THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report

of

Committee on Thesis

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Orville Norman Nelson for the degree of Master of Science. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science.

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May 27 1920
~~1918~~

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Report

of

Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given Orville Norman Nelson final oral examination for the degree of Master of Science . We recommend that the degree of Master of Science be conferred upon the candidate.

Minneapolis, Minnesota

May 27 1920

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THESIS

EXPERIMENTAL URANIUM NEPHRITIS.

A Thesis submitted to the

Faculty of the Graduate School of the

University of Minnesota

by

Orville N. Nelson, B.S., B.M.

In partial fulfillment of the requirement

for the degree of

MASTER OF SCIENCE

June

1920

EXPERIMENTAL URANIUM NEPHRITIS.

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University of Minnesota

OUTLINE.

INTRODUCTION.

Ever since Richard Bright in 1827 published his monograph on chronic nephritis, this subject has continued to arouse the interest of investigators as is evidenced by the vast literature which has accumulated. In recent years there has been a very active interest, especially in experimental nephritis. Morphologists have attempted to classify the various types of diseased kidneys, and to determine their pathogenesis and interrelationships. Experimentalists on the other hand have attempted to produce in animals the several forms of renal disease that occurs in man. Each group of workers has had as an ultimate objective the determination of the etiology and pathogenesis of human nephritis.

It has been maintained by Dickson and others that a renal lesion may be produced in animals with uranium nitrate, which is similar to human chronic nephritis.

The object of this paper is to study the effects of uranium nitrate on the kidneys, to determine the exact nature of any chronic lesion that may develop.

Human Nephritis.

It will be necessary to discuss the pathology of human nephritis in order to compare it with renal lesions produced experimentally. In accordance with prevailing opinion at the present time we may recognize the following types of renal disease:

I Renal Infections.

(a) Specific - tuberculosis, syphilis, etc.

(b) Pyogenic infections - abscess, pyelitis, - pyelonephritis, pyonephrosis, etc.

These infections are fairly well understood, and are not usually included under the designation "nephritis". They are not essentially different from inflammatory processes in other organs. Similar lesions are easily produced in animals.

II. Arteriosclerotic Kidneys. This important group of nephritis is primarily due to disease of the blood vessels of the kidneys. No etiological factors are known. A considerable percentage of cases of chronic renal disease belong to this group. No experimental lesion has ever been produced which bears any resemblance to this form of renal disease.

III. Glomerulo-nephritis.

(a) The embolic type. This form is associated usually with ulcerative endocarditis. Usually only a few glomeruli are involved. The affected glomeruli are only partly destroyed as a rule, and it is generally believed that the lesions are produced by small infected emboli from the heart.

(b) Diffuse glomerulo nephritis. This type is characterized by involvement of nearly all of the glomeruli. Usually there is swelling of the endothelial cells of the glomerulus with gradual or rapid closure of the capillaries (intracapillary type); or there is a proliferation of the capsular epithelium with compression of the glomerulus (extra capillary type). The closure of the capillaries ultimately may lead to hyaline degeneration of the glomerulus. Some weeks later a disuse atrophy is manifested in the associated tubule, and the tubule finally disappears entirely. Acute and chronic forms of glomerulo-nephritis are recognizable clinically and pathologically. Chronic glomerulo-nephritis is the usual form of chronic renal disease.

IV. The Nephroses. This term is applied to renal lesions which are degenerative rather than inflammatory. The vast majority of cases of nephrosis are secondary to some other disease. The amyloid kidney is the only chronic nephrosis that has been accepted by any considerable number of investigators. If there is any other forms of chronic nephrosis, it must be very rare.

It follows from the above discussion that chronic nephritis in man is with few exceptions either a chronic glomerulo-nephritis, or an arterio-sclerotic kidney. Any experimental lesion must correspond to one of these forms if it is to be regarded as comparable to human nephritis.

Spontaneous Nephritis in Laboratory Animals.

In any experimental study of nephritis, it is very important not to confuse the experimentally produced lesions with those occurring spontaneously. Spontaneous nephritis occurs frequently in laboratory animals. Bell and Hartzell,(1) in a study of two hundred rabbits over a period of two years, found that from 10 to 20 per cent had spontaneous nephritis. They also found that the percentage with diseased kidneys varied from time to time and was occasionally as high as 80%. In the selection of rabbits for my experiments ten out of twelve rabbits in one group were discarded because of albuminuria. In several instances, four out of six were found to have albumin in the urine. Four rabbits with normal urines were discarded because of pitted kidneys revealed by the preliminary operation. It is therefore, unsafe to assume, as is commonly done, that a lesion occurring oftener in experimental than in control animals must be due to the experiment.

Spontaneous nephritis may actually develop during the course of a long experiment, independently of the experimental procedure. Klotz[2] recognized the possibility of this. Bell and Hartzell[1] reported two such cases in control animals. In the light of these observations, great caution should be used in the interpretation of lesions in experimental animals where there is a structural resemblance to the spontaneous disease.

Description of the pathologic changes in spontaneous nephritis may be found in the papers of LeCount and Jackson,[10] Longcope,[14] Ghoreyeb,[15] Bloomfield,[16] Ophüls and Dickson[17] and others. They also describe the frequency of spontaneous lesions and the possibility of interpreting the spontaneous lesions as experimental results. According to Bell and Hartzell, the disease begins as one or more small lymphacytic accumulations in the cortex, at or near the cortico-medullary junction. These infiltrations finally result in the destruction of the parts of the tubules they enclose. Subsequently there is a disuse atrophy of the segments of the tubules distal to the point of destruction which finally results in a pit on the surface. The number and size of the surface pits depend upon the number and size of the original lymphocytic infiltrations. Numerous large infiltrations may give a diffuse exudative inflammation, but usually the disease is distinctly focal and not diffuse. The observers just mentioned, regarded spontaneous nephritis in the rabbits as an infection comparable to the renal infection of man, but having only a superficial resemblance to the arteriosclerotic kidney or chronic glomerulo-nephritis.

Experimental Chronic Nephritis.

Petroff[3] studied the effects of the oxides of heavy metals on the kidney and stated that "when the action of an irritant was continued for a considerable length of time, there resulted necrosis in the renal epithelium with definite proliferation of the connective tissue. The urine was free from albumin and casts.

Lyon[4] in 1904, published the results of experiments conducted with cantharidin, diptherial toxin, and corrosive sublimate. He concludes as follows:- "Suffice it to say that in no case and by no experimental means, have I been able to produce and follow the evolution of changes at all analagous to those which we find in subacute, and chronic diffuse nephritis in man. My results point to the fact that in animals at least, the kidney is restored to its normal integrity after the subsidence of the acute inflammatory phenomena. "

Haren Emerson[5] found that repeated inhalations of ether, alcohol, amyl nitrite, and chloroform produced "varying degrees of chronic nephritis in dogs".

Major[6] in 1917-1918 reported that he produced acute, subacute, and chronic nephritis in rabbits by the intravenous injections of cultures of Bacillus mucosus capsulatus. He seemed to believe that the lesions produced correspond closely to the changes met with in these types of human nephritis.

In a second paper, he made similar experiments using combined Staphylococcus aureus toxin and uranium nitrate, and reported the same results.

In 1909, E.C.Dickson[7] published a paper on the production of true chronic nephritis by the use of uranium nitrate. His work has formed the basis of the later work on experimental uranium nephritis. Chronic nephritis was produced in guinea pigs and rabbits either by repeated small or by a single large subcutaneous injection.

His conclusions are as follows: "By the use of uranium nitrate, lesions are produced in kidneys of guinea pigs and rabbits, which closely resemble those found in subacute and chronic diffuse nephritis in man" and that with prolonged use of this drug he gets a "kidney lesion comparable to the Weigert subacute nephritis". Furthermore, he states that "a single severe attack of uranium nephritis may be followed after some weeks by a severe fibrosis which may go on to the stage of granular atrophy. In other cases, the recuperative power of the kidney is such that only a mild fibrosis results".

In a second paper, Dickson[8] states that "by the administration of uranium nitrate it is possible to produce a chronic diffuse nephritis in guinea pigs,- dogs, and rabbits, and that the histological picture is analagous to but not identical with that found in chronic diffuse nephritis of man."

Jean Oliver[9] working under the guidance of E.C.Dickson studied the pathogenesis of uranium nephritis. She found that "proliferation of connective tissue in chronic uranium nephritis is early and progressive and due to a direct stimulation on the part of uranium and that regeneration begins about the fourth day, but varies in proportion to the dose of renal irritant given.

Reviewers have, for the most part, accepted Dickson's results as correct, although they are disinclined to accept any other experimental chronic nephritis as genuine. LeCount and Jackson[10] are apparently doubtful of all experimental chronic nephritis.

In 1911, Christian and Smith[11] studied experimental chronic nephritis produced by uranium nitrate and potassium bichromate. A large number of animals were used, 56 of which lived three months and over. About the same changes were produced with potassium bichromate as with uranium nitrate. Most of the kidneys showed no gross changes, but some had small pits on the surfaces. The gross and microscopic changes described by these observers correspond entirely to those of spontaneous nephritis. It is to be noted that the gross changes attributed to uranium are much less frequent and less severe than those reported by Dickson.

MacNider[12] studied the renal function in dogs which had been given a single subcutaneous injection of uranium nitrate (4 mg. per kilo). The animals lived six to forty-eight days. Albumin was continuously present in the urine. The elimination of phenolsulphonephthalein was decreased and blood urea was increased. These functional disturbances led MacNider to regard the condition as a chronic nephropathy. However, the gross changes reported are not characteristic of chronic nephritis, and the microscopic changes are not convincing. It seems probable that the decreased function was due to the plugging of large numbers of the tubules with casts. It is true that this is a form of chronic renal disease, but it does not resemble human chronic nephritis. Furthermore, this is not the type of lesion described by Dickson.

Karsner[13] injected cats and dogs intraperitoneally with uranium nitrate, and attempted to recover the uranium qualitatively and quantitatively from the various organs. The cats were killed at the end of forty-eight hours. In one cat, the dose of uranium injected was .1375 grams and.0269 grams (19%) was recovered quantitatively from the kidneys. "The kidney was the only organ that contained enough uranium to respond to a qualitative test." It is possible that uranium is present in the kidney even longer than Karsner's experiments extended. Possibly the prolonged albuminuria which follows a single injection of uranium (as occurred in my own experiments as well as MacNider's) may be due to the continuous action of uranium nitrate.

Experiments.

Rabbits in good nutritive condition were selected from the animal house, and put in individual metabolism cages. The collected urine was examined for albumin. The animal was not used if as much as a trace of albumin was present. If the urine was found free of albumin, the abdomen was opened over the left kidney, under ether anesthesia, and with aseptic precautions. The surfaces of the left kidney were examined carefully, and no rabbit was used if the renal surfaces were pitted even though the urine was normal. All except early cases of nephritis may be recognized by the presence of pits on the surfaces of the kidney. Both kidneys need not be examined since spontaneous nephritis is always bilateral. The above surgical prodedure eliminates active as well as healed cases of spontaneous nephritis. The rabbits were kept in clean metabolism cages in the animal house, and were fed on vegetables and oats. Ten or

twelve days after the exploratory operation uranium injections were begun, provided the wound was completely healed and the urine was free from albumin. The urine was examined every week or ten days. The heat test with 2% acetic acid in saturated NaCl solution was used. Casts were not searched for regularly since the urine was ordinarily very alkaline and the specimens were not always fresh. Autopsies were usually performed a short time after death. The kidneys were examined grossly and portions were preserved in Zenker's fluid and in formalin. Paraffin sections as well as frozen sections were prepared.

Kahlbaum's uranium nitrate was used. A solution was prepared of such strength that each cubic centimeter contained one milligram of the uranium nitrate. The fatal dose of this solution for a 1200 gram rabbit was found to be from one-half to one milligram. The injections were made beneath the skin of the abdomen.

The experiments may be arranged in two groups:

Group I. Single large injections.

There are eighteen rabbits in this group. They were given a single subcutaneous injection of uranium nitrate (0.5 mg. to 3.0 mg.). Death occurred from the fourth to the twelfth day. A severe acute nephritis developed from which none of the animals recovered. Protocals of rabbits No. 305, 317, 330, 333, 343, 344, 381, 384, 303, are illustrative of this group.

Group II. Repeated smaller and moderate sized injections.

There are thirty-six rabbits in this group. Injections of uranium nitrate from 0.031 mg. to 0.25 mg. were given every seven to ten days and frequent urine examinations were made. Some animals of this group were carried along seven months and nine

months. It was hoped that repeated acute attacks and continuous irritation would lead to a chronic nephritis with scarring and pitting of the surfaces. The protocols of rabbits No. 7,9,393, 45,318,304,320,332,336,393,392,43,41, and 21, are illustrative of this group.

The experiments were performed under the direction of Professor E.T.Bell.

Discussion of Experiments.

The acute renal injuries produced by injections of uranium nitrate are well known, and have been described by Suzuki,[18] Dickson,[7] Christian[19] and O'Hare. My results are in entire agreement with those of the observers mentioned.

The lesion is almost entirely restricted to the tubules, the glomeruli being only slightly injured. It may be compared to some of the severe nephroses found in man. There is no danger of confusing acute uranium nephritis with spontaneous nephritis, since there is no anatomic resemblance between the two diseases. There can be no question in the experiments of Group I that a definite severe acute uranium nephritis is produced.

Thirty-six experiments are included in my second group. The duration of time varied from six weeks to nine months. Fifteen rabbits were under experimentation more than three months; and six more than five months. Albuminuria was constantly present throughout practically every experiment. From nine to twenty injections of uranium nitrate were given in the experiments that lasted over five months.

Only one of the thirty-six rabbits (Rabbit No. 304) showed

any gross changes in the surfaces of the kidneys. Nine kidneys of Group II and four of Group I showed occasional small accumulations of lymphocytes. These were not much more pronounced as a rule in the chronic than in the acute cases, and correspond entirely to the early stages of spontaneous nephritis. The lesions were not far enough advanced to cause changes in the surfaces of the kidneys. There is no special reason why lesions of this type should be attributed to uranium since they are known to occur frequently in non experimental animals.

Rabbit 304 showed deeply pitted shrunken kidneys. The phenolsulphonphthalein exsretion for 2 hours was 30 to 35%. Microscopically, there were wedge shaped atrophic-cortical areas, with lymphocytic infiltration in the deeper parts. This is the typical appearance of advanced spontaneous nephritis. It may be compared to human renal infections but does not resemble chronic nephritis of man. Cultures from one of these kidneys gave a pure growth of streptococci. This seems to be the form of nephritis which occurred in Dickson's experimental animals, and which he regarded as similar to chronic nephritis of man.

Practically all the kidneys showed some tubular injury, and several contained large numbers of casts in the collecting tubules. Possibly the presence of so many casts may explain the decreased renal function obtained by MacNider. No glomerular proliferation was seen in any case, and the only fibrosis noted was rabbit No. 304 stated above.

It may be concluded from the foregoing experiments that uranium nitrate does not produce a chronic nephritis comparable in any anatomic features with human chronic nephritis. The single case of

pitted kidneys which occurred in rabbit 304, undoubtedly developed during the course of the experiment since the kidney surfaces were smooth at the time of the preliminary operation; but the most reasonable interpretation of this case is that a spontaneous infection developed subsequent to the operation. If uranium had been an important factor some of the other 35 rabbits should have shown similar lesions. It is possible that uranium by injuring the kidneys, predisposes them to the development of spontaneous infections.

It is essential in experimental chronic nephritis to have very careful controls. Pitted kidneys may be present in rabbits with normal urines. Observers who did not note the condition of the kidney surfaces at the begining of the experiment cannot rule out spontaneous nephritis in the interpretation of their results.

It is significant that Christian [11] and Smith rarely saw pitted kidneys in their experiments with uranium nitrate.

Pearce [20] in a criticism of experimental chronic nephritis states that "with the possible exception of Dickson the experimental results have neither been constant nor of such a nature to justify the term of chronic nephritis." Occasional positive findings in view of the frequency of spontaneous nephritis must be regarded with suspicion.

My experiments tend to show that Dickson's work does not constitute an exception to Pearce's generalization that no lesion comparable to human chronic nephritis has been produced experimentally.

SUMMARY.

Repeated subcutaneous injection of uranium nitrate in rabbits does not produce chronic renal disease similar to human chronic nephritis in any anatomic features.

The usual pathologic changes are tubular injuries with casts, and occasional foci of lymphocytes. Such lymphocytic foci are frequently found in the kidneys of control rabbits, and are probably not due to uranium.

In one animal granular contracted kidneys developed, but the anatomic picutre was the same as is found in ordinary advanced spontaneous nephritis in the rabbit.

The writer wishes to thank Professor E.T.Bell for the kind help and suggestions made during the course of experimentation.

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EXPLANATION OF PLATES.

Plate I. Kidney of a rabbit after a single large injection of uranium nitrate.

Plate II. Kidney of a rabbit after a large number of small injections of uranium nitrate given about ten days apart.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 305.

Male Rabbit Weight 305 G.

Oct. 3,1917 Albumen Negative.
Oct. 4,1917 Operated, kidney, and found few small pits on convex border. (One kidney removed - ~~Bac. Coli~~).
Oct.12.1917 Moderate albumen.
Oct.13,1917 1 Milg Ur. Nit. by hypo.
Oct.15,1917 Heavy albumen.
Oct.18,1917 Very heavy albumen cloud
Oct.20,1917 Rabit died and autopsied.

WEIGHT.		AUTOPSY. Gross.
Oct.2,1917	1780 G.	One kidney was definitely swollen
Oct.12,1917	1520 G.	red and congested. There were some pits
Oct.17,1917	1500 G.	on convex border, evidence of spontaneous
Oct.18,1917	1455 G.	nephritis.
Oct.20,1917	1310 G.	

MICROSCOPIC.

Large convoluted tubules decreased in size, cloudy degeneration of some of the cells lining the tubules, some of tubules are dilated. This section shows a few scattered lymphocytic foci at the cortico medullary junction and at the cortex an area of atrophied tubules corresponding to a pit. The glomeruli are not much affected. A picture of acute uranium nephritis superimposed on an old spontaneous nephritic kidney.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 303.

Oct. 2,1917.

R-303. Male Rabbit. Weight 1650 G.

Oct.2,1917 Albumin negative.
Oct.2,1917 Operated kidney surface smooth, no pits (Dr. Bell)
Oct.15,1917 Albumen Neg.
Oct.17,1917 1 Milg. Ur. N. by hypo. subcutaneously in abdomen.
Oct.18,1917 Moderate albumin.
Oct.23,1917 Heavy albumin.
Oct.26,1917 Rabbit died.

WEIGHTS

Oct.2,1917 1650 G.
Oct.15,1917 1580 G.
Oct.17,1917 1585 G.
Oct.18,1917 1495 G.
Oct.20,1917 1455 G.

AUTOPSY.

Pertoneum showed no change, kidneys congested and swollen. No marked edema. Not much change in kidney.

MICROSCOPICALLY.

The tubules show injury. There is some degeneration also.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 317.

Oct.12,1917.

Male Rabbit Weight 1520 G.

Oct.13,1917 Albumin Negative.
Oct.17,1917 Operated; kidney exposed; surfaces smooth, no pits. (Dr. Bell)
Oct.27,1917 Albumin Negative.
Oct.27,1917 1 2 Milg Ur. N. by Hypo.
Oct.31,1917 Albumin was 3 positive. Rabbit showed paralysis of both hind legs. Constant stream of urine, on moving the rabbit or turning it around. The animal was killed and autopsied.

WEIGHT		AUTOPSY. Gross.
Oct. 12,1917	1780 G.	The peritoneum was slightly congested
Oct. 26,1917	1560 G.	but there was not any fluid in the peritoneal
Oct.31, 1917	1300 G.	cavity. The kidneys were darker in color than normal and larger and swollen. On section some edema and cloudy swelling. The capsule stripped easily.

MICROSCOPIC.

Many of the glomeruli are unchanged. Collecting tubules and loops of Henle are badly damaged, showing exudate in their lumina and hyline casts. Distinctly a tubular type of nephritis. No marked glomerular change.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 330.

Oct. 28,1917.

Male Rabbit Weight 1770 G.

Oct.28,1917	Some albumin.
Oct.29,1917	Operated - kidney surface smooth.
Nov.11,1917	Albumen negative.
Nov.12,1917	1 4 Milg Ur. N.
Nov.13,1917	Albumen slight.
Nov.17 1917	Moderate albumin.
Nov.24,1917	Rabbit found dead in cage.

WEIGHT		AUTOPSY. (Gross)
Oct.27,1917	1770 Gm	No ascites. Kidney slightly swollen
Nov.10,1917	1690 Gm	and edematous looking. No cortical
Nov.16,1917	1705 Gm	depressions or pits - The capsule strips easily.

MICROSCOPIC.

There are no leucocytes and no pits. Many of the convoluted tubules, are plugged with debris and casts. The glomeruli show moderate congestion. No lymphocytic foci are present. The whole picture is one of acute uranium nephritis with little glomerular involvement.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 333.

Oct.27,1917.

Male Rabbit Weight 1810 G.

Oct.28,1917 Albumen negative.
Oct.28,1917 1 2 Milg. Ur. N.
Dec. 8,1917 Very heavy albumen.
Dec.13,1917 Rabbit died, no apparent cause. Urine at autopsy showed heavy albumen.

WEIGHT		AUTOPSY. Gross.
Oct.27,1917	1810 Gm.	No pits. Kidneys congested.
Dec. 8,1917	1710 Gm.	No ascites, and on section showed no macroscopic changes. Capsule strips easily.

MICROSCOPIC.

This shows acute injury with postmortem changes. Most of the convoluted tubules show degeneration, and the lumina are filled with exudate. The lumina are almost obliterated. Hyaline casts are seen.

The glomeruli show changes which may be due to postmortem changes In same we have necrosis, with pyknosis.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 343.

Nov.5,1917.

Male Rabbit Weight 2240 G.

Nov.6,1917 Albumin Negative.
Nov.7,1917 Left kidney exposed - surface smooth.
Nov.14,1917 Albumin negative.
Nov.14,1917 1 4 Milg Ur. N.
Nov.14,1917 Heavy albuin.
Nov.24,1917 Rabbit found dead.

WEIGHTS

Nov. 3,1917 2240 Gm.
Nov.13,1917 1765 Gm.

AUTOPSY.

White spots in liver and other organs. Kidney swollen and red and edematous-like, no cortical depressions or pits. Capsule strips easily.

MICROSCOPICALLY.

The tubules whow the most injury. There is actual degeneration of and necrossi of the tubular epithelium. There is also actual injury to the glomeruli with degenerative change - which may come in postmortem. Casts are present in the tubules. There are no pits or leucocytes.

Acute Nephritis - 10 days.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 344.

Male Rabbit. Weight 2640 G.

Nov.3,1917	Albumen negative.
Nov.7,1917	Operated, kidney surface smooth, no pits.
Nov.14,1917	Albumen negative.
Nov.17,1917	Albumen negative.
Nov.17,1917	1 32 Milg. Ur. Nitrate by hypo.
Nov.19,1917	Moderate albumen.
Nov.25,1917	Skight albumen.
Dec. 8,1917	Moderate albumen.
Dec.18,1917	Rabbit had broken its two front feet, was etherlized and killed.

WEIGHTS		AUTOPSY. Gross.
Nov.3,1917	2640 Gm.	Kidney was practically normal.
Nov.13,1917	2010 Gm.	Capsule strips easily. No pits
Dec. 8,1917	2400 Gm.	or ascites.

MICROSCOPIC.

This section does not show much change other than a mild acute nephritis. There are casts in the tubules, and many of the lumina are filled with debris.

No pits or lymphacytic foci are seen. The glomeruli look quite normal. The blood vessels are normal.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 381.

Dec. 11,1917.

Male Rabbit. Weight 1500 G.

Dec.13,1917 Slight albumen.
Jan. 8,1918 Moderate albumen.
Jan. 8,1918 3 Milg Ur. N.
Jan.10,1918 Very heavy cloudy albumen.
Jan.15,1918 Rabbit died.

WEIGHT		AUTOPSY. Gross.
Dec.11,1917	1500 Gm	No ascite, large swollen, reddish, congested kidney. On cut surface edematous and red. Capsule strips easily.
Jan. 9,1918	1620 Gm	

MICROSCOPIC.

This section shows one small focus of lymphocytes and evidence of a very early spontaneous lesion. The convoluted tubules are decreased in size, the lumina are closed.and There are not many necrotic tubules. Cast and plugs of debris fill up the lumina. The glomeruli are not badly injured. There is no connective tissue change.

Acute Nephritis 5 days.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 384.

Dec.13,1917.

Male Rabbit Weight 1700 G.

Dec. 13,1917 Moderate albumen.
Jan. 8,1918 Albumen negative.
Jan. 8,1918 2 Milg Ur. N. by hypo.
Jan. 10, 1918 Very heavy albumne.
Jan. 15,1918 Rabbit died.

WEIGHTS

Jan. 9,1918 1700 Gr
Jan. 15,1918 1550 Gr

AUTOPSY.
Gross.

No pits. Kidney surface smooth very swollen, and congested. and edematous. Cloudy swelling. Capsule strips normally.

MICROSCOPIC.

Section made. There is one large focus of lymphocytes and several smaller ones. The large convoluted tubules are decreased in sixe, and the lumina closed. There are no pits. There are only a very few necrotic tubules. Many hyaline casts are seen in the tubules. The glomeruli are congested, but otherwise look quite normal. The picture is one of acute nephritis superimposed upon a kidney which already has spontaneous lesions.

Acute Nephritis - 7 days.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 44

Feb. 7,1918.

Male Rabbit. Weight 1860 G. SPONT. NEPHRITIS.

Feb. 8,1918 Albumen neg.
Feb. 22,1918 Operated - Pitted kidneys found, Nephrectomy - left kidney removed and pits examined.
Mar. 4,1918 Very heavy albumin.

WEIGHTS		AUTOPSY Gross	MICROSCOPIC
Feb. 8,1918	1860 Gm.		
Mar. 4,1918	1620 Gm.	Pitted kidney	Section made.

MICROSCOPIC.

Section through an area showing fat shows a wedge shaped depression with lymphocytic infiltration and some deeper stained nuclear cells of the tubules showing stages of atrophy. The glomeruli in the scarred region are shunken and small.

This is a typical spontaneous lesion.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 318.

Male Rabbit Weight 2090 G.

Oct. 15,1917	Urine tested, albumen negative.
Oct. 17,1917	Operated, kidney surface found smooth, no pits.
Oct. 17,1917	Albumen negative
Oct. 27,1917	1 4 Milg Ur. Nit. by hypo.
Nov. 2,1917	Moderate albumen.
Nov.10,1917	Albumen negative
Nov.10,1917	1 4 Milg Ur. Nit. by hypo.
Nov.13,1917	Heavy albumen.
Nov.26,1917	Moderate albumen
Dec. 5,1917	Heavy albumen
Dec. 6,1917	Animal found dead, kidney removed at once. Put in fixing fluid.

WEIGHTS		AUTOPSY Gross.
Oct.13,1917	2090 Gm	Swollen, red kidney, capsule
Oct.26,1917	2000 Gm	quite tense. No edema or ascites.
Oct.21,1917	2025 Gm	No pits. Kidney surfaces smooth.
Nov. 3,1917	1810 Gm	
Nov. 7,1917	1830 Gm	

MICROSCOPIC.

The section shows no chronic lesions. No lymphocytic foci, and no pits are seen.

Occasional hyaline casts are seen in the tubules. The lumen of some of the tubules are obliterated.

LABORATORY RECORD OF ANIMAL EXPERIMENT No. 393.

Dec. 14,1917

Male Rabit Weight 2060 G

Dec. 14,1917	Albumen negative
Jan. 2,1917	Operated, kidney surface smooth.
Jan. 8,1918	Albumen negative
Jan. 8,1918	1 4 Milg Ur. N.
Jan. 9,1918	Very heavy albumen.
Jan. 12,1918	1 8 Milg. Ur. N.
Jan. 21,1918	Albumen negative
Feb. 3,1918	Albumen negative (Faulty technique)
Feb. 3,1918	1 8 Milg. Ur. N.
Feb. 9,1918	Animal died.

WEIGHTS		AUTOPSY.	MICROSCOPIC
Dec. 20,1917	2060 Gm	No ascites, kidneys swollen	Section made
Jan. 9,1918	2060 Gm	and congested, on cut surface	
Jan. 1,1918	2090 Gm	looked red and edematous No	
Feb. 3,1918	2125 Gm	pits or cortical depressions.	

MICROSCOPIC

The kidney shows no pits or chronic lesions. One small focus of lymphocytes is seen. Hyaline casts and albumen in the tubules. The glomeruli are relatively uninjured. No calcium deposits.

Chronic Kidney 1 month.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 45.

Feb. 7, 1918.

Female Rabbit Weight 2230 G

Feb. 8, 1918 Albumen Negative.
Feb. 22, 1918 Operated, kidney surface smooth, Nephrectomy - left kidney removed and surface smooth. Sections made for a control.
Mar. 4, 1918 1 4 Milg Ur. N.
Mar. 4, 1918 Albumen Negative
Mar. 6, 1918 Very heavy albumen cloud
Mar. 12, 1918 1 4 Milg Ur. N.
Mar. 16, 1918 Rabbit died.

WEIGHTS		AUTOPSY Gross	MICROSCOPIC.
Feb. 7, 1918	2230 G.	Kidney surface smooth	Section made
Mar. 4, 1918	2140 G.	No ascutes - swollen, congested kidney. On cut section looked red and edematous.	

MICROSCOPIC
Control

The section shows only normal kidney structure throughout. No spontaneous lesions present.

Uranium Kidney Section.

One small focus of lymphocytes situated at the cortico-medullary junction. No chronic changes are observed.

The tubules are filled with casts and albumen. The glomeruli show no change.

This shows control.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 7.

Jan. 9,1918.

Male Rabbit Weight 2200G.

Jan.11 1918	Albumin Negative
Jan.12 1918	Operated - kidney surface smooth.
Jan.21 1918	Albumin Negative.
Jan.23 1918	1 8 Milg. Ur. N.
Feb. 2 1918	Moderate heavy albumen cloud
Feb. 2 1918	1 8 Milg Ur. N.
Feb.12 1918	Moderate heavy albumin
Feb.19 1918	1 8 Milg Ur. N.
Feb.21 1918	Heavy albumin
Mar.2 1918	1 8 Milg Ur. N.
Mar.9 1918	1 4 Milg Ur. N.
Mar.12 1918	1 3 Milg Ur. N.
Mar.16 1918	Heavy albumin
Mar.19 1918	Rabbit died.

WEIGHT		AUTOPSY. Gross.
Jan. 9 1918	2200 Gm.	Kidney swollen, surface smooth,
Feb. 2 1918	2095 Gm.	cut section looked red and contested.
Feb.19 1918	2055 Gm.	No ascites. No pits, no cortical de-
Mar. 2 1918	2120 Gm.	pressions. Capsule strips easily and cur-
Mar. 9 1918	1770 Gm.	tex looked paler than medulla.

MICROSCOPIC.

Many of the tubules were plugged with casts and debris. No pits were seen, and no necrosis. There were a few lymphocytic foci present in cortex as well as medulla. There were large numbers of hyaline casts in the tubules. The glomeruli were relatively normal.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 9

Jan. 9,1918.

Male Rabbit Weight 2125 G.

Jan. 11,1918	Albumen Negative
Jan. 12,1918	Operated - slight evidence of pitting on kidney surface, one small pit. Nephrectomy was performed and sections made for control. Section made thru a contraction share or pit to show evidence of spontaneous chronic nephritis because there was a definite pit.
Jan.23,1918	Albumen negative (probably faulty Ur. N.)
Jan. 23,1918	1 8 Milg Ur. N.
Jan. 31,1918	Albumen Negative (probably faulty Ur. N.) (or technique of injury).
Feb.21,1918	1 8 Milg Ur.N.
Feb. 9,1918	Slight Albumen
Feb. 9,1918	1 8 Milg Ur. N.
Feb.19,1918	1 4 Milg Ur. N.
Feb.21,1918	Moderate albumen
Mar.2,1918	1 8 Milg Ur. N.
Mar.9,1918	1 4 Milg Ur. N.
Mar. 12,1918	1 8 Milg Ur. N. (fresh)
Mar. 16,1918	1 16 Milg Ur. N.
Mar. 19,1918	Very heavy albumin.
Mar. 20,1918	Rabbit died - Autopsy.

Weight	Autopsy. Gross.	Microscopic
Jan. 9,1918 2125 Gm.	No ascites - kidney surface	
Feb. 2 1918 2130 Gm.	smooth - no pits - kidney was	
Feb.19 1918 2060 Gm.	swollen and congested - on cut	
Mar. 2 1918 1900 Gm.	section looked swollen or con-	Section made
Mar. 9 1918 1900 Gm.	gested - edematous. Capsule strips easily.	

MICROSCOPIC.

The section thru the pit showed a very small area of spontaneous nephritis, otherwise the kidney tissue was normal. The other kidney which had been intoxicated with uranium showed no evidence at all of any chronic lesion. No pits or no lymphacytic foci were present. Hyaline casts in the tubules. Glomeruli were normal.

Control Nephrectomy.

LABORATORY RECORD OF ANIMAL EXPERIMENT No. 392.

Dec.14,1917

Male Rabbit Weight 1580 G

Dec.14,1917 Albumin negative.
Jan. 2,1918 Operated - kidney surface smooth.
Jan. 6,1918 Albumin negative
Jan. 8,1918 1/8 Milg Ur. N. by hypo.
Jan.10,1918 Albumin positive
Jan.12,1918 1/8 Milg Ur. N.
Jan.20,1918 Albumin Negative
Jan.23,1918 1/16 Milg Ur. N. (Fresh)
Feb. 2,1918 Albumin slight
Feb. 4,1918 1/8 Milg Ur. N.
Feb. 9,1918 Moderate albumin
Feb. 9,1918 1/4 Milg Ur. N.
Feb.19,1918 1/8 Milg. Ur. N.
Feb.21,1918 Moderate albumin - heavy
Mar. 2,1918 1/4 Milg Ur. N.
Mar. 9,1918 1/4 Milg Ur. N.
Mar.12,1918 1/8 Milg Ur. N.
Mar.16,1918 1/16 Milg Ur. N.
Mar. 23,1918 1/8 Milg Ur. N.
Apr. 3,1918 1/8 Milg Ur. N.
Apr. 9,1918 Very heavy albumin
Apr. 13,1918 1/8 Milg Ur. N.
Apr. 25,1918 Heavy albumin cloud
Apr. 29,1918 1/8 Milg Ur. N.
May 4,1918 Heavy albumin cloud
May 7,1918 1/8 Milg Ur. N.
May 13,1918 1/8 Milg. Ur. N.
May 18,1918 Heavy albumin
May 24,1918 1/8 Milg Ur. N.
May 27,1918 1/8 Milg Ur. N.
June 3,1918 1/8 Milg Ur. N.
June 8,1918 Heavy albumin
June 9,1918 1/8 Milg Ur. N.
June15,1918 Animal killed and autopsied.

WEIGHTS

Dec.30,1917 1580 Gm.
Jan. 9,1918 1780 Gm.
Jan.18,1918 1840 Gm.
Feb. 2,1918 1820 Gm.
Feb.19,1918 1850 Gm.
Mar. 2,1918 1790 Gm.
Mar.23,1918 1785 Gm.
Apr. 4,1918 1716 Gm.
Apr.13,1918 1780 Gm.
Apr.29,1918 1720 Gm.
May 7 ,1918 1795 Gm.

AUTOPSY

Gross

Kidney surface smooth. No pits or depressions of cortex. Capsule strips normally. Cortex looks paler than medulla.

EXPERIMENT No. 392 Cont.

WEIGHTS.

May 13,1918	1834 Gm
May 24,1918	1850 Gm
June 3,1918	1680 Gm
June 9,1918	1690 Gm

MICROSCOPIC.

There are no gross interstitial chronic changes. No pits. No marked infiltration. There are only a few small scattered foci of lymphocytic infiltration at the cortico medullary junction. The tubules are not badly damaged. A few hyaline casts are seen. Glomeruli are quite normal.

Six months Chr. Kidney.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 332.

Oct. 27,1917 Male Rabbit Weight 1800 G.

Oct.28,1917	Albumen negative - kidneys exposed, & surface smooth.
Dec. 8,1917	Albumen Neg.
Dec.18,1917	Albumen Neg.
Dec.18,1917	1 8 Milg Ur. N.
Jan. 2,1918	Albumen Positive
Jan. 5,1918	1 8 Milg Ur. N.
Jan.18,1918	Albumen Neg.
Jan.12,1918	1 8 Milg Ur. N.
Jan. 13,1918	Operated - kidney surface smooth.
Jan.20,1918	Albumen Neg. (Exp. by faulty Decomposition)
Jan.28,1918	1 16 Milg Ur. N.
Jan.31,1918	Moderate heavy albumen cloud
Feb. 2,1918	1 8 Milg Ur. N.
Feb. 9,1918	1 8 Milg. Ur. N.
Feb. 9,1918	Moderate albumen
Feb.18,1918.	1 4 Milg Ur. N.
Feb.21,1918	Moderate heavy albumen cloud
Mar. 2,1918	1 8 Milg Ur. N.
Mar. 9,1918	1 4 Milg Ur. N.
Mar.12,1918	1 8 Milg Ur. N.
Mar.16,1918	1 16 Milg Ur. N.
Mar.21,1918	Heavy albumen
Mar.23,1918	1 8 Milg Ur. N.
Apr. 3,1918	1 8 Milg Ur. N.
Apr. 5,1918	Very heavy albumen
Apr.13,1918	1 8 Milg Ur. N.
Apr.18,1918	Rabbit died.

WEIGHTS		AUROPSY. Gross
Oct. 27,1917	1800 Gm	No ascites + kidney surfaces
Dec. 8,1917	1840 Gm	smooth and organs normal. Kidney
Jan. 9,1918	1750 Gm	looked swollen and congested. On
Jan. 18,1918	1740 Gm	cut section was swollen edematous
Feb. 2,1918	1750 Gm	and Bl.V. Congested. No pits or
Feb. 19,1918	1820 Gm	depressions.
Mar. 2 1918	1710 Gm	
Mar. 23,1918	1680 Gm	
Apr. 4,1918	1466 Gm	
Apr. 13,1918	1280 Gm	

MICROSCOPIC.

The tubules are dilated and contain many casts. There are no lymphocytic foci or infiltration in any part of the kidney. Some of the tubules show beginning dilitation, plugged with casts and debris and atrophy. May hyaline casts, but no areas of calcification are seen.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 320

Oct. 13,1917. Female Rabbit Weight 2150 G.

Oct. 15,1917	Albumen negative.
Oct. 20,1917	Kidney exposed - surface smooth.
Nov. 1,1917	Albumen negative - 1 8 Ur. N.
Nov. 10,1917	Slight albumen.
Nov. 17,1917	Slight albumen.
Dec. 12,1917	Slight albumen
Dec. 18,1917	Slight albumen
Dec. 18,1917	1 8 Milg Ur. N. by hypo.
Jan. 5,1918	Very slight albumen
Jan. 5,1918	1/4 Milg Ur. N.
Jan.12,1918	Albumen Neg.
Jan.12,1918	1/4 Milg Ur. N.
Jan.20,1918	Albumen negative
Jan.23,1918	Albumen negative.
Jan.23,1918	1/8 Milg Ur. N.
Jan.31,1918	Heavy albumen cloud
Feb. 2,1918	1/8 Milg Ur. N.
Feb. 9, 1918	1/8 Milg Ur. N.
Feb. 9,1918	Heavy albumen cloud
Feb. 19,1918	" " "
Feb. 19,1918	1/4 Milg. Ur. N.
Mar. 2,1918	1/8 Milg Ur. N.
Mar. 6,1918	Definite albumen positive
Mar. 9,1918	1/8 Milg Ur. N.
Mar.12,1918	1/8 Milg Ur. N. (fresh)
Mar.16,1918.	1/16 Milg Ur. N. "
Mar.17,1918	Very heavy albumen
Mar.21,1918	Heavy albumen
Mar.23,1918	1/16 Milg Ur. N.
Apr. 3,1918	1/8 Milg Ur. N.
Apr. 6,1918	Very heavy albumen
Apr.15,1918	Animal died.

WEIGHTS		AUTOPSY. Gross	Microscopic
Oct.13,1917	2160 Gm.	No ascites - kidney surface smooth	Section made
Oct.20,1917	2155 Gm.	Cut section looked swollen and con-	
Nov. 3,1917	2025 Gm.	gested. No pits. Capsul strips	
Nov. 7,1917	2095 Gm.	easily.	
Nov.15,1917	1500 Gm.		
Dec. 6,1917	1720 Gm.		
Jan. 9,1918	1645 Gm.		
Jan.18,1918	1850 Gm.		
Feb.19,1918	1850 Gm.		
Mar. 2,1918	1856 Gm.		
Mar.23,1918	1366 Gm.		
Mar. 9,1918	1640 Gm.		
Apr. 4,1918	1336 Gm.		

EXPERIMENT #320 Cont.

MICROSCOPIC.

There are multiple small foci of lymphocytes, with atrophy of the tubules in this region. The epithelium stains darker. The lesion corresponds to that of a spontaneous nephritis. Not many casts are seen in the tubules. The glomeruli look normal.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 336.

Oct.28,1917

Male Rabbit Weight 2020 G.

Nov.1,1917	Albumin negative
Nov.7,1917	Kidney exposed; surface smooth
Nov.14,1917	Traces of albumin
Nov.17,1917	Moderate albumin
Nov.17,1917	1/64 Milg. Ur. N.
Nov.19,1917	Moderate Albumin
Nov.26,1917	Slight albumin
Dec. 8,1917	Albumin negative
Dec. 8,1917	1/8 Milg Ur. N.
Jan.2,1918	Albumin positive
Jan.6,1918	1/8 Milg Ur. N.
Jan.20,1918	Albumin neg.
Jan.23,1918	1/8 Milg Ur. N. (Fresh)
Jan.31,1918	Heavy albumin cloud
Feb. 2,1918	1/8 Milg Ur. N.
Feb. 9,1918	Moderate albumin cloud
Feb. 9,1918	1/8 Milg. Ur. N.
Feb.19,1918	1/4 Milg. Ur. N.
Feb.21,1918	Heavy albumin
Mar. 2,1918	1/8 Milg. Ur. N.
Mar. 9,1918	1/8 Milg Ur. N. (fresh).
Mar.12,1918	1/8 Milg Ur. N.
Mar.16,1918	1/16 Milg Ur. N.
Mar.18,1918	Heavy albumin
Mar.23,1918	1/16 Milg. Ur. N.
Apr. 3,1918	1/8 Milg. Ur. N.
Apr. 6,1918	Very heavy albumin cloud
Apr.13,1918	1/8 Milg Ur. N.
Apr.24,1918	Slight albumin
Apr.29,1918	1/8 Milg Ur. N.
May 4,1918	Heavy albumin
May 7,1918	1/8 Milg Ur. N.
May 13,1918	1/8 Milg Ur. N.
May 18,1918	Heavy albumin
May 24,1918	1/8 Milg. Ur. N.
May 27,1918	1/8 Milg. Ur. N.
June 3,1918	1/8 Milg Ur. N.
June 8,1918	Heavy albumin
July 1,1918	Heavy albumin
July 5,1918	Rabbit killed and autopsied.

WEIGHT		AUTOPSY
		Gross
Oct. 28,1917	2020 G.	Kidney suffface smooth - no pits.
Nov. 13,1917	2010 G.	Kidney looks swollen and edematous.
Dec. 8,1917	2130 G.	Capsule strips readily.
Jan. 9, 1918	2410 G.	
Jan. 18,1918	2460 G.	
Feb. 2,1918	2400 G.	
Feb. 18,1918	2360 G.	
Mar. 2,1918	2330 G.	

EXPERIMENT 336 Cont.

Weights.

Mar.9,1918 2300 Gm
Mar.23,1918 2234 Gm
Apr. 4,1918 2196 Gm
Apr.13,1918 2110 Gm
Apr.29,1918 2220 Gm
May 7, 1918 2290 Gm
May 13,1918 2360 Gm
May 24,1918 2290 Gm
June 3,1918 2244 Gm

MICROSCOPIC.

This shows one small lesion, wedge-shaped composed of dilated tubules and atrophic tubules. The atrophic tubules are smaller and more deeply stained than normal. At the apex of the wedge there is ammulation of lymphocytes.

This is a typical spontaneous lesion. Practically all of the other kidney tissue is normal in appearance. The glomeruli appear normal.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 304.

Oct. 2,1917. Male Rabbit Weight 1730 G.

Oct. 3,1917	Albumen Negative
Oct. 4,1917	Albumen Neg.
Oct.13,1917	Operated - kidney surface smooth.
Oct.14,1917	1/6 Milg Ur. N.
Nov.10,1917	Moderate albumen.
Nov.17,1917	Moderate albumen.
Nov.25,1917	Slight albumen.
Dec. 8,1917	Moderate albumen.
Dec.18,1917	Slight albumen.
Dec.18,1917	1/8 Milg Ur. N.
Jan. 2,1918	Albumen Positive
Jan. 5,1918	1/8 Milg Ur. N.
Jan.12,1918	Albumen Positive
Jan.20,1918	Albumen Negative (faulty Urine decomp.)
Jan.23,1918	Albumen Neg.
Jan.23,1918	1/16 Milg. Ur. N. (fresh product)
Feb. 2,1918	Moderate albumen.
Feb. 2,1918	1/8 Milg. Ur. N.
Feb. 9,1918	Albumen Moderate cloud.
Feb. 9,1918	1/8 Milg. Ur. N.
Feb.19,1918	1/8 Milg Ur. N.
Feb. 21,1918	Moderate heavy albumen.
Mar. 2,1918	1/8 Milg Ur. N.
Mar. 9,1918	1/8 Milg Ur. N.
Mar.12,1918	1/8 Milg Ur. N. (Fresh).
Mar.16,1918	1/16 Milg Ur. N.
Mar.23,1918	1/16 Milg Ur. N.
Apr. 3,1918	1/8 Milg Ur. N.
Apr.24,1918	Moderate heavy albumen.
Apr.29,1918	1/8 Milg Ur. N.
May 4,1918	Positive albumen cloud
May 7,1918	1/8 Milg. Ur. N.
May 13,1918	1/8 Milg. Ur. N.
May 18,1918	Heavy albumen +++
May 24,1918	1/8 Milg Ur. N.
May 27,1918	1/8 Milg. Ur. N.
June 3,1918	1/8 Milg. Ur. N.
June 8,1918	Very heavy albumen
June 29,1918	Very heavy albumen
July 1,1918	" " "
July 1,1918	PSP 30-35%.
July 1,1918	Animal killed and autopsied. Kidneys markedly contracted. Appearance of advanced spontaneous lesion (Bell).

Experiment No. 304 con't.

WEIGHTS		AUTOPSY. Gross.
Oct. 2,1917	1730 Gms.	Kidneys were both markedly pitted
Oct.13,1917	1650 Gms.	and contracted - had the appearance
Nov. 3,1917	1860 Gms.	of a chronic spontaneous nephritis.
Nov. 7,1917	1855 Gms.	Culture of this showed streptococcus.
Nov.16,1917	1730 Gms.	
Dec. 8,1917	1745 Gms.	
Jan. 9,1918	1645 Gms.	
Jan.18,1918	1720 Gms.	
Feb. 2,1918	1760 Gms.	
Feb.19,1918	1740 Gms.	
Mar. 2,1918	1780 Gms.	
Apr. 4,1918	1580 Gms.	
Apr.13,1918	1526 Gms.	
Apr.29,1918	1560 Gms.	

MICROSCOPIC.

There are wedge shaped areas of atrophy along cortex margin. The tubules in this wedge shaped area show early atrophy. The atrophic tubules are smaller and more darkly stained than normal, and their lumens are small or nearly completely obliterated. There are anumulations of lymphocytes at apical position of the wedge.

From the study this is a definite focal nephritis, ~~and not a diffuse~~

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 41.

Male Rabbit Weight 2020 Gm.

Feb.8, 1918	Albumen negative
Feb.21,1918	Operated kidney surface smooth.
Mar.4, 1918	1/4 Milg Ur. N.
Mar.12,1918	1/8 Milg Ur. N.
Mar.21,1918	Heavy albumen.
Mar.23,1918	1/8 Milg Ur. N.
Apr. 3,1918	1/8 Milg Ur. N.
Apr. 6,1918	Very heavy albumen.
Apr.13,1918	1/8 Milg Ur. N.
Apr.14,1918	Moderate albumen.
Apr.29,1918	1/8 Milg Ur. N.
May 4,1918	Albumen cloud
May 7,1918	1/8 Milg Ur. N.
May 13,1918	1/8 Milg Ur. N.
May 18,1918	Heavy albumen
May 24,1918	1/8 Milg Ur. N.
May 27,1918	1/8 Milg Ur. N.
June 3,1918	1/8 Milg Ur. N.
June 8,1918	Heavy albumen
June 10,1918	Animal killed and autopsied.

WEIGHTS		AUTOPSY.
		Gross ly
Feb.7,1918	2020 Gm.	Kidneys were slight swollen, con-
Mar.23,1918	1960 Gm.	gested and red. No pitting or scarring
Apr.4,1918	2010 Gm.	Peritoneal and sapsule are normal.
Apr.13,1918	1910 Gm.	
Apr.29,1918	1920 Gm.	
May 7,1918	2044 Gm.	
May 13,1918	2080 Gm.	
May 24,1918	2090 Gm.	
June 3,1918	2066 Gm.	
June 9,1918	2010 Gm.	

June10,1918 Animal killed, autopsied and microscopic sections made.

MICROSCOPIC

The sections show a few scattered foci of lymphocytes similar to those found in spontaneous nephritis. Hyaline casts in the collecting tubules. The lumen of many tubules are obliterated. There are no gross chronic lesions. The glomeruli look quite normal.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 43.

Feb.17,1918.

Female Rabbit Weight 2440 G.

Feb.8,1918 Albumen negative.
Feb.22,1918 Operated, Nephrectomy, left kidney removed. surface smooth Sections made for control.
Mar. 4,1918 Very slight albumen
Mar.21,1918 Albumen negative
Mar.23,1918 1/8 Milg. Ur. N.
Apr. 3,1918 1/8 Milg. Ur. N.
Apr. 6,1918 Moderate heavy albumen.
Apr.13,1918 1/8 Milg Ur. N.
Apr.24,1918 Slight albumen
Apr.29,1918 1/8 Milg Ur. N.
May 4, 1918 Moderate albumen cloud
May 7, 1918 1/8 Milg Ur. N.
May 13,1918 1/8 Milg. Ur. N.
May 27,1918 1/8 Milg Ur. N.
June 3,1918 1/8 Milg.Ur. N.
June 8,1918 Albumen heavy +++
June 5,1918 Rabbit killed and autopsied.

WEIGHTS		Autopsy. Gross.
Feb.7,1918	2440 G.	No evidence of chronic nephritis.
Mar.23,1918	2090 G	Kidneys appear normal. No pits or
Apr.4,1918	2076 G	depressions. Capsule is normal.
Apr.13,1918	2066 G	
Apr.29,1918	2100 G	
May 7, 1918	2116 G	
May 13,1918	2250 G	
May 24,1918	2210 G	
June 3,1918	2184 G	
June 9,1918	2220 G	

MICROSCOPIC.

The microscopic picture of the control kidney with normal tubules and glomeruli.

In the injured kidney, the sections show no gross changes and no lymphocytic infiltration. There are hyaline casts and albumin. Many of lumen of the tubules are packed full of debris. There is nothing in the picture to indicate chronic lesions.

Nephritomy.

LABORATORY RECORD OF ANIMAL EXPERIMENT NO. 21.

Jan. 21,1918.

Male Rabbit Weight 2080 G.

Jan.23,1918	Albumin Neg. Operated - kidney surface smooth.
Feb. 3,1918	Albumin Neg.
Feb. 3,1918	1/8 Milg Ur. N.
Feb. 9,1918	Heavy albumin cloud
Feb. 9,1918	1/8 Milg Ur. N.
Feb.21,1918	Heavy albumin
Mar. 2,1918	1/8 Milg Ur. N.
Mar. 9,1918	1/4 Milg Ur. N.
Mar.12,1918	1/8 Milg Ur. N. (Fresh)
Mar. 19,1918	Very heavy albumin cloud
Mar.23,1918	1/8 Milg Ur. N.
Apr. 3,1918	1/8 Milg Ur. N.
Apr. 6 1918	Very heavy albumin
Apr. 12,1918	1/8 Milg Ur. N.
Apr. 29,1918	1/8 Milg Ur. N.
May 4, 1918	Heavy albumin
May 7, 1918	1/8 Milg. Ur. N.
May 10,1918	Animal killed and autopsied and section made.

WEIGHT

Jan. 21 1918	2080 Gm.
Feb. 3 1918	1885 Gm.
Feb. 19 1918	1965 Gm.
Mar. 2 1918	1990 Gm.
Mar. 9 1918	1980 Gm.
Mar. 23 1918	1960 Gm.
Apr. 4 1918	1910 Gm.
Apr. 13 1918	1840 Gm.
Apr. 29 1918	1890 Gm.

AUTOPSY.

Gross

Kidneys were swollen, red and congested - No pitting. No. edema. Capsule strips readily

MICROSCOPIC.

No clronic lesions except an ocassional small foci of lymphocytic infiltration around the blood vessels, mild postmortem changes and the lumina of the tubules are closed, and have a homogenus appearance of large number of the tubules - with partial necrosis which may be due to postmortem change. No glomerular changes.

Plate I

Carol E. Young, del.

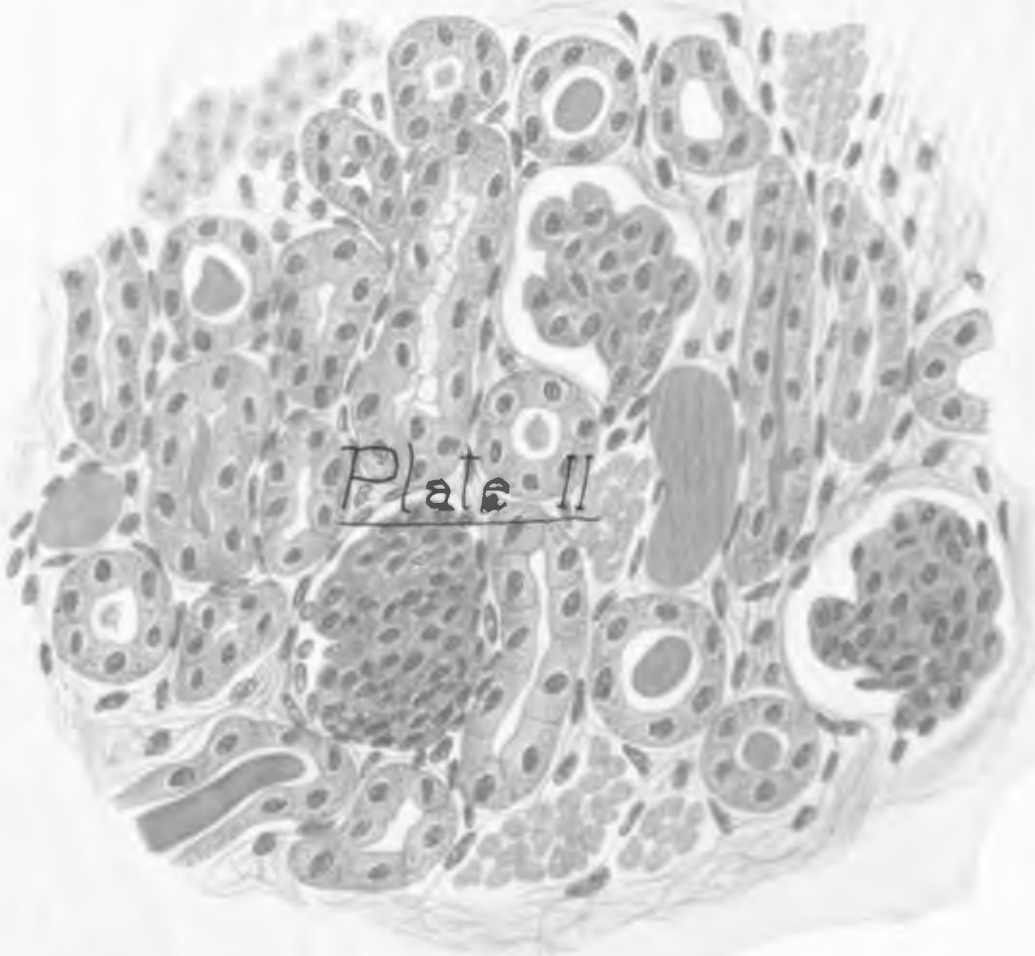
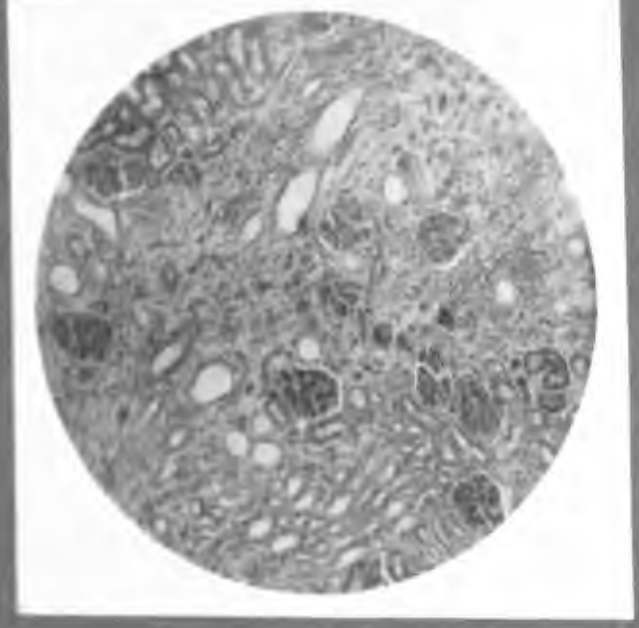
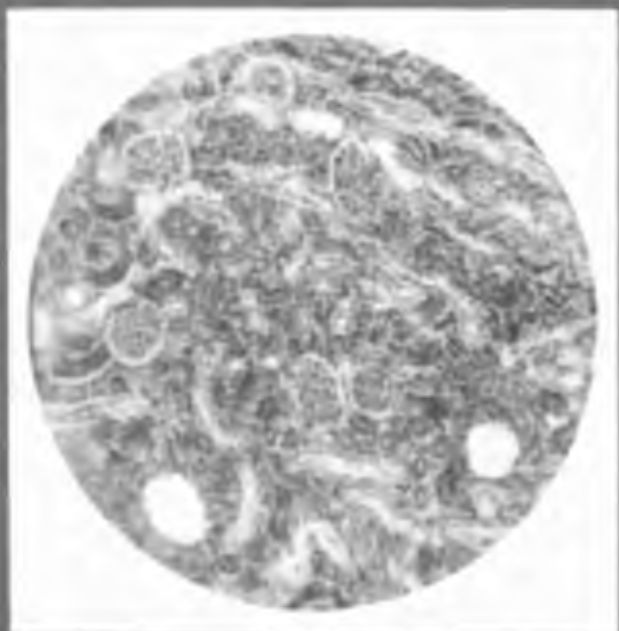


Plate II

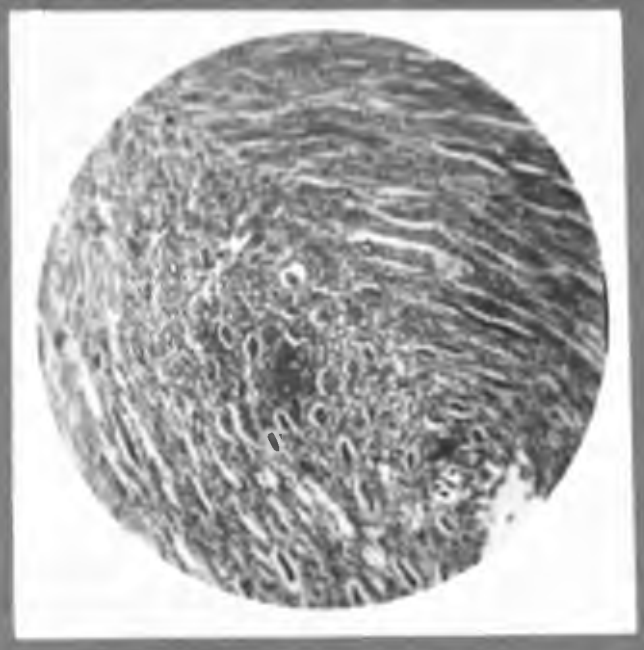
Carol E. Young, del.



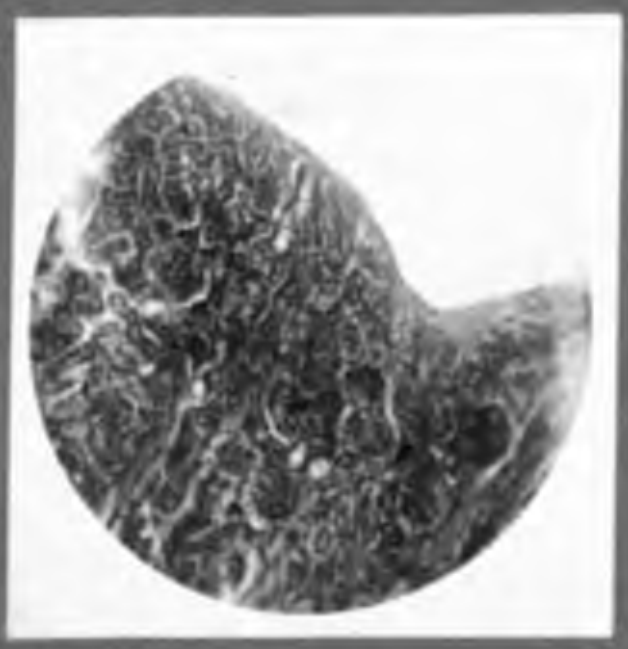
KIDNEY. RABBIT 336.
One small lesion - typical of spontaneous nephritis.



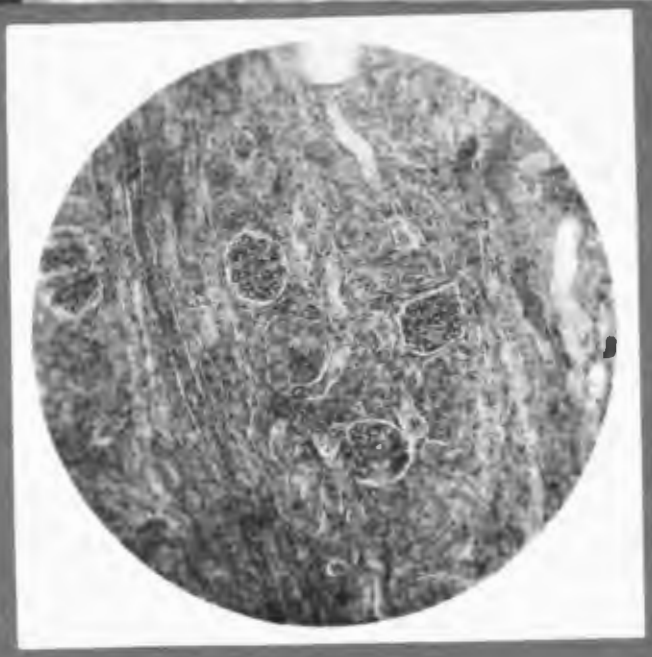
KIDNEY. RABBIT 336.
Lumina of tubules filled with casts.



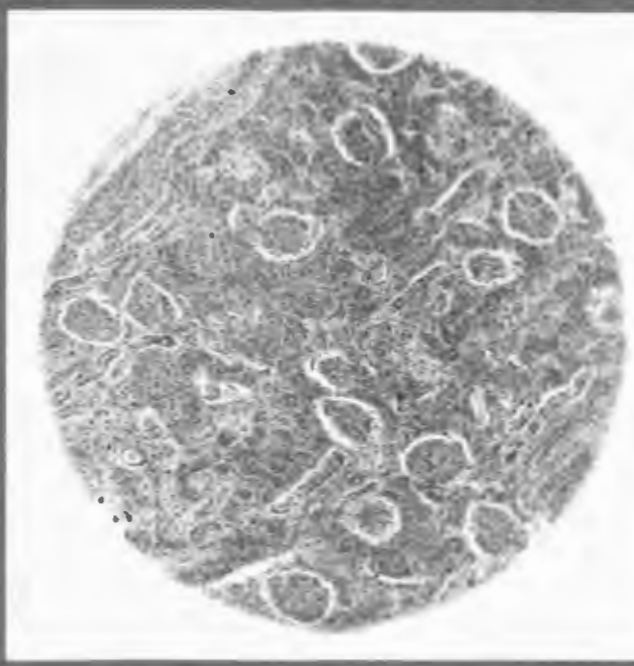
KIDNEY. RABBIT 320.
Small foci of lymphocytes
spontaneous lesions.



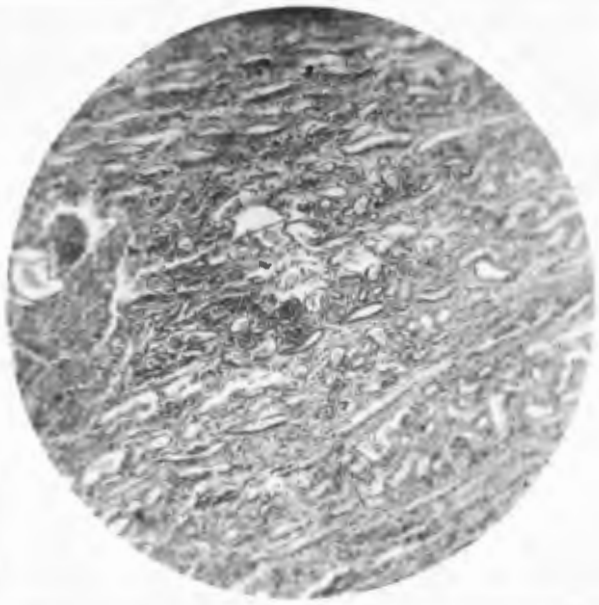
KIDNEY. RABBIT 304.
Shows a pit, a spontaneous
nephritis lesion.



KIDNEY. RABBIT 381.
Acute Uranium Nephritis.



KIDNEY. RABBIT 381.
Acute Uranium Nephritis.



KIDNEY. RABBIT 320.
Small foci of lymphocytes spontaneous lesions.