The results (Table I) of Exp. I show that hypophysectomy causes a very definite reduction in tumor growth, but does not completely suppress the growth of an implanted tumor. The tumors, apparently, grow to some extent independently of the pituitary gland; in this, we corroborate the results of the majority of the earlier workers on this subject. In Exp. II, tumor implantation was delayed until 11 days after the pituitary removal, in an effort to diminish the amounts of residual circulating hormones. This delay does not materially alter the picture (Table II).

Exp. III (Table III) confirms the results of Experiments I and II insofar as the growth-suppressing action of the pituitary is concerned. In addition, it may be stated that the enriched diet employed in this experiment exerted a growth-stimulating effect on the tumors. Comparing Group H of Exp. III with the operated animals of Experiments I and II, the body growth and tumor growth-promoting properties of an enhanced diet are quite evident. However, comparing Groups H, A, and B of Exp. III, the additional body and tumor growth of Groups A and B, over Group H, can only be due to the pituitary extracts administered. The tumor growth-inhibiting action of the pituitary removal may, therefore, be partially counteracted by injection of anterior pituitary extracts.

The only hormonal principle clearly demonstrable in our anterior pituitary extracts was the gonadotrophic hormone, as is evident from Table IIIa. In this connection, the relation between testes size and tumor size may be of significance.

Summary. Hypophysectomy in rats definitely, but incompletely, suppresses the growth of a transplanted tumor. It appears possible that a hormone, or hormones, of the pituitary are required for stimulation of tumor growth as evidenced by the effects of pituitary gland removal and the partial results of the administration of certain anterior pituitary extracts.

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Blood Flow Determinations and Cardiodynamic Effects of a Venous Shunt in Pulmonary Hypertension.* (17880)

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The following study was prompted by the recent report of Bland and Sweet(1) in which a surgical anastamoses of the azygous vein and a branch of the right pulmonary vein was established for relief of pulmonary venous hypertension in certain instances of mitral stenosis. Marked clinical improvement was noted in 3 of the 5 patients operated, indicating that such a venous shunt was presumably capable of relieving the high pressure in the pulmonary area. It was our purpose to test the capacity of this type of shunt with various acute procedures designed to increase pulmonary pressure and if possible, note the effects of the venous shunt on the cardiodynamics of such animals.

Method. The 10 dogs used in these experiments were anesthetized with sodium barbital I.V., 300 mg/kg. The chest was opened in the mid-sternal line, the pericardial sac was incised, and its edges were sewn to the thoracic walls in such a manner as to form a cradle for the heart. Respiration was maintained by use of alternating positive air pressure. The azygous vein was ligated 2 to 3 cm from the superior *vena cava*; and cannulae were inserted, one in the azygous vein proximal to its ligation and one in a large

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1. Bland, E. F., Sweet, R. H., *J.A.M.A.*, 1949, v140, 1259.

tributary of the right pulmonary vein. These cannulae were connected through a Gregg-Shipley rotameter(2) in such a manner as to shunt blood from a tributary of the pulmonary vein to the azygous vein. Blood flow through the shunt could then be measured. An 8% solution of Chlorazol Fast Pink dye, 2 cc per kilo, was used as the anticoagulant. Aortic pressure curves were recorded by inserting a sound connected to an optical manometer(3) through the left carotid artery. The cardiac output was determined by the pressure pulse method and is expressed per M^2 of the body surface(4). Pressures in the right ventricle were measured by inserting a sound through the right jugular vein into the right ventricle. In the experiments in which the left pulmonary artery was occluded, the artery was freed by blunt dissection and clamped with a rubber sleeved curved hemostat. Stenosis of the pulmonary artery was obtained by passing a ligature around the artery just distal to the pulmonary conus and drawing the loose ends of the ligature through a short, 3 to 4 cm, glass tube. The tube was pressed against the artery as the ligature was tightened, and the 2 loose ends were then clamped at their exit from the tube.

The method used to produce experimental mitral stenosis was suggested in a paper by Katz and Siegel(5). A suture was anchored posteriorly near the interauricular groove and above the auriculo-ventricular groove. The suture was then looped through the auricular tissue nearer the hilar structures of the left lung. Anteriorly a suture was anchored at the base of the left auricular appendage near its medial aspect; the anterior suture, in a like manner, was looped through the auricular tissue nearer the hilar structures. When desired, constriction of the left atrium could then be effected by threading the 2 loose suture ends through an aneurysm needle and snugging the aneurysm needle against the auricular wall by traction on the sutures. The sutures were then clamped in place with a hemostat at their exit through the aneurysm needle. To determine if flow through the shunt could be further increased, following constriction of the left atrium, a 6% solution of acacia was infused rapidly via a femoral vein in one dog. Controls with shunt open were run prior to obstruction of outflow through the pulmonary arteries or constriction of the left atrium.

Results. Effects on blood pressure. Changes in aortic pressure were only slight, on the order of ± 2 to 10 mm Hg, in those dogs in which occlusion of the left branch of the pulmonary artery was performed. There was a variable effect on those dogs with constriction of the left atrium. A significant rise in both systolic and diastolic pressures was obtained in one animal. See Table I. One other animal which, in addition, received acacia intravenously demonstrated a parallel rise in arterial pressure. In other animals with constriction of the left atrium there was little change in the arterial pressure.

Pressure in the right ventricle. The initial tension in the right ventricle usually was not altered. There was a significant rise of initial tension in only one animal (Table I).

Blood flow through the shunt. Blood flow through the shunt without attempts to produce pulmonary hypertension, varied from 37 cc to 84 cc per minute per M^2 of body surface. The rate of flow could be increased from 2 to 3 fold either by occlusion of the left branch of the pulmonary artery or by constricting the left atrium.

Heart rate. Following obstruction to pulmonary arterial flow or constricting the left atrium, the heart rate slowed on the order of 10 to 18 beats per minute.

Cardiac output. The cardiac output was diminished in each animal following either restriction of flow through the pulmonary arteries or constriction of the left atrium. There seemed to be no appreciable effect on cardiac output whether the shunt was open or closed following the above procedures.

Discussion. Bland and Sweet pointed out that too large a shunt would be undesirable

2. Crittenden, E. C., Jr., and Shipley, R. E., *Rev. Scient. Instruments*, 1944, v15, 343.

3. Hamilton, W. F., Brewer, G., and Brotman, I., *Am. J. Physiol.*, 1934, v107, 427.

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5. Katz, L. N., and Siegel, M. L., *Am. Heart J.*, 1931, v6, 672.

TABLE I.
Results in One Animal with Constriction of Left Atrium.

Procedure, shunt open	Aortic pressure, S/D	Initial tension of right ventricle, mm/Hg	M^2 body surface: Blood flow through shunt, cc/min.	M^2 body surface: Cardiac output, cc/min.	Cardiac rate
Control	138/112	22	37	3600	186
Shortly after constrict.	154/122	24	95	3300	186
30 min. constrict.	160/126	28	126	3300	168
Constrict. removed	128/ 98	22	55	3900	174
Shortly after constrict. removed	134/ 96	18	34	4030	174

(1). Shunting of blood through a large extracardiac shunt might lower pulmonary vascular pressure to such an extent that it would be insufficient to overcome the obstructed inlet to the left ventricle, and the possibility of overburdening the right ventricle with increased venous return might exist. The capacity of the shunt in our acute experiments could be increased up to 8% of the cardiac output. An effort to further increase the capacity of the shunt by rapidly infusing acacia intravenously, thereby increasing venous return and overloading the right ventricle, was not successful. One cannot conclude from acute experiments of this type that the maximum shunt flow was obtained. Although the cardiac output was diminished, there was no conclusive evidence that the presence of the venous shunt interfered with the filling of the left ventricle. Evidence of right ventricular strain by virtue of a rise in initial tension was found in only 2 of the animals. This was also noted to be variable by Katz and Siegel in their study (4). In addition, the increase of venous return, a consequence of the presence of the shunt, gave no evidence that an added burden was placed on the right ventricle. In this regard the effects over a prolonged period remain to be elucidated.

Conclusions. 1. In acute experiments producing increased pulmonary vascular pressure in dogs, the capacity of a pulmonary vein-azygous vein shunt was found to be up to 8% of the total cardiac output.

2. There was no consistent evidence that the presence of the shunt produced or added to the strain on the right ventricle or interfered with the filling pressure of the left ventricle.

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Maternal Nutrition and Hydrocephalus in Newborn Rats.* (17881)

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It is well known that female rats reproduce readily on synthetic diets, but Richardson and Hogan(1) reported that 1.7% of the young in their colony developed hydrocephalus, due to a deficiency in the maternal diet. O'Dell, Whitley and Hogan(2) observed that when folic acid was added to the diet used by Richardson and Hogan the incidence of

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2. O'Dell, B. L., Whitley, J. R., and Hogan, A. G., PROC. SOC. EXP. BIOL. AND MED., 1948, v69, 272.