THE RETICULUM OF THE LUNG *

V. ITS SIMILARITY IN BLASTOMYCOSIS TO THAT IN TUBERCULOSIS

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During the past year I have had the opportunity of studying the reticulum in two cases of blastomycosis which were placed at my disposal by my colleagues, Drs. Bunting and Medlar.[3] One of these was a case of acute blastomycosis which occurred in a boy 18 years of age, and was correctly diagnosed during his life; the other was an unsuspected case of chronic blastomycosis in a man 62 years of age, and was not correctly diagnosed until sections of the lung had been subjected to microscopic study.

Blastomycosis, as it occurs in the human lung, has been described by Irons and Graham,[1] LeCount and Myers,[2] and others who have studied its pathology, as "essentially a bronchopneumonia and more a bronchitis than a pneumonia." In each of the cases studied by myself bronchopneumonia has been the outstanding lesion although, as LeCount and Myers have stated, many of the bronchi were almost obliterated and their position could only be determined by the accompanying blood vessels.

In an address given in New York before the Harvey Society,[4] I described three types of bronchopneumonia that were associated with tuberculous lesions, and "each type presents a characteristic picture when stained for reticulum."

In Type 1, the walls of the alveoli are recognized with difficulty, and there is no increase of reticulum in their walls. No reticulum is found within the alveoli themselves. The exudate which fills the alveoli undergoes an early and rapid caseation. Miliary tubercles are rarely present.

In Type 2, the walls of the alveoli are increased in thickness and they contain an increased amount of reticulum. The alveoli are filled with an exudate in which caseation takes place quite early. Miliary tubercles are present in considerable numbers. The reticulum shows a tendency to encapsulate the caseous areas without however, extending into the alveoli themselves.

In Type 3, the walls of the alveoli are thickened; the alveoli themselves contain an exudate that consists largely of endothelial cells (mononuclear leuco-

* Aided by a grant from the National Tuberculosis Association.
Received for publication March 14, 1927.

cytes), lymphocytes, and a few polymorphonuclear leucocytes, which are enclosed within a dense network of reticulum. The reticulum in the walls of the alveoli is increased in quantity and is directly continuous with the network within the alveoli. Because of these characteristics which differentiate this type from the two preceding types, I have designated it *reticular pneumonic tuberculosis.*

If we compare a section of Type 2 (Fig. 1), of the above classification of bronchopneumonia, with a section of the lung in the case of acute blastomycosis (Fig. 2), it will be seen that, aside from the presence of the special organism of blastomycosis, they present the same characteristics, namely, a thickening of the walls of the alveoli, an increase in the amount of reticulum in their walls and no reticulum within the alveoli.

The exudate which occupies their lumina consists, in the majority of the alveoli, of mononuclear leucocytes, a few polymorphonuclear leucocytes and lymphocytes. Other alveoli contain numerous polymorphonuclear leucocytes and in some instances show the necrosis of early caseation. Whatever the character of the exudate may be, the organism of blastomycosis forms a prominent feature. Few giant cells are found. They may, or they may not, contain organisms, which when present, are usually arranged around the periphery of the giant cell.

In sections which have been impregnated by Bielschowsky's silver method the organism of blastomycosis is brought into special prominence, and this method gives a much better demonstration of the organism than staining with hematoxylin and eosin. Even in low power pictures the organism is easily recognized whether it be in the exudate of a bronchopneumonia (Fig. 2), or in a mass of caseation (Fig. 4).

When the living organism is studied under a high power (Fig. 3), the mode of propagation is seen to be by budding. On the other hand LeCount and Myers think that it is also propagated by means of spores, but I have not found them. The mature, viable organism is spherical and presents a characteristic stippled appearance; the same is true of the buds as soon as they have developed sufficiently to show a spherical outline, even though they are still connected with the parent organism.

In a previous contribution [5] I have described the part reticulum plays in the reparative process in miliary tuberculosis. It was there

shown that in the case of mononuclear or "epithelioid" tubercles, in which caseation has not taken place, there is a progressive development of reticulum which eventually is converted into collagenous tissue. In those cases in which caseation has taken place, unless the area of caseation be too large, the necrotic material is gradually absorbed and the reticulum eventually fills in the space thus created; the reparative process then proceeds as in the case of the mononuclear tubercle. The same process takes place in blastomycosis and it is possible to follow the changes in the organism, while in tuberculosis it is not so easy to demonstrate what happens to the bacilli.

In acute blastomycosis the active organism (Fig. 3), has a spherical shape and is marked with a pronounced stippling. With the death of the organism this stippling disappears and, in sections impregnated with Bielschowsky's silver stain, it appears as a shell with a clear center or as a uniform dark sphere (Fig. 8), depending on the plane which lies within the focus of the objective. In sections stained with hematoxylin and eosin, a homogeneous substance is often seen within this shell; possibly this may be the cause of the dark appearance of the shell above mentioned. In many instances a shell gives the impression of having been crushed when the section was cut; in other instances it presents an appearance not unlike the "thimble-shape" of a red blood corpuscle.

Taking up now the case of chronic blastomycosis, it was found that scattered mononuclear tubercles containing the organism were present, especially in the pleura; that numerous giant cells were present; that there was no acute inflammatory cellular exudate, and that the lesion resembled the reparative process in miliary tuberculosis.

In Fig. 4, there is an extensive area of caseation that is surrounded by a layer of collagenous fibers which are continuous with a network of reticulum that is growing into the caseous area. A large number of dead organisms are present outside the area of caseation and many organisms are also present within the caseous area although only a few of the latter appear to be living. It is evident that the progress of the caseation has been arrested and that a reparative process has already begun. On the upper border of the photomicrograph and a little to the left of the center, a band, partly of collagenous fibers, is beginning to extend into the area of caseation, and by

its further growth would probably cut off a segment of the caseous area and thus play an important part in the reparative process.

In Fig. 5, the caseous material has been still further absorbed and the lesion presents the characteristic picture of a miliary tubercle undergoing the reparative process. A large number of dead organisms are seen outside, but only a few within the caseous area. On the left, a small mass of caseous material has been separated from the main area by the extension of a band of reticulum which had, no doubt, an origin similar to the one described in Fig. 4. On the right side of the caseous area another band can be seen which, by its growth, would have divided the larger area transversely. Collagen has been deposited in the fibers around the periphery of the blastomycotic tubercle. In this figure the amount of caseation has been reduced while the reticulum has been correspondingly increased.

A still further reduction of the caseation and increase of the reticulum is shown in Fig. 6. The periphery of the blastomycotic tubercle is made up of collagenous fibers, and heavy strands are extending into the area of caseation. Many dead organisms are enclosed in the network of the collagenous fibers and of the reticulum. No giant cells are present in either Fig. 4, 5, or 6.

In Fig. 7, the only remains of caseation are a few necrotic cells in the center of the photomicrograph, and a giant cell in the upper right quadrant. Three organisms are included in the giant cell and they have the characteristic position on the periphery of the cell. Nearly all the fibers of reticulum have been converted into collagenous fibers. The organisms are not sharply outlined in the photomicrograph, due to the fact that the focus was centered on the network of fibers.

In Fig. 8, only a few remnants of the network of reticulum remain. The majority of the fibers are collagenous. All the organisms are dead and most of them show the characteristic hollow sphere; others present a broken outline, and a few have the "thimble-shape" sometimes assumed by the red blood corpuscles. The blastomycotic tubercle has passed through the entire reparative process.

Conclusion

This study of the reticulum shows that its growth and transformation into collagenous tissue differ in no way in the tubercle of blastomycosis from that in the tubercle of tuberculosis.

If the presence of the special organism be eliminated from the picture, the lesion is the same in both infections.

This leads to the conclusion that, though the organisms differ, the lesion they produce cannot be differentiated.

REFERENCES

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3. Medlar, E. M. *Am. J. Path.*, 1927, iii, 305.
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DESCRIPTION OF PLATES

All the sections were impregnated by Bielschowsky's silver method.

Plate 90

Fig. 1. Type 2 of the tuberculous bronchopneumonia described in the text. × 200.

Fig. 2. The bronchopneumonia of acute blastomycosis. Same type as Fig. 1. × 200.

Plate 91

Fig. 3. The organism of blastomycosis as seen in the exudate of acute bronchopneumonia in blastomycosis. Note the stippling of those organisms which are in exact focus; also the buds in various stages of development, and observe that they have the same markings as the adult cells. × 500.

Fig. 4. Part of an extensive area of caseation. The whole area was surrounded by collagenous fibers. Note their beginning extension into the area of caseation on the left side of the figure. Most of the organisms are dead; a few within the area of caseation are living. Chronic blastomycosis. × 100.

Plate 92

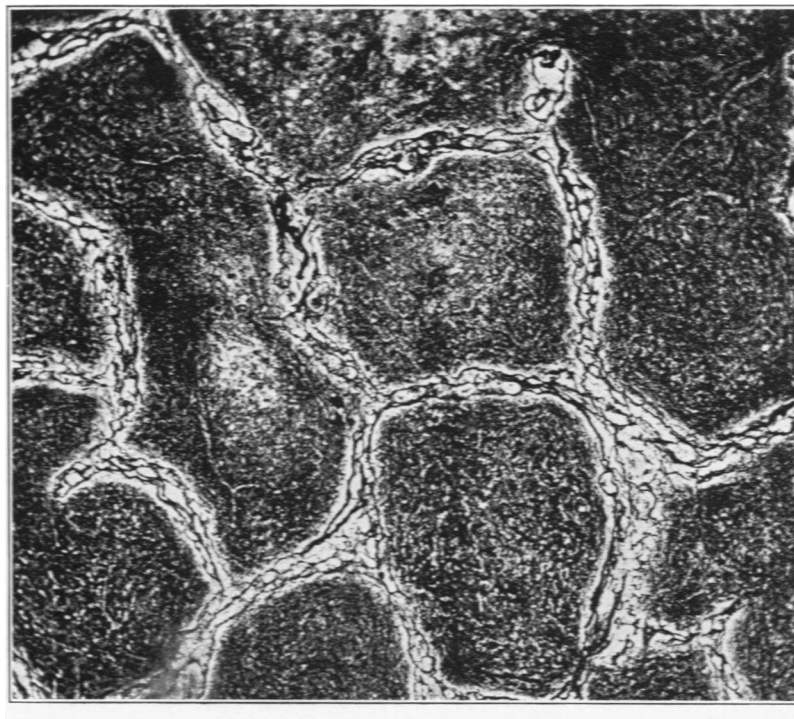
Fig. 5. A blastomycotic tubercle in which absorption of the necrotic material is taking place. The area of caseation is being subdivided by the ingrowth of reticulum. All the organisms are dead. The fibers around the periphery of the blastomycotic tubercle and many of the fibers within the tubercle are collagenous. Chronic blastomycosis. × 100.

FIG. 6. A blastomycotic tubercle in which the area of caseation is smaller than in Fig. 5. Nearly all the fibers contain collagen. All the organisms are dead. Chronic blastomycosis. × 100.

PLATE 93

FIG. 7. The only evidences of caseation in this figure are a few necrotic cells near its center and a giant cell on its right. The giant cell contains three dead organisms. There is still a small area in which reticulum is present; all the remaining fibers are collagenous. Chronic blastomycosis. × 400.

FIG. 8. There is no evidence of caseation in this figure. All the organisms are dead. But few fibrils of reticulum remain; the rest are collagenous. Chronic blastomycosis. × 150.



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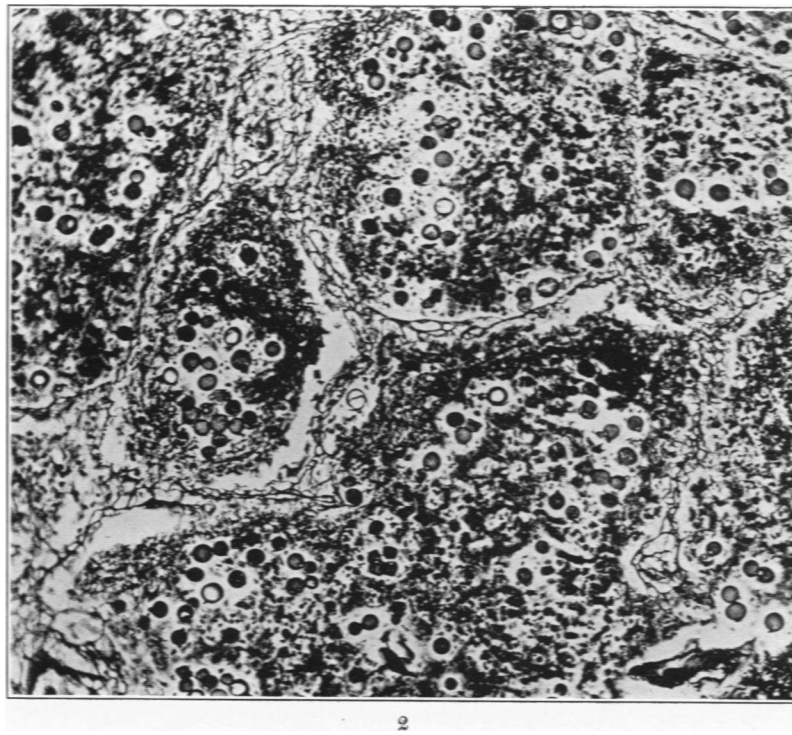

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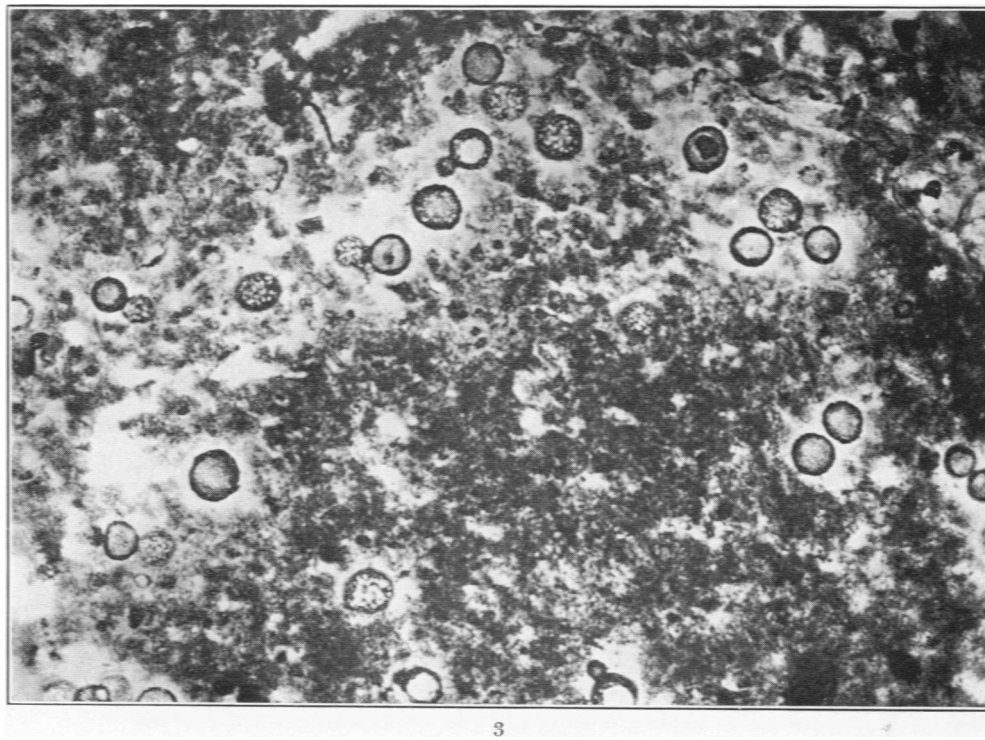

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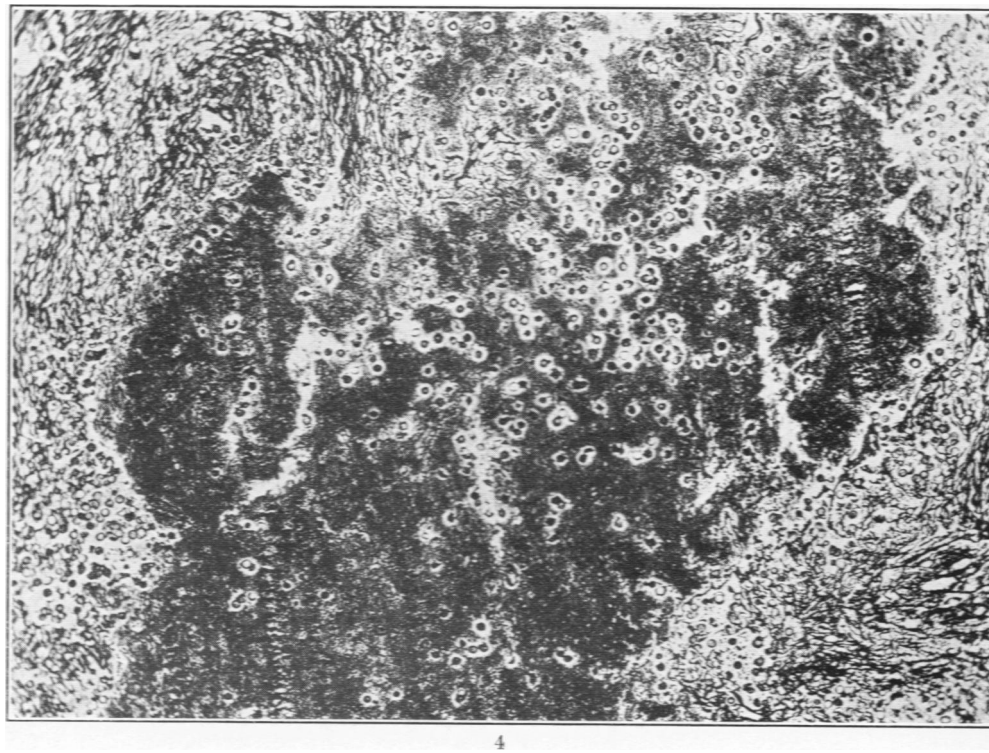

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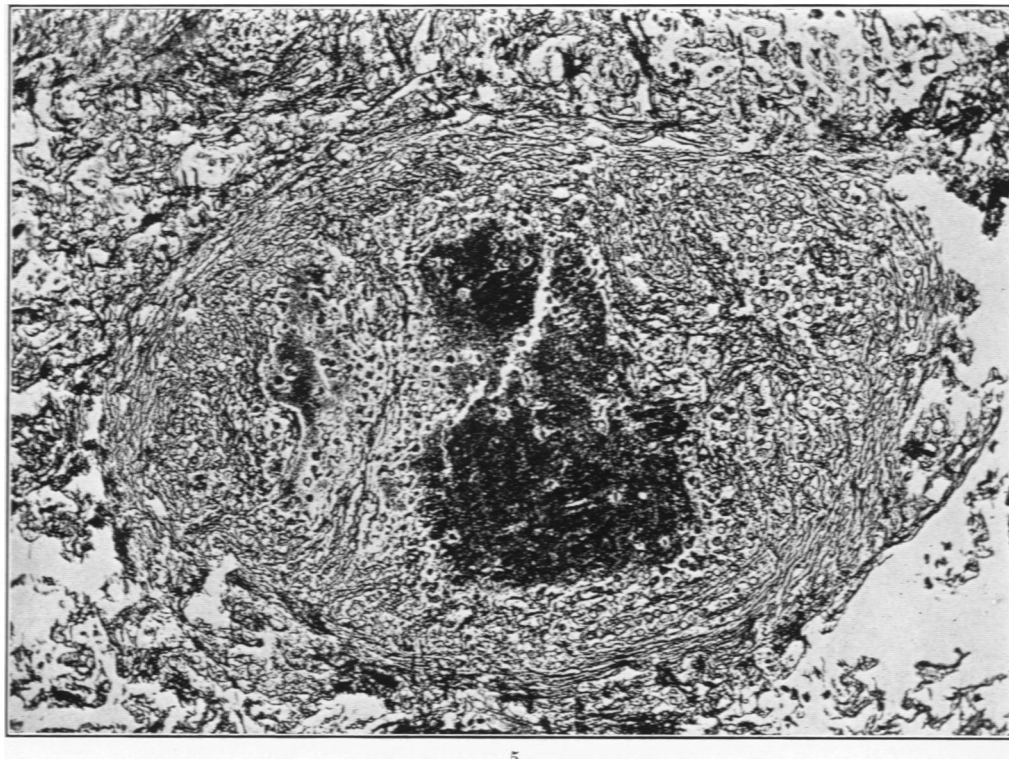
Reticulum of the Lung



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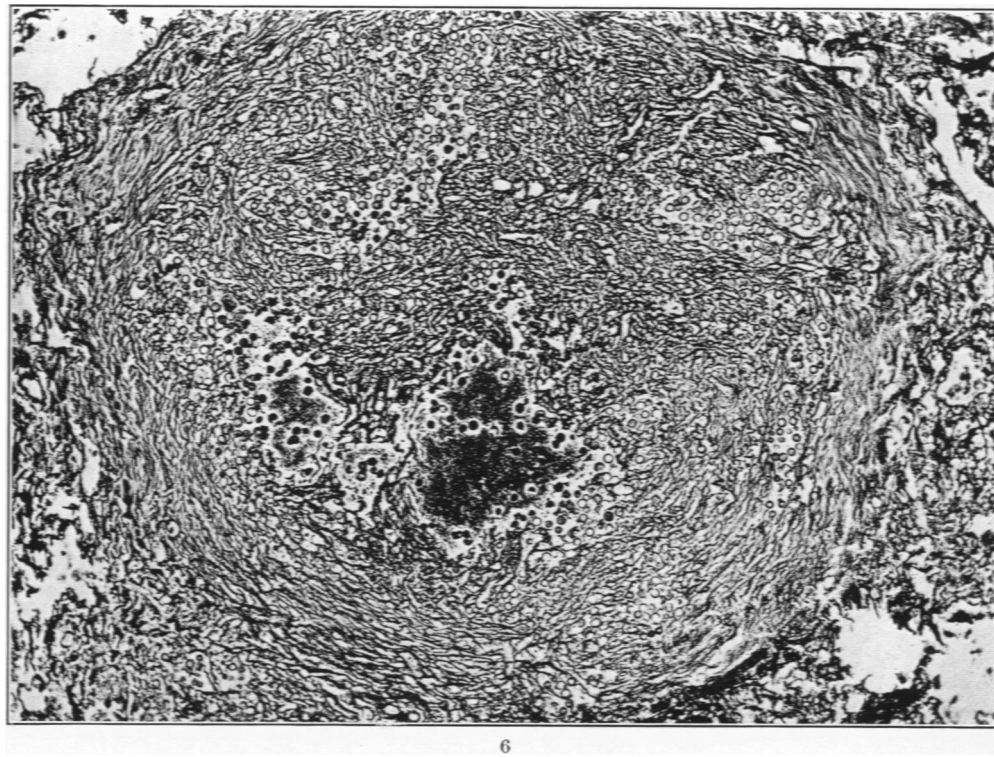

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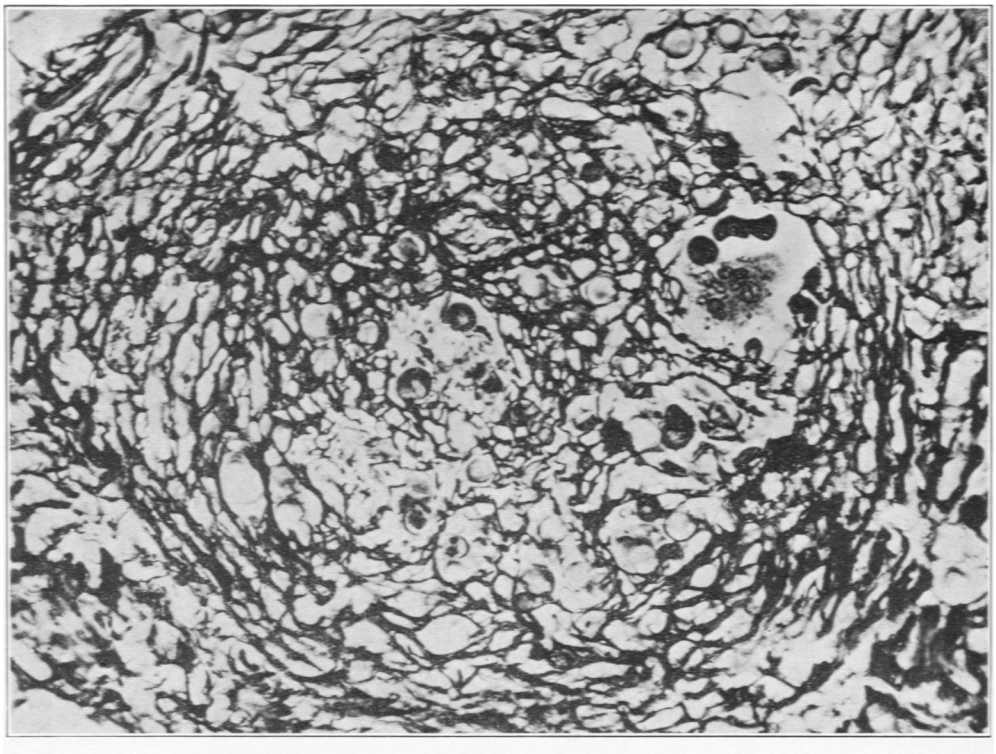
Miller Reticulum of the Lung



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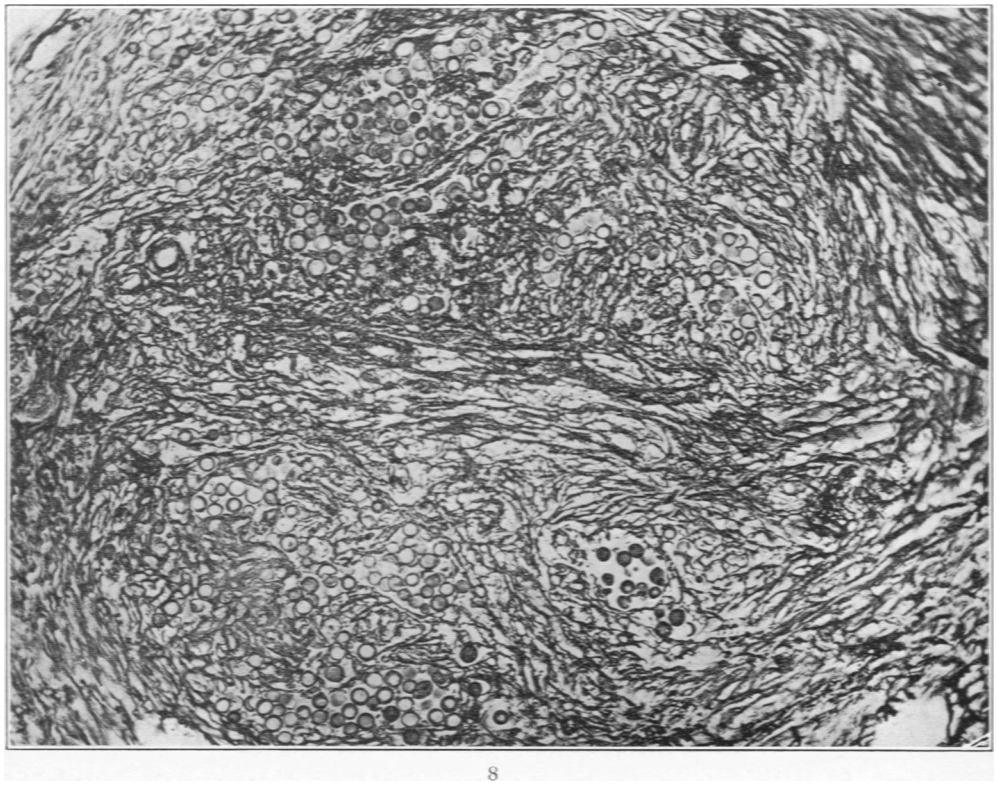

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