Currently the more promising of these alcohols are being subjected to chronic toxicity studies in rats consuming the compounds in their drinking water. The results of this investigation, including blood counts and autopsy, will be reported at a later date. It should be recorded that two long-chain alcohols tested for anticonvulsant activity are not included in the table. Both 2-ethyl-2-hexanol and 3,9-diethyltridecanol were found to be feeble and erratic anticonvulsants as measured by the supramaximal stimulation test.

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Relationship between Inorganic Phosphorus and Vitamin A in the Rat and Sheep[1]

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Ross and Gallup (*1*) have reported an inverse relationship between blood plasma inorganic phosphorus and plasma carotene in beef cattle fed phosphorus-deficient rations. Kleiber, Goss, and Guilbert (*2*) found a decreased utilization of energy in beef heifers fed rations low in this mineral.

Six experiments have been conducted with rats to study a possible relationship between inorganic phosphorus and carotene and/or vitamin A utilization. Weanling rats of the Sprague-Dawley strain were used in these studies. The rats were first depleted of vitamin A on a ration of cerelose, 68 parts; casein, 15 parts; corn oil, 5 parts; USP salt mixture No. 2, 4 parts; and irradiated dry yeast, 8 parts, by weight.

When the rats became depleted of vitamin A, as characterized by weight loss and eye symptoms, they were divided into uniform groups and placed on the experimental rations. The experimental rations were the same as the depletion ration except that different salt mixtures were used and the amount of irradiated yeast was decreased to 1 part, with a corresponding increase in the amount of cerelose. Carotene in cottonseed oil was added in equal amounts to both the high and low phosphorus rations.

In Expts I, II, and III the salt mixture used in the low phosphorus rations was that of Hubbell, Mendel, and Wakeman (*3*), without the inclusion of potassium phosphate. A corresponding increase was made in the potassium chloride content of this salt mixture. The salt mixture used in the high phosphorus ration in Expt I was USP salt mixture No. 2. In Expt II, potassium phosphate was added to the low phosphorus ration and in Expt III di-calcium phosphate was added to produce the high phosphorus rations. Thus in Expts II and III the total salt content of the high phosphorus ration was greater than that of the low phosphorus ration.

The phosphorus and carotene content of the rations fed, feed consumption, and the liver analyses obtained in the first three experiments are presented in Table 1. The rats were fed the experimental rations *ad lib* for 10 days during Expts I and II and for 15 days during Expt III.

TABLE 1

FEED CONSUMPTION AND LIVER ANALYSES OF RATS FED VARIOUS LEVELS OF PHOSPHORUS AND CAROTENE

	Experiment I		Experiment II		Experiment III	
	Low phosphorus	High phosphorus	Low phosphorus	High phosphorus	Low phosphorus	High phosphorus
Ration composition						
Phosphorus (%)	.15	.53	.18	1.07	.15	.85
Carotene (ppm)	9	9	50	50	6	6
Number rats	12	11	10	13	12	13
Feed consumed per rat						
Total (g)	79.3	72.4	88.5	41.1	58.2	40.0
Carotene (mg)	.71	.65	4.42	2.06	.35	.24
Liver analyses						
Av wt (g)	3.33	3.18	4.31	2.63	3.99	2.41
Vitamin A (IU/g)	26.4	19.3	76.2	59.4	4.3	3.5
Total IU/liver	86.6	60.2	293.1	159.6	16.4	8.3

[1] Contribution from the North Dakota Agricultural College Experiment Station. Published with the approval of the director of the station.

It will be noted in Table 1 that the rats fed the low phosphorus rations ate more total feed, had larger

livers, and stored more vitamin A. The smaller feed consumption of the rats fed the high phosphorus rations in Expts II and III may have been related to the higher salt content of these rations.

TABLE 2

AVERAGE LIVER WEIGHTS AND VITAMIN A STORAGE OF RATS FED TWO LEVELS OF PHOSPHORUS WITH CAROTENE OR VITAMIN A

Ration fed	No rats	Av wt liver (g)	Liver vitamin A	
			Per gram (IU)	Total (IU)
Experiment IV—rations fed 14 days				
Control	10	2.34	2.9	7.0
High phosphorus and carotene	9	4.76	8.4	38.6
Low " " "	9	4.15	19.5*	81.5
Experiment V—rations fed 11 days				
Control	10	2.86	1.9	5.6
High phosphorus and carotene	8	4.50	15.7	71.4
Low " " "	7	4.14	32.2*	128.7
High phosphorus and vitamin A	9	4.13	148.9	609.8
Low " " " "	9	4.00	182.0†	734.5
Experiment VI—rations fed 6 days				
Control	5	2.52	4.1	10.4
High phosphorus and carotene	7	3.10	13.5	39.7
Low " " "	8	3.53	19.6*	66.1
High phosphorus and vitamin A	6	3.35	91.7	310.6
Low " " " "	6	3.11	112.7†	346.6

* Differences from high p and carotene significant at 1% level.
† Differences from high p and vitamin A significant at 5% level.

In Expts IV, V, and VI the high and low phosphorus rations contained equal amounts of total salts, and the feed consumption was controlled so that the rats on each ration consumed the same amount. The salt mixture used in the high phosphorus ration was that of Osborne and Mendel (*4*). The same mixture was used in the low phosphorus ration except that the phosphoric acid was replaced with an equivalent amount of citric acid. The low phosphorus ration analyzed 0.13% phosphorus and the high, 0.50%. Carotene was added in equal amounts, 50 ppm, to both rations. The vitamin A rations fed in Expts V and VI contained 62 IU/g.

The number of rats, the length of time they were fed the experimental rations, and the amounts of vitamin A stored in their livers are presented in Table 2. The control rats were killed at the time the other groups were started on their respective rations.

It will be noted in Table 2 that when rats were fed equal amounts of carotene or vitamin A, those fed a phosphorus-deficient ration stored larger amounts of vitamin A. When fed carotene, the difference between the high and low phosphorus rations was significant at the 1% level. When fed vitamin A the difference was significant at the 5% level.

In addition to the experiments with rats, two groups of 10 sheep each were fed a phosphorus- and carotene-deficient ration. The rations consisted of wheat straw, cane molasses, dried beet pulp, and minerals. The wheat straw fed occasionally contained small amounts of carotene. One lot of sheep received steamed bone meal as a phosphorus supplement. After the sheep had been fed for approximately 6 months, the rations were reversed with respect to the phosphorus supplement. They were fed these rations for a total of 18 months.

The sheep were bled at intervals for blood serum inorganic phosphorus and vitamin A determinations. A highly significant negative correlation ($r = -0.39$) was found to exist between these two blood constituents (unpublished data by the authors).

A statistically significant inverse relationship has been found between inorganic phosphorus and carotene and/or vitamin A utilization.

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