bibliography is included at the end of each chapter for those wishing more detailed information.

Chapter I presents the historical milestones in radiology from the discovery of roentgen rays to the construction of the 100 million volt betatron. In the 14 pages of Chapter II a very brief but fundamental outline is given of the concepts of the structure of matter. The nature of radiations is covered in Chapter III (7 pages) and in Chapter IV the fundamentals of electricity and magnetism are given in the simplest terms. High voltage generators in Chapter V (26 pages) starts with rectification, including all the general types. It continues with short descriptions of electromagnetic and electrostatic supervoltage generators and ends with the Kerst betatron. Chapter VI (8 pages) dealing with roentgen ray tubes is perhaps too short. The next two chapters deal with the production and nature of x-rays and the interaction of radiation and matter. These chapters contain fundamental information which greatly helps in the understanding of the action of x-rays, both in their biologic action and in diagnostic procedures, the latter being considered in Chapter IX. The measurement of x-ray quantity and quality is excellently taken up in the next two chapters (64 pages). The principle of ionization chambers of various kinds and their use are well described. Diagrams, charts, curves and tables help to clarify this material. Of great interest is the chapter on tissue dosage (33 pages). Next comes radioactivity, and measurement of gamma ray quantity. Neutrons and artificial radioactivity are coming subjects of inevitable importance to the radiologist. Some of the fundamentals are presented in Chapter XV (20 pages). Dosage in gamma-ray therapy is discussed in Chapter XVI, with charts and tables; and biologic reaction to radiation in Chapter XVII. The next chapter, dealing with roentgen ray and radium therapy records, is extremely worth while as it teaches the therapist to think accurately and it is a step toward uniformity of all therapy records. The last chapter (XIX) deals with roentgen ray and radium protection and is a subject that all radiologists should constantly keep in mind.

In the Appendix, 12 depth dose tables are given covering radiation from 100 kv inherent filter only, to 200 kv, 2.00 mm cu. The volume ends with a name index and a suject index.

The book is practical in nature, covering material needed by the practicing radiologist.

GEORGE C. HENNY

SPECIAL ARTICLES

INHIBITION OF GROWTH OF MYCOBACTERIUM TUBERCULOSIS BY A MOLD[1]

A CULTURE of tubercle bacilli which had been stored in the ice box was found to be overgrown by a green mold. Subcultures of this mold on other cultures of tubercle bacilli showed rapid and luxuriant growth at room temperature but no growth at 37° C. On cultures of tubercle bacilli the mold grew faster and sporulated earlier than it did on similar sterile media.[2] Growth of the mold occurred on suspensions of tubercle bacilli in saline solution, although no growth of it occurred in the saline solution alone. The mold is as yet unidentified but probably belongs to the Penicillium group.

Experiments were carried out to determine the effect, if any, of this mold or substances produced by it, on tubercle bacilli. Several of these experiments are presented in this preliminary report.

Effect of the mold on Mycobacterium tuberculosis: Suspensions of tubercle bacilli were made in saline solution in concentrations of 3 mgm tubercle bacilli per ml. Recently isolated, rapidly growing strains of human type tubercle bacilli were used. Suspensions of the mold were made by grinding it in a mortar with saline solution. The pH of the mold suspension varied from 6.5 to 7.8. 5 ml of tubercle bacilli suspension (15 mgm of organisms) were added to 5 ml of the mold suspension and to 5 ml of saline solution as a control. The mixed suspensions were allowed to stand from 24 to 48 hours at room temperature. At the end of this period smears and cultures were made on three culture tubes and 1 ml of the mold suspension was injected into the left groin of a guinea pig.

Thirteen experiments of this type have been carried out with but one culture tube showing any growth of tubercle bacilli. In that instance only one colony was observed, whereas the control cultures grew luxuriantly. The other twelve experiments gave entirely negative results. Although no growth was observed on these tubes, acid-fast bacilli were still present in smears even after several months' incubation of the tubes. Likewise, acid-fast bacilli were seen in smears of the mixed suspensions.

Seven of the thirteen experimental guinea pigs are alive and have negative tuberculin tests, whereas all the control animals except one have died of tuberculosis. Six of the experimental animals died of tuberculosis. The results of two experiments of this type are shown in Table 1.

[1] From the Edward J. Meyer Memorial Hospital and the Department of Medicine, University of Buffalo School of Medicine, Buffalo, N. Y.

[2] F. G. Petrik, *Am. Jour. Clin. Path. (Tech. Supl.)*, 8: 134, 1938.

In a second type of experiment, the mold was grown at room temperature on cultures of tubercle bacilli. The controls were cultures of tubercle bacilli of the same strain and were kept under the same conditions. At the end of two weeks, suspensions were made of the controls and of the mold and tubercle bacilli tubes by grinding with saline solution in a mortar. Cultures, smears and guinea pig injections were done after the suspensions had stood for 24 hours as in the previous experiments. Eleven such experiments have been done. In no instance have tubercle bacilli grown in the cultures of suspensions of mold and tubercle bacilli while the control cultures have all grown rapidly. As in the previous experiments, acid-fast organisms were found in all the smears. Ten of the experimental guinea pigs are alive and well; all these have negative tuberculin reactions. One animal died of an acute enteritis on the 88th day and showed no tuberculosis. The results of two such experiments are shown in Table 2.

TABLE 1

No.	Date	Cultures	Guinea pigs
41	3/21/44	− − −	living 7/21/44
58	3/21/44	− − −	living 7/21/44
control	3/21/44	+ + +	died at 53 days (Tbc at autopsy)
63	4/7/44	− − −	died at 99 days (Tbc at autopsy)
control	4/7/44	+ + +	died at 43 days (Tbc at autopsy)

TABLE 2

No.	Date	Cultures	Guinea pigs
14	2/26/44	− − −	living 7/21/44
control	2/26/44	+ + +	dead at 41 days
15	3/3/44	− − −	living 7/21/44
control	3/3/44	+ + +	dead at 84 days

Effect of the mold on Tuberculin and P.P.D.: The mold grew well on tuberculin in dilutions as high as 1:10,000 in saline solution. It also grew on dilutions in saline solution of P.P.D. (Purified Protein Derivative of Tuberculin), in concentrations of 0.05 mgm and 0.0002 mgm P.P.D. per ml. No growth occurred on saline controls. Solutions of tuberculin and P.P.D. upon which the mold had grown no longer produced positive skin reactions in guinea pigs which had been previously injected with tubercle bacilli, although control solutions of tuberculin and P.P.D. made in the same manner and left at room temperature for the same length of time produced typical skin reactions in the same animals.

Suspensions of the mold, prepared as described above, inactivated 1:100 tuberculin in two hours when left either at room temperature or at 37° C. Supernatant fluid obtained after centrifugation of the mold suspension also inactivated 1:100 tuberculin. When the supernatant fluid was passed through a bacterial filter (E. K. Seitz), the filtrate did not inactivate tuberculin.

Experiments using fluid media, similar to that used for the production of penicillin, upon which the mold had been grown for 8 to 15 days, have shown no effect on tubercle bacilli or on tuberculin. *Staphylococcus aureus* grew on solid media upon which the mold had been grown and had been removed. Therefore it is believed that the substance produced by this mold is not similar to penicillin.

Experiments using extracts of the mold and of the supernatant fluid are in progress at the present time.

In 1910 Vaudremer[3] observed that tuberculin, when added to filtered extracts of molds such as *Aspergillus fumigatus* and *Penicillium glaucum,* loses its activity. Furthermore, he observed that tubercle bacilli were modified by maceration in extracts of these fungi. Machado[4] noticed that tubercle bacilli lost their acid fastness after three months' incubation in a culture of an unidentified mold. Smith and Emmart[5] have shown that aqueous solutions of ether extracts of Raulin-Thom culture media of *Penicillium notatum* exhibited *in vitro* at certain concentrations, marked bacteriostatic activity against tubercle bacilli, although other preparations had little or no activity.

Conclusions: Suspensions of a mold which probably belongs to the Penicillium group inhibit the growth of tubercle bacilli. Suspensions of this mold inactivate tuberculin in two hours. Filtrates of these suspensions have no effect on tuberculin.

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IODINATION OF INSULIN

IN an earlier report it was pointed out that the presence of a sufficient concentration of phosphate buffer salts at moderately elevated temperatures greatly increases the rate at which tyrosine reacts with certain oxidants.[1] This characteristic increased activity was found to be associated with the phenolic hydroxyl group. In view of the importance which has been attributed to this group, in regard to the physiological activity of a number of hormones, enzymes and proteins of disease this activity has been employed in correlating physiological and chemical activity and has been applied as a means of readily iodinating proteins or introducing other groups.

[3] A. Vaudremer, *Ann. Inst. Pasteur,* 24: 189, 1910; "Le Bacille Tuberculeux," Les Presses Universitaires, Paris, 1927.

[4] A. Machado, *Compt. rend. Soc. biol.,* 96: 484, 1927.

[5] M. I. Smith and E. W. Emmart, *Pub. Health Rep.,* 59: 417, 1944.

[1] D. E. Bowman, *Jour. Biol. Chem.,* 141: 877, 1941.