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THE RELATIVE VALUE OF THE COMMON CLINICAL KIDNEY FUNCTION TESTS IN THE DOG

BY

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There have been numerous kidney function tests devised and there is still much debate over the value and significance of the various tests.

One of the early tests was to have the patient eat asparagus and see how long it took the urine to develop a foul odor. The concentration and dilution test also is one of the early tests. The next tests to be used were the dye tests, and later, the many clearance tests and probably latest of all is the excretory pyelogram.

At the present time the most widely used tests to determine kidney function are: concentration dilution test, the dye tests, and the clearance tests. The excretory pyelogram is now also being used to evaluate the status of the individual kidney, especially by the urologists. I would like to mention that the main purpose of the excretory pyelogram is to visualize the upper urinary tract; however, since this is done by several interval time pictures, the relative ability of the kidney to excrete the x-ray opaque substance can also be evaluated. These x-ray opaque substances as diodrast are excreted in a manner similar to that of the dyes.[1]

We can now see that the tests for kidney function are of three types: 1. concentration and dilution tests 2. dye tests (including diodrast and other x-ray opaque substances used in excretory pyelogram work) 3. clearance tests. The relative value of these tests in determining kidney function is still very contraversial and there are many different

techniques advocated for performing these tests. Because the concentration and dilution test is an old test and very simple, there is more agreement as to the technique of performing it; however, some authors stress the importance of the volume output per intake rather than just the specific gravity. In general, the patient is given no food or fluid after supper and a urine sample is taken starting 12 hours thereafter. The specific gravity should go up to 1.020 or usually above 1.025 in man. The dilution test usually consists of giving the patient 1000 cc. of water in a period of one hour and collecting samples thereafter to get a dilution of 1.004 or less.

Of the many dye tests, the phenolsulfonphthalein test, with 1/2 hour and 1 hour collections, is probably most widely used. Some authors as Chapman[2,3] prefer shorter, more frequent collection periods and consider the first fifteen minute collection of the greatest importance. Collins has devised what he calls an improved procedure for performing the phenolsulphonphthalein test in dogs in which he uses the Duboscq colorimeter.[4] However, he collects a single 1 hour urine sample.

The clearance tests are not only more recent but also very numerous, more complicated and under more controversy. Although many authors prefer a clearance test which is solely a measure of glomerular filtration, as inulin clearance in man and creatinine clearance in the dog; nevertheless, urea clearance is considered the best kidney function test by some.[5,6]

The purpose of this thesis is to compare the three main types of kidney function tests and to determine the relative value of these tests.

The method of study was to run a series of concentration and dilution, phenolsulphonphthalein and creatinine clearance tests on two normal dogs. After the normals were run, an unilateral nephrectomy was performed. A series of kidney function tests were then performed at intervals to determine the effect of a 50 per cent reduction in the amount of kidney tissue.

The two female cur dogs were "Freckles", who weighed 15 kilograms, and "Black and White", who weighed 14.5 kilograms. Freckles was part shepard, easily trained and withstood experimentation well. Black and White was part terrier and became excited at times even though she was trained before experimentation was started.

The general procedure used in doing these tests is as follows:

I. Concentration and dilution test
   A. Concentration test
      1. Food and water was stopped at 4-6 P.M. the day before
      2. The dog was catheterized at 7 A.M. and the volume and specific gravity determined .
   B. Dilution test
      1. Food was stopped at 4-6 P.M. the day before
      2. 250cc of water was given by a stomach tube every 1/2 hour for 5 doses (1250 cc. total).
      3. Urine samples were collected the first hour after the first 250 cc. water was given and every 1/2 hour thereafter until 4 samples in all were obtained. The volume and specific gravity of all sam-

ples was determined. The specific gravity was determined in all cases by a regular hygrometer used to measure specific gravity of urine (urinometer). The urinometer was always standardized to distilled water at the same temperature as the urine before determining the specific gravity of the specimens.

II. Phenosulphonphthalein test
- A. Food was stopped the day before between 4-6 P.M.
- B. Dog was catheterized and 6 mgm. of P.S.P. were injected I.V.
- C. The time required for the dye to appear in the urine was recorded.
- D. Specimens were collected 1/2 hour and 1 hour after the dye was injected and the bladder was washed with 2 washings of 20 cc. each at each collection period.
- E. The specimens were diluted up to 1000 cc. after enough o.1% NaOH had been added to bring out the maximum color to the dye and were then compared with the standards of the Dunning colorimeter.

III. Creatinine clearance
- A. Food was stopped 4-6 P.M.
- B. The next day the dog was given 5 gm. of creatinine in 250 cc. water orally.
- C. In some cases 1/2 hour later the dog was given a second 250 cc. of water to bring up the urine flow.
- D. The dog was catheterized, the bladder washed and the first collection period was started 1 hour after the creatinine was given. A blood sample (10cc. of oxalated blood) was taken at the mid point of each period. The periods were 20 minutes and the bladder was washed twice with 20cc. of physiological saline each time at the end of the period. Three such periods were run for each clearance determination. The urinary output was kept between 2 and 4-5 cc./min. flow.
- E. Analysis of samples.
  1. Urine analysis
     - a. Diluted 1 to 500 in a volumetric flask
     - b. Take 4cc. of diluted urine in photoelectric colorimeter (Evelyn) test tube
     - c. Add 2cc. of picric acid solution (5 parts of saturated picric acid to 1cc. of 10% NaOH).

d. Let stand 15 minutes and read with Evelyn colorimeter.

2. Blood plasma analysis
   a. Preparation of protein-free filtrate
      1.) Take 1cc. of the plasma (after centrifuging the blood specimen) and put in a 25cc. volumetric flask.
      2.) Add 4cc. of $CdSO_4$ solution (acid solution) and mix.
      3.) Add few cc. water up to 15-20cc and mix.
      4.) Let stand 30 min. or more.
      5.) Add 4cc. of 1 normal NaOH.
      6.) Add small amount of $BaCO_3$.
      7.) Make up to volumetric mark with distilled water and mix.
      8.) Centrifuge and filter.
   b. Analysis of protein-free filtrate
      1.) Put 4cc. of protein-free filtrate in Evelyn colorimetric test tube.
      2.) Add 2cc. of picric acid reagent.
      3.) Let stand 15 min. and read with Evelyn colorimeter.
3. The clearance is calculated by the formula:

$$\text{creatinine clearance} = \frac{\text{mgm./min. in the urine}}{\text{mgm. in 1cc. of the plasma}}$$

The plan for a typical "run" is as follows:

1st day

Food and water stopped between 4-6 P.M.

2nd day

1) Concentration test

7 A.M. dog is catheterized
vol. - 20cc.
sp.gr. - 1.037

12 Noon dog is catheterized
vol. - 15 cc.
sp.gr. - 1.045

2) Creatinine clearance

12 Noon gave 5 gm. creatinine in 250cc. water
12:30 P.M. gave 250cc. water orally
1 P.M. B.W. (bladder washed)
1:10 P.M. B. (blood sample taken))
1:20 P.M. B.W. 40/80cc. (20 min.)) S 2/1
1:30 P.M. B.)
1:40 P.M. B.W. 40/85cc. (20 min.)) S 2/2
1:50 P.M. B.)
2 P.M. B.W. 40/90cc. (20 min.)) S 2/3

sample	mgm.% urine	mgm./min. urine	cc./min.	mgm./cc.plasma	clear.
S 2/1	125	5.0	2.0	10.00	50
S 2/2	126	5.36	2.2	12.00	48
S 2/3	135	6.11	2.5	13.00	47

3)P.S.P.
2 P.M. gave 6 mgm. of P.S.P. by I.V.
2:06 P.M. dye appeared in urine
2:30 P.M. B.W. 40/150 45%
3 P.M. B.W. 40/125 15%
60%
dog then given food and water

3rd day
Food stopped 4-6 P.M.

4th day
1)Dilution test
10 A.M. catheterized dog and gave 250 cc.water.
10:30 A.M. gave 250cc. water
11 A.M. gave 250cc. water and collected specimen
vol. - 80cc.
sp.gr. - 1.010
11:30 A.M. gave 250cc. water and collected specimen
vol. - 110cc.
sp.gr. - 1.007
12 Noon gave 250cc water and collected specimen
vol. - 112
sp.gr. - 1.005
12:30 P.M. collected specimen
vol. - 150
sp.gr. - 1.004

2)Clearance test
12:30 P.M. gave 5 gm. of creatinine orally in 250cc. water
1:30 P.M. catheterized dog and B.W.
1:40 P.M. B.
1:50 P.M. B.W. 40/90 (20 min.) } S 4/1
2:00 P.M. B.
2:10 P.M. B.W. 40/85 (20 min.) } S 4/2
2:20 P.M. B.
2:30 P.M. B.W. 40/80 (20 min.) } S 4/3

sample	mgm.% urine	mgm./min. urine	cc./min.	mgm./cc.plasma	clear.
S 4/1	135	6.11	2.5	13.00	47
S 4/2	126	5.36	2.2	12.00	48
S 4/3	125	5.00	2.0	10.00	50

3)P.S.P.

2:40 P.M. gave 6 mgm. of P.S.P. I.V.
2:48 P.M. dye appeared in urine
3:10 P.M. B.W. 40/70 50%
3:40 P.M. B.W. 40/60 15%
65%

The experimental data on the dogs in complete detail has been placed at the end of the thesis. The following charts and graphs which have been made from the detailed data show the results of the experiments. On all graphs each of the series of runs made on the normal dog have been plotted and an average of these was calculated and plotted. After nephrectomy, if more than one run was made, as for example three twenty minute clearance tests, the results of the three tests were plotted and then an average of these was plotted. Some of the experimental data was not incorporated in the charts and graphs because it was considered inaccurate for such reasons as too low a volume per minute output or some other error in technique. A note of explanation will be made in the experimental data where the results were considered inaccurate and not incorporated in the charts and graphs. There are two sets of summary graphs for the concentration dilution test, one set on the specific gravity, the other on the volume of urine flow per unit of time. The set on the specific gra-

vity is self explanatory. The set on volume output per unit of time is as follows: the volume during the concentration test is the output for a 5 hour period, and the volume during the dilution test is the output for a 1/2 hour period. The summary graph sheet for the P.S.P. tests has two curves for each dog: P.S.P. for the first 1/2 hour and P.S.P. for the second 1/2 hour. The creatinine clearance graph is self explanatory. On all graphs the red ink stands for "Freckles" and the black ink for "Black and "White".

SUMMARY OF DATA ON FRECKLES

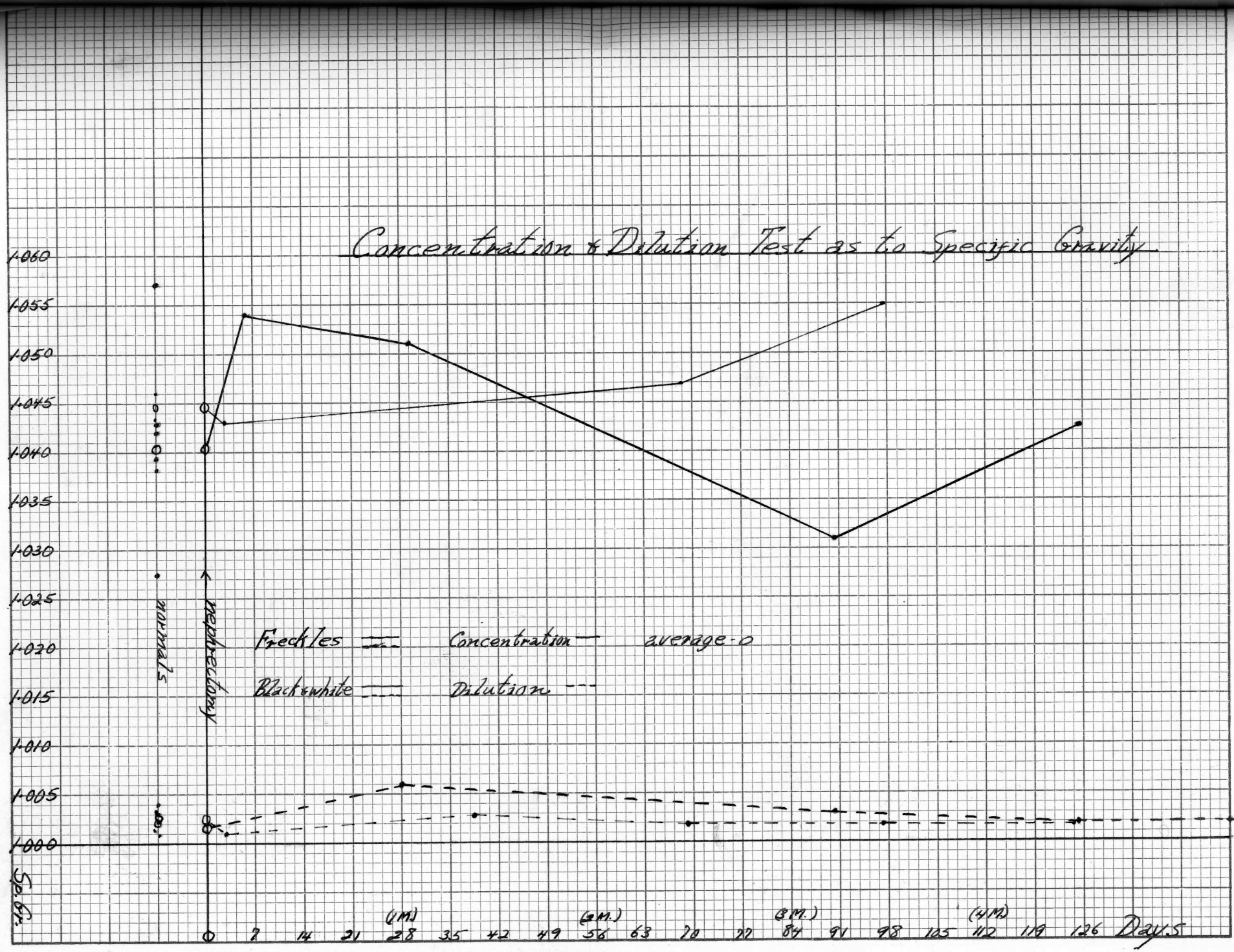
Run		1	2	3	4	5	6	7	8	9	10	11	
Conc.	cc/5hr.	10	38	52	12	16	36						
I	Sp.Gr.	1.057	1.042	1.027	1.038	1.037	1.042						1.0
Dil.	cc/½hr.	122	179	169	155	157	150						
I	Sp.Gr.	1.022	1.001	1.003	1.002	1.001	1.004						
P.S.P.	1st ½ hour	45	35	40	35	35	35					Nephrectomy	1.0
	2nd ½ hour	20	15	15	20	15	15						
I	1st ½ hour	45	45	25	30	40	40					R.	
	2nd ½ hour	20	15	15	20	15	10						
Crea-	1					59.2			50.7	out	44.4	50.0	33
	2					50.0		out	46.8	out	39.4	56.8	33
tin-	3							out	44.6			56.8	33
ine	1					56.0							
C.	2					58.5							
	3												

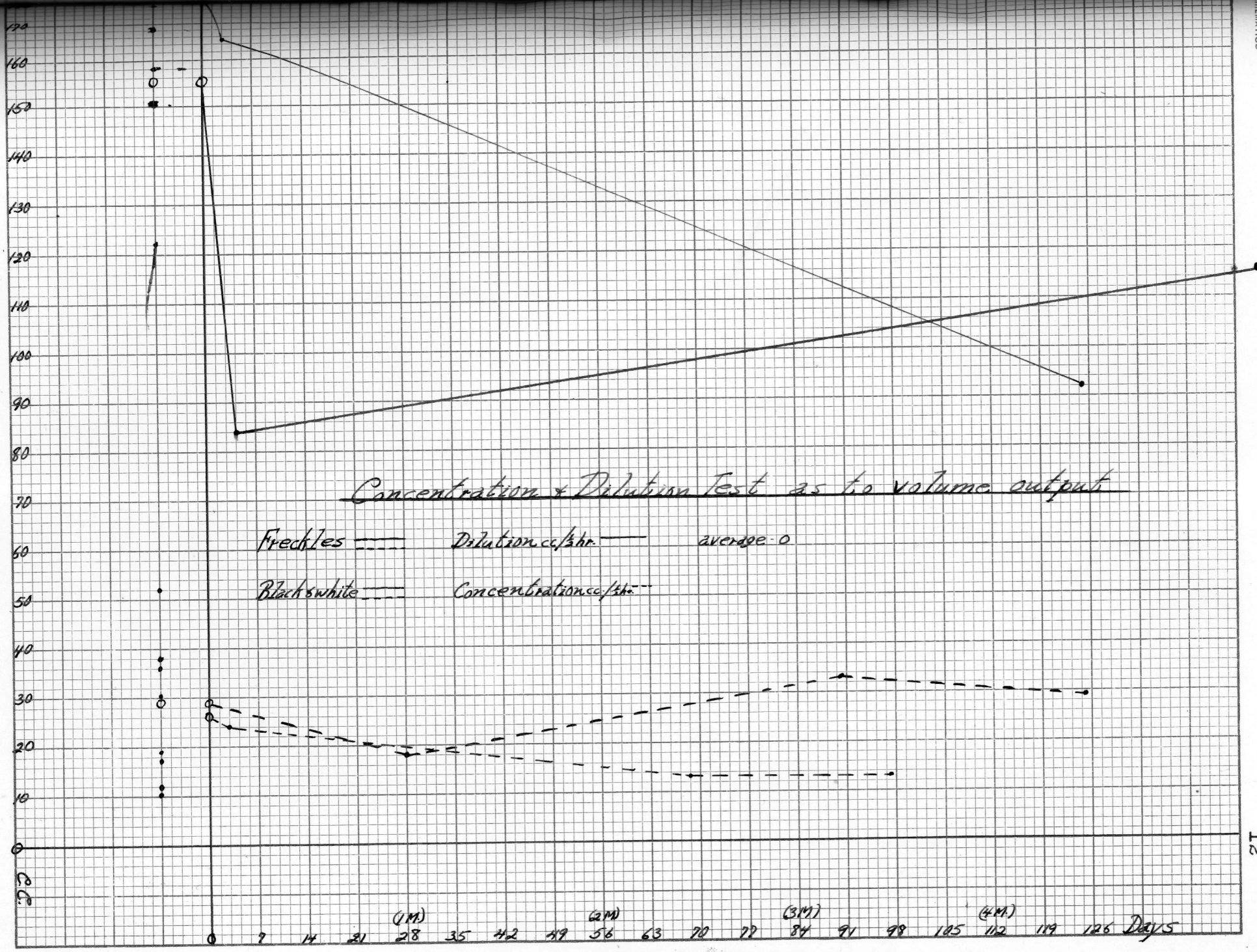
SUMMARY OF DATA ON BLACK AND WHITE

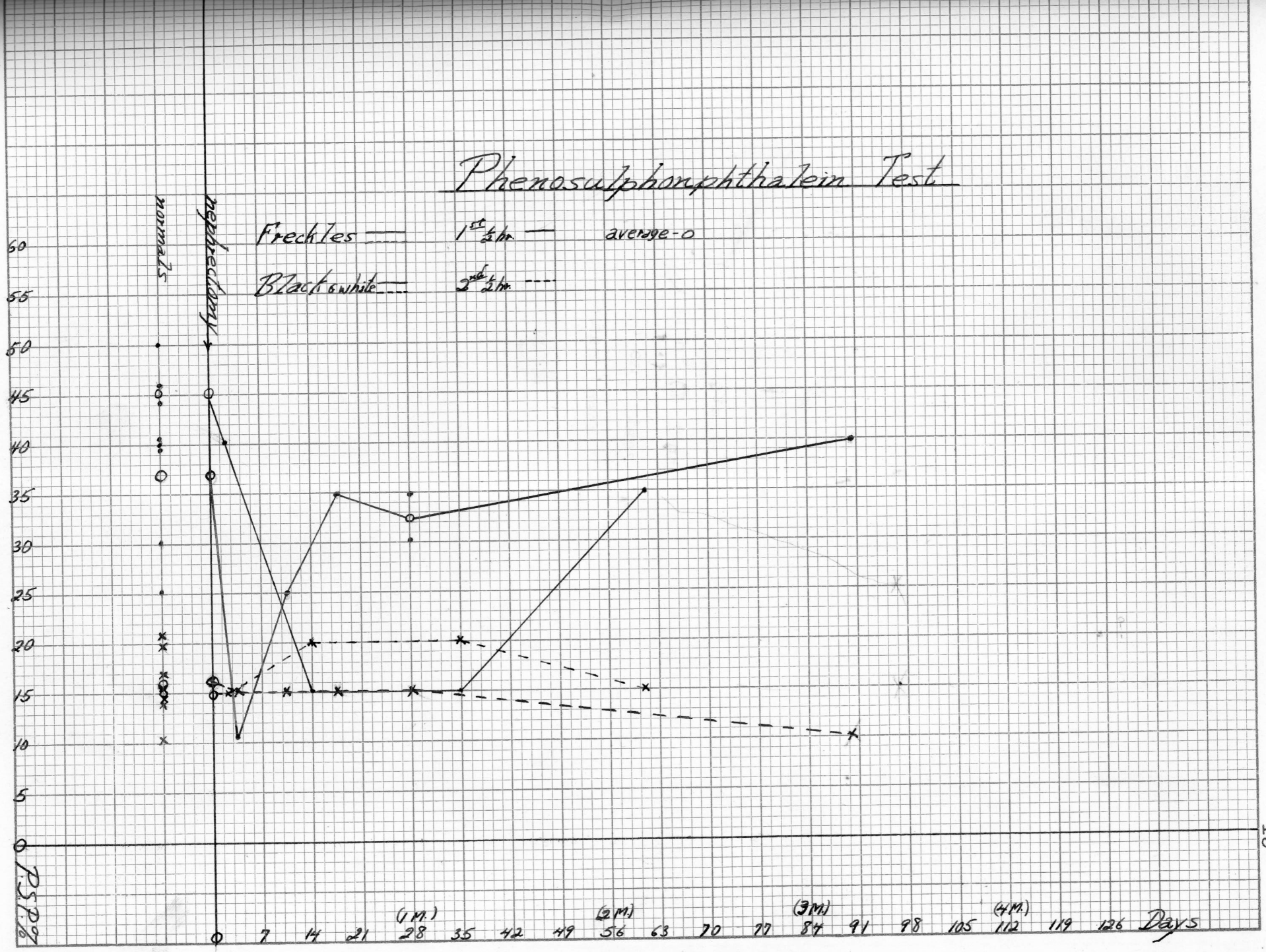
Run		1	2	3	4	5	6	7	8	9	10	11	1
Conc.	cc/5hr.	30	19			24				48.8	15	15	
I	Sp.Gr.	1.046	1.043			1.043					1.047	1.055	
Dil.	cc/½hr.	186				165							92
I	Sp.Gr.	1.001	1.003			1.001			1.003		1.002	1.002	1.00
P.S.P.	1st ½ hour		50	40		40	15	15			35		
	2nd ½ hour		15	15	Nephrectomy	15	20	20			15		
I	1st ½ hour				R.								
	2nd ½ hour												
Crea-	1	67.4	48.7		540	48	43.8		52.3	48.8	49	43.0	
tin-	2	54.0	39.5		52.6	43	37.4		46.7	45.5		43.2	
ine	3	55.1			51.2	44	36.6		49.5	44.7			
	1		68.6								47.0		
C	2		62.8								48.0		
	3		61.6								38.9		

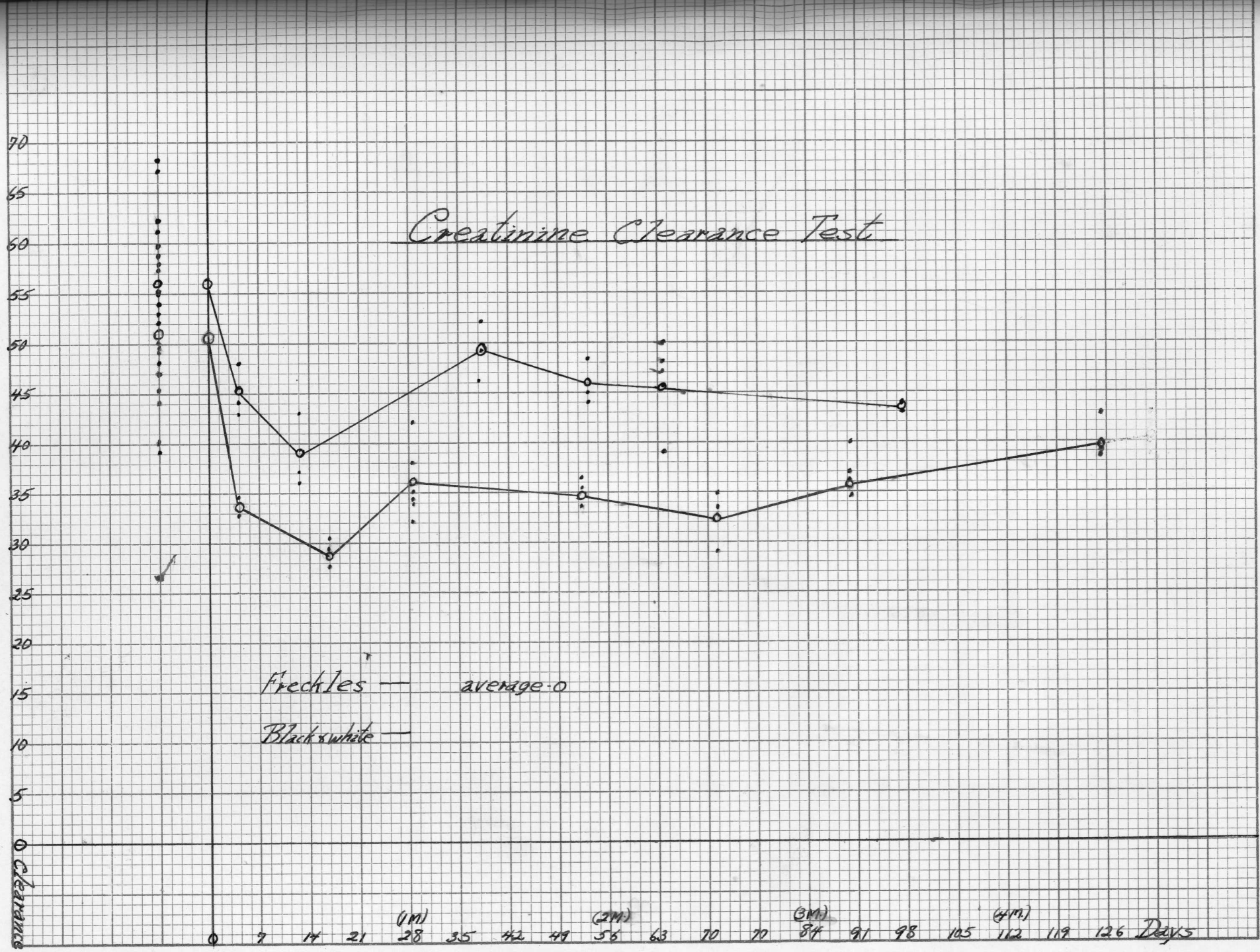
	9	10	11	12	13	14	15	16	17	18	19	20	
				23			17			33	29		
				1.054			1.051			1.030	1.042		
				82								115	
				1.002			1.006			1.003	1.002	1.002	
			Nephrectomy	10	25	35	30			40			
				15	15	15	15			10			
			R.				35						
							35						
							15						
.7	out	44.4	50.0	33.9		27.3	31.7	35.0	33.4	39.9	43.0		
.8	out	39.4	56.8	33.7		30.5	34.1	36.1	34.4	36.7	40.4		
.6			56.8	33.5		28.4	34.1	33.1	38.7	33.0	38.8		
							42.0			36.3			
							38.9						
							38.9			34.5			
							35.8						

	9	10	11	12	13	14	15	16	17	18	19	20	
	48.8	15	15										
		1.047	1.055										
				92									
03		1.002	1.002	1.002									
		35											
		15											
.3	48.8	49	43.0										
.7	45.5		43.2										
.5	44.7												
		47.0											
		48.0											
		38.9											




Concentration & Dilution Test as to volume output
Freckles ----- Dilution cc/½hr. —— average 0
Blackswhite ---- Concentration cc/½hr. ----
cc
(1M) (2M) (3M) (4M.)
0 7 14 21 28 35 42 49 56 63 70 77 84 91 98 105 112 119 126 Days


Phenosulphonphthalein Test
Freckles
Black & white
1st ½ hr.
2nd ½ hr.
average-o
normals
nephrectomy
60
55
50
45
40
35
30
25
20
15
10
5
0
P.S.P.%
0
7
14
21
(1 M.)
28
35
42
49
(2 M.)
56
63
70
77
(3 M.)
84
91
98
105
(4 M.)
112
119
126
Days



Results.

1. No demonstrable change was noted in the concentration and dilution test after unilateral nephrectomy on the two dogs other than a temporary fall in the volume output per unit of time during the dilution test on Freckles.

2. After unilateral nephrectomy there was noted a marked fall in the first 1/2 hour P.S.P. return in Freckles which returned to normal in about 2 weeks. The P.S.P.test on Black and White was normal 3 days after surgery. The next two tests run 14 days and 35 days after the operation showed a marked fall in the first 1/2 hour return. The following P.S.P. 60 days after the operation was normal. No notable change was seen in the P.S.P. return during the second 1/2 hour in either dog.

3. There was noted after unilateral nephrectomy a definite fall (however less than 50%) in the creatinine clearance in both dogs. The creatinine clearance fell for about a period of two weeks and then gradually increased toward the "normal" clearance level.

In discussing the results of this experiment I should first like to state that Freckles almost died from hemorrhage during the operation. The renal artery was not properly ligated and the dog had a massive hemorrhage of arterial blood while on the table. She went into shock and the bleeding stopped. The important factors to consider are that this dog's blood pressure, blood proteins and fluids were greatly decreased at the time. I presume the

blood pressure was low and there was fluid loss for several days following surgery and that this is the reason for the fall in the volume output per unit of time on the dilution test run four days after the nephrectomy. This may also be a contributing factor for the marked fall in the first 1/2 hour P.S.P. return and the fall in creatinine clearance; however, it seems that a marked fall in plasma proteins is the more important factor in causing the fall in P.S.P. return since the dye is carried mainly by the plasma proteins,[7] and since the P.S.P. gradually returned to normal over about a two week period which is in line with the time required for the plasma proteins to be replaced.

When one considers that the concentration and dilution test is dependent mainly on the whims of the most delicate part of the kidney, namely, the tubules that reabsorb around 99cc. for each 1cc. of urine that is produced and that you can take away half of the total kidney tissue and still get no demonstrable change as to the kidney's ability to concentrate and dilute and regulate the volume output, then you can see why this test is not so valuable. This shows the great amount of adaptability that the kidney has and also gives some idea of the amount of kidney reserve present. This experiment proves that the concentration and dilution test is of no value in detecting a small loss of renal function. It seems to me that the concentration and dilution test will aid in the diagnosis of advanced kidney disease especially when all of the kidney reserve has been used up.

Phenolsulfonphthalein is excreted, or a better term is "selectively secreted", by the tubules in the main.[1,7,8] Further proof that the dye elimination is dependent mainly on the tubules is shown by Hober and Briscoe's work[9] who have shown that the location of the sulfonate group in the dye molecule is the controlling factor in the physiological behavior of the dye. This means that some very sensitive part of the kidney as the tubules regulates the elimination of the dye according to the location of the sulfon ic group rather than a gross filtration unit that filters as to molecular size. For this reason the P.S.P. test is subject to some of the faults of the concentration and dilution test. There was a marked fall in the P.S.P. in Freckles which I believe is due in the main to the fall in blood proteins that occurred. The P.S.P. performed on Black and White three days after the nephrectomy showed no fall in the P.S.P. The two following tests showed a marked fall in the first 1/2 hour P.S.P. return, but the time required for the dye to appear in the urine was 21 and 20 minutes respectively and the volume per minute flow was low. Still, this marked fall cannot be explained as due to poor technique. A better explanation for the marked fall is based on experimental work of H.W.Smith[1] who states that the rate of excretion of P.S.P., diodrast, hippuran etc. is largely independent of filtration rate and is closely related to renal blood flow. Thus, any factor which would cause a marked fall in renal blood flow as excitement, would cause a fall in the P.S.P. return.

This dog, Black and White, did become excited at times and I believe this is the cause for the marked fall rather than the nephrectomy.[1] Thus, I believe that the P.S.P. is a more sensitive test than the concentration and dilution test but that there are a lot of variables that are hard to control, which often affect the test and are easily misinterpreted. An incidental finding that the variation in P.S.P. return occurred during the first 1/2 hour and that there was little variation the second 1/2 hour is of importance. This confirms the work of H.L.Sheehan[10] and of Sheehan and Southworth[11]. It also shows that the fractional P.S.P. test such as described by Chapman[12,13] is superior to the old type of 1 and 2 hour or 1/2 and 1 hour sample method.

The creatinine clearance test in dogs on the other hand is purely a measure of the amount of glomerular filtration that occurrs.[12,13,14] Creatinine is exclusively a glomerular filtration product in dogs and their creatinine and inulin clearance is identical, or the ratio between the two clearances is one since no tubular excretion or reabsorption occurrs. There was a very definite fall in the creatinine clearance in the case of both dogs. Although there is a "reserve"to the glomeruli and some authors feel that they never all function at one time, still the process of glomerular filtration is more of a mechanical process and has less adaptability than that of the tubules. This is my explanation for the fact that the creatinine clearance in dogs showed a definite impairment in kidney function when 1/2 of the kid-

ney tissue was removed by unilateral nephrectomy. Karsner, Hanzal and Moore's work on rabbits[15] and the work of Ellis and Weiss on man (mentioned in Karsner, Hanzal and Moore's article) showed a temporary fall in urea clearance after unilateral nephrectomy. I consider this confirmatory evidence that my results are correct.

The two papers by Winkler and Para[16,17] which concern the measurement of glomerular filtration of creatinine, sucrose, and urea in humans without renal disease and with renal disease show us that even these clearance tests may be normal in a person with nephrosis. Schulhof's paper[19] states that kidneys declared functionless by the present kidney tests have been surgically drained and their function has returned. He says the only useful test is exploration and drainage. Herrin has shown the effect of diet on urea clearance[20] and also other factors affecting urea clearance.[18] This gives us an idea of the many variables present that are bound to affect the results. Thus, we can see that even clearance tests are a crude measure of the kidney function.

In summary I would like to state that:

1. The concentration and dilution test is the least sensitive of the three tests and in no way detects reduction of the kidney tissue 50% by unilateral nephrectomy in normal dogs.

2. The P.S.P. is more sensitive than the concentration and dilution test and there was a decrease in P.S.P. return of the first 1/2 hour sample; however, there is some ques-

tion in my mind of the validity of these results.

3. The creatinine clearance is the most sensitive test of the three and did show a definite fall after unilateral nephrectomy.

4. By far the most valuable and reliable way of determining the status of the patients' kidneys is by a clinical examination.

Day Data

1 Food and water stopped 4-6 P.M. 7-29-41.

2 1. Concentration test
10:55 A.M. catheterized and urine discarded.
6:14 P.M. catheterized and urine collected.
vol. - 17 cc.
sp. gr. - 1.057 (diluted ½ to take sp.gr.)

(2. Creatinine and urea clearance
(6:20 P.M. 2 gm of creatinine given I.V.
OUT (7:11 P.M. B.W. - discarded.
poor(7:34 P.M. B. (blood sample taken)
tech+ 7:57 P.M. B.W. 40/45.2 (46 1/3 min.)
nique

	mg.%urine	mg/min.	mg.%plasma	clearance
Creatinine	673	6.54	18.83	34.7
Urea	413.8	4.03	37.0	10.9

3. P.S.P.
8:04 P.M. Injected 6 mgm. of P.S.P., I.V.
8:35 P.M. B.W. 40/42.2 - 45%
9:04 P.M. B.W.40/43.5 - 20%
65%

(9:30 P.M. dog given food & H_2O).

3. Food stopped 4-6 P.M.

4. 1. Dilution test
4:59 P.M. gave 250 cc. H_2O and catheterized D.
5:35 P.M. gave 250 cc. H_2O and
5:59 P.M. gave 250 cc. H_2O and collected sample.
Vol. 14 cc.
Sp.Gr. ?
6:31 P.M. gave 250 cc. H_2O
7:00 P.M. gave 250 cc. H_2O and collected sample.
Vol. 169
Sp.Gr. 1.004
7:29 P.M. collected sample
Vol. 122
Sp. Gr. 1.002

(2. Creatinine and urea clearance.
(7:29 P.M. gave 2 gm. creatinine I.V.
(7:30 P.M. gave 250 cc. H_2O orally.
(7:55 P.M. B.W. and urine discarded.
OUT (8:00 P.M. B. S1/1
poor(8:05 P.M. B.W. 40/93 S1/1 (10 min.)
tech+ 8:10 P.M. B.5 S2/1
nique 8:15 P.M. B.W. 40/90½ S2/1 (10 min.)

		mg.%urine	Mg./min,	plasma mg.%	clearance
Creatinine	S1/1	122.7	11.41	22.75	50.2
	S2/1	101.9	9.22	20.60	44.8
Urea -	S 1/1	81.9	7.61	31	24.6
	S 2/2	82.7	7.48	29	25.8

3. P.S.P.
8:20 P.M. gave 6 mgm. I.V.
8:50 P.M. B.W. 40/120 45%.
9:20 P.M. B.W. 40/114 20%
65%.

Run II. (normal) (Freckles)

Day Data

1. Food and H_2O stopped 4-6 P.M. 8-5-41

2. 1. Concentration test
10:45 A.M. catheterized dog.
3:00 P.M. sample collected.
Vol. 19½ cc.
Sp. Gr. ?
6:00 P.M. sample collected.
Vol. 27 cc.
Sp. Gr. 1.042
2. P.S.P.
7:03½ P.M. gave 6 mgm. of P.S.P. by I.V.
7:33 P.M. B.W. 40/40 plus 35%
8:03 P.M. B.W. 40/44 15%
50%.

3. Food stopped 4-6 P.M.

4. 1. Dilution test
5:47 P.M. catheterized and gave 250 cc. H_2O
6:17 P.M. gave 250 cc. H_2O
6:47 P.M. gave 250 cc. H_2O and collected sample.
Vol.7 cc.
Sp. Gr. ?
7:17 P.M. gave 250 cc. of H_2O and collected sample.
Vol. 32 cc.
Sp. Gr. 1.005
7:47 P.M. gave 250 cc. H_2O and collected sample.
Vol. 111 cc.
Sp. Gr. 1.001
8:17 P.M. collected sample.
Vol. 179 cc.
Sp. Gr. 1.001
2. P.S.P.
9:07 P.M. gave 6 mgm. of P.S.P., I.V.
9:37 P.M. B.W. 40/230 45%
10:07 P.M. B.W. 40/180 15%
60%

Run III (normal) (Freckles)

Day Data

1. Food and H_2O stopped 4-6 P.M. 8-18-41

2. 1. Concentration test
1:50 P.M. catheterized and discarded.

8:15 P.M. catheterized and collected specimen.
Vol. 73 cc.
Sp. Gr. 1.027

2. P.S.P.
8:36 P.M. Injected 6 mgm. of P.S.P., I.V.
9:06 P.M. B.W. 40/44 cc. 40%
9:36 P.M. B.W. 40/41 cc. 15%
55%

3. Food stopped 4-6 P.M.

4. 1. Dilution test
6:32 P.M. gave 250 cc. H_2O after catheterization
7:01 P.M. gave 250 cc. H_2O
7:32 P.M. gave 250 cc. H_2O and collected specimen.
Vol. 55 cc.
Sp. Gr. 1.008
8:02 P.M. gave 250 cc. H_2O and collected specimen.
Vol. 116 cc.
Sp. Gr. 1.004
8:32 P.M. gave 250 cc. H_2O and collected specimen.
Vol. 149 cc.
Sp. Gr. 1.003
9:02 P.M. collected specimen
Vol. 169 cc.
Sp. Gr. 1.003

2. P.S.P.
9:04 P.M. gave 6 mgm. of P.S.P. by I.V.
9:09 P.M. P.S.P. in urine (5 min.)
9:34 P.M. B.W. 40/211 25%
10:04 P.M. B.W. 40/167 15%
40%

Run IV (normal) (Freckles)

Day Data

1. Food and H_2O stopped 9-14-41

2. Concentration test
10:25 A.M. catheterized and collected specimen.
Vol. 39 cc.
Sp. Gr. 1.038
1:25 P.M. catheterized and collected specimen
Vol. 7 cc.)
Sp. Gr. ?) estimated
4:25 P.M. collected specimen) Sp. Gr. 1.036
Vol. 3 cc.)(diluted $\frac{1}{2}$)
Sp. Gr. ?)

P.S.P.
4:43 P.M. gave 6 mgm. P.S.P. by I.V.
5:08 P.M. dyeappeared in urine (26 min.)
5:13 P.M. B.W. 40/45 35%
5:45 P.M. B.W. 60/62 20%
55%

3. Food stopped 4-6 P.M.

4. 1. Dilution test
   7:40 A.M. catheterized dog
   7:50 A.M. gave 250 cc. H_2O
   8:27 A.M. gave 250 cc. H_2O
   8:50 A.M. gave 250 cc. H_2O and collected specimen.
   Vol. 27 cc.
   Sp. Gr. ?
   9:20 A.M. gave 250 cc. H_2O and collected specimen.
   Vol. 67 cc.
   Sp. Gr. 1.005
   9:50 A.M. gave 250 cc. H_2O and collected specimen.
   Vol. 111 cc.
   Sp. Gr. 1.003
   10:20 A.M. collected specimen
   Vol. 155 cc.
   Sp. Gr. 1.002

   2. P.S.P.
   10:22 A.M. gave 6 mgm. of P.S.P. by I.V.
   10:26 A.M. dye appeared in urine (4 min.)
   10:53 A.M. B.W. 40/231 30%
   11:22 A.M. B.W. 40/205 20%
   50%

Run V. (normal) (Freckles)

Day Data

1. Food and H_2O stopped 4-6 P.M. 9-24-41

2. 1. Concentration test
   7:45 A.M. dog catheterized and discarded.
   11:30 A.M. collected specimen
   Vol. 13 cc.
   Sp. Gr. 1.037

   2. Creatinine clearance
   11:30 A.M. gave 5 gm. creatinine in 250 cc. H_2O (orally).
   1:20 P.M. B.W.
   1:25 P.M. B. S25/1
   1:30 P.M. B.W. 40/50½ (1cc/1 min.) (10 min.) S25/1
   1:35 P.M. B. S25/2
   1:40½ P.M. B.W. 40/45 (.5cc/min.) (10½ min.) S25/2

		mg.% urine	mgm/min.	plasma%	clearance
Creatinine	S25/1	205.0	10.3	17.23	59.2
	S25/2	233.5	10.5	16.98	50.0

   3. P.S.P.
   5:10 P.M. gave 6 mgm. by I.V.
   5:25 P.M. dye excreted (15 min.)
   5:40 P.M. B.W. 40/43½ 35%
   6:10 P.M. B.W. 40/48 15%
   50%

3. Stopped food 4-6 P.M.

4. 1. Dilution test

8:10 A.M. catheterized and gave 250 cc. H_2O
8:40 A.M. gave 250 cc. H_2O
9:10 A.M. gave 250 cc. H_2O and collected specimen
Vol. 87 cc.
Sp. Gr. 1.004
9:40 A.M. gave 250 cc. and collected specimen.
Vol. 125 cc.
Sp. Gr. 1.002
10:10 A.M. gave 250 cc. H_2O and collectedspecimen
Vol. 127 cc.
Sp. Gr. 1.001
10:40 A.M. collected specimen
Vol. 157 cc.
Sp. Gr. 1.001

2. Creatinine clearance

10:40 A.M. gave 2 gm.creatinine I.V. in 20 cc. H_2O
11:25 A.M. B.W.
11:31 A.M. B. S 27/5
11:36 A.M. B.W. 40/82 (3.8cc/min.)(11 min.)S 27/5
11:42 A.M. B. S 27/6
11:46 A.M. B.W. 40/71 (3.0cc/min.)(10 min.)S 27/6

		mgm.%urine	mgm/min.	plasma%	Clearance
Creatinine	S 27/5	100	7.454	13.33	56.01
	S 27/6	89	6.319	10.90	58.53

3. P.S.P.

12:00noon gave 6 mgm. of P.S.P. by I.V.
12:04 P.M. dye excreted (4 min.)
12:30 P.M. B.W. 40/120 40%
1:00 P.M. B.W. 40/112 15%
55%

Run VI (normal) (Freckles)

Day Data

1. Stopped food and H_2O 4-6 P.M. 10-3-41

2. 1. Concentration test

7:00 A.M. catheterized dog and collected specimen.
Vol. 10½ cc.
Sp. Gr. ?
9:00 A.M. specimen collected)
Vol. 10½,cc.)
Sp. Gr. ?) Sp. Gr.
12:00 Noon specimen collected) 1.042
Vol. 12 cc.)
Sp. Gr. ?)

(2. Creatinine clearance
(12:15 P.M. injected 2 gm. of creatinine I.V.
OUT (1:11¼ P.M. B.W.
poor(1:23½ P.M. B. S 4/4
tech(1:35 3/4 P.M. B.W.40/45 (.2cc/min)(24½min.) S 4/4
ni- (1:56½ P.M. B. S 4/5
que (2:17¼ P.M. B.W. 40/37--error S 4/5

		mgm% urine	mgm/min.	plasma%	clearance
and (					
low (	Creatinine S 4/4	319.0	5.98,	15.65	38.2
flow(	~~S 4/5~~	~~348.5~~	~~6.54~~	~~19.00~~	

3. P.S.P.
2:39 P.M. gave 6 mgm. P.S.P. by I.V.
3:00 P.M. dye appeared (21 min.)
3:09 P.M. B.W. 40/43 35%
3:39 P.M. B.W. 40/41 15%
50%

3. Food stopped 4-6 P.M.

4. 1. Dilution test
1:49 P.M. catheterized dog and gave 250 cc. H_2O
2:19 P.M. gave 250 cc. H_2O
2:49 P.M. gave 250 cc. H_2O and collected sample.
Vol. 80 cc.
Sp. Gr. 1.010
3:21 P.M. gave 250 cc. H_2O and collected sample
Vol. 110 cc.
Sp. Gr. 1.007
3:51 P.M. gave 250 cc. H_2O and collected sample
Vol. 112 cc.
Sp. Gr. 1.005
4:21 P.M. collected urine sample
Vol. 150 cc.
Sp. Gr. 1.004

(2. Creatinine clearance test
OUT (4:18 P.M. gave 2 gm. creatinine in 20 cc. H_2O I.V.
poor(5:10¼ P.M. B.W.
tech(5:20½ P.M. B. S 6/5
ni- (5:30 3/4 P.M. B.W. 40/108(3.3cc/min)(20¼min.)S 6/5
que (5:40 3/4 P.M. B. S 6/6
(new(5:50 3/4 P.M. B.W. 40/95 (2.6cc/min)(20 min.)S 6/6

ope- (		mg.%urine	mg/min.	mg%plasma	clearance
ra- (Sample 6/5	I	84	4.48	8.73	51.3(Run I)
tor)(	II	93.5	5.05	11.5	43.9(Run II)
(Sample 6/6	I	72.5	3.44	9.48	36.3(Run I)
(	II	78.0	3.71	10.0	37.1(run II)

3. P.S.P.
5:59 P.M. gave 6 mgm. P.S.P. by I.V.
6:02 P.M. dye appeared (3 min.)
6:29 P.M. B.W. 40/135 40%
6:59 P.M. B.W. 40/117 10%
50%

Run VII (normal) (Freckles)

Day Data

1. Food and H_2O stopped 4-6 P.M. 10-9-41

2. (1. Creatinine clearance
(12:30 P.M. gave 2 gm. creatinine in 20 cc. H_2O I.V.
(1:18 P.M. B.W.
OUT (1:36 P.M. B. S 10/1
(low(2:00 P.M. B.W. 40/43 (42 min.) S 10/1
flow(2:23 P.M. B. S 10/2
(2:46 P.M. B.W. 40/44 (46 min.) S 10/2

		Mg.% urine	Mg./min.	cc./min.	mg.%plasma	clearance
S 10/1	I	528.5	5.408	(.071)	14.65	36.9
	II	528.5	5.408	(.071)	14.65	36.9
S 10/2	I	436.0	4.175	(.088)	11.48	35.75
	II	427.0	4.09	(.088)	11.68	35.3

Run VIII (normal) (Freckles)

Day Data

1. Food and H_2O stopped 4-6 P.M. 10-30-41

2. 1. Creatinine clearance
10:45 A.M. gave 5 gm. creatinine in 250 cc. H_2O
12:19 P.M. B.W.
12:28 P.M. B. S 30/1
12:37 P.M. B.W. 40/69½ (18 min.) S 30/1
12:48 P.M. B. S 30/2
12:59 P.M. B.W. 40/60 (22 min.) S 30/2
1:15 P.M. B. S 30/3
1:31 P.M. B.W. 40/48 (32 min.) S 30/3

Sample S 30/1 I mg.% urine 322.0
mgm/min. 12.42
cc/min. 1.082
mgm.% plasma 25.00
average of mgs.% plasma 24.59
clearance 50.6
II mg% urine 323.5
mgm/min. 12.21
cc/min. 1.082
mgm % plasma 24.18
average of mg.% plasma 24.59
clearance 50.8
S 30/2 I mg.% urine 380.0
mgm/min. 10.31
cc/min. .90
mgm. % plasma 22.38
average of mg.% plasma 22.05
clearance 47.0
II mg.% urine 377.5
mgm/min. 10.24
cc/min. .90
mgm.% plasma 21.63
average of mg.% plasma 22.05
clearance 46.6

Sample S 30/3 I mg.% urine 562.5
mgm/min. 8.4
cc/min. .25
mgm. % plasma 18.68
average of mg. % plasma 18.85
clearance 44.6
II mg.% urine 562.5
mgm/min. 8.4
cc/min. .25
mgm % plasma 18.98
average of mg. % plasma 18.85
clearance 44.6

Run IX (normal) (Freckles)

Day Data

1. Food stopped 4-6 P.M. 11-2-41

2. (1. Creatinine clearance
(12:00noon gave dog 5 gm. of creatinine in 250 cc. H_2O.
OUT (
low (1:03 P.M. B.W.
flow(1:14½P.M. B. S 2/1
and (1:26 P.M. B.W. 40/45½ (23 min.) S 2/1
poor(1:39 P.M. B. S 2/2
tech(1:53 P.M. B.W. 40/45 (27 min.) S 2/2
ni- (2:10 P.M. B. S 2/3
que(2:27 P.M. B.W. 40/45 (34 min.) S 2/3

Sample	mg.%urine	mgm/min.	cc/min.	mg.% plasma	clearance
S 2/1	447.5	8.85	(.23)	27.15	32.6
S 2/2	652.5	10.86	(.18)	24.38	44.6
S 2/3	744.5	9.86	(.14)	25.70	38.4

Run X (normal) (Freckles)

Day Data

1. Food stopped 4-6 P.M. 11-6-41

2. 1. Creatinine clearance
11:30 A.M. gave 5 gm. of creatinine in 250 cc. H_2O
12:20 P.M. gave 250 cc. H_2O
12:41 P.M. B.W. discarded
12:58 P.M. B. S 7/1
1:15 P.M. B.W. 40/116 (34 min.) S 7/1
1:38 P.M. B. S 7/2
2:01 P.M. B.W. 40/82 (36 min.) S 7/2

Sample		mg% urine	mgm.min.	cc/min.	mgm%plasma	clearance	average
S 7/1	I	281.8	9.62	2.23	20.95	46.1	44.4
	II	283.9	9.66		22.45	42.8	
S 7/2	I	466.5	8.33	.913	21.30	38.7	39.4
	II	463.0	8.25		20.68	40.2	

Run XI (normal) (Freckles)

Day	Data	
1.	Stopped food 4-6 P.M.	11-8-41
2.	10:15 A.M. drew samples for N.P.N.	
	1. 33%	
	2. 38%	
	10:23 A.M. gave 5 gm. creatinine in 250 cc. H_2O orally	
	11:00 A.M. gave 250 cc. H_2O orally	
	11:25½ A.M. B.W. discarded	
	11:36 A.M. B.	S 9/1
	11:45½ A.M. B.W. 40/100 (20 min.)	S 9/1
	11:57 A.M. B.	S 9/2
	12:05½ P.M. B.W. 40/111 (20 min.)	S 9/2
	12:16 P.M. B.	S 9/3
	12:25½ P.M. B.W. 40/112 (20 min)	S 9/3

Sample	Mg.%urine	mgm/min.	cc/min.	mg.%plasma	clearance
S 9/1	203.8	10.18	3.0	19.28	50.0
S 9/2	230.0	11.5	3.55	21.03	56.8
S 9/3	236.0	11.8	3.60	22.75	56.8

RIGHT NEPHRECTOMY

Day	Data
11-10-41	A right nephrectomy was performed. There was extensive bleeding into the abdominal cavity and out of the incision due to improper ligation of the renal artery. The dog went into shock. She was given 900 cc. of N.S. 300 I.V. and 600 Sub.Q. Later she was given 600 cc. of a half and half N.S. and 5% glucose solution Sub. Q. The anesthesia was ether open drop technique.
11-11-41	Dog recovering, defecated, passed urine and ate.

Run XII (after nephrectomy) (Freckles)

Day	Data	
1.	Food and H_2O stopped	11-12-41
2.	Concentration test	
	7:15 A.M. catheterized and saved specimen.	
	Vol. 4 cc.	
	Sp. Gr. ?	
	12:00 noon catheterized dog and saved specimen.	
	Vol. 23 cc.	
	Sp. Gr. 1.054	

(2. Creatinine clearance

OUT (12:05 gave 5 gm. creatinine in 250 cc. H_2O

flow (12:30 P.M. gave 250 cc. H_2O

flow (1:07½ P.M. B.W. discarded

(1:17½ P.M. B. S 13/1

(1:27½ P.M. B.W. 40/43 (20 min.) S 13/1

(1:38 P.M. B. S 13/2

(1:48½ P.M. B.W. 40/43 (21 min.) S 13/2

(1:59 P.M. B. S 13/3

(2:09½ P.M. B. W.40/42½ (21 min.) S 13/3

(Sample	mg.%urine	mgm/min.	cc/min.	mg%plasma	clearance
(S 13/1	442	9.51	(.15)	23.35	40.7
(S 13/2	442	8.65	(.14)	25.00	34.6
(S 13/3	425.5	8.62	(.11)	24.18	35.6
Check S 13/1	399	8.58			31.8
anal- S 13/2	382	8.03			32.1
ysis (S 13/3	378	7.66			31.6

3. Took food away 4-6 P.M.

4. 1. Dilution test

10:10 A.M. catheterized dog and gave 250 cc. H_2O

10:40 A.M. gave 250 cc. H_2O

11:10 A.M. gave 250 cc. H_2O and catheterized S 15/1

Vol. 8½ cc.

Sp. Gr. ?

11:40 A.M. gave 250 cc. H_2O and collected sample

Vol. 23 cc. S 15/2

Sp. Gr. 1.003

12:12 P.M. gave 250 cc. H_2O and collected sample

Vol. 58 cc. S 15/3

Sp. Gr. 1.003

12:40 P.M. collected specimen S 15/4

Vol. 82 cc.

Sp. Gr. 1.002

2. Creatinine clearance

12:42 P.M. gave 5 gm. of creatinine in 250 cc. H_2O

2:14 P.M. B.W.

2:25 P.M. B. S 15/5

2:35 P.M. B.W. 40/110 (21 min.) S 15/5

2:46 P.M. B. S 15/6

2:57 P.M. B.W. 40/106 (22 min.) S 15/6

3:11 P.M. B. S 15/7

3:25 P.M. B.W. 40/117 (28 min.) S 15/7

Sample	mg.%urine	mg/min.	cc/min.	mg.%plasma	clearance
S 15/5	139.0	7.29	3.33	21.45	33.92
S 15/6	154.0	7.41	3.0	22.00	33.7
S 15/7	173.5	7.25	2.75	21.63	33.5

3. P.S.P.

3:44 P.M. gave 6 mgm. of P.S.P., I.V.

3:49 P.M. dye appeared in urine (5 min.)

4:14 P.M. B.W. 40/86 10%

4:44 P.M. B.W. 40/92 15%

25%

Run XIII (Freckles)

Day Data

1. Stopped food 4-6 P.M. 11-21-41

2. 12:45 P.M. gave 250 cc. H_2O
2:16 P.M. gave 6 mgm. of P.S.P. by I.V. and catheterized dog.

2:46 P.M. B.W. 40/83 25%
3:16 P.M. B.W. 40/52 15%
40%

(dye appeared in urine in 4 min.)

Run XIV (Freckles)

Day Data

1. Stopped food and H_2O at 4-6 P.M. 11-24-41

2. 1. Creatinine clearance
3:07 P.M. gave 5 gm. of creatinine in 250 cc. H_2O
3:27 P.M. gave 250 cc. H_2O
4:03 P.M. B.W. discarded
4:17 P.M. B. S 25/1
4:31 P.M. B.W. 40/52 (28 min.) S 25/1
4:54 P.M. B. S 25/2
5:17 P.M. B.W. 40/140 (46 min.) S 25/2
5:31 P.M. B. S 25/3
5:46 P.M. B.W. 40/106 (29 Min.) S 25/3

Sample	mg.%urine	mgm/min.	cc/min.	mg.%plasma	clearance
S 25/1	328.3	7.28	.78	26.3	
S 25/2	308.3	9.39	2.17	30.4	
S 25/3	241.0	8.80	2.27	30.8	

(2. P.S.P.
OUT (5:52 P.M. gave 6 mgm. of P.S.P. however believe the
poor((dye was not given I,V.) but subcutaneously.
tech(6:00 P.M. dye appeared.
ni- (6:23 P.M. B.W. 40/96 20%
que (7:52 P.M. B.W. 40/70 15%
(35%

4. Took food and H_2O away 4-6 P.M. 11-27-41

5. 1. P.S.P.
1:36 P.M. gave 250 cc. H_2O orally
1:59 P.M. gave 250 cc. H_2O orally
2:47 P.M. gave 6 mgm. of P.S.P. by I.V.
2:52 P.M. dye appeared (5 min.)
3:17 P.M. B.W. 35%
3:47 P.M. B.W. 15%
50%

Run XV (Freckles)

Day Data

1. Stopped food and H_2O

2. (1. Concentration test
OUT (7:30 A.M. catheterized dog S 6/1
(dog(Vol. 49 cc.
?had(Sp. Gr. 1.037
water 12:30 P.M. catheterized dog S 6/2
(Vol. 69 cc.
(Sp. Gr. 1.018

2. Creatinine clearance
12:35 P.M. gave dog 5 gm. of creatinine in 250 cc.
1:05 P.M. gave 250 cc. H_2O H_2O
1:39½ P.M. B.W. discarded
1:50½ P.M. B. S-F 6/3
2:01½ P.M. B.W. 40/91 (22 min.) S-F 6/3
2:15 P.M. B. F 6/4
2:28½ P.M. B.W. 40/106 (27 min.) F 6/4
2:38½ P.M. B. F 6/5
2:48½ P.M. B.W. 40/96 (20 min.) F 6/5

Sample	mg%urine	mg/min.	cc/min.	mg%plasma	clearance
F 6/3	167.5	6.97,	2.3	22.00	31.7
F6/4	194.5	7.64	2.4	22.38	34.1
F6/5	164.0	7.77	2.8	22.75	34.1

3. P.S.P.
3:11 P.M. gave 6 mgm. of P.S.P. by I.V.
(dye appeared in 4½ min.)
3:41 P.M. B.W. 40/99 30%
4:11 P.M. B.W. 40/78 15%
45%

4. Food stopped in afternoon 4-6 P.M.

5. (1. Concentration test
OUT (7:50 A.M. dog catheterized
H_2O (Vol. 40 cc.
not (Sp. Gr. 1.014
stop(1:40 P.M. dog catheterized
ped.(Vol. 72 cc.
(Sp. Gr. 1.022

2. Creatinine clearance
3:00 P.M. gave 5 gm. of creatinine in 250 cc. H_2O
3:30 P.M. gave 250 cc. H_2O orally.
4:32 P.M. B.W. 40/43 discarded
4:45 P.M. B. F 9/3
4:58 P.M. B.W. 40/131 (26 min.) F 9/3
5:11 P.M. B. F 9/4
5:24 P.M. B.W. 40/126 (26 min.) F 9/4
5:34 P.M. B. F 9/5
5:45 P.M. B.W. 40/90 (21 min.) F 9/5

Sample	mg.%urine	mg/min.	cc/min.	mg%plasma	clearance
F 9/3	98.0	4.93	3.5	11.68	42.01
F 9/4	113.9	5.53	3.3	14.20	38.9
F9/5	128.0	5.8	2.6	16.15	35.8

3. P.S.P.
5:52 P.M. gave 6 mgm. of P.S.P. by I.V.
(dye appeared in 5 min.)
6:22 P.M. B.W. 40/96 35%
6:52 P.M. B.W. 40/70 15%
50%

13. Food and H_2O stopped 4-6 P.M. 2-17-41

14. 1. Concentration test
8:15 A.M. catheterized dog
1:00 P.M. catheterized dog
Vol. 15 cc.
Sp. Gr. 1.051 (Conc. 17.6 cc/5 hr.)
2. Dilution test
1:00 P.M. gave 250 cc. H_2O orally
4:30 P.M. catheterized
Vol. 125 cc.
Sp. Gr. 1.006

Run XVI (Freckles)

Day Data

1. Food stopped 4-6 P.M. 1-10-42

2. 1. Creatinine clearance
1:23 P.M. gave 250 cc. H_2O and 5 gm. creatinine
1:53 P.M. gave 250 cc. H_2O
2:37½ P.M. B.W. discarded
2:47½ P.M. B. F 21/1
2:57½ P.M. B.W. 40/91 (20 min.) F 21/1
3:12 P.M. B. F 21/2
3:26½ P.M. B.W. 40/112 (29 min.) F 21/2
3:42 P.M. B. F 21/3
3:57½ P.M. B.W. 40/110 (31 min.) F 21/3

Sample	mg%min.	mg/min.	cc/min.	mg.%plasma	clearance
F 21/1	176.0	8.03	2.5	22.95	35.0
F 21/2	189.2	7.32	2.5	20.25	36.1
F 21/3	179.0	6.35	2.2	19.13	33.1

Run XVII (Freckles)

Day Data

1. Food taken away 4-6 P.M. 2-1-42

2. 3:30 P.M. gave 5 gm. creatinine in 250 cc. H_2O
4:20 P.M. gave 250 cc. H_2O
4:48 P.M. B.W.
4:57 P.M. B. F 2/1
5:06 P.M. B.W. 40/74 (18 min.) F 2/1
5:20 P.M. B. F 2/2
5:34 P.M. B.W. 40/98 (28 min.) F 2/2
5:48 P.M. B. F 2/3
6:02 P.M. B.W. 60/94 (28 min.) F 2/3

Sample	mg%urine	mg/min	cc/min.	mg%plasma	clearance
F 2/1	160.5	6.60	1.8	19.75	33.4
F 2/2	166.5	5.84	2.0	16.98	34.4
F 2/3	156.0	5.24	1.2	18.23	28.7

Run XVIII (Freckles)

Day Data

1. Stopped food 4-6 P.M. 2-8-42

2. 1. Dilution test
12:25 P.M. catheterized dog and gave 250 cc. H_2O
1:05 P.M. gave 250 cc. H_2O
2:00 P.M. gave 250 cc. H_2O and gave 5 gm.creatinine
Vol. 46 cc.
Sp. Gr. 1.022
2:30 P.M. collected specimen
Vol. 60 cc.
Sp. Gr. 1.005
3:00 P.M. collected specimen
Vol. 90 cc.
Sp. Gr. 1.003

2. Creatinine clearance
(2:00 P.M. gave 5 gm. creatinine in 250 cc. H_2O)
3:02 P.M. B.W. discarded
3:12 P.M. B. F 9/4
3:22 P.M. B.W. 40/96 (20 min.) F 9/4
3:34 P.M. B. F 9/5
3:46 P.M. B.W. 40/90 (24 min.) F 9/5
Run stopped because dog was too nervous

Sample	mg%urine	mg/min.	cc/min.	mg.cc.plasma	clearance
F 9/4	91.0	4.37	2.8	12.05	36.3
F 9/5	114.5	4.29	2.0	12.45	34.5

3. Stopped food and water 4-6 P.M.

4. Concentration test
10:30 A.M. catheterized dog and collected specimen
Vol. 15 cc.
Sp. Gr. 1.029
2:45 P.M. catheterized dog and collected specimen
Vol. 28 cc.
Sp. Gr. 1.030

Creatinine clearance
2:50 P.M. gave 5 gm.creatinine in 250 cc. H_2O
3:30 P.M. gave 250 cc. H_2O
4:10 P.M. gave 250 cc. H_2O
4:21 P.M. B.W.
4:28½P.M. B. F 11/3
4:30 P.M. B.W. 40/86 (15 min) F 11/3
4:41½P.M. B. F 11/4
4:47 P.M. B.W. 40/74½ (11 min.) F 11/4
4:52½P.M. B. F 11/5
4:58 P.M. B.W. 40/67 (11 min.) F 11/5

Sample	mg%urine	mg/min.	cc/min.	mg/cc.plasma	clearance
F 11/3	110.1	6.34	3.0	15.90	39.9

Sample	mg%urine	mg/min.	cc/min.	mg/cc.plasma	clearance
F 11/4	85.5	5.79	3.1	15.78	36.7
F 11/5	83.0	5.06	2.4	15.28	33.0

3. P.S.P.
5:08 P.M. gave 6 mgm. of P.S.P. by I.V.
5:10 P.M. Gave 250 cc. H_2O
5:13 P.M. dye appeared (5 min).
5:38 P.M.B.W. 40/175 40%
6:08 P.M. B.W. 40/110 10%
50%

Run XIX (Freckles)

Day Data

1. Food stopped 4-6 P.M. 3-11-42

2. 1. Dilution test
9:10 A.M.Gave 250 cc. H_2O
9:15 A.M. catheterized dog.
10:00 A.M.Gave 250 cc. H_2O
10:45 A.M. Gave 250 cc. H_2O and collected specimen
Vol. 160 cc.
Sp. Gr. 1.006
11:15 A.M.Gave 250 cc. H_2O and collected specimen
Vol. 150 cc.
Sp. Gr. 1.002

(2. P.S.P.
OUT (4:15 P.M. Gave 250 cc. H_2O
samp-(4:45 P.M. Gave 250 cc. H_2O
les (4:50 P.M. 6 mgm. of P.S.P. given by I.V.
were(4:57 P.M. Dye appeared (7 minutes).
let (5:20 P.M.B.W. 40/140 20%
stand 5:50 B.W. 40/135 20%
before analysis. 40%

3. Took food and H_2O away 4-6 P.M.

4. 3. Concentration
11:45 A.M. catheterized dog
Vol. 40 cc.
Sp. Gr. 1.026
4:30 P.M. catheterized dog
Vol. 28 cc.
Sp. Gr. 1.042

8 Stopped food 4-6 P.M. 3-17-42

9. 1. Creatinine clearance
1:30 P.M. Gave 250 cc. H_2O and 5 gm.creatinine
1:50 P.M. gave 250 cc. H_2O
2:35 P.M. catheterized and discarded.
2:43 P.M. B. 18/1 dog
2:51 P.M. B.W. 40/82 (16 min.) 18/1 was
3:00 P.M. B. 18/2 very

3:09 P.M. B.W. 40/76 (18 min.) 18/2 ner-
3:19 P.M. B. 18/3 vous.
3:29 P.M. B.W. 40/78 (20 min.) 18/3

Sample	mg% urine	mg/min.	cc/min.	mg/cc plasma	clearance
18/1	151	6.80	2.6	15.78	43.0
18/2	156	6.58	2.0	16.30	40.4
18/3	159	6.20	1.9	16.43	38.8

Run XX (Freckles)

Day Data

1. Took food away 4-6 P.M. 4-8-42

2. 1. Dilution test
11:45 A.M. Catheterized and gave 250 cc. H_2O
12:15 P.M. Gave 250 cc. H_2O
12:45 P.M. Gave 250 cc. H_2O and collected specimen
Vol. 82 cc.
Sp. Gr. 1.005
1:15 P.M. Gave 250 cc. H_2O and collected specimen
Vol. 62 cc.
Sp.Gr. 1.003
1:45 P.M. Gave 250 cc. H_2O and collected specimen.
Vol. 115 cc.
Sp. Gr. 1.003
2:15 P.M. collected specimen
Vol. 85 cc.
Sp. Gr. 1.002

Run 1 (normal) (Black and White)

Day Data

1. Stopped food and H_2O at 4-6 P.M. 11-11-41

2. 1. N.P.N.
7:00 A.M. - blood for N.P.N.
a. 38%
b. 41%

2. Concentration test
7:15 A.M. catheterized dog and collected specimen
Vol. 239 cc.
Sp. Gr. 1.041
12:15 P.M. Catheterized dog and collected specimen
Vol. 30 cc.
Sp.Gr. 1.046

3. Creatinine clearance
12:32 P.M. gave 5 gm.creatinine in 250 cc. H_2O
1:05 P.M. gave 250 cc. H_2O
1:37 P.M. B.W. discarded
1:46 P.M.B. 12/1
1:55 P.M. B.W. 40/121 (18 min.) 12/1
2:02 P.M. B. W. discarded
2:12 P.M. B. 12/2
2:22 P.M. B.W. 40/44 (20 min.) 12/2
2:33 P.M. B. 12/3
2:44 P.M. B.W. 40/43 (22 min.) 12/3

Sample	mg.%urine	mg/min.	cc/min.	mg.%plasma	clearance
12/1	182.0	12.18	4.5	18.08	67.4
12/2	396.2	7.73	.2	16.15	54.0
12/3	379.0	7.42	.13	14.43	51.4

3. Stopped food.

4. 1. Dilution test
12:34 P.M. gave 250 cc. H_2O and catheterized dog.
1:00 P.M. gave 250 cc. H_2O
1:30 P.M. gave 250 cc. H_2O and collected specimen
Vol. 38 cc.
Sp. Gr. 1.004
2:00 P.M. gave 250 cc. H_2O and collected specimen
Vol. 72 cc.
Sp. Gr. 1.003
2:30 P.M. gave 250 cc. H_2O and collected specimen
Vol. 123 cc.
Sp. Gr. 1.002½
3:00 P.M. collected specimen
Vol. 186 cc.
Sp. Gr. 1.001

2. Creatinine clearance
3:01 P.M. gave 5 gm. creatinine in 250 cc. H_2O
3:52 P.M. B.W. and discarded.
4:15 P.M. B. 14/5
4:37½P.M. B.W. 40/280½ (45 min.) 14/5

4:47½ P.M. B. 14/6
4:57½ P.M. B.W. 40/83 (20 min.) 14/6
5:09 P.M. B. 14/7
5:20½ P.M. B.W. 40/79 (23 min.) 14/7

	Sample	mg.%urine	mg/min.	cc/min.	mg.%plasma	clearance
OUT---~~14.5~~		~~356.0~~	~~22.2~~	(5,34)	~~14.65~~	(151.2)
flow)	14/6	229.0	95.1	2.15	17.26	55.1
too)	14/7	284.5	97.9	1.69	15.53	63.0
high)						

Run 2. (normal) (Black and White)

Day Data

1. Food taken and H_2O taken away 4-6 P.M. 11-15-41

2. 1. Concentration test
7:55 A.M. catheterized dog and collected specimen
Vol. 81 cc.
Sp. Gr. 1.043
12:50 P.M. catheterized dog and collected specimen
Vol. 19 cc.
Sp. Gr. 1.043

2. Creatinine clearance
12:55 P.M. gave 5 gm. creatinine in 250 cc. H_2O
2:11 P.M. B.W.
2:22 P.M. B. 16/3
2:33 P.M. B.W. 40/76 (22 min.) 16/3
2:43½ P.M. B.W. 16/4
2:54 P.M. B.W. 40/45 (21 min.) 16/4
Run was stopped because volume output was low and dog was too nervous.

Sample	mg.%urine	mg/min.	cc/min.	mg%plasma	clearance
16/3	171.5	5.92	1.63	12.15	48.75
16/4	231.7	4.96	.26	12.55	39.50

4. Food stopped 4-6 P.M.

5. 1. Dilution test
12:45 P.M. Gave 250 cc. H_2O and catheterized dog
1:15 P.M. gave 250 cc. H_2O
2:00 P.M. gave 250 cc. H_2O and catheterized dog
Vol.
Sp. Gr. 1.003

2. Creatinine clearance
2:25 P.M. gave 5 gm.of creatinine in 50 cc. H_2O
3:15 P.M. B.W. discarded
3:34 P.M.B. 19/2
3:52 P.M. B.W. 40/52 (37 min). 19/2
4:20 P.M. B. 19/3
4:48 P.M. B.W. 40/53½ (56 min.) 19/3
5:03 P.M. B. 19/4
5:18 P.M. B.W. 40/46 (30 min.) 19/4

Sample	mg.%urine	mg/min.	cc/min.	mg%plasma	clearance
19/2	429	6.04	.32	8.80	68.6
19/3	590	5.64	.22	8.98	62.8
19/4	373	5.72	.20	9.30	61.6

Run 3 (normal) (Black and White)

Day Data

1. Food stopped 4-6 P.M. 11-21-41

2. P.S.P.
12:25 P.M. gave 250 cc. H_2O
1:32 P.M. gave 6 mgm. of P.S.P. by I.V. and catheterized dog.
(dye appeared in 5 min.
2:02 P.M. B.W. 40/71 40%
2:32 P.M. B.W. 40/53 15%
55%

Run 4 (normal) (Blackand White)

Day Data

1. Took food and H_2O away 4-6 P.M. 11-28-41

2. 1. Creatinine clearance
12:15 P.M. gave 5 gm.of creatinine in 250 cc. H_2O
12:50 P.M. gave 250 cc. H_2O
1:36 P.M. B.W. discarded
1:46 P.M. B. 29/1
1:57 P.M. B.W. 40/81 (21 min.) 29/1
2:42 P.M. B. 29/2
3:27 P.M. B.W. 40/88 (90 min.) 29/2
3:38 P.M. B. 29/3
3:49 P.M. B.W. 40/51 (22 min.) 29/3

Sample	mg.%urine	mg/min.	cc/min.	mg%plasma	clearance
29/1	182	7.03	2.0	12.95	54.0
29/2	626	6.14	.53	11.68	52.6
29/3	213	4.94	.50	9.70	51.2

OUT (2. P.S.P.
Stood 3:56 P.M. gave 6 mgm. of P.S.P. by I.V.
over (dye appeared in 7 min.)
1 wk 4:26 P.M. B.W. 40/51 30%
be- 4:56 P.M. B.W. 40/56 15%
fore 45%
analyzed).

RIGHT NEPHRECTOMY (Blackand White)

Day Data

1 A right nephrectomy was performed under open drop ether anesthesia. The kidney was taken out through the peritoneal cavity. The dog had an uneventful post-operative course. 12-3-41

Run 5 (Post-nephrectomy) (Black and White)

Day Data

1. Food and H_2O stopped 12-5-41

2. 1. Concentration test

7:30 A.M. catheterized dog and collected specimen
Vol. 29 cc.
Sp. Gr. 1.042
12:30 P.M. catheterized dog and collected specimen
Vol. 24 cc.
Sp. Gr. 1.043

2. Creatinine clearance

12:35 P.M. gave 5 gm. creatinine in 250 cc. H_2O
1:05 P.M. gave 250 cc. H_2O
1:42 P.M. B.W.
1:56 P.M. B. 6/3
2:10 P.M. B.W. 40/100 (28 min.) 6/3
2:24 P.M. B. 6/4
2:38 P.M. B.W. 40/92 (28 min.) 6/4
2:48½ P.M. B. 6/5
2:59 P.M. B.W. 40/71 (21 min.) 6/5

Sample	mg% urine	mg/min.	cc/min.	mg% plasma	clearance
6/3	233.0	8.68	2.1	17.95	48.3
6/4	268.2	8.82	1.8	20.43	43.1
6/5	270.5	9.40	1.9	20.60	44.25

OUT not inj. pro-per-ly

3. P.S.P.

3:21 P.M. Gave 6 mgm. P.S.P. by I.V.
Dye appeared in 7 min.
3:51 P.M. B.W. 40/66 5%
4:21 P.M. B.W. 40/44 15%
20%

4. 1. P.S.P.

4:25 P.M. gave 250 cc. H_2O
4:32 P.M. gave 6 mgm. of P.S.P. by I.V.
(dye appeared in 11 min., flow was low)
5:02 P.M. B.W. 40/90 40%
5:32 P.M. B.W. 40/114 15%
55%

(Food and H_2O stopped 4-6 P.M.)

5. 1. Dilution test

1:32 P.M. gave 250 cc. H_2O orally
1:45 P.M. gave 250 cc. H_2O orally
2:15 P.M. gave 250 cc. H_2O orally
2:45 P.M. gave 250 cc. H_2O and catheterized.
Vol. 135 cc.
Sp. Gr. 1.004
3:15 P.M. gave 250 cc. H_2O and collected specimen.
Vol. 136 cc.
Sp. Gr. 1.002
3:45 P.M. collected specimen
Vol. 165
Sp.Gr. 1.001
4:15 P.M. collected specimen
Vol. 128
Sp. Gr. 1.001
4:45 P.M. collected specimen
Vol. 132
Sp. Gr. 1.001

Run 6 (Black and White)

Day Data

1. Food taken away 4-6 P.M. 12-15-41

2. 1. Creatinine clearance
1:10 P.M. gave 5 gm. creatinine in 250 cc. H_2O
1:40 P.M. Gave 250 cc. H_2O
2:16 P.M. B.W. discarded
2:27 P.M. B. 16/1
2:38 P.M. B.W. 40/81 (22 min.) 16/1
2:50 P.M. B. 16/2
3:02 P.M. B.W. 40/76 (24 min.) 16/2
3:14 P.M. B. 16/3
3:26 P.M. B.W. 40/57 (24 min.) 16/3

Sample	mg%urine	mg/min.	cc/min	mg.%plasma	clearance
16/1	270.5	9.96	1.8	22.75	43.8
16/2	236.0	7.46	1.5	19.93	37.4
16.3	284.0	6.75	.7	18.45	36.6

2. P.S.P.
3:29½P.M. Gave 6 mgm. P.S.P. by I.V. and 250 cc.H_2O
3:50 P.M. dye appeared (21 min.)
3:59½P.M. B.W. 15%
4:29½P.M. B.W. 20%
35%

Run 7 (Black and White)

Day Data

1. Took food and H_2O away 4-6 P.M. 1-7-42

2. 1. Concentration test
10:30 A.M. catheterized dog and discarded.
2:50 P.M. catheterized dog and collected sample.
Vol. 17 cc.
Sp. Gr. 1.051

(2. Creatinine clearance

OUT low flow and poor tech- ni- que

3:00 P.M. Gave 5 gm.of creatinine in 250 cc. H_2O
Dog regurgitated about 300 cc.
3:15P.M. Gave 3 gm. of creatinine in 250 cc. H_2O
4:13½P.M. B.W. discarded.
4:24 P.M. B. 8/2
4:35½P.M. B.W. 40/44 (22 min.) 8/2
4:47 P.M. B.W. 8/3
4:59½P.M. B.W. 40/43 (24 min.) 8/3
5:11½P.M. B. 8/4
5:23½P.M. B.W. 40/43 (24 min.) 8/4

Sample	mg.%min.	mg/min.	cc/min.	mg.%plasma	clearance
8/2	479.0	7.80	.18	22.12	35.2
8/3	533.0	6.65	.13	18.75	35.5
8/4	533.0		.13	22.75	

3. P.S.P.
5:17 P.M. Gave 250 cc. H_2O orally
5:22½ P.M. Gave 6 mgm. of P.S.P. by I.V.
5:42½P.M. Dye appeared (20 min.)

5:52½P.M. B.W. 15%
6:22½P.M. B.W. 20%
35%

Run 8 (Blackand White)

Day Data

1. Stopped food 4-6 P.M. 1-11-42

2. 1. Dilution test
1:50 P.M. Catheterized dog and gave 250 cc. H_2O
2:20 P.M. Gave 250 cc. H_2O
2:50 P.M. Catheterized and gave 5 gm. creatinine in 250 cc. H_2O
Vol. 8 cc.
Sp. Gr. ?
3:20 P.M. Gave 250 cc. H_2O and collected specimen
Vol. 5 cc.
Sp. Gr. ?
3:50 P.M. Gave 250 cc. H_2O and collected specimen
Vol. 111 cc.
Sp. Gr. 1.003

2. Creatinine clearance
(5 gm. creatinine given at 2:50 P.M.)
4:00 P.M. B.W. discarded
4:20 P.M. B. 12/4
4:40 P.M. B.W. 40/266 (40 min.) 12/4
4:51 P.M. B. 12/5
5:04 P.M. B.W. 40/168 (24 min.) 12/5
5:13 P.M. B. 12/6
5:22 P.M. B.W. 40/118 (18 min.) 12/6

Sample	mg%urine	mg/min.	cc/min.	mg%plasma	clearance
12/4	126.1	84.0	5.6	14.65	52.3
12/5	125.2	87.6	5.3	19.13	46.7
12.6	136.8	89.5	4.3	18.08	49.5

Run 9 (Black and White)

Day Data

1. Stopped food 4-6 P.M. 1-25-4 2

2. 1. Creatinine clearance
3:00 P.M. gave 5 gm.of creatinine in 250 cc H_2O
3:30 P.M. Gave 250 cc. H_2O
3:52 P.M. Catheterized dog and discarded.
4:03½P.M. B. 26/1
4:14½P.M. B.W. 40/146 (22½ min.) 26/1
4:20 P.M. Gave 250 cc. H_2O
4:25½P.M. B. 26/2
4:36½P.M. B.W. 40/144 (22 min.) 26/2
4:48 P.M. B. 26/3
4:59½P.M. B.W. 40/142 (22½ min.) 26/3

Sample	mg.%min.	mg/min.	cc/min.	mg%plasma	clearance
26/1	139.5	9.08	4.7	18.53	48.8
26/2	133.5	8.73	4.7	19.93	45.5
26/3	120.0	7.38	4.7	16.98	44.7

Run 10 (Black and White)

Day Data

1. Stopped food and H_2O 4-6 P.M. 2-4-42

2. 1. Concentration test
10:10 A.M. Catheterized dog
Sp. Gr. 1.040
1:20 P.M. catheterized and collected specimen
Vol. 16 cc.
Sp. Gr. 1.047

2. Creatinine clearance
1:30 P.M. Gave 5 gm. creatinine in 250 cc. H_2O
2:00 P.M. Gave 250 cc. H_2O
2:45 P.M. Gave 250 cc. H_2O and B.W. discarded
2:56½P.M. B. 5/1
3:08 P.M. B.W. 40/88 (23 min.) 5/1
3:22 P.M. B. 5/2
3:36 P.M. B.W. 40/43 (28 min.) 5/2
3:44 P.M. B. 5/3
3:50 P.M. B.W. 40/41 (16 min.) 5/3

	(Sample	mg%urine	mg/min.	cc/min.	mg%plasma	clearance
OUT						
low	(5/1	187.5	7.16	2.0	14.65	49.0
flow	(5/2	401.5	6.16	(.1)	12.35	50.0
	(5/3	237.5	6.09	(.06)	11.38	53.5

3. P.S.P.
3:50 P.M. Gave 250 cc. H_2O
3:52½P.M. Gave 6 mgm.of P.S.P. by I.V.
4:12 P.M. dye appeared in urine (20 min.)
4:22½P.M. B.W. 35%
4:52½P.M. B.W. 15%
50%

3. Stopped food 4-6 P.M.

4. 1. Dilution test
10:15 A.M. Gave 250 cc. H_2O
10:25 A.M. Catheterized and discarded.
11:25 A.M. gave 250 cc. H_2O
11:30 A.M. Catheterized;specimen collected.
Vol. 166
Sp. Gr. 1.002
11:50 A.M. Gave 5 gm. of creatinine in 250 cc. H_2O
12:00noon collected specimen
Vol. 70
Sp. Gr. 1.002
12:40 P.M. collected sample
Vol. 142
Sp. Gr. 1.002

2. Creatinine
(5 gm. creatinine given 11:50 A.M.)
12:45 P.M. B.W. discarded.
12:58 P.M. B. 7/4
1:11 P.M. B.W. 40/152 (26 min.) 7/4
1:21 P.M. B. 7/5

1:31 P.M. B.W. 40/101 (20 min.) 7/5
1:39½P.M. B. 7/6
1:48 P.M.B.W. 40/58 (17 min.) 7/6

Sample	mg%urine	mg/min.	cc/min.	mg%plasma	clearance
7/4	145.0	8.48	4.3	17.80	47.5
7/5	154.0	7.27	3.0	16.15	48.0
7/6	196.5	6.70	1.0	17.23	38.9

Run 11 (Black and White)

Day Data

1. Food and H_2O stopped 4-6 P.M. 3-6-42

2. 1. Concentration test
11:45 A.M. catheterized dog.
Vol. 40 cc.
Sp. Gr. 1.050
6:30 P.M. catheterized dog
Vol. 20 cc.
Sp. Gr. 1.055

5. Took food away 4-6 P.M. 3-10-42

6. Clearance test
12:30 P.M. gave 250 cc.H_2O and 5 gm. creatinine
1:15 P.M. Gave 250 cc.H_2O
1:51½P.M. B.W. and discarded
1:55 P.M. Gave 250 cc. H_2O
2:06½P.M. B. 11/1
2:21½P.M. B.W. 40/100 (30 min.) 11/1
2:32 P.M. B. 11/2
2:42½P.M. B.W. 40/62 (21 min.) 11/2
2:51 P.M. B. 11/3
2:59½P.M. B.W. 40/42 (17 min.) 11/3

Sample	mg%urine	mg/cc	cc/min.	mg/ccplasma	clearance
11/1	62.0	23.50	2.0	4.80	43.0
11/2	70.0	20.65	1.0	4.80	43.2
11/3	84.0	20.75	0.1	4.93	42.1

10. Food stopped 4-6 P.M. 3-15-42

11. 1. Dilution test
1:40 P.M. Gave 250 cc. H_2O
2:00 P.M. Catheterized dog and gave 250 cc. H_2O
- Vol. 100 cc.
Sp. Gr. 1.023
2:30 P.M. Gave 250 cc. H_2O
3:00 P.M. Gave 250 cc. H_2O and catheterized
Vol. 125 cc.
Sp. Gr. 1.003
3:30 P.M. Collected specimen
Vol. 150 cc.
Sp. Gr. 1.002

2. P.S.P.

OUT (3:02 P.M. Gave 6 mgm. of P.S.P. by I.V.
sam-(3:11 P.M. dye appeared in urine (9 min.)
ples(3:32 P.M. B.W. 40/70 25%
were(4:02 P.M. B.W. 40/128 15%
left(40%
days before analyzed.

Run 12 (Black and White)

Day Data

1. Took food away 4-5-42

2. 1. Dilution test
2:45 P.M. catheterized dog and gave 250 cc. H_2O
3:15 P.M. Gave 250 cc. of water
3:45 P.M. gave 250 cc. of water and collected speci-
Vol. 28 cc. men.
Sp. Gr. 1.006
4:15 P.M. Gave 250 cc. water and collected sample.
Vol. 90 cc.
Sp. Gr. 1.003
4:45 P.M. Gave 250 cc. H_2O and collected specimen
Vol. 88 cc.
Sp. Gr. 1.002
5:15 P.M. Collected specimen
Vol. 92 cc.
Sp. Gr. 1.002

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APPROVED BY R. C. Herrin

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