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Inhibition of Mumps Virus Multiplication by a Polysaccharide.

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Recently it was reported[1] that polysaccharides derived from various sources inhibit the multiplication of pneumonia virus of mice (PVM) in the mouse lung. The capsular polysaccharide of type B Friedländer bacillus proved to be the most effective of the preparations studied. Oxidation of the carbohydrate with periodic acid did not diminish its virus inhibiting activity, but the aldobionic acid derived by acid hydrolysis was without activity.

The effect of the Friedländer polysaccharide on the multiplication of viruses other than PVM has now been more extensively studied in the chick embryo. It has been found that the carbohydrate inhibits multiplication of mumps virus in the embryo, but does not inhibit multiplication of influenza A, influenza B or Newcastle disease viruses. Moreover, the polysaccharide inhibits hemagglutination of chicken erythrocytes by mumps virus, and prevents adsorption of the virus to such cells.

Methods. The Friedländer polysaccharide (Fr.B,) used in these studies was prepared and purified as described previouslv.[2,3] The viruses employed were: influenza A, PR8 strain; influenza B, Lee strain; mumps; Newcastle disease. They were maintained by passage in the allantoic sac of chick embryos. Allantoic fluid was used as a source of virus for infectivity and hemagglutination experiments.

Experimental. As a routine, 10% chicken erythrocyte suspensions were treated with 5 mg per cc of polysaccharide for 3 hours at room temperature. Chicken erythrocytes adsorb the polysaccharide, and it is not removed by repeated washing. Such treated red blood cells are neither agglutinated by mumps virus nor are they capable of adsorbing the virus as is shown in Fig. 1. Treated cells are partially or completely inagglutinable by influenza A, influenza B and Newcastle disease viruses. However, these viruses are adsorbed by and eluted from treated erythrocytes just as they are with untreated red blood cells. The results of a representative experiment with influenza B virus are shown in Fig. 1. The polysaccharide has no demonstrable direct effect *in vitro* on any of the above viruses, including mumps.

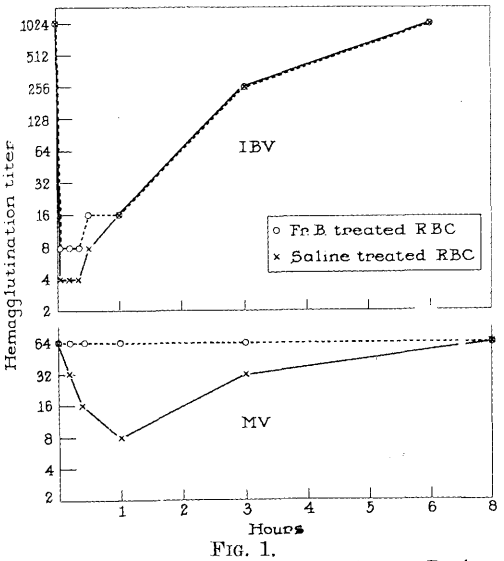

FIG. 1.
Comparison of the capacity of influenza B virus (IBV) and mumps virus (MV) to be adsorbed by and to be eluted from chicken red blood cells treated with Friedländer polysaccharide (Fr.B.).

When 0.5 to 1.0 mg of polysaccharide is injected into the allantoic sac of the chick embryo, a marked inhibition of the multiplication of mumps virus occurs even if the infecting dose is as great as 10^4 embryo infectious doses as is shown in Table I. Definite inhibition is obtained with as little as 50 μg of

[1] Horsfall, F. L., Jr., and McCarty, M., *J. Exp. Med.*, 1947, **85**, 623.

[2] Heidelberger, M., Goebel, W. F., and Avery, O. T., *J. Exp. Med.*, 1925, **42**, 701.

[3] Goebel, W. F., and Avery, O. T., *J. Exp. Med.*, 1927, **46**, 601.

TABLE I.
Effect of Friedländer Polysaccharide on the Multiplication of Mumps Virus in the Chick Embryo.

1st injection intra-allantoic 0.1 cc	Time between inj. hrs	2nd inj. intra-allantoic 0.1 cc	Mean hemagglutination titer‡ of allantoic fluids of embryos	
			Inj. with Fr.B. polysaccharide	Controls inj. with saline
Fr. B. polysaccharide*	3	Mumps virus 10^1 E.I.D.†	4	175
	3	10^2	1	264
	3	10^3	3	128
	3	10^4	4	245
Mumps virus 10^2 E.I.D.	3	Fr.B. polysaccharide	5	154
	24		2	154
	48		11	129
	72		240	—
	96		72	576
	120		384	—

* 1.0 mg per chick embryo.
† E.I.D. = chick embryo infectious doses.
‡ Mean of the reciprocals of the hemagglutination titers.

polysaccharide per embryo. In these experiments the concentration of virus in allantoic fluids was measured by the hemagglutination technique[4] 6 days following inoculation of the virus. As indicated in Table I polysaccharide may be injected 3 hours before, or as long as 48 hours after inoculation of mumps virus and still cause inhibition of multiplication of the virus. Multiplication of the virus in the allantoic sac is also inhibited when 5 mg of Fr. B. is injected into the embryonic yolk sac either 3 hours before or 3 hours after the inoculation of virus.

Comment. The role which the capsular polysaccharide of type B Friedländer bacillus plays in the inhibition of virus multiplication is not yet understood. Nor is it yet possible to correlate the activity of this and other carbohydrates with similarities in chemical constitution. It is possible, however, that knowledge of the biochemical mechanism involved in this phenomenon may lead to an understanding of the intracellular systems concerned in the multiplication of viruses. The fact remains that a substance belonging to a well-defined class of chemical compounds has been found which exerts specific inhibition on the multiplication of certain viruses in the living host.

Summary. The capsular polysaccharide of type B. Friedländer bacillus inhibits the multiplication of mumps virus in the chick embryo and prevents adsorption of the virus by treated erythrocytes.

[4] Levens, J. H., and Enders, J. F., *Science*, 1945, **102**, 117.