SOME OBSERVATIONS ON BLOOD AND URINE OF BOVINES ON VARIOUS DIETS

Thesis for the Degree of M. S.
MICHIGAN STATE COLLEGE

Mary B. Hutchings

1940

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by

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A THESIS

Submitted to the Graduate School of Michigan State College of Agriculture and Applied Science in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

Department of Animal Pathology

1940

THESIS

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INTRODUCTION

In the past, little has been published on the bovine kidney in regard to the correlation of the compositions of blood and urine from bovines fed normal diets and those fed diets of varying mineral and vitamin deficiencies.

The purpose of this investigation is to study this correlation to determine if it is of any significance in mineral and vitamin deficiencies.

REVIEW OF LITERATURE

The author has found no evidence in literature that any attempt has been made to correlate the compositions of blood and urine on bovines fed normal diets or those fed diets with varying deficiencies.

Duke (1) in his Physiology of Domestic Animals presents a few calculations pertaining to the urine analyses of normal bovines.

MATERIALS AND METHODS

This work was done on twenty-two bovines from the Michigan State College Experimental Dairy Herd. Eight blood and urine analyses were completed on two animals; seven analyses on three animals, and six analyses on eleven animals. Two animals were pastured early in the experiment. One analysis was completed on one of these animals and three analyses on the other. During the experiment, six animals died or were killed. Two analyses were completed on one of these; four analyses on two; five analyses on one; six analyses on one, and seven analyses on one.

Four groups of animals were studied. Group 1 consisted of eight animals which had been fed normal diets. The results of determinations of the individual animals in this group are presented in Tables 1-8 and summarized in Tables 9 and 10. Group 2 consisted of eight animals which had been fed diets deficient in Vitamin A to varying degrees. The results of the determinations on the individual animals are presented in Tables 11-18 and summarized in Tables 19 and 20. Group 3 consisted of five animals which had been fed magnesium deficient diets. These results are presented in Tables 21-25 and summarized in Tables 26 and 27. Group 4 was composed of one animal which had been fed a diet deficient in potassium. The results of determinations on this animal are presented in Table 28 and summarized in Tables 29 and 30.

Blood and urine samples were collected from each bovine about once every three weeks. The samples were taken at approximately the same time - eight o'clock in the morning - and the analyses were completed that day, or as in the case of the urine urea, the next day.

BLOOD ANALYSIS

The following are outlines of the blood determinations performed on these animals.

CHLORIDE - Whitehorn Method (2).

Place 10 cc. blood filtrate in a 50 cc. Erlenmeyer flask. Add 5 cc. of nitric acid and 6 cc. standard silver nitrate solution. Allow the flask to stand five minutes and add about .3 grams of powdered ferric ammonium sulfate as an indicator. Titrate the excess silver nitrate solution until a definite salmon red color persists for fifteen seconds.

Calculation -

Subtract the titration reading from 6 and multiply by 100. This gives the mg.% of chloride.

CREATININE - (2).

Unknown -

Place 10 cc. blood filtrate in a 50 cc. Erlenmeyer flask. Add 5 cc. alkaline picrate solution.

Standard -

Place 5 cc. standard creatinine solution in a 50 cc. Erlenmeyer flask. Add 15 cc. distilled water and 10 cc. alkaline picrate solution. Allow the flasks to stand for eight minutes and read with the colorimeter.

Calculation -

$\frac{\text{Standard}}{\text{Unknown}} \times 0.03 \times \frac{100}{1} \times \frac{15}{30}$. This gives the mg.% of creatinine.

GLUCOSE - Folin-Wu (2).

Unknown -

Place 2 cc. blood filtrate in a Folin-Wu sugar tube. Add 2 cc. alkaline copper solution.

Standard -

Place 2 cc. standard glucose solution in a Folin-Wu sugar tube. Add 2 cc. alkaline copper solution. Place the tubes in a boiling water bath for eight minutes. Cool in running water. Add 2 cc. acid molybdate solution to each tube and dilute to 25 cc. with distilled water. Read with the colorimeter.

Calculation -

$\frac{\text{Standard}}{\text{Unknown}} \times 0.2 \times \frac{100.}{0.2}$ This gives the mg.% of glucose.

NON-PROTEIN NITROGEN - Folin-Wu (2).

Unknown -

Place 5 cc. blood filtrate in a large pyrex test tube. Add 1 cc. dilute acid mixture and 3 or 4 quartz pebbles. Boil vigorously over a micro-burner until the characteristic dense fumes begin to fill the tube. Cover the test tube with a watch glass and reduce the flame. Continue heating until the solution is almost colorless. Allow to cool and add distilled water slowly. When the solution is cooled to room temperature, dilute with distilled water to 35 cc. Add 15 cc. Nessler's solution.

Standard -

Place 3 cc. standard ammonium sulfate solution in a 100 cc. Florence flask. Add 2 cc. dilute acid mixture and dilute to 60 cc. with distilled water. Add 30 cc. Nessler's solution and dilute to 100 cc. with distilled water. Read with the colorimeter.

Calculation -

$\frac{\text{Standard}}{\text{Unknown}} \times 30.$ This gives the mg.% of non-protein nitrogen.

UREA - Karr's Direct Nesslerization Method (1).

Unknown -

Place 5 cc. blood filtrate in a test tube. Add 1 drop buffer solution and 1 urease paper.

Standard -

Place 5 cc. standard urea solution in a test tube. Add 1 drop buffer solution and 1 urease paper. Place both in a water bath at 50°C. for fifteen minutes. The contents of the tubes are then transferred to tubes graduated at 22.5 cc. and 25 cc. Dilute with distilled water to 22.5 cc. Add 3 drops of Gum Ghatti solution and add Nessler's solution to the 25 cc. mark. Read with the colorimeter.

Calculation -

$\frac{\text{Standard}}{\text{Unknown}} \times 0.075 \times \frac{100.}{0.5}$ This gives the mg.% of urea.

URIC ACID - Brown (3).

Unknown -

Place 10 cc. blood filtrate in a 50 cc. Erlenmeyer flask. Add 5 cc. uric acid standard solution, 5 cc. sodium cyanide solution, and 0.5 cc. uric acid reagent.

Standard -

Place 5 cc. standard uric acid solution in a 50 cc. Erlenmeyer flask. Add 10 cc. distilled water, 5 cc. sodium cyanide solution, and 0.5 cc. uric acid reagent. Allow the flasks to stand for twenty minutes and read with the colorimeter.

Calculation -

$\frac{50}{\text{Unknown}}$. This gives the mg.% of uric acid.

URINE ANALYSIS

The following are outlines of the urine determinations performed

on these animals.

CHLORIDE - Simplified Volhard, Modified by McLean and Selling (4).

Place 5 cc. of urine in a 50 cc. Erlenmeyer flask. Add 10 cc. standard silver nitrate solution and allow the flasks to stand for five minutes. Titrate with standard ammonium sulfocyanate solution.

Calculation -

35 minus the reading of the titration multiplied by 100. This gives the mg.% of chloride.

CREATININE - Folin (4).

Unknown -

Place 1 cc. of urine in a 200 cc. Erlenmeyer flask. Add 20 cc. saturated picric acid solution and 1.5 cc. 10% sodium hydroxide solution.

Standard -

Place 1 cc. standard creatinine solution in a 200 cc. Erlenmeyer flask. Add 20 cc. saturated picric acid solution and 1.5 cc. 10% sodium hydroxide solution. Allow the flasks to stand for ten minutes. Dilute to 100 cc. with distilled water and read with the colorimeter.

Calculation -

$\frac{\text{Standard}}{\text{Unknown}} \times 100$. This gives the mg.% of creatinine.

GLUCOSE - Benedict's Picrate Method (2).

Place 1 cc. urine in a large test tube. Add 3 cc. 0.2% picric acid solution, 0.5 cc. 5% sodium hydroxide solution and 5 drops of a 50% acetone solution. Place in a boiling water bath for twelve minutes. Cool to room temperature and dilute with distilled water to 25 cc.

Compare with permanent standards made of ferric chloride, cobalt chloride, and dilute hydrochloric acid.

NON-PROTEIN NITROGEN (4).

Unknown -

Place 8 cc. urine in a 50 cc. Erlenmeyer flask. Add 1 cc. 10% sodium tungstate solution and 1 cc. 2/3 N sulfuric acid. Filter and dilute filtrate 1-10 with distilled water. Proceed as for non-protein nitrogen of the blood.

Standard -

Proceed as for non-protein nitrogen of the blood.

Calculation -

$\frac{\text{Standard}}{\text{Unknown}} \times 125$. This gives the mg.% of non-protein nitrogen.

The calculation presented in Bray's textbook for non-protein nitrogen of urine is as follows:

$$\frac{\text{Standard}}{\text{Unknown}} \times 250$$

After performing a number of determinations and calculating them in this way, it was found that the results were widely different from those obtained for the total nitrogen determination of the urine. These results should vary only slightly. Study of the determination and its calculation led to the discovery that the dilution factor was apparently incorrect and should be 125 rather than 250.

TOTAL NITROGEN - Folin Modified (4).

Unknown -

Place 2 cc. urine in a 200 cc. Erlenmeyer flask and dilute to 100 cc. with distilled water.

Place 1 cc. diluted urine in a large pyrex test tube. Add 1 cc. digestion acid mixture and 2 or 3 glass beads. Digest as for non-protein nitrogen of the blood.

Standard -

Place 1 cc. standard ammonium sulfate solution in a 50 cc. test tube. Add 1 cc. digestion acid mixture and dilute to 35 cc. with distilled water. Add 15 cc. Nessler's solution.

Calculation -

$\frac{\text{Standard}}{\text{Unknown}} \times 500.$ This gives the mg.% of total nitrogen.

UREA - Marshall's Urease Method (2).

Two 5 cc. portions of urine are measured into two 200 cc. Erlenmeyer flasks and diluted with distilled water to 100-125 cc. 1 cc. of a 10% solution of urease is added to one flask. Add a few drops of toluene to each flask and allow to stand at room temperature from five hours to over night. The fluid in each flask is titrated with 0.1 N hydrochloric acid.

Calculation -

The amount of hydrochloric acid required for the contents of the flask containing the urine and enzyme solution minus the amount of hydrochloric acid required for the flask containing the urine alone and that previously determined for 1 cc. of urease solution corresponds to the amount of urea originally present in the sample. This is multiplied by 60 to give the mg.% of urea.

URIC ACID - Benedict and Franke (4).

Unknown -

Dilute urine 1-20 with distilled water. Place 10 cc. diluted urine in a 100 cc. Erlenmeyer flask. Add 5 cc. sodium cyanide solution and 1 cc. uric acid reagent.

Standard -

Place 10 cc. standard uric acid solution in a 100 cc. Erlenmeyer

flask. Add 5 cc sodium cyanide solution and 1 cc. uric acid reagent. Mix and allow both to stand for five minutes. Dilute to 50 cc. with distilled water and read with the colorimeter.

Calculation -

$\frac{\text{Standard}}{\text{Unknown}} \times 40.$ This gives the mg.% of uric acid.

Qualitative tests were done for albumin and acetone.

ALBUMIN - Heller's Ring Test (2).

Place 5 cc. concentrated nitric acid in a test tube. By means of a pipette or dropper, allow urine to flow down the sides of the tube. The urine should form a layer on top of the acid. If albumin is present, a white, fluffy ring will form at the junction of the two liquids.

ALBUMIN - Heat Test (4).

Heat 5 cc. of urine in a test tube to boiling. If a precipitate forms, it is either albumin or phosphates. Add 3-5 drops of dilute acetic acid. If the precipitate is due to phosphates, the solution will clear upon the addition of the acid. If the precipitate is due to albumin, it will become more pronounced upon addition of the acid.

ACETONE.

Five cc. of urine is placed in a vial which contains 1 gm. of sodium nitroprusside and ammonium sulfate mixture (1:100). Dissolve the mixture and add 2 cc. ammonium hydroxide. The presence of acetone bodies is indicated by the development of a permanganate color.

SPECIFIC GRAVITY.

The specific gravity of the urine was determined by use of the urinometer. Corrections were made for temperature.

HYDROGEN ION CONCENTRATION.

The colorimetric method was used to determine the hydrogen ion concentration of the urine. This was done by making standards of disodium phosphate and potassium acid phosphate. Bromcresol purple and phenol red were the indicators used. The urine was collected under mineral oil and the pH was determined as soon as possible after its collection.

MICROSCOPIC EXAMINATION.

Microscopic examinations were made on the sediment to determine whether any epithelial cells, blood cells, casts or other abnormalities were present.

The tables that follow present the determinations of the various animals in each group and the autopsy findings if the animal died or was slaughtered.

Table 1

The Blood and Urine Values of Case 74

Age - 3 yrs.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
5/3/38	60.97	.1%	1.19	81.30	1.35	8.06	18.29	1398.00	450	605.00	33.70	568.17	1000.00	7.8	1.031	-	-	Amorphous
6/14/38	58.47	.2%	1.28	71.42	1.37	3.73	19.35	1182.00	450	240.00	33.89	568.17	769.22	8.0	1.030	-	-	Amorphous
7/12/38	48.30	.2%	1.26	88.68	1.37	14.54	20.68	1458.00	470	70.00	36.51	500.00	1058.20	7.6	1.033	-	-	Occ. pus cell Epithelial cells
7/26/38	50.63	.2%	1.21	80.00	1.50	13.44	7.91	1908.00	470	250.00	31.08	735.27	1212.12	7.4	1.033	-	-	Amorphous
8/9/38	45.04	.3%	1.45	75.47	1.92	15.68	20.00	1836.00	415	70.00	45.11	657.87	1315.78	7.4	1.030	-	-	Amorphous
9/6/38	60.60	.2%	1.06	84.78	1.53	17.11	20.26	2463.00	450	710.00	35.29	941.85	1666.66	7.2	1.035	-	-	Amorphous
10/4/38	57.63	.2%	1.04	79.36	1.25	10.24	36.58	2313.00	450	0.00	45.11	796.17	1481.48	7.4	1.033	-	-	Amorphous
								Died 2/1/39					Autopsy 4120					
Maximum	60.97	.3%	1.45	88.68	1.92	17.11	36.58	2463.00	470	710.00	45.11	941.85	1666.66	8.0	1.035	-	-	
Minimum	45.04	.1%	1.04	71.42	1.25	3.73	7.91	1182.00	415	0.00	31.08	500.00	729.22	7.2	1.030	-	-	
Average	54.52	.2%	1.21	80.14	1.47	11.82	20.44	1794.00	450	277.80	39.24	681.07	1214.78	7.5	1.032	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Case 74

This animal was a three year old Jersey cow. She was one of the normal control bovines. A rumen fistula operation had been performed on this animal in the fall of 1937. She had been losing flesh for some time. It was thought that the fistula may have been too low and that too much fluid was being lost from the rumen. She died February 1, 1939, and an autopsy was performed.

The animal is thin and emaciated.

The skin and subcutaneous tissues are negative.

Practically all lymph nodes of the body show enlargement of moderate to marked degree. One of the pelvic lymph nodes is 6 inches long and 3-4 inches in diameter. One of the mesenteric lymph nodes is 3 inches in diameter. Along the intestinal tract is a continuous mass of nodules of various size. On sectioning, the tissue resembles a sarcoma.

The head and neck are negative.

There is some excess pleural fluid. The lungs show some congestion throughout. The bronchial lymph nodes show considerable enlargement.

Considerable excess pericardial fluid is present and several clumps of fibrin are present in the fluid. The heart is markedly involved by growths similar to those described in the lymph nodes. These are generally distributed throughout the myocardium. Many of these bulge on the epicardial and endocardial surfaces. Some of the larger ones show good sized areas of necrosis in the center. One of the pulmonary semilunar valves and one leaf of the bicuspid valve are involved.

There is considerable excess clear peritoneal fluid.

The spleen and pancreas are negative.

The liver is negative.

There are numerous nodules over the peritoneal surface of the stomach and intestines. Some are apparently located in the walls.

The cecum and large intestines show similar involvement.

Each kidney contains several of the growths. Some bulge considerably on the surface of the kidneys.

The bladder is negative.

The uterus shows two rather small growths similar to those in the walls of the stomach and intestines.

The diagnosis is lympho-sarcoma.

Table 2

The Blood and Urine Values of Case 76

Age-2 yrs., 10 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
5/3/38	53.19	.1%	1.15	74.07	1.40	11.13	29.41	2226.00	465	50.00	48.00	744.02	1265.94	8.0	1.029	-	-	Occ. pus cell Amorphous
6/14/38	47.84	.2%	1.25	80.96	1.44	5.86	16.66	1074.00	430	100.00	30.92	612.72	800.00	8.0	1.027	-	-	-
7/12/38	47.28	.1%	1.30	100.00	1.43	16.84	6.97	774.00	470	30.00	28.57	367.62	704.22	7.2	1.034	-	-	Pus cells Occ. gran. cast
7/26/38	44.94	.1%	1.20	81.63	1.38	9.41	23.25	2640.00	495	30.00	44.11	892.85	1785.70	7.4	1.026	-	-	Occ. pus cell Occ. epith. cell
8/9/38	41.66	.2%	1.28	82.30	1.81	11.23	22.55	1596.00	405	50.00	40.00	500.00	1075.26	7.2	1.029	-	-	Occ. pus cell Occ. epith. cell
9/6/38	47.61	.1%	1.35	42.55	1.48	3.41	21.89	843.00	460	40.00	37.97	297.60	533.32	7.2	1.011	-	-	Pus and epith. cells
10/4/38	42.55	.2%	1.20	100.00	1.42	10.12	25.42	2307.00	450	40.00	48.00	862.05	1550.38	7.2	1.035	-	-	Pus and epith. cells
Maximum	53.19	.2%	1.35	100.00	1.81	16.84	29.41	2640.00	495	100.00	48.00	892.85	1785.70	8.0	1.035	-	-	
Minimum	41.66	.1%	1.15	42.55	1.38	3.41	6.97	774.00	405	30.00	28.57	297.60	533.32	7.2	1.011	-	-	
Average	46.44	.14%	1.24	80.21	1.48	9.71	20.88	1637.14	453	48.57	39.65	610.98	1102.11	7.4	1.027	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 3

The Blood and Urine Values of Case 77

Age - 2 yrs., 10 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
5/3/38	65.14	.1%	1.11	57.80	1.66	7.35	39.27	2356.20	505	155.00	43.47	905.77	1111.10	8.0	1.030	-	-	Amorphous
6/14/38	53.61	.2%	1.11	76.04	1.66	5.57	16.66	1572.00	470	260.00	30.76	833.32	1111.10	8.0	1.034	-	-	-
7/12/38	47.61	.2%	1.37	100.00	1.75	14.95	18.18	2082.00	490	110.00	39.21	657.87	1333.32	7.4	1.038	-	-	-
7/26/38	46.08	.2%	1.30	93.45	1.65	8.96	19.35	2442.00	475	80.00	37.50	905.77	1426.56	7.4	1.035	-	-	Amorphous
8/9/38	42.55	.2%	1.21	85.83	1.75	13.06	34.48	2238.00	380	80.00	45.11	868.05	1666.66	7.6	1.036	-	-	Pus cells
9/6/38	67.56	.3%	1.27	93.02	1.66	11.93	22.55	2901.00	475	640.00	38.46	1475.00	2083.32	7.4	1.040	-	-	Pus cells
10/4/38	59.70	.3%	1.19	97.56	1.66	10.73	26.54	3483.00	440	60.00	50.00	1470.57	2083.32	7.4	1.039	-	-	Pus cells
Maximum	67.56	.3%	1.37	100.00	1.75	14.95	39.27	3483.00	505	640.00	50.00	1475.00	2083.32	8.0	1.040	-	-	
Minimum	42.55	.1%	1.11	57.80	1.65	5.57	16.66	1572.00	380	60.00	30.76	657.87	1111.10	7.4	1.030	-	-	
Average	54.60	.21%	1.22	86.24	1.68	10.35	25.29	2439.10	462	198.00	40.64	1016.62	1545.05	7.6	1.036	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 4

The Blood and Urine Values of Case 78

Age - 2 yrs., 10 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
5/3/38	59.88	.2%	1.32	97.56	1.12	13.33	7.24	1860.00	505	310.00	32.43	757.57	1176.46	8.0	1.040	-	-	-
6/4/38	59.16	.2%	1.27	95.23	1.75	5.81	30.61	3168.00	450	80.00	50.00	1315.77	1818.18	7.6	1.032	-	-	-
7/12/38	51.81	.2%	1.32	125.00	1.00	12.59	17.64	2220.00	460	100.00	36.36	637.75	1388.88	7.4	1.034	-	-	Occ. pus cell
7/26/38	53.47	.2%	1.25	144.92	1.50	13.91	6.91	2466.00	450	40.00	37.03	905.77	1515.14	7.4	1.035	-	-	-
8/9/38	43.95	.3%	1.32	112.35	1.55	15.02	34.48	2940.00	440	60.00	50.00	905.77	1459.84	7.2	1.034	-	-	Occ. epith. cell
9/6/38	59.16	.2%	1.24	93.45	1.60	12.40	21.42	2721.00	480	720.00	42.25	966.55	1818.18	7.2	1.036	-	-	-
10/4/38	46.83	.1%	1.28	101.52	1.42	10.24	16.66	1731.00	510	560.00	40.00	856.15	1176.46	7.2	1.031	-	-	-
Maximum	59.88	.3%	1.32	144.92	1.75	15.02	34.48	3168.00	510	720.00	50.00	1315.77	1818.18	8.0	1.040	-	-	
Minimum	43.95	.1%	1.24	93.45	1.00	5.81	6.91	1731.00	440	40.00	32.43	637.75	1176.46	7.2	1.031	-	-	
Average	53.46	.2%	1.28	110.00	1.42	11.90	19.28	2443.71	470	267.10	41.15	906.47	1479.02	7.4	1.034	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr.-Specific Gravity
Alb. -Albumin
Acet. -Acetone

Table 5

The Blood and Urine Values of Case 267

Age = 2 yrs., 7 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
5/3/38	54.94	.2%	1.25	73.52	1.60	12.30	27.27	2664.00	540	0.00	48.00	850.32	1428.56	8.0	1.031	-	-	Occ. epith. cell Amorphous

Sent to Pasture

Average	54.94	.2%	1.25	73.52	1.60	12.30	27.27	2664.00	540	0.00	48.00	850.32	1428.56	8.0	1.031	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - MG.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 6

The Blood and Urine Values of Case C167

Age = 6 yrs., 1 mo.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
5/3/38	57.47	.3%	1.55	79.36	1.48	7.33	21.42	1362.00	500	75.00	38.71	538.77	769.22	8.0	1.030	-	-	Occ. pus cell Occ. epith. cell
6/14/38	54.79	.3%	1.35	114.28	1.81	7.32	25.64	1848.00	420	50.00	42.85	961.57	1538.46	8.0	1.032	-	-	Occ. pus cell
7/12/38	43.47	.3%	1.44	125.00	1.56	14.28	17.14	1818.00	450	30.00	39.21	694.42	1307.18	7.4	1.036	-	-	Occ. pus cell
7/26/38	57.47	.3%	1.31	137.93	1.94	21.62	20.54	2400.00	430	10.00	33.33	1059.30	1834.86	7.2	1.040	-	-	Amorphous Occ. pus cell
8/9/38	49.28	.3%	1.51	117.64	1.59	17.02	27.27	2352.00	400	50.00	44.77	932.82	1769.90	7.2	1.035	-	-	Occ. epith. cell -
9/6/38	58.82	.3%	1.32	115.60	1.69	17.77	24.00	2313.00	490	10.00	38.71	1275.50	1923.06	7.2	1.038	-	-	-
10/4/38	46.73	.3%	1.21	111.11	1.57	12.65	34.09	3123.00	440	10.00	40.00	1344.07	1694.90	7.2	1.035	-	-	-
Maximum	58.82	.3%	1.55	137.93	1.94	21.62	34.09	3123.00	500	75.00	44.77	1344.07	1923.06	8.0	1.040	-	-	
Minimum	43.47	.3%	1.21	79.36	1.48	7.32	17.14	1362.00	400	10.00	33.33	538.77	769.22	7.2	1.030	-	-	
Average	52.57	.3%	1.38	114.41	1.66	14.00	24.30	2173.70	447	33.57	39.65	972.35	1548.22	7.4	1.035	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp. Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 7

The Blood and Urine Values of Case D14

Age = 9 yrs., 3 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
5/3/38	65.78	.3%	1.32	135.13	1.48	13.33	23.07	4242.00	500	85.00	41.37	1623.37	2500.00	7.8	1.033	-	-	-
6/14/38	53.33	.4%	1.39	144.92	1.53	5.00	26.54	1944.00	440	80.00	38.96	961.57	1333.32	8.0	1.035	-	-	-
7/12/38	54.05	.3%	1.50	181.81	1.69	20.91	11.02	1806.00	430	40.00	60.00	718.37	1739.12	7.2	1.037	-	-	Occ. pus cell
7/26/38	44.44	.2%	1.40	143.88	1.63	14.54	22.22	2712.00	500	40.00	38.71	1436.77	2500.00	7.4	1.036	-	-	-
8/9/38	52.91	.1%	1.47	131.57	1.70	14.54	17.64	2364.00	400	20.00	42.85	1250.00	1851.84	7.4	1.036	-	-	-
9/6/38	54.05	.1%	1.48	106.95	1.53	8.77	20.00	1461.00	490	430.00	32.43	698.00	1063.82	7.4	1.033	-	-	-
10/4/38	57.80	.1%	1.46	196.07	1.58	13.33	8.00	2061.00	410	50.00	36.81	735.27	1428.56	7.4	1.041	-	-	-
Maximum	65.78	.4%	1.50	196.07	1.70	20.91	26.54	4242.00	500	430.00	60.00	1623.37	2500.00	8.0	1.041	-	-	
Minimum	44.44	.1%	1.32	106.95	1.48	5.00	8.00	1461.00	400	20.00	32.43	698.30	2127.64	7.2	1.033	-	-	
Average	54.62	.21%	1.43	148.62	1.59	12.91	18.35	2370.00	452	106.42	41.59	1060.48	1773.81	7.5	1.036	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 8

The Blood and Urine Values of Case A4

Age - 6 yrs., 1 mo.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/19/38	53.76	.3%	1.20	86.95	2.22	9.18	13.88	1243.20	500	120.00	37.97	480.75	909.08	6.6	1.035	-	-	Amorphous
5/10/38	54.94	.3%	1.20	106.95	2.22	15.38	13.63	2616.00	460	60.00	36.51	1024.57	1626.00	6.6	1.034	-	-	-
6/21/38	50.76	.1%	1.27	98.03	2.20	11.23	26.09	1416.00	510	100.00	42.25	698.30	1333.32	8.0	1.025	-	-	-
7/19/38	47.61	.4%	1.20	129.87	1.66	18.45	13.21	1434.00	450	130.00	26.43	600.95	1000.00	7.4	1.038	-	-	-
8/2/38	58.82	.3%	1.32	153.84	2.10	19.51	16.66	2409.00	445	50.00	35.29	1329.77	2040.80	7.2	1.032	-	-	-
9/13/38	57.80	.2%	1.14	89.28	1.62	13.11	26.31	2857.80	480	160.00	32.60	966.55	1904.76	7.2	1.031	-	-	-
									Slaughtered 7/14/39									
Maximum	58.82	.4%	1.32	153.84	2.22	19.51	26.31	2857.80	510	160.00	42.25	1328.77	2040.80	8.0	1.038	-	-	
Minimum	47.61	.1%	1.14	86.95	1.62	9.18	13.21	1243.20	445	50.00	26.43	480.75	909.08	6.6	1.025	-	-	
Average	53.94	.26%	1.22	110.82	2.00	14.47	18.29	1996.00	474	103.33	35.17	850.15	1468.99	7.1	1.032	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Case A4

This animal was slaughtered. The autopsy findings were negative except for an abscess on the left pelvic limb which affected the articular cartilages in the hock joint.

Table 9

NORMAL ANIMALS

Blood Values*

	Glucose	Creatinine	Uric Acid	Urea	Chloride	Non-Protein Nitrogen
Maximum	67.56	1.55	2.22	39.27	510	60.00
Minimum	41.66	1.04	1.00	6.91	380	26.43
Average	53.13	1.28	1.61	21.77	468	40.63

Table 10

Urine Values

	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	Non-Protein Nitrogen*	Total Nitrogen*	pH	Sp.Gr.
Maximum	.4%	196.07	21.62	4242.00	720.00	1623.37	2500.00	8.0	1.041
Minimum	.1%	42.55	3.41	774.00	00	297.50	533.32	6.6	1.011
Average	.215%	100.49	12.18	2189.70	140.68	868.56	1445.08	7.5	1.033

* - Mg.%
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity

Table 11

The Blood and Urine Values of Case A2

Age = 5 yrs., 10 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/19/38	53.47	.2%	1.31	219.78	1.47	9.14	14.70	1830.00	520	800.00	29.26	631.30	1129.94	6.6	1.039	-	-	-
5/10/38	54.20	.2%	1.92	344.82	1.73	13.61	13.33	2556.00	460	80.00	35.29	1250.00	1818.18	6.6	1.040	-	-	-
6/21/38	45.45	.1%	1.53	181.81	1.50	11.98	17.64	1542.00	520	70.00	38.46	811.67	1428.56	8.0	1.033	-	-	-
7/19/38	43.46	.2%	1.50	270.27	1.19	20.51	17.34	1818.00	440	Too high to read	28.03	1453.47	1724.14	7.2	1.040	-	-	-
8/2/38	51.68	.1%	1.54	95.23	1.90	9.69	12.19	1026.00	430	1240.00	28.57	407.15	694.44	7.4	1.029	-	-	-
9/13/38	54.64	.1%	1.61	192.30	1.56	13.61	17.14	2033.80	450	700.00	32.08	880.27	1562.50	7.2	1.040	-	-	-
9/27/38	49.14	.1%	1.47	153.84	1.39	11.85	20.54	984.00	475	650.00	29.12	581.30	1069.50	7.2	1.035	-	-	-
Maximum	54.64	.2%	1.92	344.82	1.90	20.51	20.54	2556.00	520	Too high to read	38.46	1453.47	1818.18	8.0	1.040	-	-	
Minimum	43.46	.1%	1.31	95.23	1.19	9.14	12.19	984.00	430	70.00	28.03	407.15	694.44	6.6	1.029	-	-	
Average	50.29	.14%	1.55	208.29	1.53	12.91	16.12	1684.20	470	590.00	31.54	859.31	1332.46	7.1	1.036	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 12

The Blood and Urine Values of Case A1

Age - 6 yrs., 1 mo.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/19/38	58.13	.1%	1.11	186.91	1.26	15.23	14.28	1907.00	520	750.00	26.31	735.27	1369.86	5.6	1.030	-	-	Occ. gran. cast Numerous pus cells Epith. cells, Amorphous
5/10/38	59.70	.1%	1.55	130.71	1.76	9.41	9.90	1338.00	450	1300.00	26.54	609.75	1041.66	5.6	1.025	-	-	Numerous pus cells Amorphous
6/21/38	45.45	.1%	1.23	204.08	1.70	7.80	24.00	2214.00	500	50.00	37.50	1000.00	1904.76	5.6	1.024	-	-	Numerous epith. cells Epith. cells Numerous pus cells
7/19/38	41.15	.1%	1.19	81.63	1.73	14.15	17.96	1272.00	440	50.00	28.57	416.65	727.26	6.2	1.010	-	-	Numerous pus cells
																		Died 7/20/38
Maximum	59.70	.1%	1.55	204.08	1.76	15.23	24.00	2214.00	520	1300.00	37.50	1000.00	1904.76	6.2	1.030	-	-	
Minimum	41.15	.1%	1.11	81.63	1.26	7.80	9.90	1272.00	440	50.00	26.31	416.65	727.26	5.6	1.010	-	-	
Average	51.11	.1%	1.27	150.83	1.61	11.65	16.53	1682.75	477	537.50	29.73	690.41	1260.88	5.7	1.022	-	-	Autopsy 3958

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Case A1

This bovine was a Holstein which had been off and on low Vitamin A ration for some time. She died July 20, 1938, and an autopsy was performed.

The skin and subcutaneous tissues are negative.

Most of the lymph nodes show edema and hemorrhage. The thoracic lymph nodes show marked swelling, congestion and some edema.

The pituitary body is markedly cystic and apparently shows some calcification.

There are marked and extensive adhesions throughout the pleural cavity, especially on the left side. These are mainly fibrinous. A fistulous tract through the diaphragm indicates perforation by a foreign body but the foreign body is not located.

The left apical lobe is almost entirely converted into a cavity containing dirty, grayish, foul smelling fluid. The cardiac lobe is somewhat similar. A large similar cavity is also present in the left diaphragmatic lobe. The remainder of the lungs shows patchy pneumonia, marked emphysema and considerable edema which is both pulmonary and interstitial in type. On the right side there is much pneumonia with some necrosis in the anterior lobes and some patchy pneumonia in the diaphragmatic lobe. Marked edema and emphysema are present on the right side.

The bronchi throughout the lung show marked congestion, numerous hemorrhages and some mucopurulent exudate.

The pericardium is negative except for some external adhesions and some excess fluid.

There are a few subepicardial hemorrhages in the left ventricle.

There are numerous small plaques in the endocardium. There are also some in the atrium. The aorta shows many plaques of various size apparently somewhat calcified. The right side of the heart is negative.

There is a fistulous tract from the reticulum to the diaphragm and some adhesions are present.

The spleen and pancreas are negative.

The liver shows some congestion. One abscess about 2 cm. in diameter is seen. The gall bladder is enormously distended with bile. The bile is cloudy and light in color.

The rumen is negative. The reticulum contains a piece of wire about 6 cm. long which is held in a fold by a looped end. The omasum and abomasum are negative.

The cecum shows rather marked congestion.

The small intestines show some patchy congestion throughout. The congestion is marked in some areas.

The large intestines show some patchy congestion. There is some excess viscous mucus over the mucosa.

The kidneys show some congestion.

The bladder and genital organs are negative.

The diagnosis is necrotic pneumonia.

Table 13

The Blood and Urine Values of Case 45

Age - 4 yrs., 1 mo.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/19/38	68.02	.1%	1.00	134.22	1.49	9.75	13.39	1203.00	510	960.00	25.00	520.82	1481.48	5.6	Insuff. Urine	+	-	Mod. pus cells Occ. gran. cast Epith. cells
5/10/38	56.65	.2%	1.12	142.85	1.81	13.33	16.00	1392.00	505	920.00	25.00	510.20	1712.30	5.6	1.026	+	-	Numerous pus cells Occ. epith. cells
6/21/38	61.72	.1%	1.24	166.66	1.75	16.29	18.18	1842.00	540	840.00	26.08	874.12	1428.56	5.6	1.022	+	-	Gran. casts Occ. pus cells
7/19/38	50.25	.1%	1.28	144.92	1.62	18.28	18.07	2170.00	470	250.00	35.29	961.52	1754.38	5.6	1.023	+	-	Gran. casts Occ. pus cells

Slaughtered 7/18/38

Maximum	68.02	.2%	1.28	166.66	1.81	18.28	18.18	2170.00	540	960.00	35.29	961.52	1754.38	5.6	1.026	+	-	
Minimum	50.25	.1%	1.00	134.22	1.49	9.75	13.39	1203.00	470	250.00	25.00	510.20	1428.56	5.6	1.022	+	-	
Average	59.16	.12%	1.16	147.16	1.66	14.41	16.41	1651.75	506	742.50	27.86	716.66	1594.18	5.6	1.023	+	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Case 45

This animal was slaughtered July 18, 1938, and an autopsy was performed. The animal was in a very weakened condition and had lost its power of coordination.

The animal has pneumonia very similar to that found in Case A1, but there is no evidence of a foreign body.

The trachea shows considerable hyperemia and a few hemorrhages. The nasal passages are cyanotic as is the glottis. There is considerable exudate and congestion in the bronchi.

Throughout the length of the small intestines, there is considerable congestion and numerous white crater-like areas.

The kidneys show some degenerative changes.

The liver and gall bladder are negative.

On the diaphragmatic side of the reticulum, there is a pus pocket 2 cm. in diameter. No injury is evident on the other side.

Table 14

The Blood and Urine Values of Case C245

Age = 4 yrs., 4 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/19/38	57.47	.2%	1.17	250.00	1.66	11.03	12.00	1812.00	510	620.00	25.10	657.87	1449.26	6.6	1.040	-	-	Occ. epith. cells Amorphous
5/10/38	54.34	.2%	1.12	200.00	1.81	19.27	8.95	1464.00	505	910.00	24.29	856.15	1290.28	6.6	1.039	-	-	Occ. epith. cells Numerous pus cells
6/21/38	55.55	.1%	1.42	133.33	1.75	9.09	19.48	1080.00	495	640.00	30.00	534.07	1081.08	8.0	1.030	-	-	Occ. epith. cells Mod. pus cells
7/19/38	53.33	.1%	1.33	186.91	1.81	18.60	15.38	1920.00	490	120.00	35.29	711.35	1111.10	7.4	1.032	-	-	Pus cells
8/2/38	54.05	.1%	1.31	169.48	1.69	20.64	12.14	2415.00	465	540.00	33.33	1923.07	1600.00	7.2	1.040	-	-	-
9/13/38	54.05	.1%	1.39	103.09	1.72	14.54	16.21	1471.80	450	540.00	30.00	625.00	1041.66	7.2	1.030	-	-	-
Maximum	57.47	.2%	1.42	250.00	1.81	20.64	19.48	2415.00	510	910.00	35.29	1923.07	1600.00	8.0	1.040	-	-	
Minimum	53.33	.1%	1.12	103.09	1.66	9.09	8.95	1080.00	450	120.00	24.29	534.07	1041.66	6.6	1.030	-	-	
Average	54.79	.13%	1.29	173.80	1.74	15.53	14.02	1693.80	486	561.66	29.67	884.58	1262.23	7.1	1.035	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 15

The Blood and Urine Values of Case G33

Age - 7 yrs., 9 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/19/38	52.77	.2%	1.12	181.81	1.02	9.69	12.76	2184.00	485	950.00	26.78	744.02	1333.33	5.6	1.034	-	-	-
5/10/38	74.07	.2%	1.19	169.49	1.66	10.38	13.95	1884.00	470	1340.00	25.52	879.30	1398.60	5.6	1.030	-	-	Amorphous Occ. pus cells
6/21/38	51.28	.1%	1.40	200.00	1.19	8.69	16.94	2394.00	500	370.00	30.00	1136.35	2564.10	5.6	1.026	-	-	Occ. pus cells
7/19/38	50.00	.1%	1.37	156.25	1.53	10.24	15.00	2022.00	510	60.00	34.68	722.52	1307.18	5.4	1.020	-	-	Occ. pus cells
8/2/38	53.76	Less .1%	1.44	32.46	1.53	1.80	7.55	351.00	470	280.00	33.33	204.22	270.26	6.6	1.005	-	-	-
9/13/38	55.55	.1%	1.47	186.91	1.53	14.28	18.29	1801.20	455	630.00	36.51	781.25	1503.74	5.4	1.029	-	-	-
8/27/38	52.91	.1%	1.19	125.00	1.60	10.49	18.29	1032.00	450	500.00	29.70	548.32	921.64	5.4	1.029	-	-	-
Maximum	74.07	.2%	1.47	200.00	1.66	14.28	18.29	2394.00	510	1340.00	36.51	1136.35	2564.10	6.6	1.034	-	-	
Minimum	50.00	Less .1%	1.12	32.46	1.02	1.80	7.55	351.00	450	60.00	25.52	204.22	270.26	5.4	1.005	-	-	
Average	55.76	.13%	1.31	150.27	1.43	9.35	14.68	1666.89	477	590.00	30.93	716.57	1328.40	5.6	1.024	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 16

The Blood and Urine Values of Case C118

Age - 7 yrs., 2 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/19/38	57.97	.1%	1.14	135.13	1.33	7.14	16.21	1521.00	465	700.00	31.08	670.40	1000.00	5.6	1.024	-	-	Mod. pus cells
5/10/38	50.76	.1%	1.19	139.86	1.03	7.92	15.00	1950.00	450	1170.00	27.52	833.32	1369.86	5.6	1.028	-	-	Few pus cells Amorphous
6/21/38	57.47	.1%	1.27	181.81	1.69	9.03	15.00	1452.00	495	290.00	27.27	534.07	921.64	5.6	1.015	-	-	Few pus cells
7/19/38	57.47	.1%	1.30	115.60	1.58	11.26	14.49	1872.00	480	230.00	36.15	711.35	1111.10	5.6	1.021	-	-	Pus cells
8/2/38	54.05	Less .1%	1.37	54.05	1.50	3.11	18.40	645.00	430	300.00	31.91	312.50	406.50	5.4	1.007	-	-	Numerous pus cells

Slaughtered 8/30/38

Maximum	57.97	.1%	1.37	181.81	1.69	11.26	18.40	1950.00	495	1170.00	36.15	833.32	1369.86	5.6	1.028	-	-	
Minimum	50.76	Less .1%	1.14	54.05	1.03	3.11	14.49	645.00	430	230.00	27.27	312.50	406.50	5.4	1.007	-	-	
Average	55.54	.1%	1.25	125.29	1.42	7.69	15.82	1488.00	464	538.00	30.78	612.32	961.82	5.56	1.019	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Case C118

This bovine had lost its power of coordination and was slaughtered August 30, 1938. An autopsy was performed.

Few gross changes are present. There is considerable edema in some of the nerves and lymph nodes.

The intestines show a few hyperemic areas but otherwise there is little change.

The trachea and bronchi are normal.

There is a pus sac on the liver three inches in diameter. An adhesion is present between the diaphragm and reticulum but no foreign body or tract is located.

Table 17

The Blood and Urine Values of Case C405

Age - 11 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/14/38	74.07	.2%	1.42	224.74	1.66	15.61	9.58	2802.00	500	770.00	37.50	961.52	1754.38	5.4	1.039	-	-	Epith. cells Amorphous
4/28/38	62.11	.3%	1.59	173.91	1.78	16.41	27.27	3153.00	520	675.00	47.61	1128.30	1850.00	5.6	1.038	-	-	Occ. pus cell Num. epith. cells
6/9/38	76.84	.1%	1.07	89.28	1.81	10.12	20.00	1482.00	440	1120.00	36.15	1137.85	1142.56	6.2	1.030	-	-	Epithelial cells
6/30/38	75.18	.1%	1.19	59.70	2.00	4.06	15.38	1266.00	480	470.00	44.77	553.07	746.26	5.6	1.016	-	-	-
7/7/38	78.45	.2%	1.66	98.52	1.50	6.53	22.05	2586.00	450	810.00	42.85	1000.00	1923.05	5.4	1.028	-	-	-
8/4/38	85.83	.1%	1.44	90.09	1.70	4.65	19.23	1482.00	460	660.00	42.16	641.02	892.84	5.4	1.017	-	-	-
9/1/38	75.18	.1%	1.14	20.00	1.00	Too low to read	30.61	273.00	460	60.00	29.55	148.80	161.28	6.2	1.006	-	-	-
Maximum	85.83	.3%	1.66	224.74	2.00	16.41	30.61	3153.00	520	1120.00	47.61	1137.85	1923.05	6.2	1.039	-	-	
Minimum	62.11	.1%	1.07	20.00	1.00	Too low to read	9.58	273.00	440	60.00	29.55	148.80	161.28	5.4	1.006	-	-	
Average	75.38	.15%	1.36	108.03	1.63	9.56	20.58	1863.43	473	652.14	40.08	795.79	1210.05	5.7	1.025	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 18

The Blood and Urine Values of Case C299

Age - 3 yrs., 2 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/13/38	57.14	.2%	1.54	142.85	1.35	8.37	40.00	1893.00	510	1445.00	36.15	791.12	1379.30	6.8	1.026	-	-	Pus cells
4/27/38	50.25	.2%	1.62	158.73	1.60	10.06	18.07	2560.00	505	140.00	30.76	1096.47	1580.00	6.6	1.040	-	-	Occ. epith. cell
6/8/38	81.32	.1%	1.57	102.56	1.76	8.83	21.73	2262.00	530	100.00	41.95	548.22	1250.00	8.0	1.026	-	-	Occ. epith. cell
																		Sent to Pasture
Maximum	81.32	.2%	1.62	158.73	1.76	10.06	40.00	2565.00	530	1445.00	41.95	1096.47	1580.00	8.0	1.040	-	-	
Minimum	50.25	.1%	1.54	102.56	1.35	8.37	18.07	1893.00	505	100.00	30.76	548.22	1250.00	6.6	1.026	-	-	
Average	62.90	.16%	1.57	134.71	1.57	9.09	26.60	2238.33	515	561.66	36.28	811.94	1403.10	7.1	1.031	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 19

VITAMIN A DEFICIENT ANIMALS

Blood Values*

	Glucose	Creatinine	Uric Acid	Urea	Chloride	Non-Protein Nitrogen
Maximum	85.83	1.92	2.00	40.00	540	47.61
Minimum	41.15	1.00	1.00	7.55	430	24.29
Average	58.11	1.34	1.57	17.60	483	32.11

Table 20

Urine Values

	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	Non-Protein Nitrogen*	Total Nitrogen*	pH	Sp.Gr.
Maximum	.3%	344.82	20.64	3153.00	Too high to read	1923.07	2564.10	8.0	1.040
Minimum	.1%	20.00	1.80	273.00	50.00	148.80	161.28	5.4	1.005
Average	.13%	149.79	11.27	1746.14	596.68	760.94	1294.14	6.1	1.027

* - Mg.%
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity

Table 21

The Blood and Urine Values of Case C273

Age - 3 yrs., 11 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/27/38	54.34	.2%	1.54	190.47	1.69	8.27	20.54	1041.00	465	330.00	36.51	1061.42	1961.00	6.6	1.035	-	-	Occ. pus cell
6/8/38	69.44	.1%	1.35	196.07	1.50	7.03	19.48	2826.00	480	680.00	32.43	1166.05	2272.72	5.6	1.025	-	-	Occ. pus cell
6/29/38	68.25	.1%	1.51	227.27	1.70	7.61	15.78	2358.00	530	650.00	24.69	807.45	1481.48	5.6	1.026	-	-	Occ. pus cell
7/6/38	55.55	.2%	1.66	250.00	1.70	7.33	15.00	2988.00	510	840.00	37.03	1538.46	1865.65	5.4	1.028	-	-	Occ. pus cell
8/10/38	64.51	Less .1%	1.55	66.00	1.51	2.93	26.31	990.00	495	270.00	46.15	376.50	628.92	5.4	1.007	-	-	-
9/7/38	80.00	Less .1%	1.66	151.51	1.21	6.27	23.07	2175.00	430	980.00	50.00	1041.65	1360.54	5.4	1.026	-	-	-
10/13/38	66.66	.3%	1.82	250.00	1.72	9.41	40.54	2727.00	505	300.00	54.54	880.27	1818.18	6.4	1.025	-	-	-
Maximum	80.00	.3%	1.82	250.00	1.72	9.41	40.54	2988.00	530	980.00	54.54	1538.46	2272.72	6.6	1.035	-	-	
Minimum	54.34	Less .1%	1.35	66.00	1.21	2.93	15.00	990.00	430	270.00	24.69	376.50	628.92	5.4	1.007	-	-	
Average	65.53	.14%	1.58	190.19	1.57	6.98	22.96	2157.60	486	578.55	40.19	981.68	1626.92	5.7	1.024	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 22

The Blood and Urine Values of Case C387

Age - 1 yr., 4 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U			Urine			
4/7/38	57.30	.1%	1.37	142.80	1.50	5.52	20.97	1056.00	490	960.00	39.73	1068.25	921.60	6.2	1.021	-	-	-
4/13/38	55.55	.1%	1.37	107.52	1.46	11.23	41.66	2370.00	500	1600.00	37.91	1086.95	1481.48	6.4	1.023	-	-	Occ. gran. cast Occ. epith. cell
4/27/38	53.47	.1%	1.50	192.30	1.81	16.24	18.18	1683.00	445	960.00	32.43	905.77	1200.00	6.0	1.026	-	-	Num. gran. cast Occ. epith. cell
6/8/38	63.69	.1%	1.37	208.32	1.66	16.84	22.72	882.00	480	1050.00	32.25	529.65	1290.32	6.0	1.026	-	-	Gran. casts Epith. cells
6/29/38	60.60	.1%	1.41	118.04	1.73	10.15	17.34	1608.00	490	410.00	23.52	583.32	1176.46	6.2	1.020	-	-	Occ. epith. cells
7/6/38	50.00	.2%	1.35	161.29	1.70	12.59	18.75	1194.00	470	840.00	41.37	540.54	1116.05	6.2	1.023	-	-	Occ. epith. cells
8/10/38	61.72	.1%	1.45	93.02	1.49	8.65	20.26	1740.00	440	420.00	42.24	735.27	234.74	5.6	1.017	-	-	Mod. epith. cells Numerous pus cells
9/7/38	77.51	.1%	1.32	42.10	1.53	3.10	21.89	867.00	385	160.00	49.18	411.17	776.52	6.0	1.012	-	-	Occ. pus cell
10/13/38	65.50	.2%	1.44	217.39	1.73	10.95	34.88	1713.00	470	1200.00	43.79	1179.27	2105.26	5.4	1.036	-	-	Occ. pus cell
Maximum	77.51	.2%	1.50	208.32	1.81	16.84	41.66	2370.00	500	1600.00	49.18	1179.27	2105.26	6.4	1.036	-	-	
Minimum	50.00	.1%	1.32	42.10	1.46	3.10	17.34	867.00	385	160.00	23.52	411.17	234.74	5.4	1.012	-	-	
Average	60.58	.12%	1.39	142.53	1.62	10.58	24.07	1457.00	463	844.44	38.05	782.24	1144.71	6.0	1.022	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 23

The Blood and Urine Values of Case C359

Age - 1 yr., 11 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U				Urine		
4/28/38	74.07	.2%	2.02	58.82	1.76	5.16	20.28	417.00	480	260.00	38.71	257.20	531.00	6.4	1.007	-	-	Occ. gran. cast Pus cells
6/9/38	90.90	.1%	2.11	85.47	1.90	4.33	38.96	1284.00	490	380.00	68.18	416.65	917.42	5.8	1.016	-	-	Occ. gran. cast Pus cells

Died 6/29/38

Autopsy 3942

Maximum	90.90	.2%	2.11	85.47	1.90	5.16	38.96	1284.00	490	380.00	68.18	416.65	917.42	6.4	1.016	-	-	
Minimum	74.07	.1%	2.02	58.82	1.76	4.33	20.28	417.00	480	260.00	38.71	257.20	531.00	5.8	1.007	-	-	
Average	82.84	.15%	2.06	72.14	1.83	4.74	29.62	850.20	485	320.00	53.44	336.92	724.21	6.1	1.011	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Case C359

This animal was a two year old Jersey cow which had been fed a low magnesium diet. She died June 29, 1938, and an autopsy was performed.

The skin, subcutaneous tissues, lymph nodes, head and neck are negative.

There are marked fibrous pleural adhesions over the right anterior lobe of the lung. The pleural cavity contains rather clear serous fluid.

The lungs show marked pulmonary and interstitial edema throughout. There is some patchy congestion. The lower apex of the right diaphragmatic lobe shows some bronchopneumonia. Some of the bronchi appear somewhat dilated and contain purulent material.

The pericardium and heart are negative except for some subepicardial hemorrhage. The aorta shows no gross lesions.

In the pelvic cavity there is a large encapsulated cavity which contains thick fluid pus and two rather large masses of firm caseous material. This fills a considerable portion of the pelvic cavity. A small abscess about 1 cm. in diameter is present on the peritoneal surface of the omasum.

The spleen and pancreas are negative.

The liver shows marked post mortem change.

The rumen shows considerable thickening and hypertrophy of the villi. These villi appear somewhat club shaped. The wall of the reticulum is considerably thickened but the mucosa appears normal. The omasum is practically empty. The abomasum shows considerable congestion

of the mucosa and contains very little food material.

The cecum and large intestines are negative.

The right kidney is of normal size and is somewhat lighter than normal in color. The change is apparently a post mortem change. The left kidney appears enormously enlarged and has the appearance of a kidney involved with pyelonephritis. On section, the condition is found to be perirenal. The capsule is enormously distended with fluid and some pus. The kidney shows what appears to be considerable degenerative change but this is thought to be at least partly post mortem.

The diagnosis is pelvic abscess, perirenal infection and pulmonary edema.

Table 24

The Blood and Urine Values of Case C401

Age - 1 yr., 3 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U				Urine		
4/14/38	78.12	.2%	1.40	476.19	1.39	17.02	6.63	1095.00	465	1285.00	23.43	657.87	1149.42	6.0	1.034	-	-	Occ. gran. cast Occ. pus cell Occ. epith. cell
4/28/38	80.00	.3%	1.47	259.74	1.49	18.49	7.61	687.00	460	1120.00	26.78	403.22	790.00	6.2	1.025	-	-	"
6/9/38	95.23	.1%	1.19	263.15	1.66	9.49	10.10	2172.00	450	330.00	26.20	657.87	1438.84	8.0	Insuff. Urine	-	-	"
6/30/38	80.00	.2%	1.30	161.29	1.19	7.75	7.28	690.00	500	1780.00	21.42	304.87	584.78	6.4	1.030	-	-	Occ. pus cell Occ. epith. cell
7/7/38	88.88	.2%	1.76	121.21	1.90	6.53	8.33	1020.00	490	590.00	22.98	403.22	772.15	6.6	1.014	-	-	Occ. pus cell
8/4/38	83.33	.1%	1.33	126.58	2.50	8.27	13.95	1986.00	410	560.00	35.29	806.45	1092.88	7.2	1.023	-	-	Occ. pus cell
9/1/38	65.57	.2%	1.31	285.70	1.33	9.52	23.43	2403.00	420	450.00	26.08	925.92	1574.80	7.2	1.030	-	-	-
Maximum	95.23	.3%	1.76	476.19	2.50	18.49	23.43	2403.00	500	1780.00	35.29	925.92	1574.80	8.0	1.034	-	-	
Minimum	65.57	.1%	1.19	121.21	1.19	6.53	6.63	687.00	410	330.00	21.42	304.87	584.78	6.0	1.014	-	-	
Average	81.59	.18%	1.39	241.98	1.63	11.01	11.04	1436.00	456	873.57	26.02	594.20	1057.55	6.8	1.026	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 25

The Blood and Urine Values of Case A4's Calf

Age - 1 yr., 2 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U				Urine		
4/7/38	83.33	Less .1%	1.37	112.30	1.44	Too low to read	8.45	00.00	500	250.00	24.00	1225.00	800.00	7.4	1.006	-	-	Occ. pus cell Occ. epith. cell
4/14/38	71.42	.1%	1.54	571.42	1.42	11.43	6.41	1503.00	470	1710.00	23.71	1041.65	2666.66	5.4	Insuff. Urine	-	-	Occ. gran. cast Occ. pus cell
4/28/38	76.84	.4%	1.66	416.66	1.76	10.98	13.45	4323.00	465	595.00	31.75	1420.45	2270.00	6.4	1.030	-	-	Occ. epith. cell "
6/9/38	68.02	.1%	1.31	204.08	1.81	4.70	9.09	1308.00	460	440.00	27.27	462.95	1219.50	6.2	1.015	-	-	"
6/30/38	69.44	.4%	1.40	444.44	1.48	13.11	8.33	2670.00	500	810.00	30.92	1106.67	1904.76	6.0	1.040	-	-	Occ. pus cell Occ. epith. cell
7/7/38	74.62	.4%	1.87	555.55	2.27	14.54	11.23	3704.00	470	350.00	22.22	1818.18	2840.90	5.8	Over 1.040	-	-	Pus cells
8/4/38	85.11	.1%	1.42	75.75	2.70	2.82	11.53	792.00	430	20.00	40.00	409.82	468.42	7.6	1.007	-	-	Pus cells Num. epith. cells
9/1/38	59.88	.1%	1.48	86.20	1.42	2.11	21.42	573.00	440	240.00	26.08	242.22	544.82	6.8	1.010	-	-	Occ. gran. cast
Maximum	85.11	.4%	1.87	571.42	2.70	14.54	21.45	4323.00	500	1710.00	40.00	1818.18	2840.90	7.6	1.040	-	-	
Minimum	59.88	.1%	1.31	75.75	1.42	Too low to read	6.41	00.00	430	20.00	22.22	242.22	468.42	5.4	1.006	-	-	
Average	73.77	.22%	1.50	308.30	1.78	8.52	11.23	2124.14	467	551.87	28.24	965.87	1589.50	6.4	1.021	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 26

MAGNESIUM DEFICIENT ANIMALS

Blood Values*

	Glucose	Creatinine	Uric Acid	Urea	Chloride	Non-Protein Nitrogen
Maximum	95.23	2.11	2.70	41.66	530	68.18
Minimum	50.00	1.19	1.19	6.41	385	21.42
Average	72.86	1.58	1.68	19.78	471	37.18

Table 27

Urine Values

	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	Non-Protein Nitrogen*	Total Nitrogen*	pH	Sp.Gr.
Maximum	.4%	571.42	18.49	4323.00	1780.00	1818.18	2840.90	8.0	1.040
Minimum	.1%	42.10	Too low to read	00.00	20.00	242.22	234.74	5.4	1.006
Average	.16%	191.03	8.36	1604.99	633.38	732.18	1228.58	6.2	1.021

* - Mg.%
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity

Table 28

The Blood and Urine Values of Case C394

Age - 1 yr., 3 mos.

Date	Glucose		Creatinine*		Uric Acid*		Urea*		Chloride*		NPN*		Total N*	pH	Sp.Gr.	Alb.	Acet.	Sediment
	B*	U	B	U	B	U	B	U	B	U	B	U				Urine		
4/13/38	58.82	Less .1%	1.35	95.23	1.29	7.90	45.45	1134.00	435	1130.00	39.96	555.55	943.38	6.4	1.012	-	-	Occ. epith. cell
4/27/38	52.63	Less .1%	1.54	107.56	1.53	7.51	22.55	1041.00	470	330.00	36.15	480.75	1025.00	6.4	1.012	-	-	Gran. casts Occ. epith. cell
6/8/38	66.66	Less .1%	1.19	72.99	1.47	4.87	19.80	1194.00	400	120.00	37.50	500.00	1000.00	7.0	1.009	-	-	Gran. casts Occ. epith. cell
6/29/38	60.24	Less .1%	1.31	112.35	1.58	9.25	7.81	582.00	480	240.00	18.80	344.35	581.38	6.8	1.012	-	-	Gran. casts Occ. epith. cell
7/6/38	57.80	Less .1%	1.37	93.45	1.50	7.53	20.00	642.00	545	480.00	41.66	416.66	700.25	6.6	1.011	-	-	Occ. epith. cell
8/10/38	53.33	Less .1%	1.15	50.00	1.42	4.57	10.79	768.00	415	230.00	32.43	304.87	487.80	6.6	1.006	-	-	Amorphous
9/7/38	66.66	Less .1%	1.09	49.01	1.45	5.24	20.00	999.00	420	440.00	36.36	670.42	684.92	6.4	1.015	-	-	Amorphous
10/13/38	59.16	.1%	1.15	53.19	2.27	2.93	32.60	927.00	460	400.00	33.33	362.37	595.22	6.6	1.012	-	-	Amorphous
Maximum	66.66	.1%	1.54	112.35	2.27	9.25	45.45	1194.00	545	1130.00	41.66	670.42	1025.00	7.0	1.015	-	-	
Minimum	52.63	Less .1%	1.09	49.01	1.29	2.93	7.81	582.00	400	120.00	18.80	304.87	487.80	6.4	1.006	-	-	
Average	59.41	Less .1%	1.27	79.22	1.56	6.22	22.37	910.87	453	421.23	34.52	454.31	752.24	6.6	1.011	-	-	

B - Blood
U - Urine
NPN - Non-Protein Nitrogen

* - Mg.%
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration

Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 29

POTASSIUM DEFICIENT ANIMALS

Blood Values*

	Glucose	Creatinine	Uric Acid	Urea	Chloride	Non-Protein Nitrogen
Maximum	66.66	1.54	2.27	45.45	545	41.66
Minimum	52.63	1.09	1.29	7.81	400	18.80
Average	59.41	1.27	1.56	22.37	453	34.52

Table 30

Urine Values

	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	Non-Protein Nitrogen*	Total Nitrogen*	pH	Sp.Gr.
Maximum	.1%	112.35	9.25	1194.00	1130.00	670.42	1025.00	7.0	1.015
Minimum	.1%	49.01	2.93	582.00	120.00	304.87	487.80	6.4	1.006
Average	.1%	79.22	6.22	910.87	826.25	454.37	752.24	6.6	1.011

* - Mg.%
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity

As there was a possibility that the composition of urine might vary considerably at different times of the day, a series of analyses were performed on bovine urines to determine whether the time of collecting samples caused any appreciable variation.

The animals were fed twice daily, at five o'clock in the morning and at five o'clock in the afternoon. There was water before them at all times. Samples were taken from the same bovine approximately every four hours, from five o'clock in the morning until nine o'clock in the evening.

Four animals were selected for the first series. Results of these determinations are presented in Tables 31-34. Two of these bovines were selected for the second series. Results of these determinations are presented in Tables 35 and 36. The same two were used two days later for a third series. Tables 37 and 38 present the results of these determinations.

Table 31

Series 1

Urine Values of Case C273

Time	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	NPN*	Total N*	pH	Sp.Gr.	Alb.	Acet.
5:00 A.M.	.1%	181.81	8.46	2406.00	1350.00	1470.57	2272.72	7.6	1.033	-	-
10:00 A.M.	.1%	175.43	9.66	3570.00	1250.00	1602.55	2500.00	7.2	1.035	-	-
1:00 P.M.	.1%	200.00	9.69	4044.00	1110.00	1250.00	2105.26	7.0	1.035	-	-
5:00 P.M.	.1%	173.91	11.30	3174.00	1350.00	1136.35	1818.18	6.8	1.035	-	-
9:00 P.M.	.1%	200.00	12.55	2694.00	1370.00	1250.00	2380.94	6.8	1.033	-	-
Maximum	.1%	200.00	12.55	4044.00	1370.00	1602.55	2500.00	7.6	1.035	-	-
Minimum	.1%	173.91	8.46	2406.00	1110.00	1136.50	1818.18	6.8	1.033	-	-
Average	.1%	186.25	10.33	3177.60	1286.00	1341.89	2215.42	7.1	1.034	-	-

* - Mg.%
NPN - Non-Protein Nitrogen
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 32

Series 2

Urine Values of Case C401

Time	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	NPN*	Total N*	pH	Sp.Gr.	Alb.	Acet.
5:00 A.M.	.1%	232.55	11.93	936.00	1930.00	512.27	800.00	6.0	1.025	-	-
10:00 A.M.	.1%	153.84	12.45	774.00	1390.00	420.87	533.32	5.8	1.014	-	-
1:00 P.M.	.1%	350.87	20.00	1338.00	1260.00	568.17	1000.00	5.8	1.029	-	-
5:00 P.M.	.1%	139.85	7.69	376.00	1300.00	205.15	425.52	6.6	1.014	-	-
9:00 P.M.	.1%	55.55	1.96	136.00	1280.00	116.65	168.90	6.6	1.008	-	-
Maximum	.1%	350.87	20.00	1338.00	1930.00	568.17	1000.00	6.6	1.029	-	-
Minimum	.1%	55.55	1.96	136.00	1260.00	116.65	168.90	5.8	1.008	-	-
Average	.1%	186.53	10.80	712.00	1432.00	364.62	585.55	6.16	1.018	-	-

* - Mg.%
NPN - Non-Protein Nitrogen
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 33

Series 1

Urine Values of Case D14

Time	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	NPN*	Total N*	pH	Sp.Gr.	Alb.	Acet.
5:00 A.M.	.1%	105.26	13.39	2772.00	1900.00	1190.47	1886.78	7.8	1.030	-	-
10:00 A.M.	.1%	108.10	13.33	3840.00	1930.00	1666.65	2666.66	8.0	1.031	-	-
1:00 P.M.	.2%	125.00	13.06	3580.00	1930.00	1602.55	1886.78	7.8	1.032	-	-
5:00 P.M.	.2%	166.66	20.38	3780.00	1900.00	1436.77	2564.10	7.2	1.038	-	-
9:00 P.M.	.2%	102.70	19.27	3180.00	1900.00	1106.17	1923.06	8.0	1.037	-	-
Maximum	.2%	166.66	20.38	3840.00	1930.00	1666.65	2666.66	8.0	1.038	-	-
Minimum	.1%	102.70	13.06	2772.00	1900.00	1106.17	1886.78	7.2	1.030	-	-
Average	.16%	121.54	15.88	3430.40	1912.00	1400.52	2185.47	7.76	1.033	-	-

* - Mg.%
NPN - Non-Protein Nitrogen
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 34

Series 1

Urine Values of Case 74

Time	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	NPN*	Total N*	pH	Sp.Gr.	Alb.	Acet.
5:00 A.M.	.1%	86.95	11.85	3780.00	1480.00	1623.37	2127.64	7.4	1.029	-	-
10:00 A.M.	.1%	54.94	7.33	1686.00	1880.00	1250.00	1538.46	7.4	1.021	-	-
1:00 P.M.	.1%	70.42	11.43	3264.00	1680.00	1470.57	1694.90	7.8	1.028	-	-
5:00 P.M.	.2%	90.90	17.29	2898.00	1830.00	1666.65	2173.90	7.8	1.035	-	-
9:00 P.M.	.1%	84.02	13.67	3744.00	1850.00	1388.87	2127.64	7.8	1.033	-	-
Maximum	.2%	90.90	17.29	3780.00	1880.00	1666.65	2173.90	7.8	1.035	-	-
Minimum	.1%	54.94	7.33	1686.00	1480.00	1250.00	1538.48	7.4	1.021	-	-
Average	.12%	77.44	12.32	3074.40	1744.00	1479.89	1932.51	7.64	1.029	-	-

* - Mg.%
NPN - Non-Protein Nitrogen
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 35

Series 2

Urine Values of Case C273

Time	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	NPN*	Total N*	pH	Sp.Gr.	Alb.	Acet.
5:00 A.M.	.1%	160.00	7.14	801.00	1590.00	1008.05	1739.12	5.6	1.030	-	-
10:00 A.M.	.1%	172.41	8.37	2301.00	1600.00	1923.05	1923.06	5.8	1.030	-	-
1:00 P.M.	.1%	200.00	8.65	3069.00	1550.00	1602.55	2272.72	5.8	1.030	-	-
5:00 P.M.	.1%	235.29	11.43	3357.00	1550.00	1712.32	2380.94	5.6	1.030	-	-
9:00 P.M.	.2%	235.29	13.80	3489.00	1440.00	1760.55	2083.32	5.8	1.032	-	-
Maximum	.2%	235.29	13.80	3489.00	1600.00	1923.05	2380.94	5.8	1.032	-	-
Minimum	.1%	160.00	7.14	801.00	1440.00	1008.05	1739.12	5.6	1.030	-	-
Average	.12%	200.59	9.87	2603.40	1546.00	1601.30	2079.53	5.7	1.030	-	-

* - Mg.%
NPN - Non-Protein Nitrogen
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 36

Series 2

Urine Values of Case C273

Time	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	NPN*	Total N*	pH	Sp.Gr.	Alb.	Acet.
5:00 A.M.	.1%	294.11	14.90	489.00	1950.00	838.92	1379.30	7.4	1.035	-	-
10:00 A.M.	.2%	212.76	11.03	315.00	1970.00	664.87	881.04	7.4	1.033	-	-
1:00 P.M.	.2%	289.85	21.05	1137.00	1980.00	833.32	930.22	6.6	1.040	-	-
5:00 P.M.	.2%	298.50	21.33	1065.00	1830.00	722.57	934.56	6.8	1.031	-	-
9:00 P.M.	.1%	88.88	5.16	417.00	1480.00	250.00	384.60	7.0	1.015	-	-
Maximum	.2%	298.50	21.33	1137.00	1980.00	838.92	1379.30	7.4	1.040	-	-
Minimum	.1%	88.88	5.16	315.00	1480.00	250.00	384.60	6.6	1.015	-	-
Average	.16%	236.82	14.69	684.60	1842.00	661.93	901.94	7.0	1.031	-	-

* - Mg.%
NPN - Non-Protein Nitrogen
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 37

Series 3

Urine Values of Case C273

Time	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	NPN*	Total N*	pH	Sp.Gr.	Alb.	Acet.
5:00 A.M.	.1%	64.51	3.07	867.00	1600.00	312.50	492.60	5.6	1.009	-	-
10:00 A.M.	.1%	110.27	5.71	1695.00	1420.00	600.95	1052.62	5.6	1.018	-	-
1:00 P.M.	.1%	160.00	7.01	2319.00	1150.00	833.32	1398.60	5.6	1.024	-	-
5:00 P.M.	.1%	181.81	9.46	2301.00	1150.00	925.92	1851.84	5.4	1.023	-	-
9:00 P.M.	.1%	137.93	7.84	2253.00	1350.00	657.87	1149.42	5.4	1.020	-	-
Maximum	.1%	181.81	9.46	2319.00	1600.00	925.92	1851.84	5.6	1.024	-	-
Minimum	.1%	64.51	3.07	867.00	1150.00	312.50	492.60	5.4	1.009	-	-
Average	.1%	130.90	6.62	1887.00	1334.00	666.11	1189.01	5.5	1.018	-	-

* - Mg.%
NPN - Non-Protein Nitrogen
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration
Sp.Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

Table 38

Series 3

Urine Values of Case C401

Time	Glucose	Creatinine*	Uric Acid*	Urea*	Chloride*	NPN*	Total N*	pH	Sp.Gr.	Alb.	Acet.
5:00 A.M.	.1%	166.66	12.07	1155.00	1960.00	441.57	790.50	6.0	1.030	-	-
10:00 A.M.	.2%	263.15	16.84	2397.00	1560.00	862.05	1666.66	6.2	1.035	-	-
1:00 P.M.	.2%	333.33	37.64	2337.00	1730.00	861.57	1769.90	5.8	Over 1.040	-	-
5:00 P.M.	.1%	307.69	23.18	1533.00	1950.00	670.42	1156.06	6.2	1.032	-	-
9:00 P.M.	.1%	125.00	10.24	765.00	1970.00	333.32	666.66	6.6	1.028	-	-
Maximum	.2%	333.33	37.64	2397.00	1970.00	861.52	1769.90	6.6	1.040	-	-
Minimum	.1%	125.00	10.24	765.00	1560.00	333.32	666.66	5.8	1.028	-	-
Average	.14%	239.16	19.99	1637.40	1834.00	633.78	1209.99	6.1	1.031	-	-

* - Mg.%
NPN - Non-Protein Nitrogen
Total N - Total Nitrogen
pH - Hydrogen Ion Concentration
Sp. Gr. - Specific Gravity
Alb. - Albumin
Acet. - Acetone

DISCUSSION

The blood exhibited no extreme variations from the normal in any of the analyses performed. There were some variations in results, but these were within the range of normal values for bovines.

The urine analyses also exhibited some variations in results, but similar variations were obtained for bovines fed normal diets.

The results of the creatinine determinations in the urine of bovines fed low Vitamin A diets and low magnesium diets were higher than those found in the urine of bovines fed normal diets. However, the values for urea, non-protein nitrogen and total nitrogen in the urine of bovines fed low Vitamin A diets and low magnesium diets were lower than those obtained in the urine of bovines fed normal diets.

The results of the uric acid determinations in the urine of the above three groups were all quite similar.

The variations noted in all of the determinations were no greater than those found in a single group of bovines.

The hydrogen ion concentration was lower in bovines fed normal diets than those fed low Vitamin A or low magnesium diets, while the specific gravity was higher in the group of bovines fed normal diets.

The results of the urine analyses on the animal fed a low potassium diet were on the whole lower than in any of the other three groups of bovines. This is not conclusive evidence, however, as there was only one animal in the group, and the low results obtained may have been due to an individual idiosyncrasy of this animal.

The urine samples which were collected for analyses were obtained at approximately ten o'clock A.M. After performing several

urine analyses on each animal, the thought occurred that possibly the time of collection of the samples might have some effect on the ultimate results.

It was unfortunate that a twenty-four hour composite sample of urine could not be collected from each bovine. In order to determine what variation might be present, five samples were taken at four hour intervals during the day. It was found that the values showed little variation. The results of the determinations were lowest in the early morning and night samples, while the noon samples gave the highest results. The ten o'clock samples gave determinations which compared very closely with the average. Therefore, collection of the samples of urine at ten o'clock was continued.

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ACKNOWLEDGMENTS

The author wishes to express her appreciation to Dr. L. B. Sholl and Dr. E. T. Hallman of the Department of Animal Pathology for assistance in this work, and to Dr. L. A. Moore of the Dairy Department for assistance in obtaining blood samples.


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