tion of lipides in lipoproteins and atherogenesis in this species.

Summary. 1) Using the agar precipitation method and low temperature fractionation for determination of beta-lipoproteins, amounts of beta-lipoproteins, total lipides, phospholipides, and cholesterol in serum of atherosclerosis-susceptible and resistant breeds of pigeons were compared. The agar precipitation method seems a reliable method for estimating levels of beta-lipoprotein cholesterol in serum. 2) No significant differences were seen when male birds of the 2 breeds were compared. Lipoprotein levels of females varied within wide limits, probably due to phospholipemia associated with egg-laying activity. Such activity is accompanied by increased proportion of cholesterol in beta-lipoproteins. At time of egg-laying, total lipides and total phospholipides (but not total cholesterol) are increased in the serum. Thus, such cyclic changes appear to produce a more "favorable" (*i.e.*, lowered) cholesterol/phospholipide ratio. In contrast to cholesterol-fat fed chicks, female pigeons of susceptible breed are not protected against aortic or coronary atherosclerosis.

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Renal Tubular Excretion of Riboflavin in the Chicken.* (25473)

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The renal tubule has been demonstrated to be capable of excreting a number of organic bases by an active transport system. Tetraethylammonium(1,2), n-methylnicotinamide (3), tolazoline (Priscoline)(4), choline and thiamine(5) represent a few of these compounds, most of which are quaternary ammonium compounds. Studies of competitive inhibition among this series indicate that the substances are transported by a common system. Excretion by the renal tubule of the chicken has been demonstrated for all of these substances. This study describes the renal tubular excretion of riboflavin (6,7-Dimethyl-9-1(d-l'-ribityl-) iso-alloxazine) in the

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chicken and demonstrates that it shares the transport system for one of the organic bases previously studied.

Methods. The renal tubular excretory rates of the various compounds in question were determined in unanesthetized hens (1.8 to 3 kg) according to method previously described by Sperber(6), Lindahl and Sperber (7) and by Rennick *et al.*(2,8). The compounds were infused at a constant rate into the renal portal circulation of one kidney *via* the ipsilateral saphenous vein, urine being collected separately from ureters of the 2 kidneys during successive 10-minute periods. The rate of renal tubular excretion of any given compound, by the kidney on the infused side, is expressed as the Apparent Tubular Excretion Fraction (ATEF), according to the formula $\frac{Exc_I - Exc_C}{INF} \times 100$, in which Exc_I represents rate of total urinary excretion of the compound on the infused side, Exc_C denotes rate on the contralateral side, and INF represents rate of infusion, all expressed in the same units. Thus, the ATEF expresses excess of the infused compound excreted by tubules of the infused kidney as a percentage of amount infused. It should be pointed out that the renal portal circulation is not obligatory since only a portion of the saphenous venous blood is diverted to the ipsilateral kidney and its tubules. The proportion of blood thus diverted and the proportion which bypasses the ipsilateral kidney to enter the renal vein and thus the systemic venous circulation are controlled by a muscular valve interposed between renal portal and renal veins. As index of the proportion of saphenous venous blood, and hence of injected compound, which does enter the portal circuit, excretion of p-aminohippuric acid (PAH), infused simultaneously, was measured in all experiments at levels well below the Tm. Tubular transport rates of various quaternary compounds are therefore also expressed as the ratio of their ATEF values to that of PAH. Details of procedure are given in references cited. *Analyses of urine and infusion solution* for PAH were made by the method of Smith *et al.*(9). Riboflavin was determined by measuring transmittance in the Beckman DU at 450 mμ. The experiment was done in controlled light and analyses on urine samples and infusion were done immediately and protected from light.

TABLE I. Renal Tubular Excretion of Riboflavin (RIB) and PAH in the Chicken.

	ATEF			
	Avg		RIB	
	PAH	RIB	PAH	No. obs.
	45	13	.29	7
	88	36	.41	7
	65	27	.42	10
	69	23	.33	3
	64	25	.39	4
	67	18	.27	3
	62	20	.32	3
	54	25	.46	3
	70	19	.27	3
	70	33	.47	3
	53	29	.54	3
	42	20	.48	4
Avg	62	24	.39	53

Results. Riboflavin was infused into the renal portal circulation in the hen in doses of from 0.06 mol to 0.24 mol/minute. There was an ATEF for riboflavin of 24 or an absolute excess from the infused kidney of 24% as an average of 53 observations indicating tubular excretion of riboflavin (Table I). PAH administered simultaneously gave an ATEF of 62 and the ATEF $\frac{\text{Riboflavin}}{\text{PAH}}$ was 0.39. There was no consistent relationship between dose infused and ATEF resulting, so it was concluded that levels were not near Tm. The insolubility of riboflavin limited the range of concentrations used.

In an attempt to determine the transport system utilized by riboflavin, competitive inhibition by members of organic acid transport system and organic base transport systems were used. Benemid in a dose of 1500 γ/min after 30 minutes inhibited both PAH and riboflavin to 40% of original transport rate. As PAH and riboflavin were usually infused simultaneously there was the possibility that they were mutually inhibitory. When either one was separately infused, addition of the other did not affect ATEF. It was apparent that in the doses used they did not inhibit the transport of each other.

Quantitative comparison of organic base

TABLE II. Renal Tubular Excretion of Riboflavin and PAH in the Chicken and Inhibition of Riboflavin Excretion by Priscoline. Avg for 3 experiments.

	ATEF			
	PAH	RIB	RIB/PAH	No. obs.
	Before Priscoline			
	70	33	.47	3
	53	29	.54	3
	42	20	.48	4
Avg	55	27	.49	10
	After Priscoline			
	90	20	.22	4
	57	14	.25	3
	55	6	.11	4
Avg	67	13	.19	11

transport mechanisms have shown that tolazoline is one of the most potent competitive inhibitors within the system(10). When tolazoline was added to the infusion of riboflavin and PAH, excretion of riboflavin fell and PAH was not affected or rose. This was considered evidence of participation of riboflavin in the organic base transport system selectively. Fig. 1 shows the results of such an experiment. Table II describes results of 3 experiments in which tolazoline selectively inhibited riboflavin transport. In the dose of tolazoline used, 1.9 μM/min the tubular excretion of riboflavin was reduced 50%.

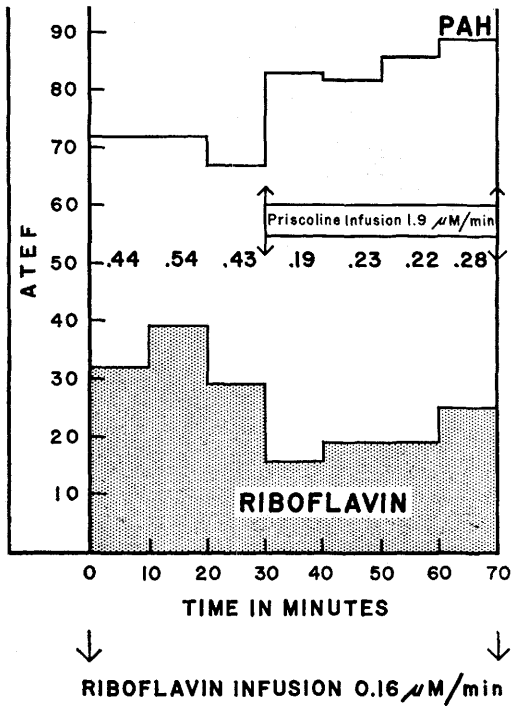

FIG. 1. ATEF for riboflavin and PAH are shown before and after addition of tolazoline (Priscoline). Numerals in center represent ATEF ratio Riboflavin/PAH.

Summary. Riboflavin excretion by renal tubular cells would seem to use the transport system for organic bases. This conclusion is based on the fact that tolazoline selectively inhibits riboflavin while not impairing PAH excretion. PAH excretion was even enhanced by tolazoline presumably as a result of diversion of more blood to the portal circulation. Benemid can inhibit transport of both PAH and riboflavin.

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