of the human or bovine strains of the tubercle organism. On this medium *B. larvae* cultures grow well, but fail to sporulate. When the tubercle organisms are present, however, sporulation occurs. Since the human and bovine strains studied show a different inhibition response to the presence of *B. larvae* and since the avian strain is not inhibited, a cultural method of differentiating such strains might be possible.

The antibiotic is soluble in water, but not in the common organic solvents or alcohols. It is adsorbed on activated charcoal or infusorial earth, but no eluent has been found. The material does not pass through either a Cellophane or a parchment membrane. It possesses moderate heat stability and can be sterilized by pasteurization without appreciable loss of potency. Active preparations have been obtained from scales held for over four years in the laboratory. Antibiotic activity is greatly inhibited by the presence of glucose, but not by sucrose, glycerol, xylose or cysteine.

A certain amount of toxicity was demonstrated when a scale extract was injected intraperitoneally into mice, but no toxicity was evident upon oral adminstration. Experiments to determine possible therapeutic use are in progress.

The writer wishes to acknowledge the assistance of C. K. Mingle and J. O. Heishmann, of the Animal Disease Station of the Agricultural Research Center, in preparing certain cultures, and especially the help of A. Frank in preparing the *Mycobacterium* cultures.

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THE CONTINUOUS CULTIVATION OF MICRO-ORGANISMS

IT was in the belief that micro-organisms could be so handled that the substrate could be continuously collected, spent organisms removed and fresh substrate added that the following two experiments were performed.

Experiment 1. The cultivation of Penicillium notatum. All glassware was chemically clean and sterile before the start of the run and all manipulations were done in a manner to maintain sterility or rather to prevent the entrance of organisms foreign to the desired ones.

The *Penicillium notatum* used was an experimental surface-growing strain that under normal handling had been producing 50 units per cubic milliliter[1] of substrate. The substrate was the standard corn steep composition and four days was chosen as the incubation period.

Daily cultivations from the removed matt showed that during the course of the run no morphological change occurred to the organism and no change in its penicillin production could be detected. Daily estimations of the penicillin level of the outflow from the apparatus showed no change.

The diagram of the apparatus is self-explanatory. Sizes of glassware were dictated by availability and may not have been optimum. The prime requisite of the set-up is the regulation of the flow and removal of the matt at such a rate that self-inoculation occurs with the minimum lag period and the removal of adult organisms before they can mutate.

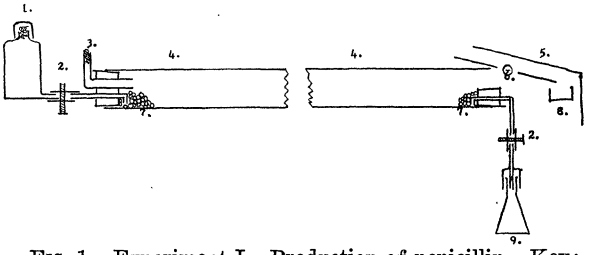

FIG. 1. Experiment I. Production of penicillin. Key: 1. Container for sterile substrate. 2. Screw clamps to regulate inflow and outflow, in this case 20 ml per hour. 3. Aeration tube (cotton plugged). 4. Fermentation tube in this case 4 cm × 200 cm and containing 200 cc of fermenting substrate. 5. Glass baffles to protect open end of tube. 6. Emery covered roller to remove matt. 7. Glass beads to fill lower portion of fermentation tube so that a thin film of fluid floats the matt. 8. Jar to hold removed matt. 9. Shielded container to hold penicillin containing outflow.

Experiment II. Cultivation of Yeast. To determine the possibility of utilizing the principles involved in the Penicillium experiment with other organisms the following experiment was set up.

A commercial strain of brewers' yeast was used. The details of the apparatus had to be varied due to the difference in characteristics of the organism. The wire screens indicated in the diagram serving as baffles worked with relative satisfaction, the outflow being only slightly turbid. The yeast cells in the collecting columns compacted to remove most of the fluid and yielded a pasty mass of cells.

The alcohol estimation of the outflow was based on the specific gravity and is quite inaccurate, the per cent. on this basis was indicated as about 4 and did not vary more than a very small amount from day to day. Daily culture of the yeast at the removal point did not show any change in characteristics.

The diagram (Fig. 2) is self-explanatory. As with the first experiment sizes were determined by availability and are probably not optimum.

Aeration of the reaction chamber in both experi-

[1] Recently strains of Penicillium have been isolated having much greater yields than the strain used. This, however, does not have any bearing on the experiment itself.

ments was adequate, although a forced draft could have been used if desired.

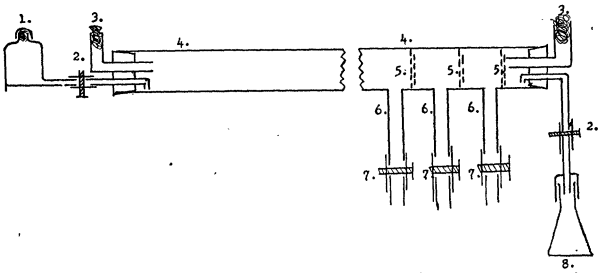

FIG. 2. Experiment II. Fermentation by brewer's yeast. Key: 1. Container for sterile substrate. 2. Screw clamps to regulate inflow and outflow in this case 50 ml per hour. 3. Aeration tubes cotton plugged. 4. Fermentation tube in this case 4 cm × 200 cm and containing 300 ml of substrate. 5. Wire screen baffles to help deposit of yeast cells in side arms. 6. Side arms for partially compacting and removing yeast cells. These side arms were 2 cm by 50 cm. 7. Screw clamps for use in removing semi compacted yeast mass. 8. Container for alcohol containing fluid.

These two experiments are presented with the idea that a useful method has been devised for the massive cultivation of micro-organisms without resort to very large containers with the attendant loss of time for discharge, cleaning and recharging. It is also believed that the technique could be applied to the cultivation of any micro-organism if the proper modifications in the basic apparatus were devised.

It is believed that the method would prevent a large loss of substrate by preventing the formation of mutants and by the possibility of stopping the reaction at any point if contamination should occur with only the loss of the preceding material.

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SOCIETIES AND MEETINGS

THE AMERICAN PHILOSOPHICAL SOCIETY

THE American Philosophical Society and the National Academy of Sciences held a joint meeting in Philadelphia on Friday and Saturday, November 16 and 17, 1945. The open sessions were devoted to a symposium on "Atomic Energy and its Implications." About four hundred members of the two societies and specially invited guests were present. Because of this large number and the fact that the meetings were open the sessions on Friday were held in the auditorium of the University Museum of the University of Pennsylvania, and on Saturday the open session was held in the Old Custom House, Chestnut Street below Fifth, now occupied by the Carl Schurz Foundation. At each of the open sessions there were approximately six hundred persons present.

The following papers were read at the morning and afternoon sessions on Friday:

Henry DeWolf Smyth, Princeton University, "The Scientific Background of the Atomic Bomb."

J. Robert Oppenheimer, California Institute of Technology, "Atomic Weapons."

Robert S. Stone, M.D., University of California, "The Health Protection Activities on the Plutonium Project."

Joseph H. Willits, The Rockefeller Foundation, "The Process of Social Adjustment to Atomic Energy."

Jacob Viner, University of Chicago, "Implications of Atomic Bomb for International Relations."

Irving Langmuir, General Electric Company, Schenectady, "World Control of Atomic Energy."

James T. Shotwell, Carnegie Endowment for International Peace, "The Control of Atomic Energy under the Charter."

Awards made by the National Academy of Sciences at the dinner on Friday evening at the Benjamin Franklin Hotel were announced in SCIENCE for November 30.

Preceding the Friday evening lecture by Arthur Holly Compton on "Atomic Energy as a Human Asset," which was given in the Auditorium of the Edison Building of the Philadelphia Electric Company, Dr. Conklin presented the Benjamin Franklin Medal of the American Philosophical Society on behalf of the society. After reviewing the history of this medal he turned to Dr. Compton and said "To you, Arthur Holly Compton, preeminent in science, distinguished successor of Franklin in exploring the fire from the sky in the form of cosmic rays, philosopher and statesman in education, ethics and international relations the American Philosophical Society awards this Benjamin Franklin Medal."

The following papers were read at the open session on Saturday:

Harold C. Urey, University of Chicago, "Methods and Objectives of Isotope Separation."

Enrico Fermi, University of Chicago, "The Development of the First Chain Reacting Pile."

Eugene P. Wigner, Princeton University, "Resonance Reactions."

John Wheeler, Princeton University, "Problems and Prospects in Elementary Particle Research."

All the papers read at this meeting will be published in No. 1 of Volume 90 of the Proceedings of the American Philosophical Society.