was no significant difference in the rate of oxidation of ethylyene glycol to CO_2 in rats fed the 2 levels of magnesium used in this work. Hammarsten(13) has reported that the hyperoxaluria which occurs following administration of ethylene glycol to rats is not affected by dietary magnesium levels. It is possible that in experiments reported here as well as in our previous studies(5) magnesium may protect against the renal deposition of oxalate by altering the solvent characteristics of urine.

In this and many other laboratories rats are routinely fed diets containing 40 mg % of magnesium. This level of magnesium and 0.2 mg % pyridoxine HCl in otherwise complete diets permits maximal growth. Nevertheless, in these experiments the provision of additional Vit. B_6 and/or magnesium provided a greater degree of resistance to chronic ethylene glycol toxicity. This suggests a basis for a possible course of therapy in cases of human ethylene glycol poisoning, in which survival is prolonged beyond the initial phase of central nervous system depression and in which the renal lesions become operative. Animal experiments are in progress to study the value of magnesium and Vit. B_6 in the treatment of such renal oxalate deposits once established.

Summary. Oral administration of ethylene glycol to rats and the resultant renal deposition of calcium oxalate were studied in terms of dietary levels of Vit. B_6 and magnesium. Under the conditions of these experiments partial protection against oxalate deposition was achieved with excessive dietary Vit. B_6 while complete protection resulted when large amounts of MgO were fed. The *in vivo* oxidation of ethylene glycol to CO_2 was found to be related to amount of Vit. B_6 administered. Dietary magnesium levels, however, did not affect oxidation of ethylene glycol and it is suggested that dietary magnesium protects against renal deposition of calcium oxalate by altering the solvent characteristics of urine.

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Effect of Cysteine and Pyridoxine on Taurine Excretion of Male Rats.* (27116)

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The decrease in urinary excretion of taurine in Vit. B_6 deficiency(1) has been attributed, in part, to the decrease in level of the pyridoxal phosphate enzyme, cysteinesulfinic

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acid decarboxylase, which catalyzes the formation of hypotaurine(2). The activity of this enzyme in rat liver decreases very rapidly following transfer of the rats from a Vit. B_6-supplemented diet to a Vit. B_6-free diet (2).

The rapid fall in taurine excretion after removal of dietary sources of Vit. B_6 suggested that taurine excretion after a test dose of cysteine might have promise as a means of evaluating Vit. B_6 nutrition. Chapeville and Fromageot have shown that cysteine is an important precursor of cysteinesulfinic acid (3).

Materials and methods. Both young and adult male rats of the Long-Evans strain, bred in our colony, were used in this study. All of the rats were housed individually in wire-bottom cages. The adult rats, which weighed 300-350 g, were fed a commercial rat chow *ad lib.* without additional vitamin supplements.

The young rats, whose dams were given Vit. B_6-deficient diet 1 week before weaning of the young, weighed 35-40 g at weaning (21 days of age). The young rats were fed a 20% casein-sucrose diet(4). Vitamin supplements were not included in the diet but were given separately(4). Pyridoxine, when fed, was supplied in the B Vit. supplement at a level of 50 μg/rat/day. Vit. B_6 deficiency was created by omission of pyridoxine from the B Vit. supplement. The rats were considered Vit. B_6-deficient when they failed to gain more than 3 g in 1 week, and depletion occurred approximately 3 weeks after weaning. Daily food intake of the pyridoxine-supplemented rats was restricted to the average food intake of the Vit. B_6-deficient rats.

For collection of urine, the rats were placed in cages with plastic screen bottoms over pans covered with aluminum foil. The rats had access to water, but not food, during the 24-hour collection period. The supplements of cysteine and pyridoxine were given by stomach tube in one tube feeding in the morning (200 mg of L-cysteine hydrochloride hydrate, alone, or with 100 μg of pyridoxine hydrochloride in 2.0 ml of neutralized aqueous solution). The collection pans were washed with hot distilled water, and the washings diluted to 100 ml. The taurine content of aliquots of the diluted urine was determined by the method of Pentz *et al.*(5) which measures absorption of the dinitrophenyl derivative of taurine at 355 mμ.

TABLE I. Effect of Cysteine and of Cysteine and Pyridoxine on Urinary Excretion of Taurine by Adult Male Rats.

Rat No.	Diet	Urinary taurine, mg/24 hr: Supplement: None	Supplement: Cysteine*	Supplement: Cysteine + B_6†
1	Chow	.8	1.4	—
	" + B_6‡	.8	9.0	10.3
2	Chow	.9	1.7	4.2
	" + B_6	1.8	4.0	7.1
3	Chow	1.5	2.5	—
	" + B_6	3.2	13.2	12.2
4	Chow	1.0	1.9	4.2
	" + B_6	3.5	12.2	9.3

* 200 mg of L-cysteine hydrochloride hydrate (A grade, California Corp. for Biochem. Research) in 2.0 ml of aqueous solution, pH 7.

† 200 mg of L-cysteine hydrochloride hydrate and 100 μg of pyridoxine hydrochloride (Nutritional Biochemicals Corp.) in 2.0 ml of aqueous solution, pH 7.

‡ 50 μg of pyridoxine hydrochloride per day supplied from a 20% ethanol solution containing 59 μg/ml. Two ml of this solution were fed 3 times weekly for 2 wk prior to the urine collections, for an estimated avg intake of 50 μg/day.

Results. A. Adult rats. The basal 24-hour excretion of taurine by the fasting adult rats previously fed a commercial rat diet ranged from 0.8 to 1.5 mg (Table I). Following administration of cysteine, excretion of taurine was approximately doubled, ranging from 1.4 to 2.5 mg. If the basal taurine excretion is subtracted from the value after feeding cysteine, then taurine excretion increased by 0.6 to 1.0 mg, increases which corresponded to 0.45%-0.68% of the cysteine supplement.

To test whether supplying pyridoxine together with cysteine would increase taurine formation even in rats which presumably had received a diet adequate in Vit. B_6, 2 of the rats were fed 100 μg of pyridoxine hydrochloride, together with the cysteine. Taurine excretion in these 2 rats rose to 4.2 mg in 24 hours, and the increase in taurine could account for 2.3% of the cysteine fed.

The unexpected increase in taurine excretion after a dose of both cysteine and pyri-

TABLE II. Effect of Cysteine and of Cysteine and Pyridoxine on Urinary Excretion of Taurine by Normal Young Rats and by Vit. B_6-Deficient Young Rats.

Diet	Rat No.	Urinary taurine, mg/24 hr		
		Supplement		
		None	Cysteine*	Cysteine + B_6†
$+B_6$	1	.11	1.7	2.3
	2	.11	1.8	2.4
$-B_6$	1	.04	.09	.09
	2	.01	.08	.07
	3	.05	.06	.07
	4	.03	.06	.05

* 200 mg of L-cysteine hydrochloride hydrate (A grade, California Corp. for Biochem. Research) in 2.0 ml of aqueous solution, pH 7.

† 200 mg of L-cysteine hydrochloride hydrate and 100 μg of pyridoxine hydrochloride (Nutritional Biochemicals Corp.) in 2.0 ml of aqueous solution, pH 7.

doxine suggested two possibilities, either that intake of Vit. B_6 from the commercial diet may have been insufficient for saturation of the tissues with Vit. B_6, or that providing extra pyridoxine, together with cysteine, would automatically divert a greater proportion of the cysteine into taurine formation, even in animals fed high intakes of Vit. B_6. Consequently, all of the rats were supplemented with pyridoxine (50 μg pyridoxine hydrochloride daily) for 2 weeks, and taurine excretion was again measured (Table I).

In comparison with the previous results, the 24-hour basal excretion of taurine was now greatly increased (1.8 to 3.5 mg) and was as large as that previously observed after feeding cysteine. This result suggested that the basal ration may have been somewhat deficient in Vit. B_6. The ration, however, was not analyzed for Vit. B_6.

When cysteine was given, excretion of taurine now reached values (4.0 to 13.2 mg) from 2 to 10 times greater than the basal level, and 1.6% to 7.0% of the cysteine supplement appeared to have been converted to taurine. When cysteine and pyridoxine were given together, the results, compared to those with cysteine alone, were more variable: taurine excretion declined in 2 of the rats, increased approximately 15% in the third, and doubled in the fourth. In this instance, the increase in taurine excretion could account for 3.7% to 6.5% of the cysteine supplement.

B. Young rats. The basal 24-hour excretion of taurine was 0.11 mg for the young rats previously fed a purified diet supplemented with pyridoxine (Table II). Administration of cysteine produced a 14-fold increase (1.6 mg) in taurine excretion, corresponding to about 1% of the cysteine supplement. When cysteine and pyridoxine were fed together, taurine excretion rose to 2.3 mg. The increase in taurine corresponded to 1.6% of the cysteine supplement. A study was also made of the effect of methionine on taurine excretion, but on an equimolar basis with cysteine, methionine produced only a very small increase in urinary taurine.

Taurine excretion was very low in the Vit. B_6-deficient rats (0.01 to 0.05 mg). A slight increase occurred after feeding cysteine (0.06 to 0.09 mg). No further increases occurred, however, when pyridoxine was fed together with cysteine. In the deficient rats, the increase in taurine excretion after feeding cysteine accounted for less than 0.10% of the cysteine supplement.

Discussion. The very small increase in the urinary taurine of the Vit. B_6-deficient rats fed cysteine or cysteine together with pyridoxine, in comparison with the large increases shown by the pyridoxine-supplemented rats, suggests that the excretion of taurine after an oral dose of cysteine might be useful in evaluation of Vit. B_6 nutrition. The fact that taurine formation did not increase in the Vit. B_6-deficient rats fed pyridoxine together with cysteine suggests a lack of some of the apoenzymes involved in taurine formation, as well as a lack of pyridoxal phosphate(2).

The greater taurine excretion after feeding the combination of pyridoxine and cysteine to the young rats previously fed 50 μg of pyridoxine daily, in comparison with the excretion after feeding cysteine alone, suggests that the concomitant administration of pyridoxine may have diverted a larger amount of cysteine into pathways leading to taurine formation. The results with 2 of the adult rats also support this conclusion.

The additional pyridoxine could have achieved this effect by causing the cysteine-sulfinic acid decarboxylases of different tissues to be saturated temporarily with pyri-

doxal phosphate. Bergeret *et al.*(6) found that brain cysteinesulfinic acid apodecarboxylase was not saturated with pyridoxal phosphate in rats fed 15 μg of pyridoxine hydrochloride daily although the liver apoenzyme appeared saturated.

With the other adult rats previously fed 50 μg of pyridoxine daily, however, taurine excretion after feeding cysteine and pyridoxine was somewhat less than after feeding cysteine alone. This suggests that their previous intake of pyridoxine may have been sufficient to "saturate" the enzymes concerned in taurine formation although it is possible that other factors involved in taurine formation may have altered during this collection period.

Summary. Feeding cysteine alone or with pyridoxine greatly increased urinary excretion of taurine in young or adult rats fed adequate amounts of pyridoxine. In Vit. B_6-deficient young rats, these treatments caused only a slight increase in taurine excretion. The results indicated that the relative increase in urinary excretion of taurine after an oral dose of cysteine or cysteine and pyridoxine might be used as an index of Vit. B_6 nutrition.

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Comparative Effects of Valine-5 Angiotensin II Amide and Pitressin on Renal Excretory Function in Diabetes Insipidus.* (27117)

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Angiotensin causes antidiuresis, sodium retention and renal vasoconstriction in normal human subjects(1). These effects are associated with an increased secretion and excretion of aldosterone(2,3). Whether the antidiuretic effect of angiotensin is attributable wholly or in part to its vascular action on the kidney is not clear, nor is it known what role the concomitant stimulation of aldosterone secretion plays. The suggestion has been made(4) that the antidiuresis by angiotensin may be due to a mechanism similar to that of the antidiuretic hormone (ADH).

The present experiments were undertaken with the aim of comparing the effects of angiotensin to those of pitressin on excretion of water, sodium and potassium. To eliminate the influence of endogenous ADH the studies were performed in subjects suffering from diabetes insipidus.

Material and methods. The experiments were performed on 3 subjects. One patient had diabetes insipidus of unknown etiology, and 2 patients developed diabetes insipidus after complete hypophysectomy for removal of a chromophobe adenoma and for treatment of metastatic carcinoma of the breast, respectively. In all subjects the absence of antidiuretic hormone (ADH) production was confirmed by a negative response to nicotine administered intravenously according to Dingman *et al.*(5), and by their inability to form concentrated urine after fluid deprivation for 12 to 14 hours. Two subjects (B.M. and P.R.) were placed on a low salt diet (2 g NaCl daily); the third subject (G.C.), however, was given a regular hospital diet (approximately 10 g NaCl daily).

The effects of valine-5 angiotensin II

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