All the freezing treatments increased the denitrifying activity as measured by gas production, so that neither quick freezing using dry ice nor freezing in the refrigerator (and maintenance of low temperatures) preserved the denitrifying activity found at the time of sampling the soil from the field. The lower the temperature maintained for the 28 days after the initial freezing of the soil, the greater the denitrifying activity on subsequent anaerobic incubation. Air drying also increased the denitrifying activity, an observation substantiated by other experiments not reported here.

Evolution of measurable quantities of nitrogenous gases began after the same length of time for all treatments as determined by the manometric technique; the rate of gas evolution also remained constant until the nitrate substrate was exhausted. These observations suggest that any changes in activity or numbers of the denitrifying organisms between treatments are relatively small. The increase in rate of denitrification following soil freezing therefore indicates that the denitrifying organisms are more able to utilize oxidizable substrate, and this could arise from a reduction in numbers of other micro-organisms resulting in an increased nutrient supply for surviving denitrifiers, or from an increase in the availability of the soil organic matter itself. An analogy can be drawn between these results for what is essentially anaerobic respiration in soils and those of Soulides and Allison[2], who found that the effects of freezing and drying of soils were to increase aerobic respiration.

Freezing and drying, therefore, cannot be recommended as a universal means of preserving the denitrifying activity of freshly collected soil. A corollary to this work is that the denitrifying activity of soils in the field, particularly surface soils, could well be expected to change seasonally due to natural freezing and drying. This latter aspect is at present being investigated.

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[1] Gasser, J. K. R., *Nature*, **181**, 1334 (1958).
[2] Soulides, D. A., and Allison, F. E., *Soil Sci.*, **91**, 291 (1961).
[3] Mack, A. R., *Nature*, **193**, 803 (1962).
[4] McGarity, J. W., *Plant and Soil*, **14**, 1 (1961).

VETERINARY SCIENCE

A Reciprocal Relationship between the Urinary Excretion of Magnesium and Phosphorus in Wether Lambs

In a series of investigations[1] into the cause and prevention of ovine phosphatic urinary calculi, a reciprocal relationship between the urinary excretion of phosphorus and magnesium was observed in wether lambs. Also, lambs which developed visible uroliths in the bladder or kidney excreted more phosphorus and less magnesium than did the non-affected animals.

This pattern was found to hold regardless of the dietary treatment. While the magnitude of excretion changed from year to year and study to study, the decrease in urinary magnesium and the increase in urinary phosphorus in affected wethers were observed in all instances. Table 1 presents the average excretion results from our most recent test. The coefficient of correlation between the excretions of phosphorus and of magnesium was found to be negative and highly significant.

Table 1. Excretion of Magnesium and Phosphorus in 24 h Urine Samples

	No. of samples	Magnesium (mg/100 ml. urine)	Phosphorus (mg/100 ml. urine)
Diet *A*. Average daily intake: 13·8 g Ca, 3·8 g P, 2·9 g Mg (No calculi)			
First 28 days	7	84	2
Second 28 days	7	85	3
Third 28 days	4	64	3
Fourth 28 days	7	69	2
Diet *B*. Average daily intake: 6·7 g Ca, 3·6 g P, 4·9 g Mg (38 per cent calculi)			
First 28 days	6	133	5
Second 28 days	6	99	16
Third 28 days	5	124	16
Fourth 28 days	7	53	34
Diet *C*. Average daily intake: 6·0 g Ca, 5·0 g P, 4·4 g Mg (80 per cent calculi)			
First 28 days	6	31	29
Second 28 days	6	8	66
Third 28 days	3	7	67
Fourth 28 days	8	16	50

$\rho = -0·798$, $P < 0·01$ (Groups *A*, *B* and *C*). $\rho = -0·919$, $P < 0·01$ (Groups *B* and *C*). $\rho = -0·962$, $P < 0·01$ (Groups *A* and *C*).

A comparison of the excretory-levels in animals which developed calculi with those lambs not affected revealed a higher urinary phosphorus and a lower urinary magnesium excretion by affected lambs during the course of the 112–140 day feeding periods on a sorghum grain, cottonseed hull and meal, and molasses based ration. These averages of excretory levels, which were obtained from selected animals in each treatment group, could be used to forecast those treatments which would be calculogenic prior to the development of any serious number of clinical cases of urinary calculi.

The reciprocal relationship between phosphate and magnesium excretions by the kidney may mean that urinary calculi represent one end of a spectrum of metabolic interactions of minerals bounded at the other end by hypomagnesæmic tetany – grass tetany and related maladies.

The accumulation of magnesium in the blood sera of lambs affected with urinary calculi has been previously reported[2].

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[1] Crookshank, H. R., *et al.* (to be published).
[2] Kunkel, H. O., Whitaker, Earl S., Packett, jun, Leonard V., and Crookshank, H. R., *J. Anim. Sci.*, **20**, 940 (1961) (abst.).

PSYCHOLOGY

Relations between Excitatory and Inhibitory Retinal Responses as determined by a Revised Apparatus for the Study of Induced Negative After-Images

Induced negative after-images are of interest in that they reflect relations between inhibitory and excitatory retinal function. In 1897, Bidwell[1] reported that when a coloured, a white, and a black stimulus