

precipitation following incubation is inversely proportional to the amount of salt solution added. The tube, for example, which contains serum and antigen without salt solution may show marked precipitation after 1 hour incubation; the one which contains 0.2 c.c. may show moderate precipitation while the one which contains 0.4 c.c. of salt solution may show no precipitation after the same period of incubation. The above table illustrates this point.

The question presented itself whether the delay in precipitation in those tubes which received salt solution as indicated in the table was due to sodium chloride or the element of dilution. A series of experiments was thereupon carried out employing distilled water, 0.425 per cent. and 2 per cent. sodium chloride solutions and the regular antigen mixture employed in the tests. The results in each case were similar to that obtained with normal salt solution, indicating that the delaying effect is produced by the dilution element and not by the sodium chloride. Of particular interest is the finding that the addition of increasing amounts of antigen exerts the same retarding effect on precipitation as, for example, distilled water or normal salt solution.

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Relation between serum and antigen in precipitation reaction for syphilis proposed by author.

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The optimum relation between serum and antigen in the precipitation test for syphilis proposed by the author has been observed to be in the neighborhood of 4:1. On the basis of this relation one may employ 0.4, 0.3, 0.2 or 0.1 c.c. of serum with 0.1, 0.075, 0.05 or 0.025 c.c. of antigen respectively with similar results. This relation holds true also with smaller quantities than 0.1 c.c. Thus 0.04 c.c. of serum with 0.01 c.c. of antigen has been found to give results comparable with 0.4 c.c. of serum

and 0.1 c.c. of antigen. Increasing the amount of antigen beyond this relation tends to delay precipitation, while the employment of equal amounts of serum and antigen will inhibit the reaction in some cases.

133 (1880)

The use of morphine in connection with serumtherapy of botulism.

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Some time ago¹ we have observed the delay in the rate of absorption of botulinus toxin in the animals subjected to ether anesthesia. Combining ether anesthesia with the specific serum therapy, we have been able to save animals poisoned with botulinus toxin where antitoxin alone failed to do so.

In view of the fact that the application of ether anesthesia in cases of botulinus poisoning in men would be difficult on account of the pronounced respiratory distress present as a predominant symptom in such cases, we have attempted to find a satisfactory substitute for ether anesthesia.

Among various substances thus far tried with various degrees of success, morphine seems to give the best results. Thus, one-quarter of a cubic centimeter of botulinus toxin (125 M.L.D.) given by the mouth causes death of a guinea pig of 250 grams in from 10 to 12 hours. The administration of an excess of antitoxin intracardially does not save the animal if more than three hours have been allowed to elapse between the feeding of the toxin and subsequent injection of antitoxin.

If guinea pigs of 250 grams are similarly fed with 125 M.L.D. of botulinus toxin and if 0.02 gram of morphine is given to them subcutaneously (in 10 per cent. solution) soon after feeding of the toxin, such guinea pigs die in from 26 to 46 hours if not given any antitoxin. Thus 0.02 gram of morphine delays the death from botulinus poisoning and more than doubles the length of the life of the animal. If antitoxin is introduced intracardially into such

¹ PROC. SOC. EXP. BIOL. AND MED., 1921, xviii, 253.