ceived (February 9) H_{37} live bacilli. All the animals died before May except the two which were still sensitized. These are still living and in good health. This experiment was only an indication that the sensitizing substance may act as a protective one. Further experiments, now under way, involving 46 animals, appear to confirm this impression.

The sensitizing substance may, therefore, be able, if separated from the toxic material which accompanies it in the whole bacilli, to protect animals against tuberculosis.

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AN INOCULATED PENICILLIN DRESSING

CONCENTRATED and purified penicillin are not available to civilians except in extreme circumstances. For intravenous administration it is desirable to use the purest and most potent product obtainable. There are conditions, however, in which it is possible to use advantageously penicillin of less potency. Wounds, furunculosis, sinus infections, gonorrhea and other infections of the skin or mucous membranes might be so treated.

In order that patients may have the benefits of penicillin treatment not otherwise available we have explored some of the possibilities of the use of the crude product.

The Florey or Oxford Unit is defined as "the amount of penicillin which, when completely dissolved in 50 ml of meat extract broth, just inhibits completely the growth of the test strain of *Staphylococcus aureus*."[1] Thus a solution containing one unit per cc represents a bacteriostatic agent against the staphylococcus diluted 50 times. The average production from Czapek's synthetic medium is about 4 units.[2]

Since, in the accounts of the therapeutic use of penicillin, the continuous exposure of the infecting organism to the penicillin is stressed, it seemed possible to us that in surface infections the substance might be produced in contact with the lesion. A dressing 5 cm × 5 cm composed of eight layers of gauze was placed in a Petri dish and saturated with a medium containing 1 per cent. yeast extract, 2 per cent. dextrose, 2 per cent. corn starch and 2 per cent. glycerine. This was autoclaved and inoculated with penicillium. After two days at room temperature 1 cc of sterile human plasma was allowed to flush underneath the dressing to simulate as well as possible its application to an open wound. At intervals, shown in the protocol below, the Petri dish was tipped so that the small amount of liquid would drain away from the gauze. This was titrated by the ring test and dilution method. Fresh plasma was substituted under the dressing for that withdrawn. (See Table 1.)

TABLE 1

TITRATION OF PENICILLIN PRODUCED ON INOCULATED DRESSING

Days after inoculation	Diameter of ring test	Units of ring test	Dilution of complete inhibition	Units by dilution method
3	30 mm	5+	.....	...
4	22	.75	.....	...
6	24	1.0	1:200	4
7	..	...	1:200	4
8	21	.75	.....	...
10	10	.25	1:10	.20
3	25	1.5	.....	...
Control washed with salt sol.				

It is impossible to say that these *in vitro* tests represent the exact conditions which would result in the application of the dressing to a lesion, yet the tests demonstrate that a fair amount of penicillin is produced over a period of 4 or 5 days and a bacteriostatic condition would be maintained at the point of contact with the lesion.

Clinical application of the penicillium inoculated gauze dressings and the crude liquid penicillin was made, employing patients who had not been relieved by other acceptable forms of therapy.

One patient had an acute osteomyelitis and periostitis of the right humerus of two weeks' duration. A previous wide incision had been made over the site of the lesion and sulfonamides were prescribed without relief. An inoculated gauze dressing was planted over the wound. Within three hours there was less pain, and in ten days the patient was discharged from the hospital clinically well.

Another patient who had a large furuncle on the back of his neck was treated by injecting the crude liquid penicillin into the open crater and by the local application of an inoculated gauze dressing. Three days later the patient was relieved of all discomfort and the wound was granulating.

A third patient had multiple soft tissue abscesses over his lower back and sacral region. This infection has been recurring regularly for three years. The infecting organism was a *Staphylococcus aureus*. His last period of hospitalization under accepted methods of therapy has been of six months' duration. Crude liquid penicillin was injected into the abscesses and their sinuses and penicillin inoculated gauze dressings were placed over the larger abscesses. This patient is remarkably improved and is still under treatment.

Two other cases of chronic osteomyelitis and periostitis of the femur are being treated with the crude liquid penicillin and the inoculated penicillin gauze

[1] H. W. Florey and M. A. Jennings, *Brit. Jour. Exp. Path.*, 23: 120, 1942.

[2] E. P. Abraham and E. Chain, *Brit. Jour. Exp. Path.*, 23: 103, 1942.

dressings. These patients are clinically improved, but final evaluation will await a subsequent report.

Our laboratory observations and limited clinical experience indicate that this method of treating acute and chronic pyogenic surface infections may hold promise of a possible addition to our therapeutic armamentarium.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN AUTOMATIC FLOW SWITCH FOR WATER-COOLED APPARATUS

IT is often desirable in the continuous operation of a water-cooled apparatus, such as a diffusion pump, to have an automatic device to stop the heating should the flow of cooling water drop appreciably or even stop. A simple and easily constructed device for the protection of such apparatus is described.

The switch was made from 8 mm pyrex tubing as shown in Fig. 1. Two sealed-in leads of tungsten

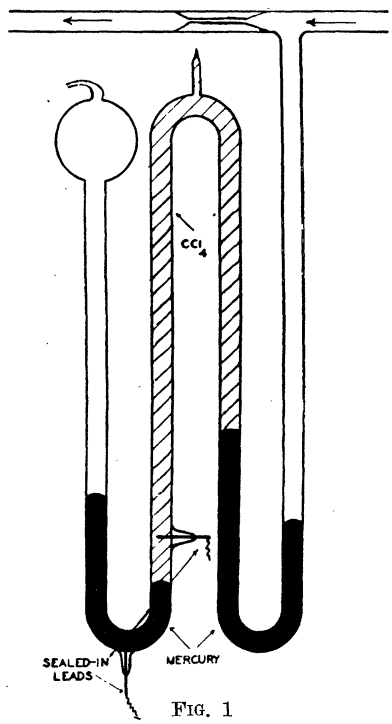

FIG. 1

wire were used for contacts. The two U-tubes are approximately twenty cm in height, but the dimensions are, of course, not critical. Two U-tubes in series are necessary to prevent ordinary chlorinated tap-water from coming in contact with the leads. The size of the orifice is 2 to 3 mm and must be varied with the flow rate desired. The two U-tubes are partially filled with mercury, with the intervening space filled with either an inert liquid or air. The use of a column of air to connect the two mercury columns renders the switch extremely sensitive to slight pressure changes.

The switch is inserted in the cold water inlet of the condenser or other water-cooled apparatus, and as long as sufficient cooling water is flowing the mercury in each U-tube stands at different heights. Should the flow of water cease, however, the mercury is restored to the normal level and electrical contact is made between the two sealed-in wires. The switch is connected in series with a normally closed relay to break the heater circuit when the flow of water ceases.

If the uppermost sealed-in lead is built into the opposite arm of the U-tube, the mercury is in contact with the two leads as long as the water is flowing, and in this case the circuit is broken rather than closed by a drop in flow rate of cooling water. Thus, the switch can be constructed so that failure of cooling water supply will either complete or break an electrical circuit, and hence the switch can be used with either a normally closed or normally open relay depending upon which side of the U-tube the contact wire is inserted. If the heater current is reasonably low the switch itself can be used directly in the heater circuit without the use of a relay.

This safety device was developed during an investigation which was supported by a grant from the Abbott Fund of Northwestern University.

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