

X

Illustrations

of the Thesis.

The Malpighian bodies of the Kidney.

presented by

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for the degree of Doctor of Medicine, and as
a competitor for the Goodsir Memorial Fellow-

ship. + *Gunning Prize in Pathology.*

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March 1899.

INTRODUCTION.

The illustrations in this volume are photomicrographs of sections of kidneys prepared in the Pathological Laboratory. The greater part of them are taken from the Human foetal kidney, but others are from the kidneys of other of the Vertebrata, and a few illustrating some Human pathological changes have been added.

The series on development comprise all up to Fig. (23.) Of these the first two give a general outline of the arrangement of the various structures in the Kidney at the 4th and 6th months respectively. Figs. (3-10) show the development of a Malpighian body and

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its tubules at different stages, from its first appearance till its union with the Ureter branch. Figs. (11-23) have to do principally with the development of the Malpighian body. The photomicrographs have been taken from sections of Human kidneys of different ages, most are from the kidneys of a six months' foetus. Figs. (15-19) are from a 4 months' and Fig. (12) from an eight months' foetus.

The degree of development of a Malpighian body has no relation to the degree of development of the kidney as a whole. In every kidney the different stages can be seen, but in some they are more plain than in others. This depends partly on the state in which the specimen has been fixed, some material being better than others, and partly on the relative proportion of connective tissue and glandular elements present. The kidney at the 6th month is in a state of active growth, and its connective tissue is decreasing. I have found the best specimens illustrating the various stages in kidneys of that age.

Figs. (24-27) are illustrative of some points of interest in Comparative anatomy.

Descriptions below each figure are very incomplete, but full references are made in the text of the Thesis. The plates have been placed in a separate

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volume for the sake of convenience in reference from the text.

I have selected photomicrographs in preference to drawings because of their greater accuracy, the subject of development is usually illustrated by very diagramatic figures, which give no detail, and are more liable to misconstruction.

The photomicrographs have been taken by Mr. Richard Muir, and I have great pleasure in acknowledging my indebtedness to him for the trouble he has taken with them.

The slides & microscopic specimens have been left under the charge of Professor Greenfield in the Pathological Laboratory of the University. If necessary they can be obtained from him.

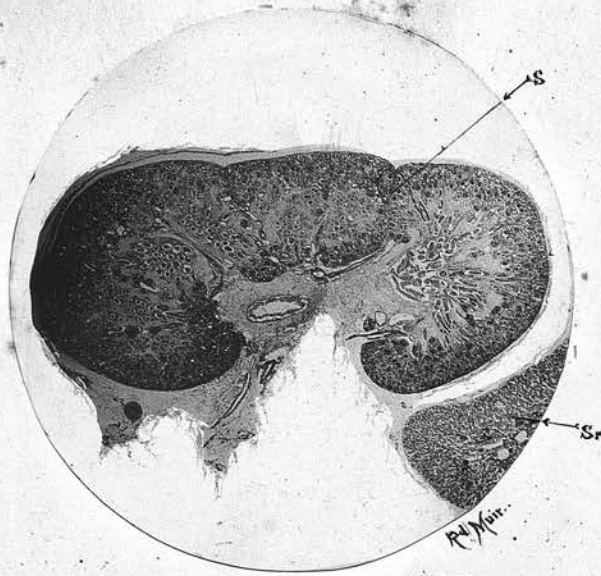


Fig 1.

Fig 1. Human Kidney. 4th month. x.8.

Division into lobules not yet well marked. Kidney consists almost entirely of Collecting tubules, Malpighian bodies and Connective tissue.
S. interlobular septum. Sr. Suprarenal.

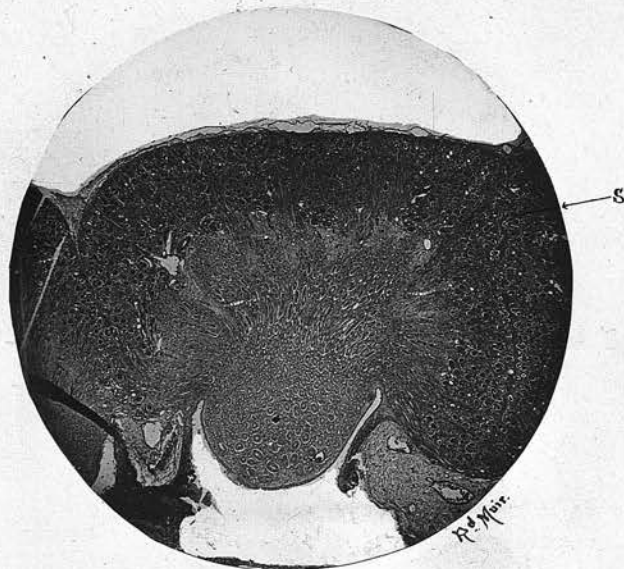


Fig 2.

Fig 2. Human Kidney. 6th month. x.9.

Lobules well marked & separated by mesoblastic septa. Cellular layer round the periphery is darkly stained & shows new formation taking place. Connective tissue still large in amount.

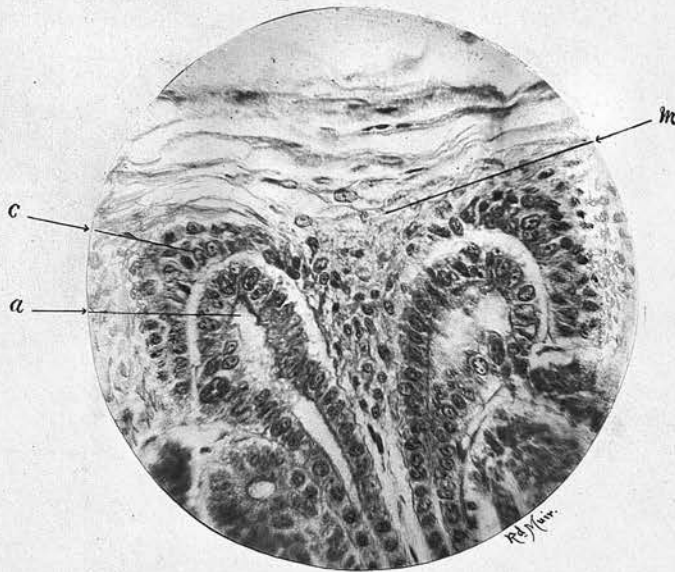


Fig 3.

Fig 3. Human Kidney. X 300.

Two ureter branches or collecting tubules end under the capsule in dilatations or Ampullae. Over them Cell Caps are forming.
 A. Ampulla. C. Cell Cap. M. Mesoblastic layer under capsule.

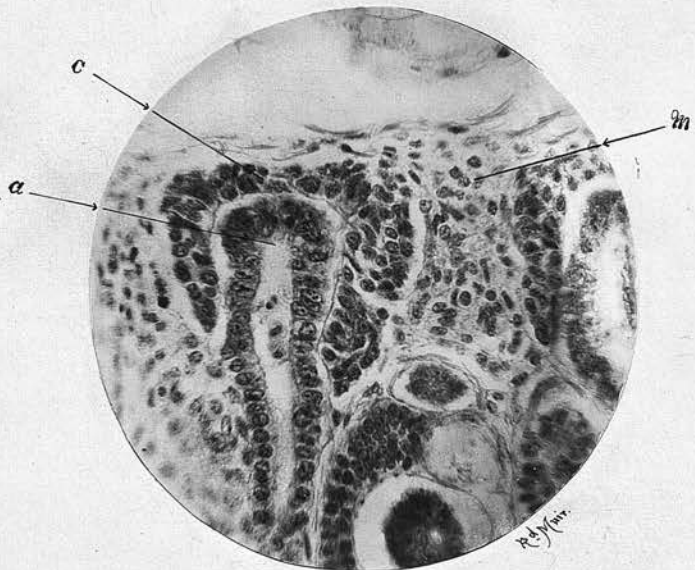


Fig 4.

Fig 4. Human Kidney. X 300.

Ureter branch ending in Ampulla. Cell cap over Ampulla is further developed, division is about to take place in the middle.
 A. Ampulla. C. Cell cap. M. Mesoblastic envelope

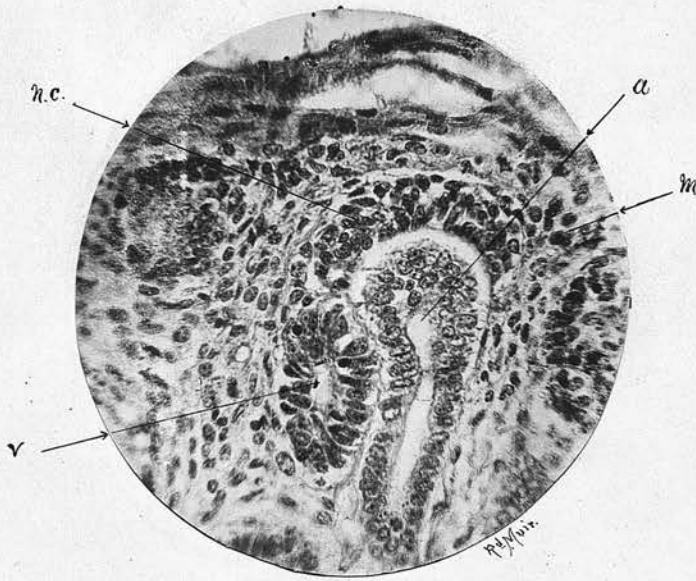


Fig 5.

Fig 5. Human Kidney. X 300.

Ureter branch ending in Ampulla cut obliquely. Cell cap of one side now forming a hollow vesicle. Vesicle renale. New Cell cap appearing. V. vesicle. n.c. new cell cap. a. Ampulla. m. Mesoblastic envelope.

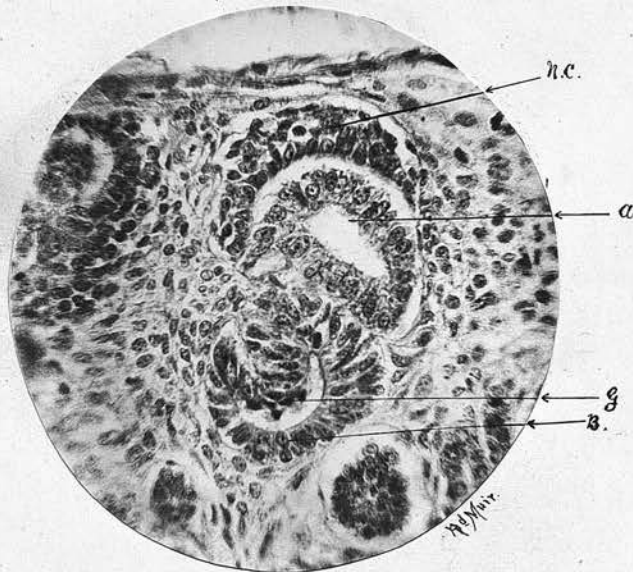


Fig 6.

Fig 6. Human Kidney. X 300.

The vesicle has become Comma shaped. Its lumen is split-like. The tail of the Comma directed upwards towards the capsule is the first appearance of the Malpighian body. G. becomes glomerulus. B. Bowman's capsule. a. Ampulla. n.c. new cell cap further developed.

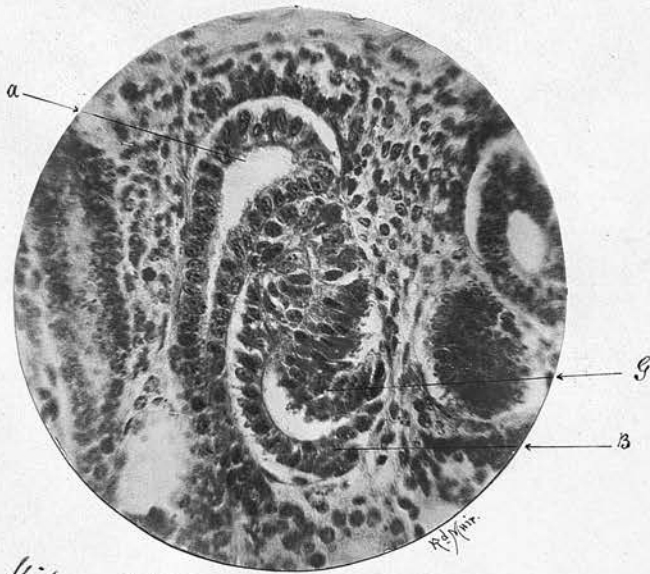


Fig 7.

Fig 7. Human Kidney. x 300.

The Comma shaped body has now begun to elongate + assume the shape of an S. Its lumen is not continuous with that of the ureter branch. The lower limb of the S is always turned away from the ureter branch + the upper limb towards it. The epithelium of Bowman's capsule has begun to flatten.

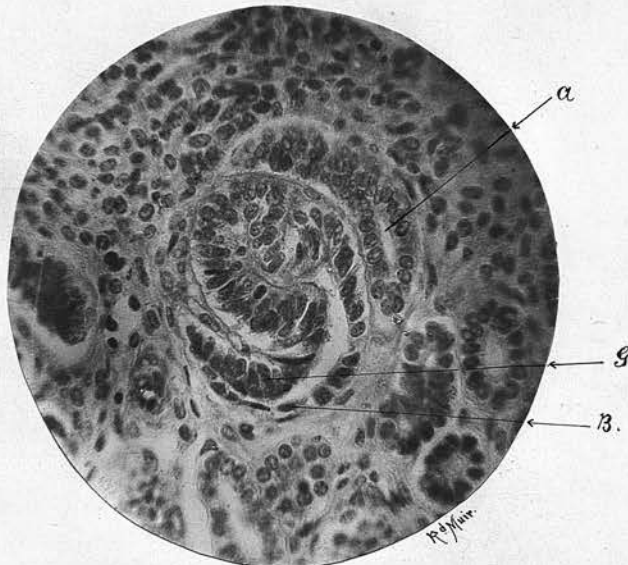


Fig 8.

Fig 8. Human Kidney. x 300.

One branch of the Ampulla only is shown cut obliquely, + curving round to its fullest extent. The shape of the new tubule is more distinctly an S. The flattening of cells in what becomes Bowman's capsule, + the thickening of cells in what becomes the glomerulus is well marked. Lumens are not yet continuous.

a. Ampulla. b. Bowman's capsule. g. glomerulus.

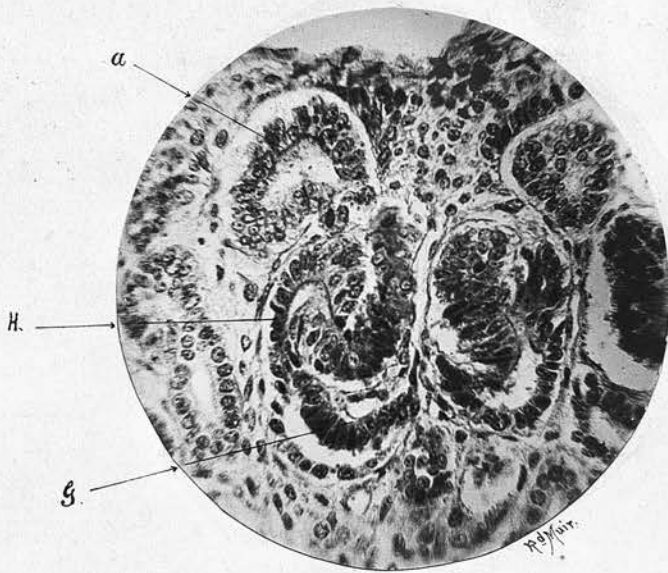


Fig 9.

Fig 9.

Human Kidney. x 300.

The S shaped tubule has increased in length & the upper bend is beginning to descend to form Henle's loop. Junction is taking place between Ampulla & the upper limb. Malpighian body more advanced & at the stage known as the "Pseudoglomerulus". Bowman's capsule flattened. Glomerulus thickened. Capillaries appearing in it. H. Henle's loop.

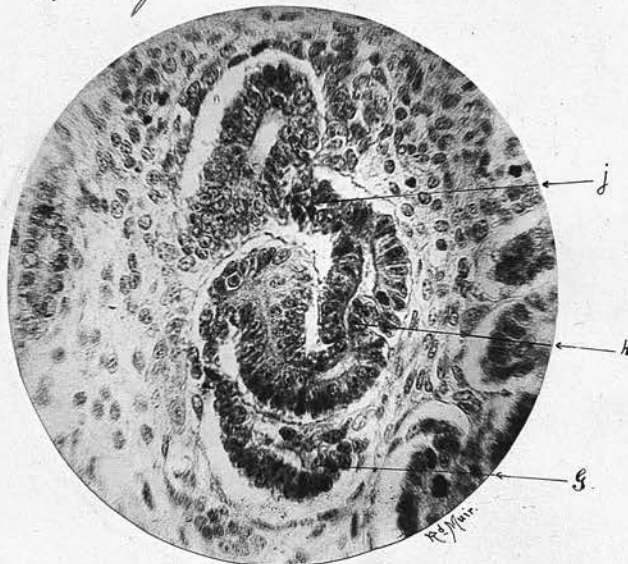


Fig 10.

Fig 10. Human Kidney. x 300.

Junction has taken place by a narrow tubule, the junctional tubule. J. Convoluted tubules forming. Henle's loop lower. Glomerulus larger & containing developing capillaries. Epithelial covering thick & deeply staining. Bowman's capsule quite flattened, large cavity. Ampulla growing peripherally. H. Henle's loop. J. junctional tubule. G. glomerulus.

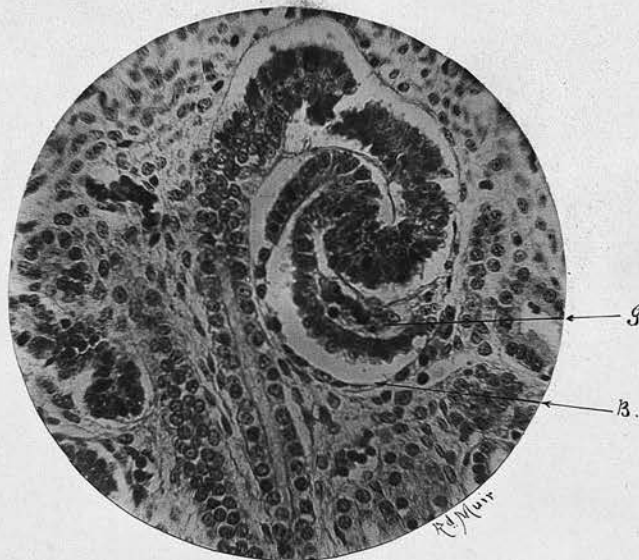


Fig 11.

Fig 11. Human Kidney. $\times 285$.

Complete union of the tubules has taken place, but the point of union is easily torn. The cells have retracted from the surrounding connective tissue. The cavity of Bowman's capsule is large + the neck of the tubule at the side of the base of the glomerulus next its collecting tube. The glomerulus is still in the condition known as Pseudo-glomerulus but capillaries are forming in situ.

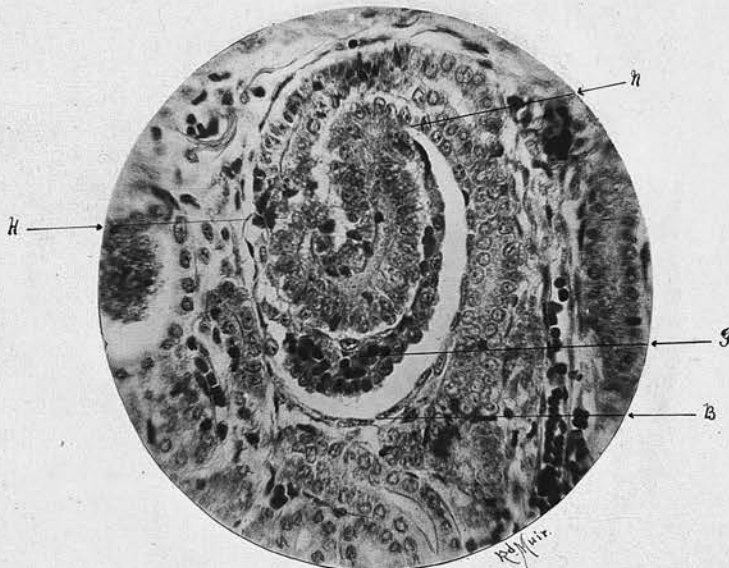


Fig 12.

Fig 12 Human Kidney. $\times 300$.

At the same stage as above. The cavity of the capsule is prolonged well into the tubule + the greater part of it afterwards becomes convoluted tubule. The neck of the tubule is here a long way behind the base of the glomerulus it ultimately descends to occupy a position opposite its middle.

H. neck of tubule. G. glomerulus. B. Bowman's capsule.

H. Henle's loop is descending towards medulla.

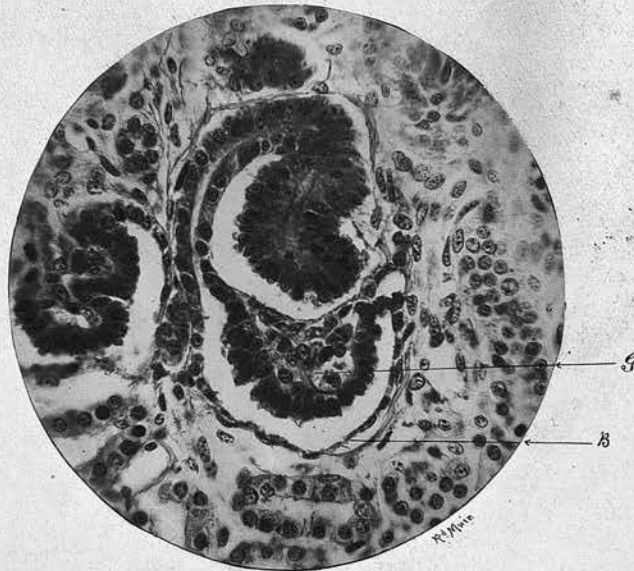


Fig 13.

Fig 13. Human Kidney. x 300.

The Malpighian body is more advanced. Arcus's loop has disappeared from its first position. The layer of cylindrical cells with large nuclei over the glomerulus is well marked. Capillaries are forming inside. The relative positions of the parts of the Malpighian body are preserved but the neck of the tubule is now at the side of the base of the glomerulus which is becoming constricted.

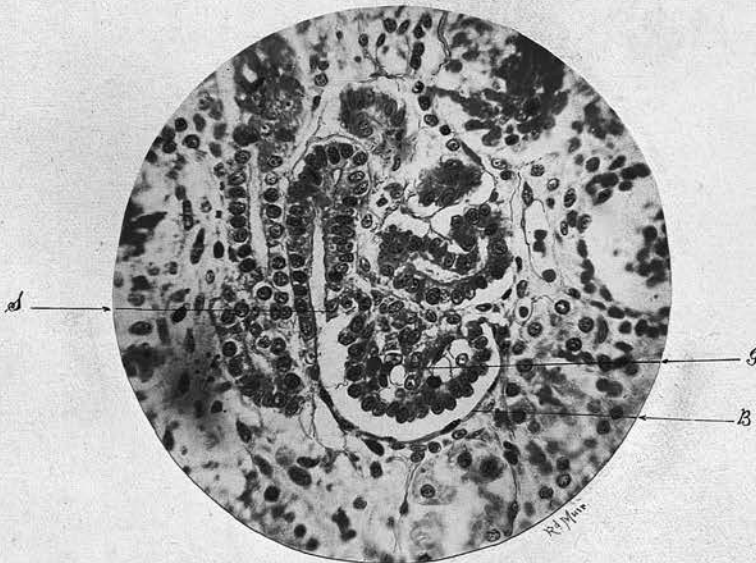


Fig 14.

Fig 14. Human Kidney. x 300.

The Malpighian body is still further advanced. Capillaries are formed in the glomerulus the cells covering which are now cubical. By constriction of the base of the glomerulus + growth of the convoluted tubule a septum *s.* is forming. The base of the glomerulus remains in the same position, but the neck of the tubule descends.

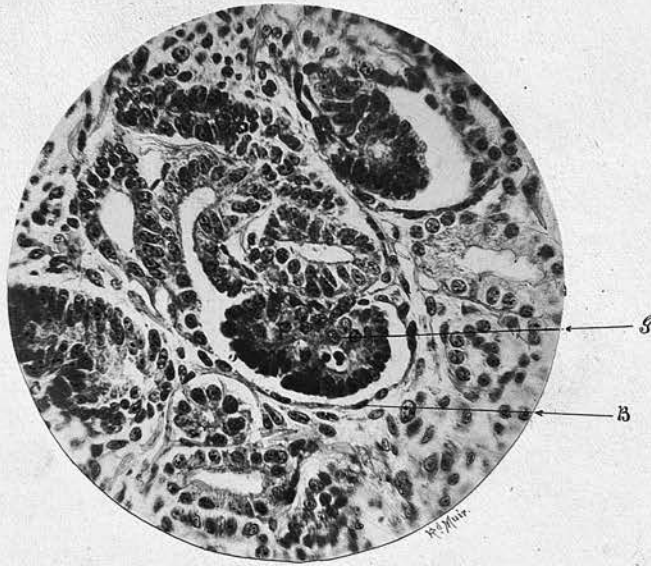


Fig. 15.

Fig 15 Human Kidney. x 300.

Very similar to the last. Base of glomerulus is becoming constricted and tubule leaves at one side. The cells over the glomerulus are still large & deeply staining, those of Bowman's capsule are flat.

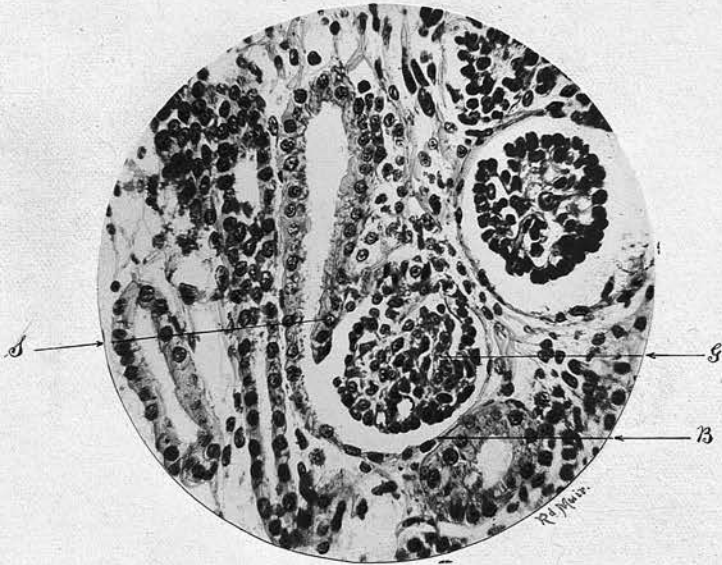


Fig 16.

Fig 16. Human Kidney. x 300.

Malpighian body further advanced, capillaries of glomerulus formed. Neck of tubule descending owing to downward growth of the septum S. Base of glomerulus still opposite periphery of lobule.

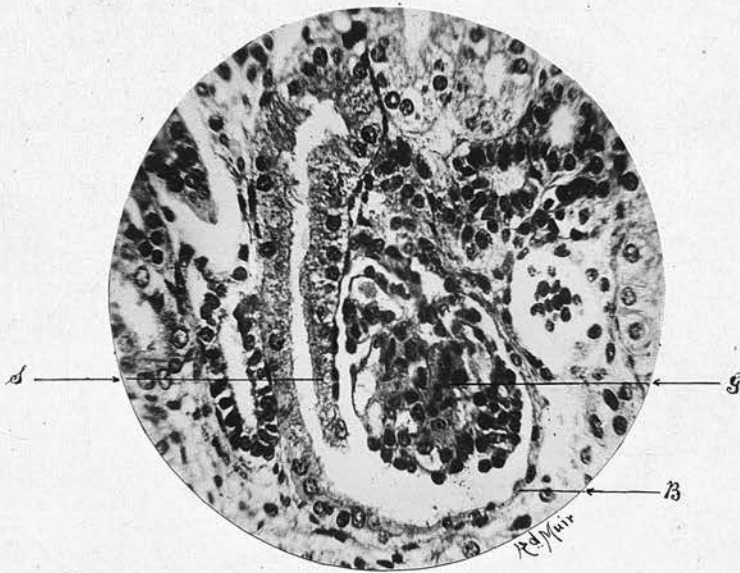


Fig. 17.

Fig 17. Human Kidney. x 300.

The neck of the tubule has descended lower & the structure of the septum is clearly shown. On the side of the glomerulus the cells are flattened, on the tubule side they are cubical. The cells lining Bowman's capsule are flat but near the entrance of the tubule they gradually become cubical.

The base of the glomerulus is still in the same position as regards its relation to other structures in the kidney, it has not rotated.

The epithelium covering the capillaries of the glomerulus is becoming flattened.

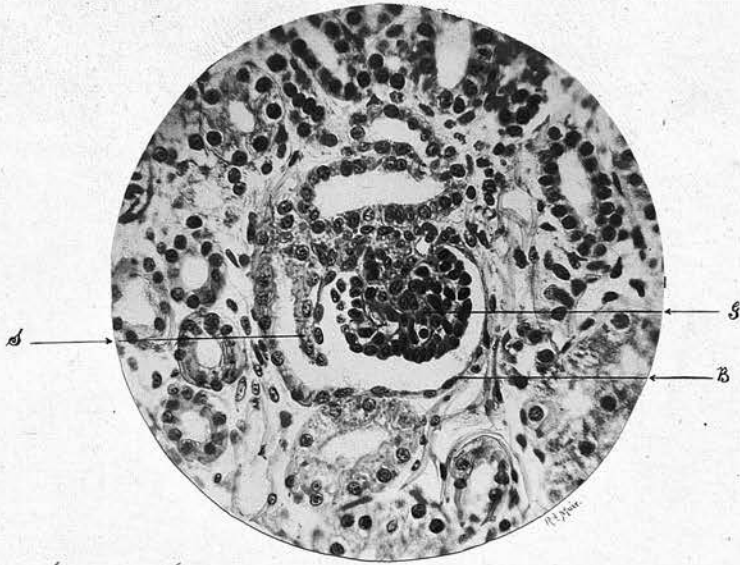


Fig 18.

Fig 18. Human Kidney. x 300.

Another Malpighian body at a stage not quite so fully developed. The septum is well shown.

The connective tissue in the neighbourhood is being replaced by capillaries.

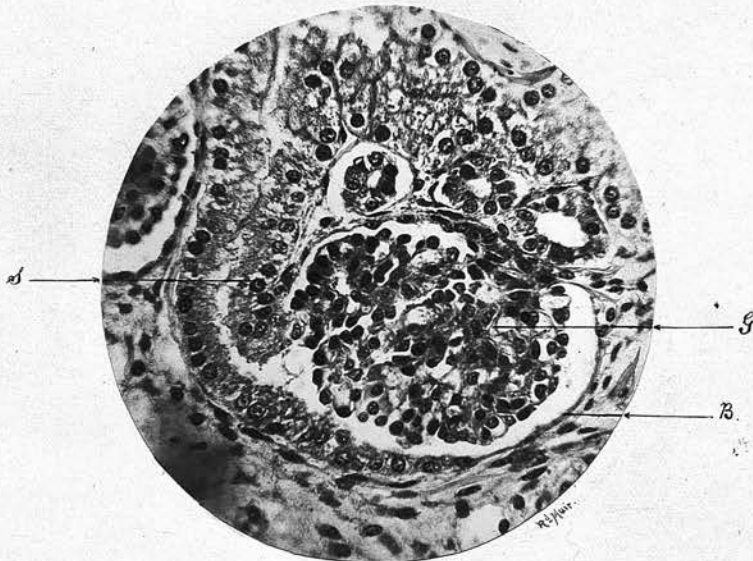


Fig 19.

Fig 19. Human Kidney. x 300.

An almost fully formed Malpighian body from near the pelvis in a 4 months old kidney. The tubule leaves almost opposite the base of the glomerulus & takes an upward direction. The neck is wide & some of the cells still pass into Bowman's capsule.

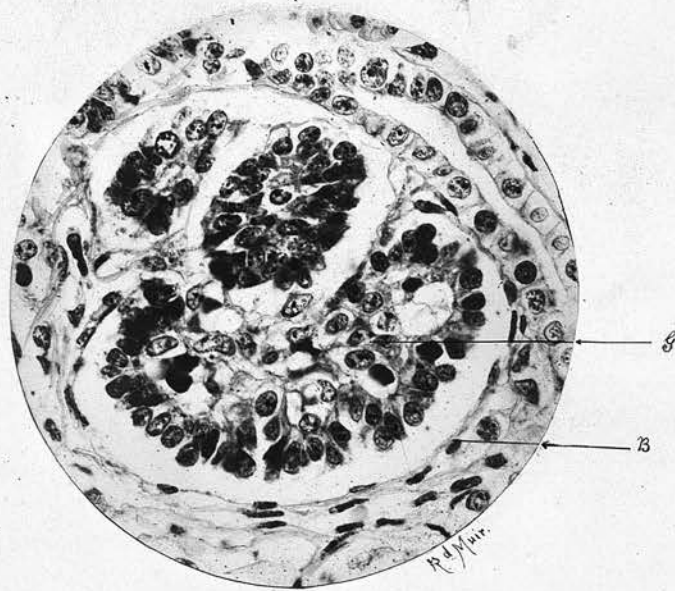


Fig 20.

Fig 20. Human Kidney. $\times 600$.

Transverse section through a Malpighian body more highly magnified. The contrast between the cells lining Bowman's capsule & those covering the glomerulus are well marked. Bowman's capsule has no visible basement membrane but is cellular.

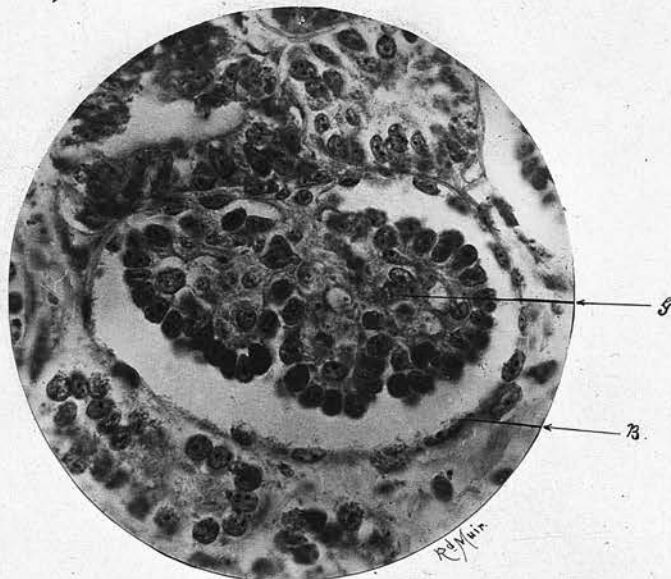


Fig 21.

Fig 21. Human Kidney. $\times 600$.

Transverse section through a Malpighian body. The large cells covering the glomerulus are penetrating between the capillaries & dividing it into lobes.

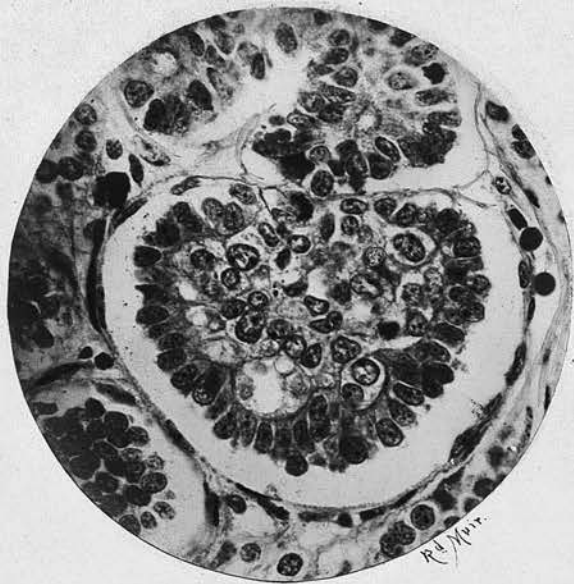


Fig 22.

Fig 22. Human Kidney. x 600.

The constitution of the glomerulus is here well shown. In the centre are capillaries, & surrounding them are the large nucleated cells which shape the glomerulus. Some are dipping into the interior. The cells lining Bowman's capsule closely resemble endothelium.

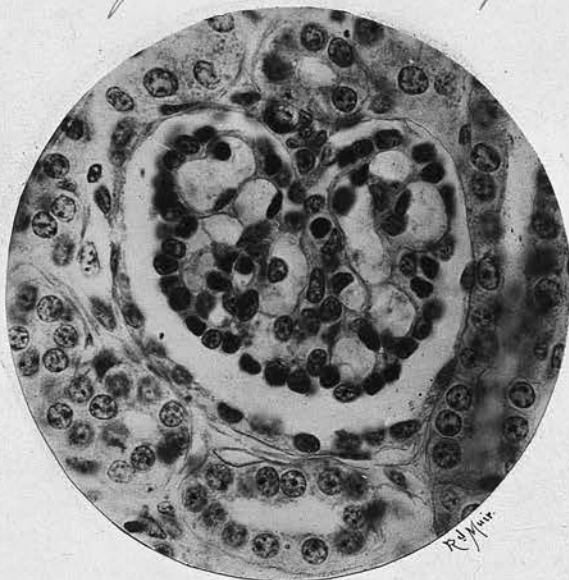


Fig 23.

Fig 23. Human Kidney. x 600.

The capillaries of the glomerulus are well formed & two kinds of nuclei are distinct. One belonging to the cells of the capillaries, the other to the cells of the membranous covering.

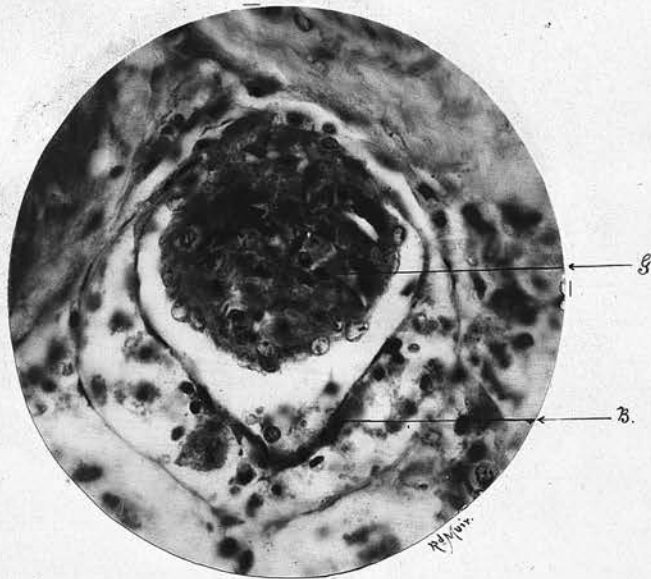


Fig 24.

Fig 24. Pronephros of the Cod. (*Gadus morhua*) x 700.

Section through a Malpighian body. The glomerulus is dense & its vessels are covered with round cells with round nuclei. The cells lining Bowman's capsule are very flat. The Malpighian bodies are very small.



Fig 25.

Fig 25. Mesonephros of the Skate. (*Raja Batis*) x 150.

Section through a Malpighian body. The capillaries of the glomerulus are large & covered by a distinct layer of flat cells. Bowman's capsule is irregular & lined by flat cells. Opposite the base of the glomerulus is the neck of a tubule, the ciliated cells of which extend some little distance into the capsule. Malpighian bodies are very large.

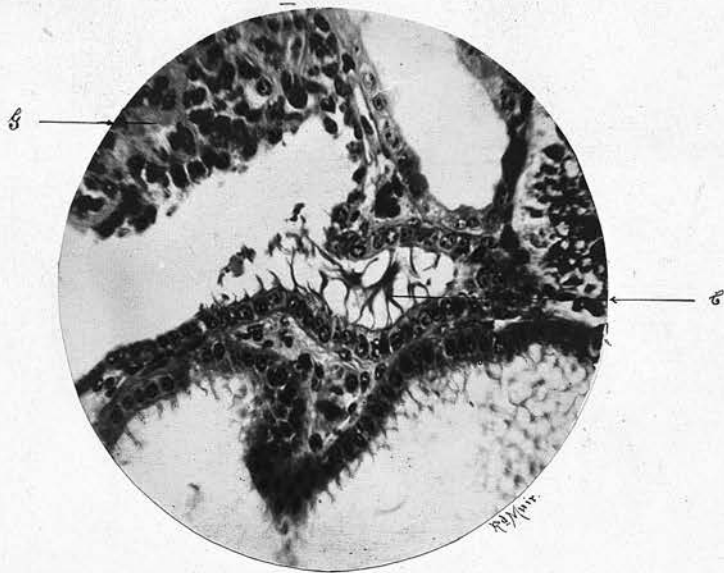


Fig 26.

Fig 26. Mesonephros of the Skate. (*Raja Betula*) X 280.

Section through a Malpighian body near its base. A tubule is seen leaving the cavity near the base of the glomerulus. The cells of the tubule are continued into the capsule + are flagellated. C.

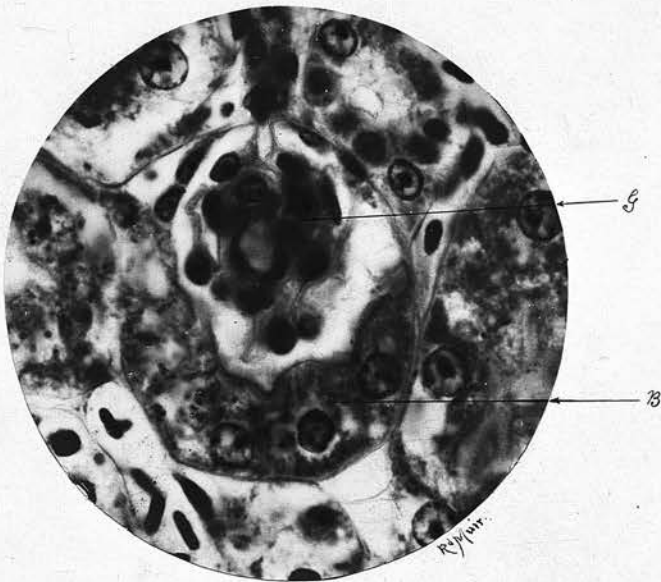


Fig 27.

Fig 27. Kidney of adult Sparrow. X 1000.

A Malpighian body. They are very small. The glomerulus consists of a few capillaries. Bowman's capsule is for the most part lined with cells similar to those of the convoluted tubule.



Fig 28.

Fig 28. / Human Cystic Kidney. Adult. x 300.
 Thick basement membrane.
 Swollen condition of cells lining capsule.



Fig 29.

Fig 29. / Kidney of Bat. x 340.
 Corrosive Sublimate poisoning.
 Increase of nuclei in tuft, + compression by cells of
 convoluted tubule lying inside Bowman's capsule.

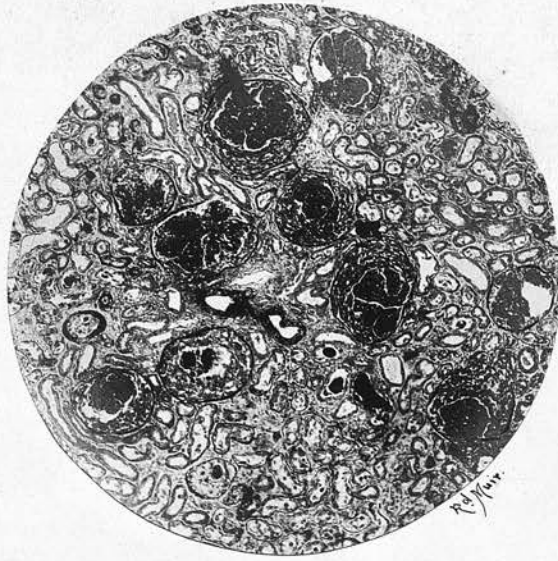


Fig 30.

Fig 30. Human kidney. x 60.

Subacute nephritis. Basement membranes well marked, & proliferation of cells inside Bowman's capsules, compressing glomeruli.

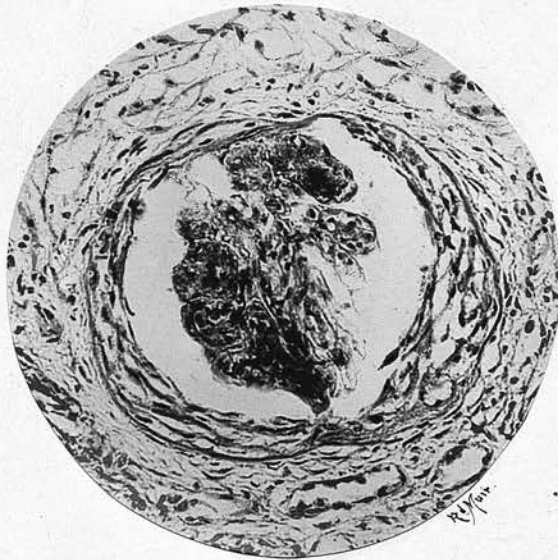


Fig 31.

Fig 31. Human kidney. x 200.

Malpighian body. Subacute nephritis. Proliferation of endothelial lining of Bowman's capsule. Atrophy of glomerulus.