

jects, where no appreciable effect was noticed. It might be supposed that these effects were due to the considerable amounts of orange juice and its vitamins. When, however, gelatine was discontinued and the same amount of fruit juice maintained, the work output rapidly fell to an approximation of the pregelatin level, thereby indicating that the effect was primarily that of the addition of gelatine to the diet. The sexual variation is also of interest from the point of view of the interpretation of the results. As mentioned above, Rose, *et al.*, found a marked sexual variation in the ability to store creatine. These experiments are most suggestive since they indicate a situation comparable to that found in our own experiments. It would seem as though this action of gelatine were particularly concerned with the creatinogenic action of its amino acids, especially glycine.

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Effect of the Experimental Production of an Accessory Blood Supply Upon Normal Kidney.

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The present report is concerned with the effects of the experimental production of an accessory blood supply upon the structure and function of the normal kidney.

Eleven dogs, weighing from 6 to 15 kilos, were used. In 7 of these dogs an accessory circulation was produced in the left kidney and, in 4, in the right kidney. Under general ether anesthesia a mid-line incision was made into the peritoneal cavity. The capsule of the kidney to be used was removed. A small protected arterial clamp was placed upon the renal artery. An incision was made in the antihilar surface of the kidney extending longitudinally from the upper to the lower pole. The incision extended in depth to, but not through, the renal pelvis. Little bleeding occurred from the kidney during this phase of the operation. The omentum was lifted up from the peritoneal cavity and gently packed into the gaping incision in the renal parenchyma. Four sutures of No. 0 chromic catgut were passed through the renal tissue and omentum, which was thus anchored to the kidney. Following the release of the arterial clamp, a moderate amount of bleeding occurred, but this soon ceased.

The abdominal wound was closed in the usual manner. Two of the dogs were subsequently reoperated upon, and the renal arteries of the involved kidneys were divided between ligatures. After a period of 10 days to 6 weeks from the primary operation, the functional value of the accessory renal circulation was examined. There was no operative mortality in this series of animals. The animals recovered quickly from the operative procedure.

The histological changes in operated kidneys are of interest. The omentum quickly becomes adherent to the renal parenchyma. The fatty connective tissue of the omentum in the depths of the renal incision becomes partially replaced by fibrous connective tissue. Large arterial and venous blood channels can be found running from the omentum into the renal parenchyma, and branching out into many fine capillaries. The vascularization of the entire operated kidney is considerably greater than that of the non-operated kidney. The intertubular and glomerular capillaries of the artificially vascularized kidney are distended. After a variable period of time, the operated kidney shows some diminution in size, and, microscopic evidence appears of a relative increase in the number of glomeruli and a marked dilatation of the renal tubules. A moderate number of phagocytic monocytes containing haemosiderin pigment was present in the fibrous connective tissue. Microscopic study of the unoperated kidneys revealed no pathology.

In Table I are presented representative data concerning the water diuresis in the vascularized kidney compared with the normal kidney upon the opposite side. The ureter on each side was cannulated under nembutal anesthesia, and the character and volume of the urine from each kidney was determined following the intravenous injection of 1000 cc of 5% glucose solution or of 0.85% sodium chloride solution. For a period of 10 days after operation, the urine from the operated kidney is of low specific gravity and contains red blood cells and albumin. Thereafter, the specific gravity rises and the urine becomes free from albumin and red blood cells. The specific gravity of the urine from the operated kidney, however, tends to remain slightly lower than that from the normal kidney. Water diuresis was greater—5% to 100% increase—from the artificially vascularized kidney in 8 out of 9 animals, which were examined from this standpoint. Preliminary studies of renal function were carried out, using the urea clearance and P.S.P. tests. The results in one animal are shown in Table II, and would suggest that the experimental production of an accessory circulation to a kidney, by the method described, enhances its work output. The operated kidney, in the data presented, was capable of clearing 28.3 cc of

TABLE I.
Experimental Production of Accessory Blood-supply to a Kidney upon Its Urine Secretion Function.

Dog Wt Kg	Type of injection	Urine Secretion, cc				
		1 hr	2 hr	3 hr	4 hr	
Exp. 5 10	5% Glucose Sol.	*Left kidney	34	44	51	86
		Right "	10	16	18	50
Exp. 6 12	5% Glucose Sol.	*Left "	26	44	50	56
		Right "	8	15	16	18
Exp. 11 6	5% Glucose Sol.	Left "	60	114	142	143
		*Right "	64	120	162	177
Exp. 10 11	0.85% NaCl Sol.	Left "	0	4	12	34
		*Right "	5	12	24	48

*Provided with accessory blood supply.

TABLE II.
Influence of an Accessory Blood Circulation upon Renal Function.

Dog wt 8.5 kg	Total quantity urine, cc	Sp. Gr.	pH	Urine urea nitrogen, mg %	Blood urea nitrogen, mg %	Urea clearance test (Cs)	P. S. P. Test % of dye excreted		
							Exp. 12 A	Exp. 12 B	
*Right kidney	1st hr	88.5	1015	7.1	61.6	9.32	8 cc	(Urine secretion = 178 cc)	40%
	2nd "	76.5	1022	7.1	168.0	—	20.3 "	(Urine secretion = 27 cc)	5%
Left kidney	1st hr	83.5	1020	7.1	72.8	—	9.2 "	(Urine secretion = 84 cc)	25%
	2nd "	51.5	1023	7.1	44.8	—	4.42 "	(Urine secretion = 3 cc)	2.5%

*Supplied with accessory blood circulation.

blood of its urea content per minute in comparison with the 13.62 cc cleared by the opposite normal kidney. Over a period of 2 hours, the operated kidney excreted 45% of the injected phenolsulphonphthalein compared with the excretion of 27.5% from the opposite normal kidney. The intravenous injection of 10 cc of 20% urea solution produced a greater diuresis from the kidney with the accessory circulation than from the unoperated kidney.

The data here presented suggest that the experimental production of an accessory blood supply to the kidney is practicable. Such an additional blood circulation may have a functional value, inasmuch as diuresis, urea clearance, and phenolsulphonphthalein excretion are somewhat greater from a kidney provided with such an extra blood supply, as indicated by preliminary renal function tests. Further evidence of the establishment of an additional blood circulation by the outlined operation is provided by the fact that the injection of 10 cc of a 1% solution of methylene blue into the femoral vein produces a diffuse staining of the renal parenchyma after ligation and division of the renal artery, provided that an accessory blood supply is maintained to the kidney through the omentum.

Conclusion. An operation is described for the production of an accessory blood supply to the kidney by the way of the omentum. The effects of the procedure in 11 dogs are described.

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Concentration of Sulfanilamide in Spinal Fluid and Blood Following Single Intrathecal Injection of Drug.

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Sulfanilamide, which is successfully used in the treatment of patients suffering from purulent meningitis due to beta-hemolytic streptococcus and meningococcus, is readily absorbed after oral administration and is found in the blood and spinal fluid; usually, the concentration in the spinal fluid is somewhat lower than in the blood (Marshall, Emerson, and Cutting^{1, 2}). Some authors, including

¹ Marshall, E. K., Emerson, K., and Cutting, W. C., *J. Am. Med. Assn.*, 1937, **108**, 953.

² Marshall, E. K., Emerson, K., and Cutting, W. C., *J. Pharm. and Exp. Therap.*, 1937, **61**, 196.