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Tonus Changes in the Gall Bladder Induced by Faradic Stimulation.

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In previous publications it has been shown that a stimulus that usually causes contraction of the human gall bladder may sometimes induce the reverse effect.^{1, 2} This has led us to believe that evacuation of the gall bladder is regulated in part by a reflex mechanism, and that from the standpoint of biliary stasis the reflex control may be more important than any other. Accordingly we have undertaken to ascertain whether reflex inhibition of the gall bladder musculature can be induced by stimulating the intramural portion of the common bile duct with a weak faradic current. Preliminary observations show that if such a current is applied when the gall bladder is under contraction (either spontaneous or after ingestion of egg yolk) tonus diminishes and the column of iodized oil in the gall bladder drops. This work is being supplemented by further experiments dealing with other sensory areas and degrees of stimulation, and with the gall bladder in different initial states of tonus.

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Nature of Local Immunity in Lungs of Rabbits Immunized Against Pneumococci.*

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In a series of experiments designed to study the pathogenesis of experimental pneumococcus pneumonia in rabbits by the method employed by Lamar and Meltzer,¹ Winternitz and Hirschfelder² and

¹ Boyden, E. A., and Parmacek, L., *PROC. SOC. EXP. BIOL. AND MED.*, 1928, **xxv**, 462.

² Boyden, E. A., and Saunders, A. M., *Ibid.*, 1928, **xxv**, 458.

* This is a preliminary report on one of a series of studies on respiratory diseases carried out in connection with the Influenza Commission, established and financially aided by the Metropolitan Life Insurance Company of New York.

¹ Lamar, R. V., and Meltzer, S. J., *J. Exp. Med.*, 1912, **xv**, 133.

² Winternitz, M. D., and Hirschfelder, H. D., *J. Exp. Med.*, 1913, **xvii**, 657.

Armstrong and Gaskell,³ it was found that the intrabronchial insufflation of a broth culture of virulent type I pneumococcus leads to infection of the lungs, with a marked rise in body temperature within 24 hours, usually followed by death of the animal in 1 to 3 days. While pneumococci were recovered from the peripheral blood in only a few of the rabbits before death, blood agar plate cultures of the individual lobes of the lungs, the heart's blood and trachea, taken at autopsy, revealed large numbers of pneumococci. The leukocyte counts were not particularly significant, in that marked increases in numbers were observed in some rabbits and decidedly fewer numbers in others of the same series.

The pathological study of the lung tissues from these animals presents a fairly uniform picture. There is a marked acute inflammatory reaction, the polymorphonuclear leukocyte being the predominant cell of inflammation, with macrophages and lymphocytes in lesser numbers. Eosinophiles are only rarely seen. A diffuse edema of the lungs is common; when areas of consolidation occur they tend to be of a lobular type or the result of dense infiltrations of polymorphonuclear leukocytes in the perivascular and peribronchial lymphatics. The pulmonary lymph follicles are not unusually hyperplastic.

In another series of experiments in which an attempt was made to balance the resistance of the rabbits against the virulence of the pneumococci by partial immunization as reported by Wadsworth,⁴ the course of events was found to be entirely different.

When rabbits were injected daily from 1 to 10 days in the submucosa of the cheek with 1 minim amounts of a heat killed saline suspension of type I pneumococci,⁵ or the nose and mouth sprayed daily with the same vaccine, and this was followed 10 to 20 days later by an intrabronchial insufflation of virulent type I pneumococci, a definite immunity sufficient to preserve the life of the rabbit was observed to be present in those animals which had received 5 or more vaccinations. Furthermore, the body temperature and leukocyte reactions were not accelerated to any marked degree and blood cultures were sterile. In a series of vaccinated rabbits which were killed at 2 and 3 day intervals following a test dose of virulent pneumococci by intrabronchial insufflation, blood cultures of the lungs, heart's blood and trachea were uniformly negative, in contrast to the great numbers of pneumococci present in the unvaccinated controls.

³ Armstrong, R., and Gaskell, J. F., *J. Path. and Bact.*, 1914, **xix**, 126.

⁴ Wadsworth, A., *Am. J. Med. Sci.*, 1904, **cxxvii**, 851.

⁵ Stuppy, G. W., and Falk, I. S., *J. Prev. Med.*, **ii**, 175.

The histological picture of the inflammatory reaction in the lungs of the vaccinated rabbits is the following: the predominant cell of inflammation is the histiocyte, which is present in large numbers. Many of these contain mitotic figures and hyperchromatic nuclei, and the alveolar spaces are filled with such cells, together with precipitated protein from edema. In many areas, both within the lumina of blood vessels and around them, or in collections in the tissues, are numerous eosinophiles with polymorphous nuclei. Polymorphonuclear leukocytes are distinctly in the minority as compared with histiocytes. The pulmonary lymph follicles in many instances, and particularly near the hilus, are markedly hyperplastic with prominent germinal centers rich in mitotic figures.

It is evident then, that the previous treatment of these rabbits with a killed saline suspension of pneumococci has been followed by an altered reactivity upon later intrabronchial insufflation of living virulent pneumococci of the same type. This altered reactivity is distinctly an increased immunity, inasmuch as the animals show less marked reactions and usually recover from the intrabronchial insufflation. It is interesting to recall that Bull and McKee⁶ have reported the development of sensitization to pneumococcus autolysate following pneumococcus infection after intranasal inoculation.

The rapid cellular response of histiocytes and eosinophiles indicates that the reaction is allergic in nature,⁷ and is evidence of a definite, increased local immunity of the pulmonary tissues. This appears to be somewhat analogous to the findings of Gay⁸ *et al.* in regard to the local immunity obtained in experimental streptococcus infections, especially so far as the response of the histiocyte or clasmatocyte is concerned. It would appear that the previous introduction of pneumococcus antigen had so sensitized the pulmonary tissues that their reactivity was increased to the extent that the later insufflation of the living organisms was followed by a rapid and vigorous exudative and proliferative reaction, with the histiocyte as the principal cell of defense.

⁶ Bull, C. G., and McKee, C. M., *J. Am. Med. Assn.*, 1928, xci, 396.

⁷ Maximow, A. A., *Arch. Path. and Lab. Med.*, 1927, iv, 588.

⁸ Gay, F. P., *Arch. Path. and Lab. Med.*, 1926, i, 857.