graduations to be engraved into the glass. The pipette, in turn, is used to measure Penicillin solutions in the assay laboratories

Fleming might have discarded the dish, but this keen man noticed a peculiar thing—the mold was surrounded by a clear space in which no bacteria grew. Something the mold was giving off had destroyed the bacteria! So Dr. Fleming took a little excursion into mold growing, and discovered that the strange secretions from a certain mold species would kill many harmful bacteria without damaging human blood corpuscles. He named the strange substance "Penicillin."

Other British researchers took up this study and by 1940 had produced a pinch of brown powder so potent that one part in several million would slow bacterial growth. But these tests were still "in vitro," all performed in laboratory test tubes, not on living beings.

From Mice to Men

So the scientific route of mice to men was followed. A wide range of infections was treated—with amazing results. Here was a drug that not only arrested the growth of deadly germs but, unlike any other known drug, did not have any ill effect on the patient. Recovery in many instances is so quick and so complete that the greatly improved morale of patients is of untold value.

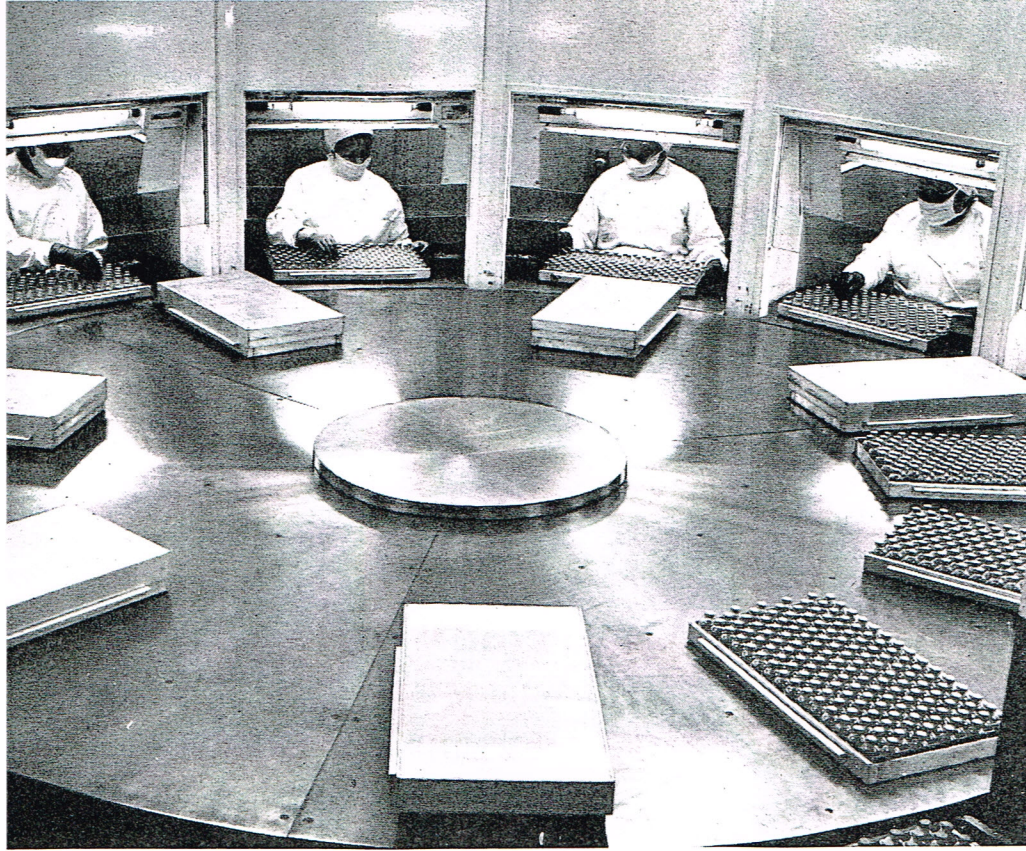
Research on Penicillin was begun in this country in 1941. Surface mold growth was used. Pyrex flasks like those in the accompanying photograph were partially filled with a culture liquid; steam-sterilized to kill unwanted spores; then carefully inoculated with a "shot" of the right mold spore, *Penicillium notatum*. Held at the right temperature for a period of days, this mold grew into a thick green mat, and as it grew

accurately measuring-out of the diluted samples are used extensively at this step. Pyrex piping also is used in many Penicillin plants for sight flow glasses in metal pipelines. And at one deep tank plant the entire piping system, including valves, is of glass.

After the proper concentration of Penicillin is reached, the big production tanks are dumped and the Penicillin must be extracted by solvents from the liquor. It is then made into Penicillin Sodium, the form in which it is sold. From this stage forward all the Penicillin Sodium solution, now very concen-



Technician preparing assay dishes to determine the strength of finished Penicillin at laboratory of Merck & Co., Inc., Rahway, N. J.



Even the air is sterilized by germicidal lamps of CGW glass in this room where rubber stoppers are inserted into bottles of dried Penicillin at the Pfizer Company

trated, is handled in large Pyrex flasks or bottles for safekeeping until it is packaged.

Now a thorough laboratory check is made on the product. Here Pyrex petri dishes are used extensively to carry out assay tests that determine the potency of the Penicillin solution.

Filtered Through Glass

Next, the concentrated solution of Penicillin Sodium—filtered through a bacteria-removing filter and finally a Pyrex fritted glass filter that removes all solid particles—is measured into small sterile bottles which hold about three-fourths of an ounce. A number of large producers specify Pyrex bottles for this purpose. Enough solution goes into each bottle to assure a package containing at least 100,000 units of dry powdered Penicillin Sodium.

The liquid in these bottles is frozen, then the bottles are placed in large vacuum chambers where the Penicillin in each bottle is dried to less than 2% moisture content. This drying is very necessary to preserve the potency of the product, for Penicillin Sodium is stable for long periods only when perfectly dry.

Each bottle is stoppered under sterile conditions. Many ultraviolet lamps equipped with CGW glass are used to kill bacteria in the air entering the sterile rooms in which this work is performed. After rubber stoppers are

inserted in the bottles, they are capped with aluminum pressure seals that firmly hold the stopper in place and prevent tampering with the product. Now labels are applied and the bottles of dried Penicillin Sodium, each containing 100,000 Oxford units, are ready for packaging.

Laboratory control is not completed, however. Random samples of the finished bottle packages are tested again for potency and for toxic and fever-producing substances. All tests are carried out with the assistance of Pyrex laboratory glassware strictly in accordance with Food and Drug Administration procedures. Thousands of petri dishes are used every day for this important work.

Shipped in Pyrex Bottles

Even when the Penicillin is shipped to the Army or Navy or to civilian outlets the use of Pyrex glassware does not cease. The bottles contain dry powdered Penicillin Sodium. To use this the physician must tear off the aluminum bottle cap, stick a hypodermic needle through the stopper, and inject 20 cc or so of sterile salt solution or glucose solution into the bottle to dissolve the Penicillin. When the contents are dissolved, the doctor can withdraw whatever amount of solution is necessary for injecting into the patient. The syringe barrels used for this important work in many instances are made of CGW

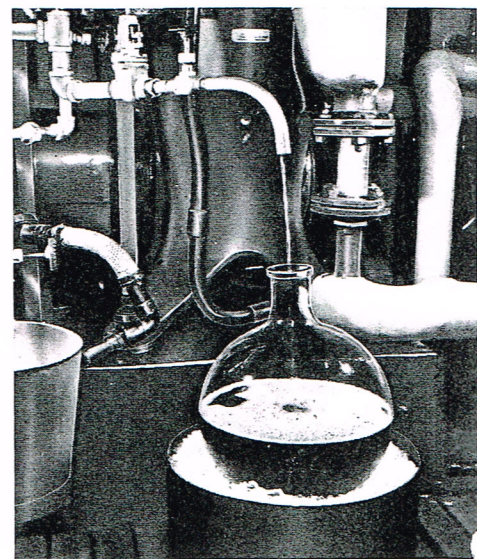
glass, and frequently the armed forces and most of the leading hospitals specify Pyrex brand syringe barrels made by Corning customers.

Practically all Penicillin is given now by the hypodermic needle method—intravenously or intramuscularly. Development of satisfactory methods of taking Penicillin by mouth have not been completed yet. But research continues on this problem and no doubt we shall see satisfactory pills and capsules developed in the near future.

Cures Effected in 24 Hours

Penicillin is truly a remarkable drug. It can cure most cases of gonorrhea within 24 hours, and has been used with clinical success in syphilis treatment. These social diseases may some day be wiped out if proper treatment is followed. The drug is very effective for all staphylococcal infections, gas gangrene, all hemolytic streptococcal infections, pneumonia of various types and bacterial endocarditis, the grim reaper of old age. Penicillin is not effective, however, against many diseases.

No drug, including Penicillin is the cure-all for every human ill. But Penicillin has not only proved effective for many of man's worst bacterial enemies—it has opened the door to wider research into clinical medicine. From the development of Penicillin will come other powerful anti-bacterial agents, some of which are already being tried clinically. We are on the threshold of a new era in medicine. The men and women of CGW can help usher in this era by continuing to provide the new and better tools our scientists require.



Concentrated Penicillin solution pours from the extraction process into a Pyrex balloon flask at Charles Pfizer & Company plant in Brooklyn