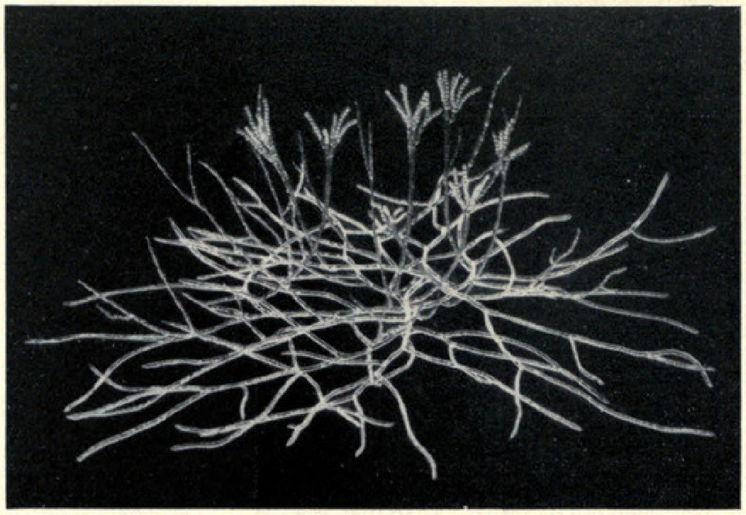
AN EXHIBIT ILLUSTRATING SOURCES OF PENICILLIN

Penicillin—the most famous recent addition to materia medica—what it looks like, what it is derived from, and how it is produced in quantity for use by the medical profession—is the subject of a special exhibit recently installed in Stanley Field Hall.

Mr. William A. Daily, writer of the accompanying article, who has been engaged in research on penicillin at Butler University, acted as scientific consultant for the Museum in preparation of the exhibit.

A notable feature, and one which would not be available to the average layman anywhere else, is a scientifically accurate model of a pinpoint fragment of the blue mold (Penicillium notatum) from which the drug is obtained, magnified 400 times. Modeled in glass by Mr. Emil Sella of the Museum's plant reproduction laboratories from direct studies of an actual specimen under the microscope, it resembles superficially a cluster of ice-coated twigs on a leaf-bare tree in winter. Most of the profusely branching filaments are colorless, but a few which stand more or less upright bear sparse tassels formed of four to eight chains of the reproductive cells or spores to which Mr. Daily refers in his article following. The spores in mass impart a blue color to the mold. Other branches, as shown in the model, grow more or less downward, and from these penicillin diffuses into culture bases used in the production of penicillin.

The remainder of the exhibit consists of material illustrating the appearance and growth of blue mold, and the methods devised for quantity production of penicillin. Two familiar molds found on rotting fruit, stale bread and other organic matter are shown as they grow on agar to which food has been added. Both species are employed in the commercial production of penicillin.



THE INVISIBLE MADE VISIBLE

Model of a pinpoint fragment of the blue mold Penicillium notatum as seen magnified 400 times under the microscope. Included in the exhibit relating to the sources and production of penicillin, prepared in the plant reproduction laboratories of the Department of Botany and currently displayed in Stanley Field Hall. Note the spores on the upright filaments—it is these which impart a blue color to the fungus organism from which Sir Alexander Fleming first extracted the antibiotic substance penicillin.

One model is of a culture which is a direct descendant of the original used in 1929 by Sir Alexander Fleming, the discoverer of penicillin and its effect on bacteria, thus lending a historical aspect to the exhibit.

PENICILLIN—ITS HISTORY, DERIVATION AND USES

By WILLIAM A. DAILY
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The discovery of penicillin is credited to Sir Alexander Fleming of London, who for this reason received the Nobel prize for physiology and medicine. Fleming was by no means, however, the first to observe the antagonistic action of some organisms against others growing in culture.

Having previously isolated a substance from egg white which would dissolve bacteria, and being especially interested in finding new antibacterial substances, he made an extensive study when he found the growth of a culture of pathogenic bacteria inhibited by a contaminating mold, *Penicillium notatum.* An attempt to isolate the active agent by extraction from the culture medium in which the mold grew was only partially successful, because the substance obtained, which he called "penicillin," was unstable. By his experiments, however, he demonstrated that if it could be obtained in stable form, penicillin had qualities recommending it for clinical use.

The study of penicillin was not resumed until ten years later when Dr. Howard B. Florey and his colleague, Dr. Ernest B. Chain, both of Oxford University, began the work which resulted in the successful isolation, purification and clinical testing of this substance. They likewise have been honored by sharing the Nobel prize with Sir Alexander.

Spurred by increasing misfortune in war, Great Britain in 1941 sent Dr. Florey to the United States with the seemingly difficult task of encouraging American scientists in government and large commercial institutions to take up the study and preparation of this little-known drug. The result from combined English and American effort is now a major landmark in medical history, and large quantities of penicillin are now being produced commercially.

In the manufacture of penicillin, strict attention is directed toward the maintenance of suitable cultures of *Penicillium notatum.* A spore of this "blue mold" germinates to produce a thin-walled cellular filament (hypha) which branches many times to form a prolific whitish fluffy mold (mycelium). From this mycelium arise numerous erect branches which produce at their ends chains of spores in a brush-like arrangement. The characteristic color of the mold is produced by the spores *en masse* and partly by the aerial and submerged mycelium.

In the popular method of production, a piece of the mold of proper specifications is placed in a huge metal tank which contains thousands of gallons of liquid suitable for the growth of the fungus. Proper temperature, aeration and agitation are necessary in the tank during the period of growth to ensure the maximal production of penicillin. As soon as the mold has ceased producing it, the penicillin is extracted and purified from the liquid. Tests are made for potency and safety.

Penicillin is an acidic nitrogenous compound with a marked instability toward heat, acid, and alkali; and the commercial product is a deep reddish-orange fluid, yellow in dilute solutions, with a faint but characteristic odor and a bitter taste. Potency is lost rapidly while in the liquid state; therefore penicillin is dried *in vacuo* as a sodium or calcium salt and stored as such. Pure crystalline material is now being prepared, but only in small quantities. In spite of nation-wide intensive research, efforts to synthesize penicillin have been futile to date.

Some of the bacteria highly susceptible to penicillin are *Streptococcus pyogenes* (causing pus formation and puerperal fever), *Staphylococcus aureus* (causing bone disease, boils, etc.), both of which are important in war wounds, and *Streptococcus pneumoniae* (causing pneumonia). The usually fatal staphylococcic and streptococcic septicemias show decided improvement within 24 hours after treatment with penicillin has begun. Other susceptible organisms are those causing diphtheria, gas gangrene, gonorrhea, syphilis, meningitis, tetanus and actinomycosis.

Broadly speaking, the Gram positive bacteria and Gram negative diplococci are sensitive to penicillin; whereas the Gram negative bacilli are affected by it to various degrees. Some of those much less sensitive to the effects of penicillin are the bacteria causing typhoid fever and a form of food poisoning; while some, such as those of plague, cholera, dysentery, and tuberculosis, are quite insensitive. Malaria has not been controlled by penicillin.