with a form of tumor which under these experimental conditions in 12 to 15 days produces a 100% mortality in mice. How the treatment has influenced the tumor cells is, of course, hard to tell. Three possibilities seem acceptable:

1. The sulfomucopolysaccharides used have a neutralizing effect on the toxic products derived from the tumor cells.

2. The sulfomucopolysaccharides exercise a general resistance-increasing effect on the tissues of the organism.

3. The sulfomucopolysaccharides in question exercise a direct growth-suppressing effect on the tumor cells.

Naturally, we have not been able to decide how the substances in question act; we only wanted to suggest these possibilities. It is of interest to note that Cramer and Simpson[11] and Holmgren and Wohlfart[12] have shown that in methyl cholanthrene tumors in mice and rats, great masses of mast cells can appear. Cramer and Simpson point out that the mast cells in the skin increase in number before the tumors are developed, and that resistant mice show an ample number of mast cells in the skin. They further point out that the reaction of the mast cell is involved in a defensive process directed against the development of skin cancer. They also point out that this is of interest as the mast cells contain heparin (Holmgren and Wilander[13]), Jorpes, Holmgren, and Wilander.[14] It is also of interest that hyaluronic acid and other mucopolysaccharides are widely distributed in different tissues. Balazs and Holmgren[15] have shown that sulfomucopolysaccharides appear in injured tissue where they with all probability have a suppressing effect on the growth of the regenerating tissue.

Summary. Sulfomucopolysaccharides (sodium heparinate and the sodium salt of agar acid) suppress the growth of cells from methyl cholanthrene tumors in the rat *in vitro*. To ascertain whether the substances in question had a similar effect on growing tissues *in vivo* mice were inoculated intraperitoneally with the suspension of cells from Ehrlich's carcinoma, after which they were treated in various ways with sodium heparinate and with sodium salt of agar acid. It was found that the mortality of the control animals was greater than that of the treated animals. The results and various possible explanations are discussed.

[11] Cramer, W., and Simpson, W. L., *Cancer Res.*, 1944, **4**, 601.

[12] Holmgren, Hj., and Wohlfart, G., *Cancer Res.*, 1947, **7**, 686.

[13] Holmgren, Hj. and Wilander, O., *Ztschr. f. mikr. anat. Forsch.*, 1937, **42**, 242.

[14] Jorpes, E., Holmgren, Hj., and Wilander, O., *Ztschr. f. mikr. anat. Forsch.*, 1937, **42**, 279.

[15] Balazs, A., and Holmgren, Hj., *Cell. Res.*, 1949, in press.

Received August 16, 1949. P.S.E.B.M., 1949, **72**.

Detection of Mumps Virus in Mice Sacrificed at Different Periods of Time after Injection. (17357)

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During the past 2 years we have experimented with the cultivation of mumps virus in embryonated chicken eggs, and have prepared inactivated virus vaccine for laboratory use and trial in human subjects.[1]

In the course of a portion of this work, we have recently attempted to infect (looking for both apparent and inapparent infections) several of the smaller laboratory animals. To date, we have not been able to bring about any such infections or produce definite gross or microscopic lesions. We have used "raw" periembryonic egg fluid virus, and also such virus after concentration by the alcohol

[1] Muntz, H. M., Powell, H. M., and Culbertson, C. G., *J. Lab. and Clin. Med.*, 1949, **34**, 199.

TABLE I.

Complement Fixation Tests of Periembryonic Fluids from Eggs Injected with Mouse Tissue Dilutions for Assay of Mumps Virus. Mice sacrificed 1 hour after injection of virus.

Mouse No.	Route inj.	Mouse organ	Dilution: 1 part in	Complement fixation titer of egg fluids 1:2	1:4	1:8	1:16	1:32	1:64
1	ip	Brain	10	—	—	—	—	—	—
			100	—	—	—	—	—	—
2	ip		10	++	—	—	—	—	—
			100	—	—	—	—	—	—
3	in		10	—	—	—	—	—	—
			100	—	—	—	—	—	—
4	in		10	—	—	—	—	—	—
			100	—	—	—	—	—	—
1	ip	Liver	10	++++	++++	++++	++	+	—
			100	++++	++++	—	—	—	—
2	ip		10	—	—	—	—	—	—
			100	—	—	—	—	—	—
3	in		10	+++	—	—	—	—	—
			100	—	—	—	—	—	—
4	in		10	++	—	—	—	—	—
			100	—	—	—	—	—	—
1	ip	Spleen	10	++++	++++	++++	++	—	—
			100	++++	++	—	—	—	—
2	ip		10	++++	++++	++++	++++	+	—
			100	++++	+++	+	—	—	—
3	in		10	—	—	—	—	—	—
			100	—	—	—	—	—	—
4	in		10	—	—	—	—	—	—
			100	—	—	—	—	—	—
1	ip	Lung	10	++++	++++	+++	±	—	—
			100	++++	++++	++++	++	—	—
2	ip		10	++++	++++	++++	+	—	—
			100	++++	+	—	—	—	—
3	in		10	—	—	—	—	—	—
			100	—	—	—	—	—	—
4	in		10	not tested					
			100	+++	+	—	—	—	—
1	ip	Testes	10	—	—	—	—	—	—
			100	—	—	—	—	—	—
2	ip		10	—	—	—	—	—	—
			100	—	—	—	—	—	—
3	in		10	—	—	—	—	—	—
			100	—	—	—	—	—	—
4	in		10	—	—	—	—	—	—
			100	—	—	—	—	—	—

Legend: ip indicates intraperitoneally; in indicates intranasally.

method. Our negative results are in conformity with those of others who used mainly "raw" (*i.e.* non concentrated) virus. In the course of these tests, however, we have determined the titers of mumps virus in various organs and tissues at different times after injection of active virus, and the results of such tests showing appearance and disappearance of mumps virus in mice seem of sufficient interest to report.

Two groups of Swiss mice were injected with Enders strain[2] of mumps virus in periembryonic fluid. This virus had a 4+ complement fixing (C.F.) titer of 1:16.[3] One group of mice received doses of 1.0 cc of this virus intraperitoneally. The other group of mice received doses of 0.05 cc of this virus intranasally. Pairs of mice from each group were

[2] Virus and information obtained from Dr. J. F. Enders, Boston, Mass.

[3] Bengtson, I. A., *Public Health Rep.*, 1944, **59**, 402.

sacrificed at 1 hour, 24, 48, 72 and 96 hours and at 2 and 3 weeks after injection. Dilutions of the homogenized organs obtained at autopsy were injected into 7 day embryonated eggs, and after proper incubation the periembryonic fluids from these eggs were tested for the presence of mumps virus by the C.F. test.

The results of the first test of mouse organs and tissues removed one hour after injection of mumps virus are shown in Table I. It is observed that spleen, lung and liver contained considerable virus. A trace of virus was found in the brain, while none was found in the testes. Although further negative results are not tabulated here, we found the virus neither in the pancreas, heart muscle, nor blood.

In these experiments, the mice which received intranasal virus got only one-twentieth the amount of virus given intraperitoneally. This intranasal dose however was sufficient to give rise to demonstrable titers of virus in the liver and lung one hour after injection.

Twenty-four hours after injection of mumps virus into mice we found, at autopsy, only traces of virus in the spleen, lung, liver and brain. As before, no virus was found in the testes, pancreas, heart muscle, and blood.

No mumps virus was found in the organs and tissues heretofore examined in mice sacrificed at 2, 3, and 4 days, and at 2 and 3 weeks after injection of virus. Negative results after these longer periods of time indicate that inapparent infection does not occur.

Summary. Mumps virus administered to mice intraperitoneally or intranasally appears within an hour in the lungs, liver, spleen, and to a lesser extent in the brain (in the latter case after intraperitoneal injection only.) Sojourn of viable virus in organs where found is short. Testes, pancreas, heart muscle, and blood were found not to contain virus at any time. Mice used in these tests of mumps virus did not exhibit symptoms of toxicity at all comparable to mice injected at different times in the past with influenza virus, although these 2 viruses are somewhat similar otherwise.

Received August 19, 1949. P.S.E.B.M., 1949, **72**.

Production of Acute Experimental Circulatory Failure by Graded Pulmonary Artery Constriction.* (17358)

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Because of the practical and technical limitations of studying congestive heart failure in human subjects, numerous attempts have been made to produce heart failure in animals employing many different methods. Various drugs have been administered, including chloroform, ethyl alcohol, potassium chloride, chloral hydrate, and diphtheria toxin,[1] posterior pituitary extracts,[2] and quinidine,[3] in an effort to depress the myocardium. In addition, irritants have been injected into the pericardium[4] and myocardium;[5] the ventricular wall has been severely cauterized,[6] the coronary arteries ligated,[7,8] and the myocardial capillaries plugged with foreign sub-

* This research was supported by a grant from the Life Insurance Research Foundation.

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1 Fahr, G., and Buehler, M. S., *Am. Heart J.*, 1943, **25**, 211.

2 Nolasco, J. B., and Kohrman, R., PROC. SOC. EXP. BIOL. AND MED., 1947, **66**, 108.

3 Reiss, R. A., and DiPalma, J. R., *Am. J. Physiol.*, 1948, **155**, 336.

4 Armstrong, T. G., *Quart. J. Exp. Physiol.*, 1940, **30**, 263.

5 Luisada, A., *Medicine*, 1940, **19**, 475.

6 Starr, I., Jeffers, W. A., and Meade, R. H., *Am. Heart J.*, 1943, **26**, 291.

7 Orias, O., *Am. J. Physiol.*, 1932, **100**, 629.

8 Gross, L., Mendlowitz, M., and Schauer, G., PROC. SOC. EXP. BIOL. AND MED., 1936, **35**, 446.