

surrounded in part by bone as in Experiment III. Insertion of urinary bladder mucosa into the knee joint was followed by attachment of the mucosa to the synovial membrane and formation of a plaque of bone here.

*Experiment IX:* Clean excision of the mucous membrane of the urinary bladder with the exception of the trigone and a narrow strip around each ureter and the urethra, was followed by regeneration of the mucosa over the denuded parietes, but no bone formed at the end of 90 days.

*Experiment X:* Transplantation of bladder mucosa to the sheath of the abdominal rectus muscle in 6 rabbits produced epithelial lined cysts surrounded by connective tissue but no bone as early as 60 days. In one rabbit at 93 days, there was a deposition of bone.

*Conclusion:* The influence of epithelium on connective tissue in certain places causing the formation of bone is demonstrated for the first time.

## 4758

### Bronchial Fistula. A Method of Experimental Production.\*

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Bronchial fistula, a not uncommon complication following certain operations and disease conditions in man, has been found somewhat difficult to produce experimentally. This fact is substantiated by the work of Pool and Garlock,<sup>1</sup> and others, who found the production of bronchial fistula in dogs attended with great technical difficulties. Their method consisted of resecting a piece of rib and suturing the underlying lung lobe to the very thin parietal pleura over an area 1.25 inches in diameter. At a second stage operation 2 weeks later, the lung parenchyma found adherent to the chest wall was entered by careful blunt dissection until a fair sized bronchus was located. This was then opened and the skin margins sutured to the opening in the bronchus. They were unable to retain this opening, however, without almost daily cauterization, as it tended to close spontaneously.

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<sup>1</sup> Pool, E. H., and Garlock, J. H., *Ann. Surg.*, 1929, xc, 213.

Having no knowledge of the above procedure, we first attempted to produce a bronchial fistula in much the same manner, *viz*: At the first operation a piece of rib was resected and the underlying lung sutured to the parietal pleura and periosteum over an area 1.5 inches in diameter. At a second operation 2 weeks later, the area enclosed by the suture was entered with the actual cautery heated to a dull red until an area 1 cm. in diameter and about 1 inch in depth was burned in the lobe. The skin was sutured around the burned area. A bronchial fistula resulted; however it was very deep seated and also quite small so that this method was cast aside and the following procedure adopted. At the first operation, 2.5 inches of the right 6th rib were removed sub-periosteally at about its mid-point. Under positive-pressure ether anesthesia<sup>2</sup> the thoracic cavity was entered through a longitudinal opening in the rib-bed about 2 inches in length. The right middle lobe was then located and about 75% of it delivered outside the thoracic wall. By using a fine curved needle and a double fine silk suture the lobe was secured to the surrounding pleura, periosteum and intercostal muscles by a single row of continuous sutures. The tissues were then closed in layers over the lung lobe, using catgut for muscle and subcutaneous tissues and linen for the skin. Two weeks later the second operation was performed. The scar of the former operation was excised and the lung lobe outside the thoracic wall located and separated by blunt dissection, from the surrounding tissues down to the row of silk sutures. Firm adhesions were found between the lung lobe and chest wall. The lobe was then amputated close to the chest wall with the actual cautery heated to a dull red. Hemostasis was easily obtained with the cautery. The largest air passage was then located and a rubber tube about 0.25 inch in diameter inserted into it for a distance of 1 or 2 cm. The tissues were then closed in layers over the amputation stump and around the tube, catgut being used beneath the skin, and linen for the latter. A safety pin was placed in the rubber tube and a sterile dressing and body cast applied. Daily dressings were applied through a window cut in the cast, at which time the tube was cleansed and the wound flushed with warm dilute iodine solution. However, the fistula always became infected. The cast was taken off and the tube removed in 2 to 3 weeks.

*Results:* Of 12 dogs treated in the above manner, 3 died on the 1st or 2nd day following the 2nd stage operation; one presumably from shock, another from hemorrhage due to trauma of the wound

<sup>2</sup> Livingstone, H., and Hrdina, L. S., "An Apparatus for the Administration of Positive Pressure Anesthesia." (Unpublished work.)

by clawing and a third from pneumothorax due to false passage of the tube into the lung parenchyma with subsequent perforation into the pleural cavity. The remaining 9 are healthy, lively animals with a bronchial fistula. If the fistula remained infected there has been no tendency toward closure up to the present time, a period of 4 months. However, if the infection clears up, as it has done in some dogs, there occurs a "crusting" at the broncho-cutaneous junction, with closure of the fistula by granulation tissue.

In some recent experimental work on bronchial injury and repair,<sup>3</sup> it was found that a bronchus 0.25 to 0.5 inch in diameter could be completely stenosed by repeated thermal cauterization. A complete stenosis was also obtained within 2 weeks with one application of a 75% silver nitrate solution. In view of these findings, it is reasonable to believe that a persistent bronchial fistula may be permanently closed by one of these methods.

## 4759

### Changes in Humoral Immunity Occurring During the Early Stages of Experimental Pneumococcus Infection.\*

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A study was made of the changes in humoral immunity occurring during the early phases of experimental pneumococcus infection in the dog and cat, employing the methods devised by Robertson and Sia<sup>1</sup> for demonstrating the presence of anti-pneumococcus properties in the serum of animals naturally resistant to this microorganism. It was found that with a generalized and overwhelming infection accompanied by early blood invasion, there was a prompt and rapid decrease in the concentration of natural humoral immune bodies which frequently disappeared entirely by the time of death. This same early diminution of humoral immune substances, opsonins, agglutinins, and pneumococcal promoting bodies was observed to occur in animals recovering from a moderately severe generalized infection with the difference that the concentration of immune bodies

<sup>3</sup> Adams, W. E., and Livingstone, H., *Ann. Surg.* (in press).

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<sup>1</sup> Robertson, O. H., and Sia, R. H. P., *J. Exp. Med.*, 1924, xxxix, 219; 1927, xlvi, 239.