Observations on the Anatomy of the Capsulæ Supra-Renales,

— an Exercise —

for the Degree of Doctor in Medicine in the University of Edinburgh,

— by —

Dyce Duckworth. M.R.C.S.L:

(Awarded a Gold Medal by the Medical Faculty. Aug.t I. 1863.)

Edinburgh:

MDCCCLXIII.

Dissertatio Academica Inauguralis.

"Atque in anatomia corporum organicorum (qualia sunt hominis et animalium) opera sane recte et utiliter insumitur; et videtur res subtilis et scrutinium naturæ bonum." Lord Bacon.

Note

This Thesis was composed in part in Edinburgh, Liverpool, in Trin. Coll. Oxford and in St. Bartholomew's Hospital London in the years 1861. 1862. 1863. A condensed extract from it with new matter, was prepared in 1865 for the 1st. Vol. of the Saint Bartholomew's Hospital Reports, and was published with 6 coloured plates on 1. Octr. 1865, occurring with essays in that volume by other members of the staff of the Hospital. It was not permitted for writers in the Reports to obtain reprints of their essays, hence it was not possible to present 40 copies of it to the University, as I wished to do, in accordance with the Statutes.

D. D.

70. Wimpole St.
Cavendish Square London. W.
March. 15. 1866.

Introduction.

I was induced by various circumstances in the year 1861 to take up with minuteness the study of a disease to which the name of Morbus Addisonii has been applied.

This disease has been hitherto classed amongst the Diathetici, and is considered to be a blood-affection.*

Be the nature of the disease what it may, all are agreed that the late Dr Addison directed the attention of the profession to a definite series of symptoms which he was inclined to associate

---

* Prof. Laycock places this disease amongst his Hæmo-Cachexiæ. (Private notes of Lectures on Princip and Pract: of Physic. Edin. Univ. 1861–1862.)

Dr Aitken includes it in the Diathetici. (Handbook of Science and Practice of Medicine. p. 377.).

associate with a morbid condition of the Supra-renal Capsules *

Of these symptoms, we may mention an anæmic condition of the patient, a gradual loss of constitutional power, and a certain change affecting the deep or pigmentary layer of the epidermis, as being the most striking. The morbid condition of the Supra-renal Capsules found to be associated with the above symptoms may be defined, generally to consist in the presence of unorganized lymph within the tissue of the organs in greater or less amount. It is correct to state, however, that other changes in these bodies

---

* On the Constitutional and Local effects of Disease of the Supra-renal Capsules, by Thomas Addison. M.D. Edin: etc. Senr Physn to Guy's Hosp.l Lond. 1855.

bodies have been met with in connexion with the same series of Symptoms.

In endeavouring to trace the ~~connexion~~ asserted connexion between the Symptoms and the lesions, or, in other words, to work out the pathology of Morbus Addisonii — the object I have ultimately in view — I am fully cognizant of the difficulty of the task which I have allotted to myself. I feel assured however that there is much room for research and investigation in the subject, and it is no less due to the memory of Dr Addison than it is a privilege to ourselves, to try and discover if there be adequate and scientific grounds for establishing the existence of such a

disease

disease.

There can be no doubt that a true pathology is founded upon exact anatomical and physiological data, and bearing in mind this fact, I have determined to investigate successively the anatomy and physiology of the supra-renal capsules.

In the present exercise, it is my intention to limit myself to the consideration of <u>some points</u> in the anatomy of these organs, and the statements which I have to make are deduced from constant examinations of the capsules during the last Eighteen months.

It is not my purpose to give a complete description of these bodies, to do so, would be to write a long treatise and in which I should be compelled to take up matter which

which may be regarded as already observed and explained. I have decided therefore, while working out for myself their general and minute anatomy, both human and comparative, to direct attention to certain points concerning which doubt or difference of opinion exists. I think it right to mention here, that I have not omitted the study of such morbid specimens as I have met with, these examinations, though necessary and interesting, occupied time that might perhaps have been devoted with advantage to the special subject of this Exercise.

I have to acknowledge my obligations to Dr Haldane of Edinburgh, Drs Andrew and Davy of London, for their kindness in furnishing me with healthy and morbid

specimens

specimens of the capsules, to Professor Rolleston of Oxford for facilitating some of my dissections and examinations of them in the University Museum, also to Professor Goodsir, Drs Wilks and Beale and to Mr Turner for numerous and valuable suggestions during the period of my observations.

The Observations which I have to record may be at once classified under the heads of - first - General Anatomy, and second - Minute Anatomy.

Believing that the Regional or Topographical Anatomy of the Supra-renal Capsules has been completely described, I have nothing special to say under this head.

I therefore proceed to consider some points in their General Anatomy and shall take them up in the following order.

α. The investing connective or areolar tissue.

β. The anatomical Relations of the Capsules to the Kidneys.

γ. The naked-eye appearances as modified by age and other (apparently normal) circumstances.

δ. Accessory Supra-renal Capsules.

ε. The appearances presented on their section.

α. Investing Connective or Areolar Tissue of the Supra-renal Capsules.

The Supra-renal Capsules lie with the kidneys behind the peritoneum imbedded in a large quantity of areolar tissue. This tissue has large meshes in it and is rather loose in its nature. It contains frequently a considerable amount of adipous tissue imbedded in its meshes. At times the fatty material is of the granular

granular variety, sometimes it is firm and lardaceous, approaching to the character of the fat in the appendices epiploicæ and mesentery of corpulent subjects or those suffering from physconia viscerum.

In lean subjects this tissue is quite vesicular and free from fat, and in such bodies are the capsules best seen with their general anatomical relations.

The tissue connecting the capsule to the kidney is more dense in character than the general investing tissue*, and is perhaps

---

* I am inclined to think so, though H. Frey describes the investing areolar tissue as 'closely woven', and states that the capsule is attached inferiorly to the kidney by a looser areolar tissue.

perhaps less liable to fatty infiltration than the same. Both are highly vascular.* In that portion between the base of the capsule and the upper portion of the kidney are several noteworthy vessels. I have traced in my various dissections several of them passing through this tissue, which I propose to call connecting tissue, from the basal fissure of the capsule through the fibrous coat of the kidney and penetrating deeply into

---

* I do not mean to assert that there is a peculiarly vascular condition of these tissues, but think it perhaps worth bearing in mind at the present time when connective tissue and cellular theories are struggling for a position in pathology.

into the cortical substance.

Mr Turner has recently, by some beautifully fine injections, improved our knowledge as to the vascularity of the viscera and their investments at the back of the abdomen, and has shewn in fact that a direct connexion, by means of bloodvessels, exists between them and the anterior abdominal parietes. I cannot do better here than give his own terse and lucid description of these facts which he has most kindly communicated to me. "I have demonstrated," he states, "and have preparations to exhibit, the passage through the fibrous capsule of the kidney, of several well marked branches of the renal artery into the fatty capsule surrounding the kidney, in which mass of fat

fat and connective tissue they form a very beautiful plexus, which plexus communicates directly with the blood-vessels of the abdominal wall. Thus, I have injected the circumflex ilii, epigastric and other parietal arteries from the renal, through the arrangement just indicated. The supra-renal arteries in a similar manner communicate with a plexus of bloodvessels in the loose fat and connective tissue in which the capsules lie, and through this plexus with the vessels of the wall.

I am prepared to make the following general statement — that there exists behind the peritoneum in the loose cellular tissue and fat a very well-marked

-marked vascular plexus, which plexus communicates on the one hand with the visceral branches of the abdominal aorta, and on the other with the parietal vessels. In different localities this communication possesses various modifications. Quain and other writers speak of branches going to the fatty capsule of the kidney from the renal artery before that vessel enters the kidney substance, but this is a different arrangement to that which I have described."

I consider this discovery of Mr Turner's to be a very valuable one, and likely to be of much import in

pathological

pathological research as explanatory of many physiological and morbid phenomena.

B. The anatomical relation of the Supra-renal Capsules to the Kidneys.

These organs in the class Mammalia are always supra-renal. They lie immediately in front of the superior surface of either kidney. Frey states that they rest on their excavated bases like a cap on the kidney. This statement, I think, hardly conveys a correct impression of their relation to those organs, because the excavated or fissured bases vary much in size and never envelope the entire upper borders of the kidneys. The fissured

base

base varies much in its form, both as to width and depth, and the entire base always falls within the area of superior renal surface. I think it more correct to state that the supra-renal capsules lie upon the upper surface of the kidneys, and that their anterior surfaces are prolonged downwards further upon the kidneys than the posterior ones. This description will hold good in most cases, whatever be the extent of basal fissure.

γ The naked-eye appearances of the Supra-renal Capsules as modified by age and other, apparently normal, circumstances.

This is an important matter to enter upon a description of. Opinions have varied much amongst Anatomists, and many statements that are either incorrect or that give but a partially true description of their naked-eye appearance, have been put on record. The limits between healthy and morbid specimens have been but faintly, if at all, drawn, and much doubt at present prevails as to the normal appearance of the supra-renal capsules in the human

Subject.

subject. That such should be the case is curious, for it but amounts to a matter of observation within the reach of many; however but few appear to have taken up the subject in a special manner.

I purpose considering first, the external appearances; the internal aspect, as presented on sections through these organs, ~~I have placed under~~ we shall describe under our fifth division (E).

To the eye of any one who was familiar with animal tissues, but who had never seen a supra-renal capsule, I think the idea that they were glandular bodies would suggest itself. Their form, size and weight are ascertained with

sufficient

subject. That such should be the case is curious, for it but amounts to a matter of observation within the reach of many; however but few appear to have taken up the subject in a special manner.

I purpose considering first, the external appearances; the internal aspect, as presented in sections through these organs, ~~I have placed under~~ we shall describe under our fifth division (E).

To the eye of any one who was familiar with animal tissues, but who had never seen a supra-renal capsule, I think the idea that they were glandular bodies would suggest itself. Their form, size and weight are ascertained with sufficient

---

* The word hilus I have not been able to find. Hilum means a mark or the black point on a bean or certain seeds; it should be considered to express a point of attachment or entrance for nutritive supply when employed in anatomical language. Descriptive anatomists do not usually speak of a hilus in the capsules, Kölliker and Mr Erasmus Wilson however mentions its existence. I can certify as to the constancy of this fissure, but cannot agree with Mr Wilson (some anatomists) in thinking that it appears to divide the organ into two lobes, though I have seen cases where this description would hold good, as for instance in the foetus at full time and in the capsules of infants.

nihilum.

sufficient accuracy, I shall not therefore make any mention of these points.

Regarding each organ as presenting two surfaces and two borders, we may state that the anterior and posterior surfaces resemble each other generally. The one is however to be distinguished from the other by the fact, already alluded to, that the anterior surface is longer in its vertical diameter in both organs, and is transversely fissured in its upper third.** The vertical diameter is longer in the left than in the right capsule, the diameters of which are respectively the converse of those of the left one. By means of the excavated bases the organs may be always put in situ

* The so called hilus whence issues the vena supra-renalis.

in situ when removed from the body, thus they must be held with the groove looking backwards. In removing them separately from the body, a portion of the vena cava inferior is generally attached to the right organ since the right vein runs into that vessel; not unfrequently too, in careless manipulation, on removal of the liver from the body this capsule is torn, and a portion of it is found attached to the under surface of the liver at a point where there is a slight depression on the inferior pecoral surface to receive its apex. The left capsule may be known out of the body by its diameters, being larger and latter more crescentic or semilunar in form than the right

which

which is more like a cocked hat in shape, and by its being free from the great vessels.

Dr Harley has perhaps misstated the facts as to their relative shape in his able papers on the histology and general anatomy of these organs*, wherein he observes that "the left is more triangular in shape than the right capsule, the latter being often crescent shaped". However it is certain that their form is not constant in all cases, and some latitude must be allowed in the description of this part of their anatomy.

The

---

* 'An experimental inquiry into the functions of the Supra-renal Capsules, & their supposed connexion with Bronzed Skin'. Brit. & For. Medico-Chirurg! Review. Jan.y 1858. and 'Histology of the Supra-renal Capsules', by George Harley. M.D. Edin: F.C.S. Lancet. June. 1858.

The above-mentioned author gives perhaps the best account of their external and internal appearances that we have, I cannot however agree with him in all his statements regarding them. My own observations have convinced me that these organs (in the human subject) vary much in their naked-eye appearance, that the variations are, in a great measure, due to age, and that they consist in changes affecting size texture and tissue; furthermore, that these alterations are so far consistent with apparent health and functional activity, that the organs may be regarded as in a normal and not a morbid condition.

First, as to the Fibrous Capsule of these

bodies,

bodies. They possess a special investment of firm fibrous tissue quite analogous to the fibrous capsules of the liver, spleen and kidneys, though slighter in texture. This is very difficult to dissect off the organ. I have however done so frequently under water, and it is more easy to remove it thus from specimens that have been somewhat hardened in spirit or solution of chromic acid. I have delineated its microscopical characters in some of the drawings illustrating part II of this thesis - fig 13. p 60.

It is everywhere intersected by small afferent and efferent vessels and in many places by nervous filaments. Numerous processes pass off from it with the

---

* Thus they are smooth in the ox, sheep, musk deer, rabbit, cat.

the vessels and enter the parenchyma of the organs. This fibrous capsule does not however lie evenly upon their surfaces as in the case of the liver or spleen, on the contrary it has to accommodate itself to a number of furrows or depressions upon them. These wrinkles I have observed to be more marked on the anterior surfaces and basal borders of the organs than posteriorly. It is quite peculiar to and characteristic of the human supra-renal capsules* since they are generally smooth in the lower mammalia*.

---

* Since writing the above, I have dissected the supra-renal bodies in a large Cetacean, (vide fig. I. p. 7. Appendix) and found them to possess an arrangement very similar in this respect to the human capsules. I find too, that in the Ant-eater and Armadillo, which I have examined, the surfaces of these organs are wrinkled, and so they are in the pig.

I must now consider the various appearances presented to the naked eye when modified by the before-mentioned conditions.

The Supra-Renal Capsules are small before puberty and increase in size as do the other organs of the body. I desire to direct particular attention to this fact, for there can be no doubt that it has not only been overlooked, but these bodies have been regarded as important embryonic and foetal structures since they are of such large size during intrauterine life.

It is true that they are largest about the second month and diminish towards the close of foetal existence, but it is no less true that they go on growing again up to the adult period. It must not be forgotten moreover, that their large size in the embryo is, as far as is known, peculiar

peculiar to the human subject, and is certainly not found in quadrupeds.*

It is true that the capsules are as inconstant in size as in form, but careful observation will, I believe, prove that they continue to grow up to the adult period.

It has been stated that they diminish in size in aged persons. I am inclined to think that this observation is a presumption from the preconceived view of their possessing most size and activity of function in Embryonic life. I have not found that these organs are smaller in old people.

My

---

* Professor Allen Thomson informs me that according to his observations, the supra-renal capsules do not present that preponderance in any other mammalia animal which they exhibit in man; and that in the various mammalian foetuses in which he has examined them, he has found them small as compared with their size in the human subject. Vide Appendix. C. p 10.

My observations lead me to the following conclusions - viz^{t} that before puberty these organs are small, firm and translucent, further, that they contain at this period a minimum amount of fatty matter. In the adult they are larger less firm and translucent, while the amount of fatty material is increased. In advanced age the capsules remain the same size, become somewhat softer and not unfrequently friable from the presence of a large quantity of fatty matter. I do not mean to aver that these appearances will be found in all cases, indeed I have met with several exceptions to them; however I think that the description I have given will be found to apply in the greater number of cases.

My

My Examinations of Supra-renal capsules in the lower animals have shewn me that they are generally firm organs and contain very little fat. I refer now to what I term adventitious fat, not proper to these tissues. But it must be borne in mind that the animals examined, though full grown, were young and vigorous.

I have not had the opportunity of observing the state of these bodies in old animals, but I should expect them to become fatty with advancing age.

I consider Dr Harley's comparison of the colour of the external portion of the cortex in human capsules to powdered scammony very apt, but it is not universally applicable: such a description will not usually apply to the organs in young subjects. The colour varies, I believe,

according

Fig. I.

Fig. 2.

Fig. 3.

Fig. 4.

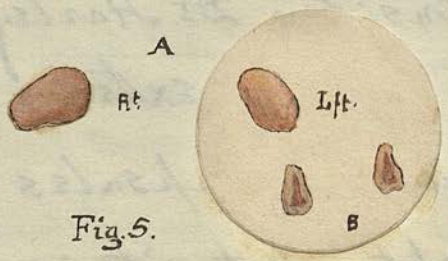


Fig. 5.

Fig. I. Represents the appearances presented by sections of the Supra-renal Capsules of the Ox.

Fig. 2. Shews the different appearance of a section of the organ in the Calf.

Fig. 3. Drawings of sections from these bodies in the Sheep.

Fig 4. Drawing of section of adult human supra-renal Capsule.

Fig. 5. Supra-renal bodies in (white) rabbit; A. External aspect. B. Sections.

according to age, and the change is due either to the amount of adventitious fat in their tissues, or to Excess of oily granules in the cortical substance. I am led to state this from observing that the cortex in the capsules of the ox and sheep is of a dark brownish or madder-brown tint, and the tissues when Examined prove to be free from an abundance of oily granules, while in the rabbit and human subject they exist in large amount and the cortical matter is of a paler hue approaching to yellow or pinkish-yellow. vide figs. 1—5. p. 28.

Cortical pigment is found most commonly at the inner third or two thirds of this portion in human and some few other capsules*. It is very obvious to the naked

Eye

---

* Thus it is well seen in these organs in the guinea pig vid. Microscopic Preparation № 21.

Eye as I have already remarked. By its presence the limits of the cortical and medullary portions are more clearly defined than they otherwise would be. In healthy organs steeped in chromic acid and subsequently prepared with ammoniacal solution of carmine, the pigmented portions remain unaltered.

Part I.

d

Accessory Supra-renal Capsules.

On examining freshly removed human supra-renal capsules, we may often observe that attached to the cortical matter there are present one or more glandular looking bodies. They are generally of the same colour, (though sometimes paler) as the cortical substance, and in texture rather less firm. They are attached to the capsule by

Fig. 6.

Human Accessory Supra-renal Capsule drawn in situ.

by the surrounding areolar tissue and vessels: their most frequent site, according to my observations is in or near the basal fissure, more commonly on the anterior surface perhaps than the posterior. They may sometimes be scooped out as round or elongated oval bodies from the cortex. In general they are not much larger than a millet seed, and on careful examination from one to three may usually be found.

Vide fig. 6. and fig. 16. Part II. p. 65.

Dr Harley once found two supernumerary capsules in a sheep; I have not met with any in this animal, but thought I had done so on two occasions when the glands however proved on examination to be truly lymphatic in their character.

ε. Appearances presented on Section of the Supra-Renal Capsules.

I now take up the most disputed point, perhaps, in the descriptive anatomy of these organs. If we compare the statements of the best authorities on the subject, we shall certainly be perplexed and have difficulty in forming an exact idea of the appearances that are really to be met with.

The incongruities in the descriptions have only occurred in the case of the human Supra-Renal capsules, and for the obvious reason that they are the most difficult to describe in the entire mammalian series.

The difficulty is due to the fact that these organs change their appearance at different periods, and this has not been sufficiently taken into consideration. The descriptions

in

in the books are either incorrect or incomplete. Anatomists have for a long period described the existence of a cortical and a medullary portion; they have not, however, distinguished sufficiently the ordinary characters of each of these. H. Frey states, for example, that the medulla in man is of a reddish brown colour*: Professor Sharpey, in the last edition of Quain's Anatomy† states that the medulla is dark soft and pulpy, and of a brownish black hue. Other descriptive anatomists make the same statements. The most accurate accounts of the naked-eye appearances of the human capsules are those given by Kölliker‡ and Dr Harley‡. It is certain that some latitude

---

* Vide Article. 'Supra-renal Capsules.' Todd's Cyclopædia of Anatomy and Physiology. by H. Frey.

† Vide. Quain's Anatomy. 3rd. Edit.n by Dr Sharpey and Mr Ellis. 1856. Vol iii. p. 329.

‡ Vide Manual of Human Microscopic Anatomy. Kölliker. p. 421.

‡ Op. Cit.

latitude of opinion must be permitted here, but the following statements, I may mention, are founded upon numerous observations.

Cortex. On section of a human supra-renal capsule two distinct substances are exposed to view, the cortex and medulla. The cortex is generally firm and bears some degree of handling, while the medulla or central portion is for the most part soft and delicate, at times even diffluent. I refer now to healthy organs. The cortex is of a yellowish or scammony-powder colour in the greater part of its extent, more especially however in its outer two thirds. It is striated from without inwards towards the medulla and has a somewhat fibrous appearance. Its inner third is found to be of a brown or brownish-red hue; vid. figs. 4. p 28. 15. p 64. Throughout it is of the same consistence, being generally rather friable

friable and disposed to break in the direction of the striations, i.e, from without inwards. From what has been previously stated, it will be easily intelligible that the texture and consistence of this portion must vary according to the condition of its intimate tissues.

It certainly forms by far the largest portion of the organs in man and all animals in which I have Examined them. Perhaps the calf is an exception to this, for in this instance the medulla exceeds or at least equals the cortical substance in amount.*

The <u>Medullary</u> or internal portion of the human capsules varies more in its aspect than does the cortex; indeed, I consider that we may regard the cortical appearances as, almost if not quite, constant

The

* In the capsules of man, the calf and some few other animals, the cortex may be stripped from the medulla with comparative ease.

The reason for the varying medullary aspect is to be found in the fact that this portion is the site of a large venous plexus, and in proportion to the amount of blood in these vessels is the tint or aspect of this part; thus, if the organ be congested, the medulla will be found of a dark reddish-brown colour, if free from congestion or examined in an anæmic subject, it is of a pale grey or milk-white hue. Vide fig 4. p. 28.

Many anatomists have described a cavity as existing instead of a medullary portion. I have frequently met with cavities here. In the dissecting rooms I used always to find cavities in the interior of the supra-renal capsules. I have likewise met with them in post mortem theatres on examining capsules removed but a few hours after death. I think

think too, that I have sometimes produced them in the operation of removing them from the body.

In the first case, the cavity exists, I believe, in consequence of putrefactive changes, while in the other instances, they are due to rough manipulation during the removal or dissection of the organs.

The medullary portion is more liable to be ruptured and broken down when its vessels are turgid. The appearance of these cavities varies somewhat; in some, few contents are found and their walls are soft and velvety and generally of a dark brown colour. The colour of their walls is due to the abutting portion of the inner third or pigmentary layer of the cortex which is thus exposed to the cavity. In some of

these

* Vide Prep^{n} 12.

these cavities may be found a dark pultaceous mass consisting of blood and broken down medullary matter. (In healthy capsules during life I do not believe that any cavity exists.)

In the centre of the medulla lie several venous sinuses; they are generally three or four in number and comparatively of large size. The largest one is to be found in the transverse diameter of the organ and is seen on its way to form the vena supra-renalis. vide figs 1-4. p. 28.

Numerous smaller vessels are apparent opening into the sinuses, so that when the latter are slit open, their walls have a well-marked cribriform appearance.*

Owing to the delicacy of the medullary substance there is a great tendency for

these

these sinuses to rupture into one another and thus produce a cavity, and I am inclined to the belief that this is, in many cases, the commencement of the formation of cavities within these organs.

The medulla is sometimes so soft that much of it can be rubbed down between the fingers.

In injecting capsules, I have found that the site of rupture, when it occurs, is in one of the medullary venous sinuses which communicates with another; thus a cavity is formed and on subsequent section is seen to be filled with Extravasated injection.

We may form a good conception of the relation of the cortex to the medulla in human organs, if we regard it as a continuous fold of this peculiar tissue with special involutions around

around the central medullary mass. The cortex may be unfolded and peeled off from the medulla and laid out almost flat. I have however noticed that the cortex is not always folded around, or in contact with, medullary matter, for very often in the anterior overlapping surface of the organ, the cortex is folded upon itself, so that the two pigmentary portions of the opposed layers are in contact. They may be separated without much difficulty and no medullary tissue is to be met with. Vide figs. 4. p. 28 and fig. 15. p 64, also microscopic preparations. Nos 5. 6 & 7.

Part II.

Having now considered the points relative to the general anatomy of the supra-renal capsules, I pass on to offer some observations upon their minute anatomy. The statements which I have to make may be conveniently classified under the following heads —

α. The relations of the investing Fibrous Capsule.

β. The structure and arrangement of the Cortical portion.

γ. The relation between the Cortical and Medullary portions.

δ. The Structure and arrangement of the Medullary portion.

α. The relations of the investing fibrous capsule.

Under this head I have but little to remark. In all the capsules which I have examined the same general arrangement of investing tissue has been met with. That arrangement may be roughly defined as follows. From the external fibrous capsule, the general characters of which are described in part I. div. γ., processes or bundles of fibro-areolar tissue pass into the parenchyma to form the matrix of the cortex and medulla. This fact is demonstrated in numerous microscopic sections of these organs which I have prepared to illustrate some of the statements made in this thesis. From the investing sheath bundles of fibrous tissue penetrate the cortex; as they pass in towards the medulla they break up more and more forming the meshes

meshes of the cortex. From the sharply defined line of cortex numerous fine filaments and small bundles are seen emerging to form the medullary matrix or stroma.

There may be seen, in the carmine-stained specimens of microscopic sections,* the nuclei or formative cells of the fibro-areolar tissue lying in the course of the interweaving fibres. Many elastic fibres occur here and at the most external portions of the specimens may be seen loose areolar connective tissue with a somewhat cribriform appearance in parts where formerly fat cells existed.

In the capsules of the Cetacean which I examined I found that the bundles of fibrous tissue entering the organs were very large and coarse, separating the cortical matter into compartments, though incompletely. Vide Mc preparations 16 & 17, and Appendix. p 9. In the capsules of the ox a somewhat similar arrangement

* Nos 6 and 7.

arrangement exists, though not so well marked. Vide fig 1. p. 28. The special distribution of the bundles of fibrous tissue in the cortex and medulla we shall describe when treating of the respective minute anatomy of these portions.

We have seen that the investing fibrous sheath may be traced to the centre of the supra-renal organ, and we may regard it as terminating there in part by anastomosis, and partly by joining the fibrous coat of the venous sinuses in the medullary centre. It is everywhere accompanied by the bloodvessels of the organ.

Part II.

B. The Structure and arrangement of the Cortical portion.

I purpose to consider under this head the following points — 1. Appearance under

under low magnifying powers. 2. Nature of the expressed juice of the cortex. 3. The matrix. 4. The arrangement and nature of the cortical columns. 5. The minute structure of the accessory Supra-renal capsules. 6. The bloodvessels. 7. The nerves.

---

1. Appearance under low magnifying powers.

If a good section of a supra-renal capsule be examined with a power of 80 diameters, the cortical matter is seen to consist of a linear series of apparently tubular masses, passing from without inwards towards the medulla. This appearance is well seen in some of the sections which accompany this exercise. Vide preparations 1.2.3.4.5.6. Examined under low magnifying powers, the idea that the cortex is composed of a series of tubes seems a very tenable one. The inner third is seen to be coloured

coloured by pigmentary matter which is sharply limited at the point where the medullary matter comes into view. It is obvious however, even under a low power, that these tube-like masses do not start from the periphery of the organ, but that they only begin at some little distance from it, the peripheral portion being composed of smaller and broken up masses having however the same general character as the tubular or columnar portion.

In some of the preparations it may likewise be seen that the tubular masses do not always run to the internal margin of the cortex, but apparently stop short at some little distance from it, the most internal portion resembling in character the periphery of the organ but containing in addition the pigmentary matter. In some of the specimens where the cortex has been torn and teased

out

* Professors Gerlach's, & Welcker's and Mr Lockhart Clarke's methods of preparation have been employed in studying the microscopic anatomy of these organs with the greatest success.

out a little, the tube-like masses seem to have become isolated and are very well seen. They appear to contain a granular material under this power, and in the carmine-stained specimens the granules have taken up the colouring matter.* (Vide preparations 1—6.)

These appearances are universally found in all the mammalian capsules which I have examined, provided that the sections are made parallel to the direction in which the tube-like masses run.

We find then that the central portion contains the most continuous columnar masses, and I can fully agree with Prof. Kölliker's observations on this point which are entirely consonant with my own.

In well cut sections of either fresh or prepared capsules, examined under low magnifying powers, the cortex has much the appearance of a thatched roof in its

its arrangement; this Simile is not inapplicable even when higher magnifying powers are brought to bear upon the section.

It is in consequence of this columnar structure that the cortex has that fibrous aspect which we alluded to when treating of its naked-eye appearances, and for a similar reason is it that it tears most readily in the direction of these masses.

I do not recollect that I have ever separated in fresh human or other capsules, columns which looked like tubes; however in some of the hardened and stained preparations, isolated tube-like bodies may be seen teased out from the cortex and containing scattered cells, but these do not prove to be real tubes when carefully Examined.* We shall consider this question at length under another division of this part of our subject.

---

* Vide Preps Nos 6 and 7, and Figs.

2. Characters of the Expressed Juice of Cortical Substance.

From an observation of the expressed juice of the cortex we are led to more exact knowledge of its component structure, and this examination is absolutely necessary as a preliminary step to ascertaining its minute anatomy. If we scrape with a clean scalpel some of the juice of the cortex and submit it to a magnifying power of from 350 to 450 diameters linear, we may observe a variety of bodies floating about in the fluid material The objects vary somewhat in different animals, and not only so, but are found to vary according to the age of the individual.

I have made most of my own observations on the juice of the cortex in the capsules of the sheep, I have however frequently examined its nature in the human organs as well as in those of the ox, calf, pig and rabbit. I have

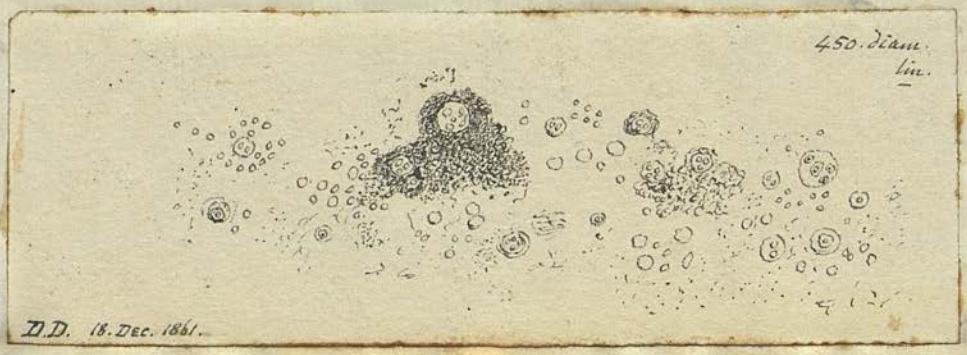


Fig. 7.

Juice of Human Supra-renal Capsule, (Man) shewing numerous cells in various stages of development, oil globules and granules, molecular matter etc.

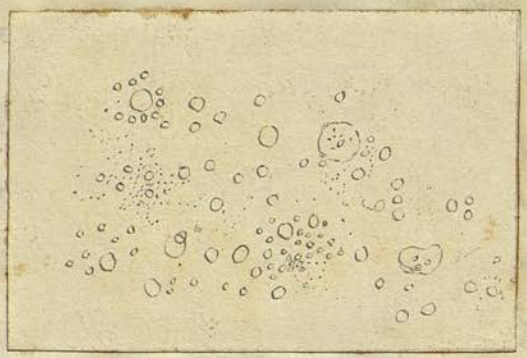


Fig. 8.

Juice of Cortex of Human Supra-renal Capsule (Man æt. 35.) more fatty than that depicted in Fig. 7.

(450. diam.)

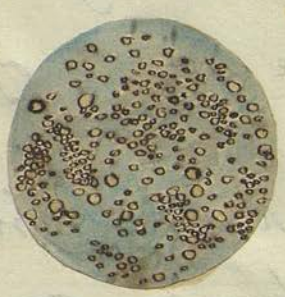


Fig. 9.

Drop of New Milk. magnified circ. 300 diam.

have represented the appearances met with in the juice of the cortex of the Rabbits' Capsule in fig. 10, and in fig. 11. the same from the sheep is depicted – p 50.

The most striking objects are the myriads of bright yellow refracting molecules and granules, the former of which are seen in motion. They remind the observer, as Dr Harley remarks, of the appearance of a drop of new milk when seen highly magnified – vid. fig. 9.

These molecules and granules I find to vary in number in different animals. They are most plentiful in the human organs and those of the rabbit, less so in the case of the sheep and least abundant of all in the ox. They are of a lemon yellow colour and surrounded by a dark rim. In the juice from the cortex of the ox I find that there is a quantity of fine molecular matter which surrounds

the

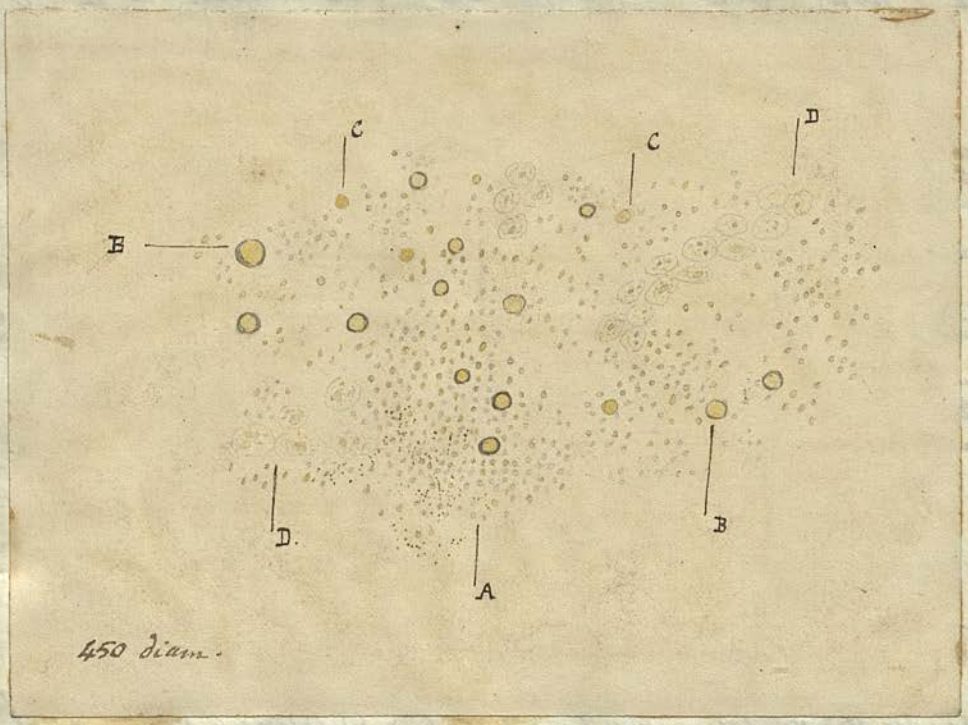


Fig. 10.

Juice of Cortex of Supra-renal Capsule of Rabbit. The letter
A. represents bright yellow refracting granules and molecular particles.
B. large bright oily globules with dark ring. Smaller granules
adhering to larger globules.
C. Yellow blood corpuscles.
D. Pale round or oval cells, oftentimes seen in linear series,
nuclear and nucleolar contents.

the other objects. Besides the bright molecules and granules are found a number of globules, evidently of an oily nature, since they refract light brightly, are of a yellow colour and surrounded with a dark rim; some of them are of large size. The smaller granules are oftentimes seen to cling to them having been attracted to the larger body. On adding water molecular motion is excited and subsequently the smaller particles aggregate into irregularly shaped flocculi. Blood corpuscles are met with and are easily distinguishable from the other elements. Besides all these, there exist a number of pale cells, oval for the most part, though often approaching rotundity & sometimes almost polygonal in shape. They have a well defined cell wall and contain usually one nucleus, though in many two may be seen.

The nuclei vary much in size and are of a lemon yellow colour, and there is likewise

pale

pale yellow refracting granular matter within the cell wall. These bodies resemble lymph corpuscles in their general aspect. The cells lie isolated and in linear groups as shown in fig. 10. they attract the surrounding granular matter towards them and are often seen to be enveloped in a firmly adherent mass of it - vid. fig. 11. This latter appearance I have noticed most frequently in the juice of the sheep's capsule.

Other smaller cells are seen, pale and containing granular contents without any nuclei. I am inclined to think with Dr Harley that these bodies may possibly be free nuclei.

The position of the adhering cells is worthy of attention, two and three and five and six of them are seen frequently bound together by granular matter, and rows of them one and two deep occur invested likewise by dark and bright granules. Ecker considers these

to

pale yellow refracting granular matter within the cell wall. These bodies resemble lymph corpuscles in their general aspect. The cells lie isolated and in linear groups as shewn in fig. 10. they attract the surrounding granular matter towards them and are often seen to be enveloped in a firmly adherent mass of it - vid. fig. 11. This latter appearance I have noticed most frequently in the juice of the sheep's capsule.

Other smaller cells are seen, pale and containing granular contents without any nuclei. I am inclined to think with Dr Harley that these bodies may possibly be free nuclei.

The position of the adhering cells is worthy of attention, two and three and five and six of them are seen frequently bound to-gether by granular matter, and rows of them one and two deep occur invested likewise by dark and bright granules. Ecker considers these

to

Expressed Juice from Sup. Ren. Capsule. (Sheep.)

Fig. 11.

Shewing various stages of Cell formation, granular matter adhering to cells. 450 diam. lin.

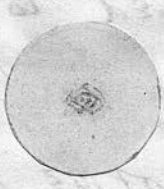


Fig. 12.

Cell drawn from the Juice of Capsule of the Pig.

450 diam. lin.

to be nuclei, and A. Frey, in his elaborate article on the Supra-Renal Capsules in Dr Todd's Cyclopædia, gives a drawing (after Ecker) illustrating his views. Ecker seems to hold and urge the molecular theory of cell formation throughout his statements, and supposes that the granular mass surrounding these nuclei is being developed into a cell wall. With all due deference to such an authority, I must beg to differ from this view, for as far as my observations have gone, they have never permitted me to see a perfect cell of this kind. I have described how a granular material adheres to the cells (nuclei of Ecker) and the appearance of this certainly much resembles the cell in process of formation as depicted in Ecker's drawing & I have sketched what I have seen in fig. 11. from the sheep. Not only have I never seen such cells as Ecker supposes to exist in the

the expressed juice, but not in the most favourable fresh or prepared sections of the cortex have I ever seen such cells in situ, while I have always found an abundance of what Ecker considers to be nuclei and I regard as true cells *

The action of reagents upon these various elements is worthy of attention.

Dilute Acetic Acid is useful in clearing up the cells and shewing nuclei and granular contents, they then look like nucleated white blood corpuscles. On adding strong liquor Potassæ the cell walls break up and the field of the microscope becomes covered with amorphous matter and small yellow refracting molecules, while the large yellow bright granules disappear. The large ones may break

---

* Dr Hartley mentions the presence of nuclei that appear to be surrounded by indistinct marks of a cell wall which he thinks may lead to the supposition that a cell wall is either in course of formation, or has been partly destroyed. Vide figs. 11 & 12. p. 52.

break up into little masses, and many of the latter may be liberated contents from the cells. A weak solution of Caustic Potass dols not dissolve the cell wall. When a weak solution of Caustic Soda is employed the cells are seen very distinctly and their walls are not dissolved; a strong solution however dissolves the walls and nuclei, and after a lapse of time all the granular material disappears. Membranous shreds remain on the field which are probably portions of fibrous stroma or membrana propria.

The bright granules in the capsules of the pig which are circular and very abundant are for a long time unaffected by a strong solution of Caustic Soda; subsequently they aggregate irregularly as if pure water had been added to them.

---

3. The Matrix of the Cortex.

This admits of brief description. We found

found that the matrix of the entire capsule might be traced in continuity from the investing fibrous sheath of the organ. A good view of the cortical matrix may be obtained from a thin section which has been well brushed and washed, and a weak solution of Caustic Soda will render its structure still more apparent. With a magnifying power of 350 diameters fibrous septa may be seen passing inwards in an almost regular linear series from the periphery to the internal part of the cortex. These fibrous columns are connected by cross bands at varying intervals so that a mesh or coarse network of fibrous tissue is formed, the cavities or areolæ being for the most part elongated and cylindrical; this is especially the case in the middle third of the cortical portion, while at the outer and inner thirds, the loculi are round

or

or oval in form. I have depicted some of the appearances presented by it in figs

The arrangement therefore entails the formation of a number of differently shaped compartments or loculi. As we shall find subsequently these support certain contents, and sometimes a loculus may be seen without its contents which have most probably been removed in the manipulation of the specimen.

4. Arrangement and Nature of the Cortical Columns.

We really commenced this subject when considering the appearances manifested in the cortex when examined under low magnifying powers. It is one of the many 'questiones vexatæ' in the minute anatomy of these organs. In describing the appearances which

which I have myself observed during the most careful and exhaustive examinations, I find I have to agree with no observer more closely than Dr Harley. This result, I consider, is due to our having employed the same methods in conducting the examination of these tissues, methods which – be it observed – are of recent introduction and which differ from any that had been previously employed. The mental conflicts that have occurred to me during the prolonged period of my observations as to the exact structure of the different portions of these organs have been not less instructive than they were disturbing and disappointing.

To determine whether a certain columnar mass be a true tube or an elongated and closed cylinder, and whether it communicate with another such, seems to be no difficult problem for solution, but

in

in fact the determination proves to be no easy task. Nor is this all, for other questions remain, as for example, is the cortical matter composed of tubes, cylinders or vesicles? – or does the removal of the walls of adjoining vesicles by absorption cause their fusion and coalescence into a tubular mass? I shall now briefly address myself to these difficulties concerning the arrangement of the cortical masses, and trust to explain them by the facts which I have observed.

If we examine a well prepared section of the cortical substance, we find that the columnar masses do not invariably course directly from without inwards, they do so in some portions and seem to run thus in the middle third of the cortex more especially. At the external and internal

borders

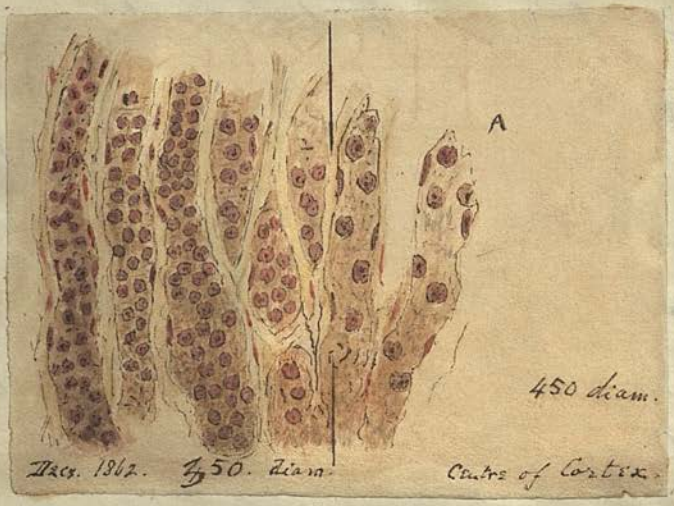


Fig. 13.

Human Supra-renal Capsule. Drawing of portion of thin section of Cortex. (Prepared section). The structure of the Cortical columns is shewn, collections of cells invested by membrana propria. Cortical matrix.
A. Isolated contents of a loculus, much resembling an epithelial tube cast from a kidney affected with Morbus Brightii.

borders round or oval vesicles occur filled with the same contents as the elongated masses. In fig. 13. and microscopic section No. 6. these appearances are seen. We found that the cortical matrix indeed entailed such an arrangement.

I have never seen any kind of communication between a so-called vesicle and an elongated cylinder, or between the elongated tube-like masses themselves.

I believe that the loculi contain their own proper elements intact, further, that the contents are similar in all, and that the columns and vesicles are thus essentially the same in structure. They must then be regarded as variously-formed but closed sacculi lying in the fibrous cortical stroma.

And next as to the nature of the cortical masses. Numerous preparations

illustrate

Fig. 13.

Human Supra-renal Capsule. Cortex and investing
A. cellulo-fibrous structures. Organ not quite healthy, it contained adventitious fat, molecular and globular.

B. Same treated with Tincture of Iodine proving the presence of Amyloid or lardaceous deposit in the columns.

(Amyloid Disease found in kidneys, spleen, liver, pancreas and Costal Cartilages. Patient died of Phthisis pulmonalis).

illustrate this point (vid. prep. 6.) as also figs. 13 & 14. In these the loculi are seen to be filled with a number of nucleated and granular cells and in the fresh state with all the elements which we have already described as occurring in the cortical juice, excepting only the blood corpuscles. By pressure upon the section the contents of the spaces may be squeezed out and scattered over the field of the microscope; the cells are then seen in linear masses adhering to-gether, also in an isolated state amidst granular matter as before described. vid figs. 10. 11. 12.

In the prepared specimens the loculi may be seen crowded in some portions with their contents and in others almost free from them; (Vid. Preps 6. 7.) this is due to their having been removed during the process of preparation, and the isolated appearance of the cells in certain portions, I am inclined

Fig. 13.″

Isolated Cortical Columns from Human Supra-renal Capsule. Adventitious fat in a molecular form at their outer extremities.

(From same capsule as Fig. 13′ was drawn from.)

250 diam lin.

inclined to attribute to the influence of spirit or chromic acid.

In the fresh state the cells, when seen lying *in situ* in sections through the loculi, seem to be disposed somewhat in a tesselated manner; they occur in single and double rows and have thus, perhaps from compression, a distinctly polygonal periphery.

A cross section of the loculi, at right angles to their direction (axis) is very instructive as illustrating their structure and the arrangement of their contents, and further, as enabling us to prove that they are not tubes at all, but closely occupied spaces. If such a section be examined under high magnifying powers the columns are seen bound together and invested by the fibrous matrix. It appears moreover that

the

inclined to attribute to the influence of spirit or chromic acid.

In the fresh state the cells, when seen lying *in situ* in sections through the loculi, seem to be disposed somewhat in a tesselated manner; they occur in single and double rows and have thus, perhaps from compression, a distinctly polygonal periphery.

A cross section of the loculi, at right angles to their direction (axis) is very instructive as illustrating their structure and the arrangement of their contents, and further, as enabling us to prove that they are not tubes at all, but closely occupied spaces. If such a section be examined under high magnifying powers the columns are seen bound to-gether and invested by the fibrous matrix. It appears moreover that

the

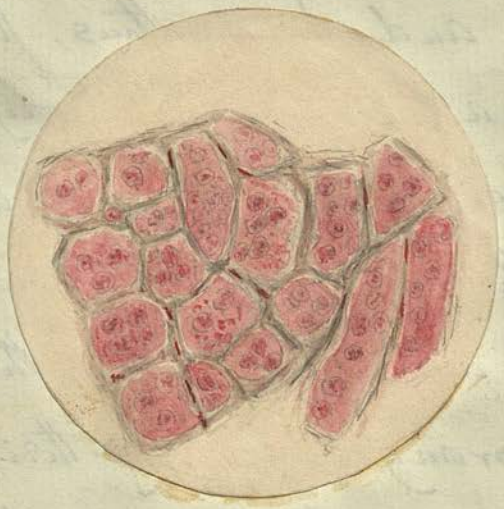


Fig. 14.

Human Supra-renal Capsule. Drawing of Section made at right angles to direction of Cortical columns, shewing their structure and form, with disposition of matrix.

450 diam.

the shape of each loculus is different, their general form, as exhibited in this section, may be called polygonal, many however are round and others again oval and even elongated, Vide fig. 14. The cavities are seen to be densely crowded with cells and granular matter.

From the large amount of carmine which the contents of the loculi imbibe they would seem to consist in a great measure of germinal matter. *

No internal cavity is recognizable in the loculi and there is no appearance in this section of a tube or tubes lined by any form of Epithelial cells as in the case of renal tubes or tubular glands properly so-called. As to the loculi being lined by basement or homogeneous membrane, I have

---

* Vide Dr Beale's views in his work on the 'Structure of the Simple Tissues.' p. 27. etc.

have to state my belief that they are so.

I have both in fresh and prepared sections seen the columns cleared of their contents, but the cavities occupied by membranous shreds with sometimes a few cells adhering or remaining entangled within them: again, I have frequently seen empty loculi which strongly contrast with those in which the basement membrane still remains. I have found that this membrane resists for a long time the action of a strong solution of Caustic Soda, this is considered by some authorities to be characteristic of membrana propria.

Ecker and Frey described its presence in the loculi, Kölliker however denies its existence; Dr Harley agrees with the views of the two first-mentioned anatomists, and I can confirm his observations.

I have yet to describe the inner third or pigmentary layer of the cortex somewhat

more

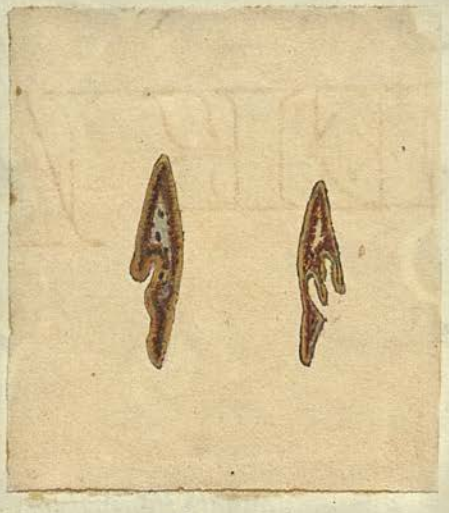


Fig. 15.

Human Supra-renal Capsules. Appearances presented by sections made vertically. Medulla rather pale. (Anamic).

more minutely.

Frey does not mention the presence of pigment in the cells of the loculi at the innermost portion of the cortex, Kölliker however does, Drs Harley and Beale have also satisfied themselves of this, and I have many preparations demonstrating the fact.* The pigment is of a brown or yellowish-brown sienna hue and is deposited as molecules and small granules around the cortical cells in some places, while in others the loculi are seen to be filled up with this matter which also occupies the interior of the cells.

When the cells are much loaded with pigment granules they lose the power of imbibing the ammoniacal solution of carmine, and thus they contrast strongly with those that remain free from this deposition. Some pigmented cells however seem to take up a little carmine in their interior.

---

* Vide Preps 5.6 & 7.

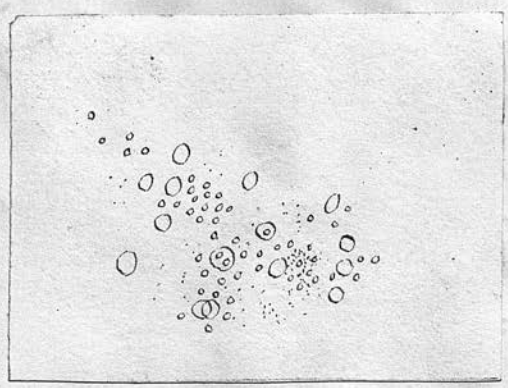


Fig. 16.

Juice from human accessory Supra-renal body.
It consisted entirely of oil globules in this instance

450 diam.

5. The minute structure of the Accessory Supra-renal Capsules.

In fig. 16 - I have depicted the appearance presented on magnifying the expressed juice from a human accessory supra-renal body.

The microscopic preparations 3 & 4 illustrate beautifully their minute structure. This proves to be precisely similar to that of the cortex, there being no medullary portion within them. Indeed they not unfrequently bear a strong resemblance to isolated portions of true cortical matter. The loculi seem to be most cylindrically serial and parallel in the centre of the mass as is the case in the cortex of the large organ, while they are smaller and more scattered at the peripheral portion.

6. The Bloodvessels of the Cortex.

In preparations 19. 20. and 21. the arrangements of the bloodvessels may be well seen The distribution of arterial branches is from the peripheral portion of the organs; the venous branches merge for the most part towards the medulla. There are numerous veins which accompany the arteries in the fibrous and cellulo-adipous sheaths and find their way into the corresponding veins of the main arteries which supply the organ; hence the vena Supra-renalis is not the only source of return for the blood to the System.

Arterial branches are seen to lie ramifying on the fibrous capsule at right angles to the cortical columns, from these are given off numerous branches which dip in with the septa of the loculi and course parallel with the columns. Numerous crop branches come off from these and thus a rich anastomosis is

6. The Bloodvessels of the Cortex.

In preparations 19. 20. and 21. the arrangements of the bloodvessels may be well seen

The distribution of arterial branches is from the peripheral portion of the organs; the venous branches merge for the most part towards the medulla. There are numerous veins which accompany the arteries in the fibrous and cellulo-adipous sheaths and find their way into the corresponding veins of the main arteries which supply the organ; hence the vena Supra-renalis is not the only source of return for the blood to the System.

Arterial branches are seen to lie ramifying on the fibrous capsule at right angles to the cortical columns, from these are given off numerous branches which dip in with the septa of the loculi and course parallel with the columns. Numerous cross branches come off from these and thus a rich anastomosis is

is formed around the loculi and their contents. The inosculation becomes most dense towards the inner third of the Cortex and this circumstance doubtless must tend, in a measure, to produce the dark colour which is met with in this situation, irrespective of the pigmentary matter of this portion. I have not been able to see in the injected capsules of the cat, guinea pig and rat any such arrangements as Nagel has pointed out. The injected vessels form a beautiful microscopic object, being quite arborescent in arrangement starting from the large venous trunks at the margin of the Medulla, then forming rich anastomoses which become less and less marked towards the peripheral portion.

---

7. Nerves of the Cortex.

It is almost impossible to examine any section

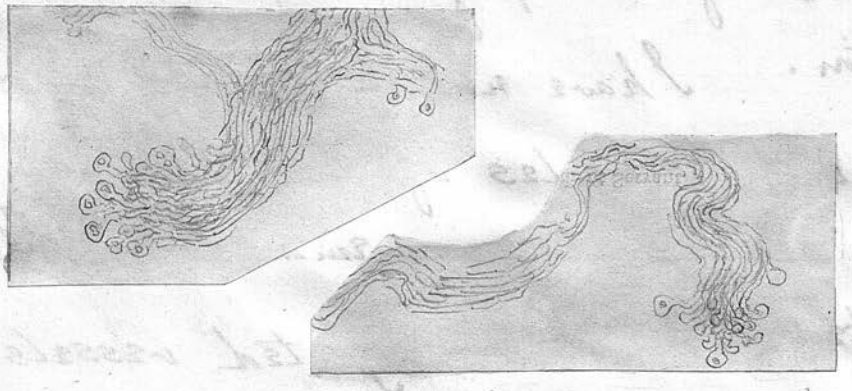


Fig. 17.

Bundles of nerves from Cortex of Supra-renal Capsule in Sheep and Ox, their wavy direction is shewn; afferent or efferent bundles joining or leaving the larger masses: hammer-headed extremities of the fibres.

section of the cortex of a Supra-renal capsule without finding a considerable amount of nervous tissue disposed throughout it. There may likewise frequently be seen numerous nerve fibres curling and interlacing outside the fibrous capsule of the organs.

In fig. 17. I have drawn the appearances manifested by the nerves in the cortex of the sheep and ox. They are seen passing from without inwards amongst the areolar tissue as bundles of fibres.

The bundles are dense and compact for the most part, varying however in size, and their arrangement seems to be by no means a definite one. They follow a wavy and rather tortuous course inwards to the medulla and are often joined at right angles and various degrees of obliquity by smaller bundles which actually appear in some places to form decussations with them. Ecker denies that

the

the bundles give off any branches in the cortex, I am convinced however that I have seen numerous fibres given off from the larger masses in various directions and dipping amongst the cortical Coculi.

I have not observed a double contour upon these fibres in the fresh state, nor are any contents apparent. Numerous amputations occur in their course, not unlike those of the fibres entering the medulla spinalis. On treating them with Caustic Soda they were well demonstrated and the double contour became manifest. In the preparations to which I added the Ammoniacal Solution of Carmine the fibres became granular in the interior and shewed no double contour.*

I have not satisfied myself as to the existence of a special enveloping sheath to the fasciculi within the substance of the capsules. At the extremities the fibres

Expand

---

* Vide. Fig. 24. p. 89.

expand into club-headed masses or end in ganglia which contain nuclei and nucleoli.

These appearances are only visible in fresh capsules*.

The different bundles may be traced only for a short distance as they dip in amongst the cortical loculi and are then lost to view. I have found that the statements I have made apply as exactly to the nerves of the human organs as they do in the case of the ox, pig and sheep. The fibres in the pig, I should mention, are much finer than those of any animal in which I have examined them.

---

* Vide remarks on 'Nerves of Medulla'. p. 88.

Part II.

V. The Relation between the Cortical and Medullary portions of the Supra-renal Capsules.

The remarks which I have to offer upon this head may be briefly made.
In a section of a healthy capsule, we have found that to the naked eye there appears a well marked limit between the cortical and medullary portions; further that in many cases the line of demarcation is rendered more obvious from the presence of pigmentary matter in the inner layer of the cortex. With a magnifying power of from 350 to 450 diameters, the minute relations of the parts are not difficult to ascertain.

We find that the fibrous matrix is prolonged from the cortical loculi into the medulla; there is thus a distinct connection

between

between one portion and the other. The fibres pass in to form the medullary matrix, and they are accompanied in many places by bundles of nerve fibres which are coursing inwards to ramify in the medulla. The cortical columns and smaller loculi with their contents are seen to terminate abruptly and their ends abut boldly against the more delicate medullary tissue. Numerous microscopical preparations shew this, vide Nos 1 to 7.

The intercolumnar vessels moreover after having formed the most dense portion of their anastomoses pass on amongst the fibres of the matrix as single vessels for the most part and of considerable size to form the plexus of medullary veins.

Thus the fibrous matrix limits the boundaries of the two portions, and while on one side we have the abutting cortical

masses

masses, on the other we have the contents of the Medullary fibrous meshes.

The fibrous tissue connects as well as limits the two portions, and the vascular and nervous elements, common to both, are directly continuous, as we have seen, from one to the other.

Part II.

δ. The Structure and Arrangement of the Medullary Portion.

I purpose considering under this head 1. The appearance under low magnifying powers, 2. Character of Expressed Juice of Medulla, 3. The Matrix, 4. The Contents of the Medullary meshes. 5. The Blood Vessels, 6. The Nerves.

1. The appearance under low magnifying powers.

powers.

If in a section of a Supra-renal Capsule the Medulla be examined with a lens magnifying 80 diameters, but little of its structure and arrangement is to be ascertained.

Its substance is seen to be much more transparent than that of the Cortex, the venous sinuses in the centre are well seen. Around the latter there is not unfrequently to be discovered a ring of cortical structure which contains sometimes pigmentary matter in its columns. The lamellæ radiate towards the wall of the sinuses and abut against them. Several of the microscopic sections reveal this arrangement.*

In the prepared sections there is much granular matter to be seen, the granules absorb the carmine solution. If a fresh section be washed and brushed, fine areolar meshes may be seen, but the granules have disappeared.

---

* This arrangement is well seen in the Medulla of the ox and calf, and almost always in human Capsules. Vide Figs. 1. 2 and 4. p. 28.

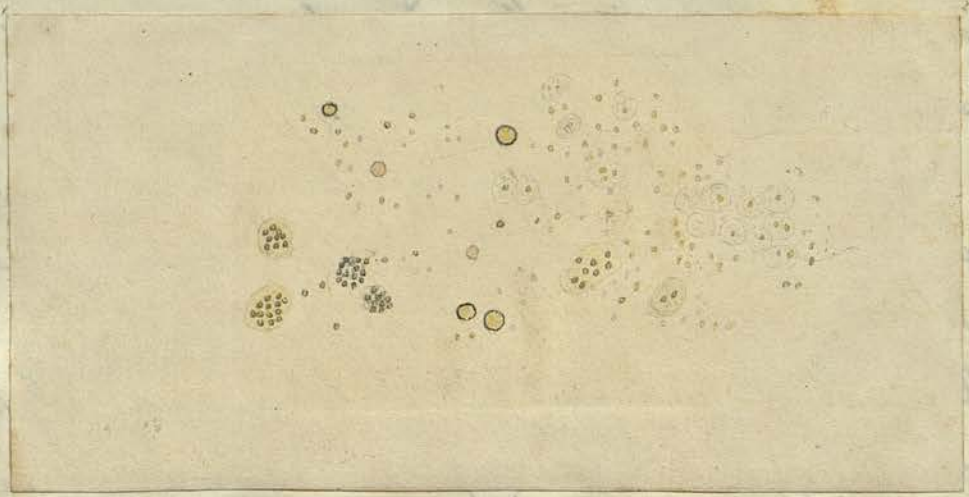


Fig. 18.

Juice of Medullary portion of Supra-renal Capsule of Rabbit. Its striking similarity to that of the cortex is obvious in the existence of bright refracting granules and variously sized globules & pale nucleated and nucleolated cells. Aggregations of small refracting granules with an apparent investing membranous wall.

450 diam.

disappeared.

2. Characters of the Expressed Juice of the Medullary Portion.

It is almost impossible, according to my observations, to discover any difference between the respective expressed juices from the cortex and medulla.

In fig. 18. I have drawn the appearances of the medullary juice taken from the rabbit. If this figure be compared with fig. 10. p. 50 the great similarity between them will be at once manifest. The most striking difference consists in the number of the granules which are not nearly so numerous in the medullary juice, they are however of the same nature.

A number of pale nucleated and granular cells are seen, quite similar to those found in the cortex; some large oval pale cell-like masses containing many bright refracting dark-rimmed or oily granules. Aggregations

of

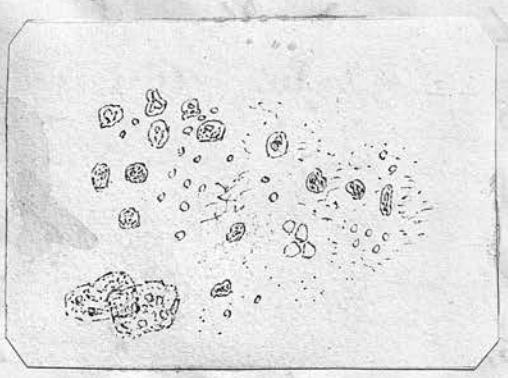


Fig. 19.

Human Supra-renal Capsule, juice of Medullary portion.

of granules without any investing membrane occur - vide fig. 18. p. 75.

In the juice of the sheep's medulla I found an abundance of oval or round cells with one or two nuclei, and in some instances with nucleoli. Numerous granules were included in these cells. On adding Dilute Acetic Acid the cells became clearer, and their contents were rendered more distinct. ~~Fig. 18. p. 75.~~ Represents the juice from the entire cut surface of the sheep's capsule and therefore includes the medullary elements. Fig. 19. was drawn to give the characters of the juice expressed from the medulla of the human capsule.

H. Frey mentions that small circumscribed collections of fat are not unfrequently found in the medullary substance in the rabbit. The cells I have described containing the aggregations of oily granules may be what he alludes to. Vide fig. 18. p. 75.

Kölliker states that he has almost always

always obtained, on careful treatment and in fresh preparations, pale cells of an angular form and exhibiting processes from their sides one or more in number and sometimes branching.

In the medullary juice of all the different capsules which I have examined in the fresh condition and with the employment of various reagents, I have never succeeded in finding any such cells.

The cells I have referred to are quite oval or round, nucleated and sometimes nucleolated. I have never even seen a cell from the medullary juice present a caudate appearance.

3. The Medullary Matrix.

We have already described the source, and to some extent, the arrangement of this structure. We saw that it was continuous with the cortical matrix and most of the microscopical preparations illustrate this fact.

A rich network of fibrous tissue is formed, not regularly or in a definite manner, but in indefinite areola. In the medulla of most capsules the fibres are seen to radiate from masses having a caudate or stellate shape as I have depicted in figs. 20. 21. 23.: they then frequently turn in a semicircle so as to form meshes of a somewhat round rather than angular character. Many of the round areola are for the transmission of veins in this part as some of my sections prove. In the stained specimens it will be found that the interior

Fig. 20.

Human Supra-renal Capsule. Medullary matrix and contents. Stellate bodies of matrix, appearance of cells in them but generally appearing more or less granular.

interior of these caudate masses contains granular matter which imbibes the carmine abundantly. The granules may be also seen in a fresh specimen. I have seen in some preparations what appear to be cells in the midst of the mass and have drawn the appearances in figs. 20. 21. which may be compared with preparations. These cells apparently contain a nucleus and are surrounded by granular matter.

In the course of the fibres numerous stained portions occur which are neither granular nor cellular; this appearance is seen in preparations Nos 6 and 7. and in fig. 20.

I am inclined to the belief that these caudate masses in the matrix, which, I should mention become more apparent when the tissue is washed and brushed, have been taken for other bodies than they really are.

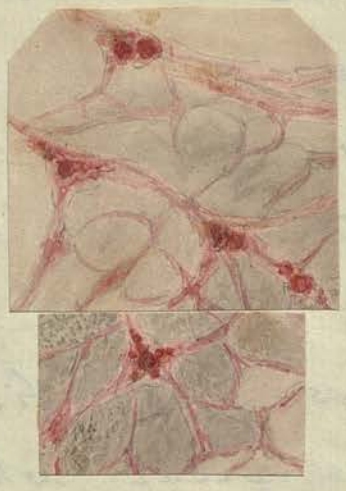


Fig. 21.

Stellate bodies from Medullary Matrix of Supra-renal Capsule of Sheep.

are. They present much the appearance of stellate or multipolar nervous ganglia, but that they are not so I think I have repeatedly proved to myself since I have found in fresh sections stained by the imbibition process that the nervous branches ramify and course beside them without receiving from or transmitting to them any fibres of connexion*. The medullary cells lie closely in relation to the fibres of the matrix and it is difficult to brush or remove them from it. The fibres form here numerous loops through which the veins of this portion ramify. The nervous bundles course amongst its meshes, but appear to bear no definite relation to it.

---

* I am inclined to think that the cellular appearance, to which I have alluded, is due, in some instances at least, to the presence of a medullary cell, either attached to the caudate mass or lying directly underneath it, being in the latter case brought distinctly into view by alteration of the focus of the microscope.

4. The Contents of the Medullary Meshes.

A magnifying power of 300 or 400 diameters enables the contents of the fibrous matrix to be studied with accuracy. They consist of the cells which we have previously described with a few bright refracting oily granules and fine granular and molecular matter. The cells merely fill up the spaces and as seen in section are disposed apparently in a somewhat tesselated manner; this is well shewn in the injected microscopical specimens of the capsules of the guinea pig and cat, vide preparations Nos 21. 21 also the human specimens, Nos 6 and 7.

There is no definite arrangement however of the contents, and there are no determinable aggregations of cells or of medullary matter as in the cortical substance.

There is no basement or limitary membrane

to

4.

The Contents of the Medullary Meshes.

A magnifying power of 300 or 400 diameters enables the contents of the fibrous matrix to be studied with accuracy. They consist of the cells which we have previously described with a few bright refracting oily granules and fine granular and molecular matter. The cells merely fill up the spaces and as seen in section are disposed apparently in a somewhat tesselated manner; this is well shewn in the injected microscopical specimens of the capsules of the guinea pig and cat, vide preparations Nos 21. 21 also the human specimens, Nos 6 and 7.

There is no definite arrangement however of the contents, and there are no determinable aggregations of cells or of medullary matter as in the cortical substance.

There is no basement or limitary membrane

to

to be seen, and in this circumstance the medulla differs materially from the cortex.

Hence we must conceive these contents as lying free within the meshes and in direct connection with the vascular and nervous arrangements of this portion of the organ.

5. The Bloodvessels of the Medullary Portion.

From the fact that there are no valves in the veins of the supra-renal capsules it occurs that injections forced into the arteries or veins of the organs run from one set of vessels into the other without any hindrance. Thus from the rich anastomosing arterial network in the cortex a few small vessels are seen to pass into the medulla, the bulk of the vascular plexus in this portion is however decidedly venous in its nature. If a transverse section of the capsule in the ox or sheep be prepared, the numerous openings into the central venous sinuses are well seen. If bristles be inserted into its cribriform substance a better idea of the number and direction of the small veins may be obtained. An arborescent

arborescent arrangement exists, the smaller branches passing into the central trunks.

In the injected specimens another view is exhibited under magnifying powers of from 80 to 200 diameters. It is seen that the veins resulting from the dense cortical anastomoses, which exist in some specimens about the outer portion and in others in the inner half or third, commence immediately and course singly, radiating towards a larger trunk which receives at different angles other branches from various directions. The large trunk thus formed passes inwards and is either lost sight of owing to some imperfection in the section or laceration during its manipulation, or, it is seen to dip down through a fibrous areola to join a deeper trunk; in other situations the trunk may be seen passing into a still larger one which itself opens into one of the central sinuses.

Thus

Thus a loose venous mesh is formed composed for the most part of variously sized trunklets; a smaller arterial set of vessels likewise ramifies in this portion and is seen to form a network around the fibrous areola which in a fully injected specimen can, I think, be distinguished from the venous plexus.

6 The Nerves of the Medullary Portion.

It is impossible to submit to magnifying powers of 300 or 400 diameters a small portion of medullary matter without finding an abundance of nervous tissue. To ascertain and define its exact arrangement however is very difficult. I think there can be no doubt that the medulla is the portion of the organ in which the nervous matter is most elaborately and minutely disposed: it exists here, as I have stated, in the greatest abundance.

When considering the nerves of the cortex I shewed that numerous bundles of fibres coursed inwards to the medulla.

The individual fibres present the same characters in both portions, thus the same amputations are visible in their course as they curl and interlace; with the aid

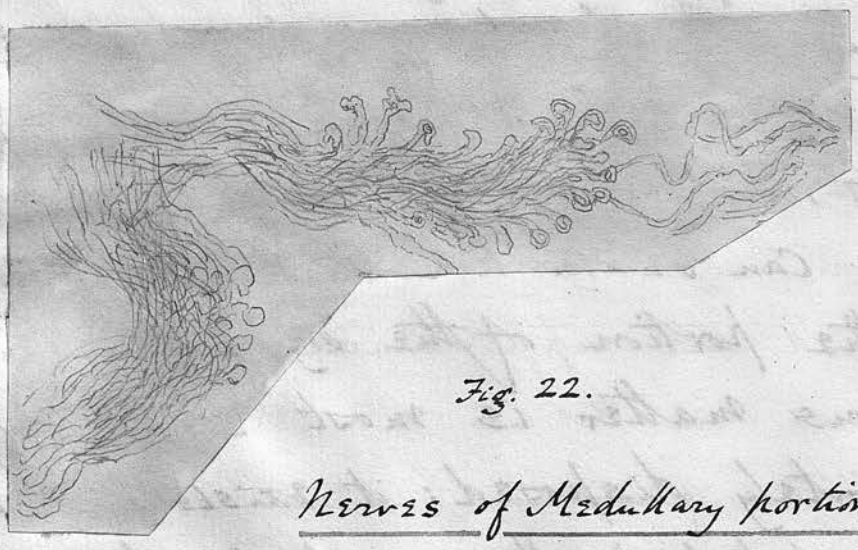


Fig. 22.

Nerves of Medullary portion of Supra-renal Capsules of Ox and Sheep, shewing decussations, ampullations, ganglioform extremities of the fibres and passage to or from them of fibres.

350 × 450 diam.

aid of a solution of Caustic Soda a double contour is apparent in many of them and dark borders in others, while at the ends of many I have seen what I have taken to be ganglia, of this last appearance however I am not able to speak with certainty. I stated in my Remarks on the nerves of the Cortical portion that I had noticed ganglia at their extremities, albeit, I think it possible to confound the appearances produced by pressure on the cut ends or ruptured sheaths of nerve fibres with those of true ganglia, I therefore speak with caution.

I have however traced single fibres passing onwards from these gangliform masses, which were, apparently, nucleated and nucleolated, to other bundles of nerves in the medulla*. Vide fig 22. If these be true ganglia they must then be considered as bi-polar.

I

*Medulla of Capsule of the Ox.

Fig. 23.

Bundle of Nerve fibres from Medulla of Supra-renal Capsule of Sheep. Numerous fibres are seen to course along with the medullary matrix

450 diam.

I have never seen a stellate or multi-polar ganglion or gangliform mass.

Many of the fibres issuing from the tortuous bundles run along with the fibro-areolar matrix. I have depicted this arrangement in fig. 23. Other fibres appear amongst masses of cells and dip down again and are hidden from view. Dense decussations occur in many parts and from these pass off variously sized bundles. The ultimate fibres are lost sight of amongst the medullary fibrous meshes.

At the extremities of the bundles numerous fibres appear to be reflected into the mass after forming little loops.

The nerves are best seen after washing fine sections and treating them with a Solution of Caustic Soda.

My observations, which have been numerous and varied, lead me therefore to conceive

that

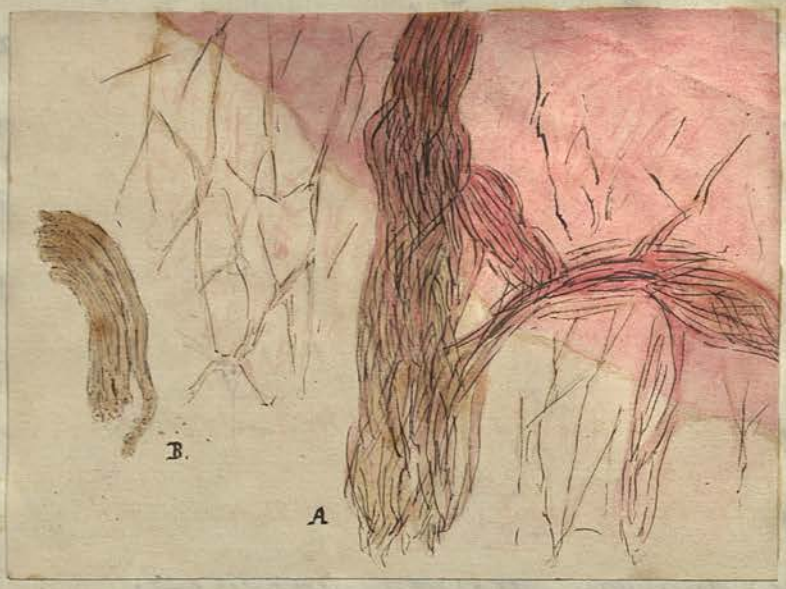


Fig. 24.

Supra-renal Capsule of Ox. A. Large bundle of nerves traversing the Cortex and entering the medulla. Decussations seen in the course of the fibres. Bundles of considerable size are seen to join or leave the larger trunks in the Cortex
B. Individual fibres drawn after treatment for 24 hours with ammoniacal solution of Carmine.

450. diam.

that a dense nervous network exists in the medulla; as to its exact and immediate relation to the other tissues of the part I cannot at present speak with certainty. I am moreover at a loss to devise any method whereby this part of the minute anatomy of these organs may be more clearly and completely demonstrated.

My belief is that the presence of large stelliform ganglionic masses (nervous) in the medulla, the view now held by most anatomists, is not by any means proved and that there are many reasons for doubting their existence here altogether.

A. Frey's remarks on this point deserve attention in this place, he states that "in the human subject it would seem there are no ganglionic corpuscles in this sympathetic nervous tissue, but in the horse in whose capsules there is a

richer

Zicher nervous plexus ganglion corpuscles
may be seen on the nerve trunks."
I have not yet had the opportunity of
Examining the capsules in the horse and
am therefore unable to verify Frey's statements.

Note.

I might fairly have been expected to discuss in a treatise of this nature the question of the homologies of the Supra-renal capsules; I have not however done so because I do not think I am at present in possession of a requisite number of facts from which to deduce sound conclusions. It is my intention to develope this question when I have completed my researches upon the physiology of these organs, and I shall then endeavour to translate the homological relations of the most characteristic portions of their structure either in confirmation or refutation of my present crude views upon the subject.

In thus issuing the foregoing observations I am not only conscious of the imperfect manner in which I have expressed my views, but am not without wholesome fears that I may have misinterpreted much that might have been put in its true light by those better qualified to observe and form opinions than myself.

I am not diffident however in committing them to the indulgence of the Medical Faculty in the University, though I should be very unwilling to make them, in their present condition, more public than this, bearing well in mind the sage advice of Horace as expressed in the following lines ——

"si quid tamen olim
Scripseris, in Metii descendat judicis aures,
Et patris et nostras, nonumque prematur in annum
Membranis intus positis; delere licebit
Quod non edideris; nescit vox missa reverti."

Hor. De Arte Poeticâ. l. 396.
Etc

Appendix.

When I originally formed the plan of my Thesis, I supposed that all my observations would be included under the heads and divisions that I then made. During the period that I have been working at the subject however, I have made some other observations in connection with it which I could not with propriety introduce into the substance of the thesis: I have therefore decided to record them in the form of an appendix, and shall treat of the different subjects in the following order —

A. Observations upon a point in the Chymistry of the Supra-renal Capsules.

B. Notes of the Dissection of the Supra-renal

renal Capsules in a large Cetacean, (Lagenorhynchus albirostris) or White beaked Bottle-Nose.

C. Observations made in order to determine whether the Supra-renal Capsules are relatively larger than the kidneys in various Mammalian Foetuses.

D. List and description of the Microscopical preparations and Dissections accompanying and illustrating the Exercise.

Observations upon a point in the Chymistry of the Supra-renal Capsules.

I repeated M. Vulpian's experiments with Iodine upon the capsules. An aqueous solution of iodine was applied to the medullary portion of the capsules of the sheep, pig, ox and calf, and I satisfied myself that a beautiful rose pink tint was produced after a short lapse of time. I applied it to the cortical substance likewise, but no change was produced. On adding a drop of solution of Per-Nitrate of Iron, a dark sap green colour was produced in the medulla which passed ultimately into a dark slate or grey colour. It did not affect the cortex in any peculiar way.

I

I was led to add the iron solution by a remark made by Kölliker, who states that M. Vulpian obtained a substance from the cortex having a beautiful rose colour in its watery solution which turned green on the addition of persalts of iron

M. Vulpian observed that oxygen and light together produced the same colour in a less degree, also, that most oxydizing agents exerted a similar influence.

Dr Harley has confirmed some of these experiments. I am inclined to consider that the change in colour may be due in some degree to the action of oxygen upon the blood within the medullary meshes, in the case of its production by air and light; this action is very observable on cutting sections of the spleen and exposing

them

them to air and light.

I consider the green colour produced after the addition of the iron solution to be an iodide of iron, and Kölliker does not allude to the production of the rose pink colour by iodine when he states that the addition of iron produced a green colour.

Appendix. B.

Notes of the Dissection of the Supra-renal Capsules in a large Cetacean, (Lagenorhynchus albirostris,) (Gray,) or White beaked Bottle-Nose.

A fine specimen of this creature having been captured alive off Hilbre Island at the mouth of the Dee, was sent to the Liverpool Museum*. It died ere reaching the tank of sea water which had been there prepared for it. Mr Moore the Curator having removed the skin and soft parts, immersed them in salt: at the end of a week, by his kindness, I was enabled to make a partial dissection of the creature.

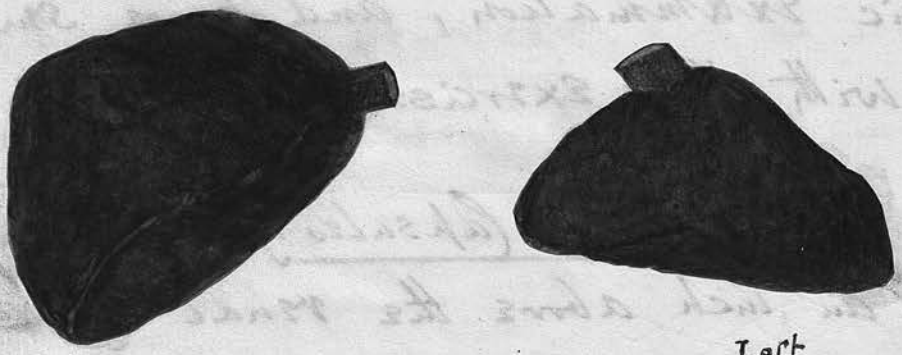
I

* I believe this creature has only been met with twice in British Seas.

I extract the following particulars, relative to the supra-renal capsules from my notes of the dissection. It was impossible to inject the specimens, I have therefore dissected their investments, and made some thin sections for microscopic examination, and have sent them in with this exercise.

"Supra-renal Capsules found lying about half an inch above the renal organs; no fatty investment existed. They were firmly bound down to the diaphragm posteriorly by dense fibrous adhesions, and anteriorly by the peritoneum. They were in connexion with the fibrous capsules of the kidneys by loose areolar tissue. On removing the superjacent viscera, they were at once exposed to view. They were somewhat discoloured by decomposition, & by the action of

7.



Right.

Left.

Fig. 1.

Supra-renal Capsules of the Cetacean.

('Lagenorhynchus albirostris'.)

Anterior surfaces are here figured, and the emergence of the vena supra-renales is shewn.

(Vide Preparations 13ᴬ 13ᴮ.)

(The kidneys weighed 2½ lbs and measured in the vertical diameter 11 inches, transverse diam. across centre, 5 inches, thickness at centre 2 inches.)

of the salt in which they had been steeped for a week.

The Right Capsule was larger than the Left one in all its diameters, except in thickness. Both organs were firm. The respective measurements were as follows—

Right Capsule. Longest vertical diameter. 1 3/8 in:
Greatest transverse -do- . 2 in:
Maximum thickness at Base . . 3/8 in:
Minimum thickness at Superr Margin } 1/8 in:

Weight. 2 drachms.

Left Capsule. Longest vertical diameter. . 7/8 in:
Transverse diameter (longest) 1 7/8 in:
Maximum thickness at External Border. } 1/2 in:
Minimum thickness at inner and upper Border. . . . 3/16 in:

Weight 1 drachm. 50 grs.

Both had their covering from peritoneum and their own fibrous coat, the latter being furrowed as in the human and other organs. They did not lie upon or touch

* Nos. 16 and 17.

touch the kidneys. Both were in intimate relation to the Vena Cava inferior into which entered the two renal supra-renales."

H. Frey observes that the supra-renal Capsules are small and lobulated in the Cetaceans. This is the case in the Seal, where I believe the surface of the organ is divided into a multitude of lobules or acini. I have not seen the capsules in the seal. In shape these organs in the Lagenorhynchus albirostris reminded me much of the human ones.

The microscopic sections of these capsules on examination shew in the cortical portion a tendency towards lobulation, the bundles of fibrous tissue being very dense and circumscribing on their passage inwards to the

the medullary stroma.

Appendix. C.

Observations made in order to determine whether the Supra-renal Capsules are relatively larger than the Kidneys in various Mammalian Fœtuses.

I have examined in various Museums the specimens of fœtal Supra-renal capsules and have also dissected numerous fœtuses for the purpose of procuring some exact data upon this point. I cannot do better than describe the facts obtained exactly as they came before me.

Human Fœtuses. The earliest human fœtal capsules which I have seen are those from fœtuses five months old. Preparation 1596 in the Oxford Museum shews them to be nearly as large as the kidney (fœtus 5 mos old) and overlapping their upper border. The have several deep grooves on their anterior surface, the most

5th Month.

* Sent in with this Thesis.

most superior one, subsequently the hilus, being perhaps the best marked.

5th Month. Specimen. 35.37. St. Bartholomew's Museum. (Fœtus circ. 5 mos. old.) Sup.-ren Capsules nearly as large as the kidneys. Their inner and lower margins overlap about half of the anterior surface of the botryoidal renal organs.

5th Month. Specimen. 35.61. St. Bartholomew's Museum. (Fœtus circiter 5 mos. old.). Capsules large and bi-lobed, equal in bulk to the kidneys, fitting their superior margins like caps. Their anterior borders do not extend so far down upon the anterior surface of the kidneys as in the other specimen.

6th Month. Specimen. 35.38. St. Barthol. Museum. (Fœtus circ. 6. mos.) Capsules more than one third as large as the kidneys, their lower anterior borders reaching half way down the anterior surfaces of the kidneys.

6½ Months. Specimen № 6*, which I removed by Mr. Skey in St. Bart. from a six and a half months fœtus (cut out by Cæsarian operation) shews the capsules as large bi-lobed organs, about one third the size of the kidneys, their anterior borders cover about a third of anterior renal surface.

7th Month. Specimen in Guy's Hospital Museum. (Fœtus circ 7. mos.). Capsules about one third the size of kidneys. Hilus well marked, also deep grooves on the anterior surfaces. Accessory capsule at the postero-inferior margin.

7½ Months. Specimen in St. Bartholomew's Museum 35.58. (Fœtus circ. 7th to 8th month.) Capsules seem to have risen up and not to have become larger than they had been at the sixth month, while the kidneys, still botryoidal, have

advanced

7½ Months. advanced considerably in size. In this instance they surmount and envelope the kidney exactly like two cocked hats.

8th vid. infra

9th Month. Specimen 1592. Oxford Museum. (Fœtus about full time) Capsules large, about one third the size of the kidneys. Hilus well marked, causing bi-lobed appearance of the organs.

Since I described the above specimens, I have had the opportunity of dissecting a fœtus of Eight months old. It was procured from a patient with a large ovarian tumour, premature Labour being induced to avoid the Cæsarian Section. I have sent in the preparation of the capsules and kidneys in situ. N°VI.

8th. Month. Specimen N°VI. Supra-renal Capsules of Eight months Fœtus, about one fourth the size of the kidneys and covering their upper —

Hilus well marked in both organs, causing a bi-lobed appearance. (The Fœtus was a male and of remarkably large size for its age.)

Fœtal Sheep. Specimens 1589 and 1590 in the University Museum at Oxford illustrate the relative proportions between the Supra-renal capsules and the kidneys at the second and third months of fœtal life. In both of these specimens the capsules are very large; in 1590 they are larger than the kidneys, and in both cases they overlap their upper surfaces.

In my own dissection (№ 8.) of the fœtal sheep at the full time, the capsule is seen to be small when compared with the bulk of the renal organ. In this case the preponderance has ceased to exist for some time.

Fœtal Pig. My own dissection of a fœtal pig at the full time (№ 7.) shews the relation in size of the capsules to the kidneys. The former organs are small, and if during the earlier months of fœtal life they ever did preponderate over the kidneys that condition

has

has apparently ceased to exist for some time.

Fœtal Elk. ('Cervus Axis'. (Ceylon)). In a fœtus of this animal, which was sent to me from Ceylon by my brother, about four or five months advanced, the supra-renal capsules are very small in proportion to the size of the kidneys. They do not lie upon the kidneys but are situated about 3 lines above their superior margins.

Fœtal Napu Musk Deer. ('Tragulus Javanicus' (Pallas.)

I dissected a fœtus of this beautiful creature at Oxford and found that the supra-renal capsules were very small and did not at all preponderate. It was at the full time.

I intended to have sent in with this exercise the kidneys and capsules, but the specimen was so delicate and soft that it was unfortunately injured while being mounted.

J

I have however sent in the capsules of a full grown specimen (№ 10.) which I procured in Liverpool.

Fœtal Rabbit. In this animal, about the full time, I found that the supra-renal organs were small and did not at all preponderate over the kidneys. I have sent in the specimen with this exercise. (№ 9.).

Generalizations from the preceding observations.

It is manifest that in the case of the human subject the supra-renal capsules preponderate greatly in size over the kidneys during the earlier months of fœtal life; further, that the relative preponderance diminishes towards the close of intra-uterine life, but even at this time the capsules are large as compared with the renal organs.

As far as I know, this description will not apply

apply to the capsules of any quadruped.

In the sheep the preponderance is very marked in early fœtal life, after the second or third month the capsules do not exceed the kidneys in size; at this period they cease to be relatively large and at full time, as we have seen, bear but a very small proportion to the amount of renal organ. Thus, though they agree with the human organs in the point of their early fœtal preponderance, they differ very markedly from them in the ratio of their subsequent development.

So far then as my observations teach, we may consider that the relative preponderance of the supra-renal capsules over the kidneys is most remarkable in the case of the human subject, though the fact of their large size in the early months of fœtal life in the sheep must make us careful not to limit this condition to man alone.

Appendix. D.

List and Description of the Microscopical preparations and Dissections accompanying and illustrating the Exercise.

α. Microscopical Preparations.

β. Dissections.

α. Microscopical Preparations.

(1.). Human Supra-renal Capsule. Vertical Section hardened in Solution of Chromic Acid and treated subsequently with an Ammoniacal Solution of Carmine, shewing investing fibrous tissue, Cortex, medulla and venous Sinuses: the Section has been made also through an accessory Supra-renal Capsule and shews the purely cortical nature of it.

(2.). Human Supra-renal Capsule. Vertical Section hardened in Chromic Acid Solution, shewing Cortex, medulla, Sinuses etc.

(3.). Human Supra-renal Capsule. Vertical Section prepared as No I. shewing Cortex, accessory bodies, Medulla, Sinuses etc.

(4.). Human Supra-renal Capsule. Vertical Section prepared as No II, and shewing the same structures.

(5.). Human Supra-renal Capsule. Transverse Oblique Section prepared as the last. This preparation shews well the pigmentary layer of the Cortex and the limitation thereby of the Cortical and Medullary portions. The investing Cellular and fibrous tissues are also exhibited.

(6.). Human Supra-renal Capsule. Vertical Section after hardening, treated with Carmine Solution, shewing investing fibrous tissue, Cortex, Medulla, Sinuses etc. This preparation exhibits beautifully, at the left hand side where the section is very thin, the structure of the cortical columns. The Medulla is also well seen, its cells and matrix with the stellate (ganglionic) bodies being very obvious.

(7.). Human Supra-renal Capsule. Vertical Section, prepared as the last, shewing

Cortex

Cortex, Medulla etc. This preparation shews the structure of the medullary portion very beautifully. The fact that the medulla does not exist in the thin overlapping basal portion is here exhibited, as the right border of the section has been carried through it.

(8.). Human Supra-renal Capsule. Horizontal Section through Cortex prepared as the last. This section shews that the cortical columnar masses are not true tubes but cylinders of various forms, more or less elongated as a rule and packed with cells etc.

(9.). Supra-renal Capsule of Sheep. Vertical section, not hardened but, treated with the Ammoniacal Solution of Carmine and mounted in glycerine. Cortex and Medulla shewn. The medullary matrix is especially well seen as also its relation to the cortical matrix and large central venous Sinus. Stellate bodies of the matrix likewise visible

(10.). Supra-renal Capsule of Calf. Vertical Section prepared without hardening and mounted in glycerine, shewing cortex, large area of medullary matter, sinuses

surrounded

surrounded by cortical substance, investing fibrous tissue etc.

(11.) Supra-renal Capsule of Sheep. Vertical Section, not hardened, treated with carmine Solution and mounted in glycerine. The relation of parts is well seen in this Section which is suitable for low magnifying powers.

(12.) Supra-renal Capsule of Calf. Vertical Section, prepared as the last. The structure of Cortex and of medullary mass is shewn in this specimen, also the limits of cortex and medulla, the matrix, and the occurrence of cortical matter within medullary territory. Sinuses etc.

(13.) Supra-renal Capsule of Ox. Vertical section prepared as the last, shewing Cortex, medulla, large sinuses and the occurrence of Cortical matter within medullary territory Limits of cortex and medulla.

(14.) Similar Section and Preparation.

(15.) Supra-renal Capsule of Sheep. Section similar to No 9.

(16.). Supra-renal Capsule of a Cetacean, 'Lagenorhynchus albirostris'. Vertical Section, hardened in salt and spirits of Wine and mounted in glycerine. Exhibiting Cortex and Medulla, sinus in centre etc. The cortex is seen to be somewhat lobulated, the separated masses being apparently elongated and cubical; they are invested by firm fibrous tissue. Some cortical matter is seen within the medullary territory

(17.). Similar Section from same Capsule.

(18.). Supra-renal Capsule of Pig. Vertical section not hardened, treated with Carmine Solution and mounted in glycerine, shewing structure of cortex, Medulla and Central Sinus.

(19.). Supra-renal Capsule of Pig. Vertical oblique section, not hardened, mounted fresh in glycerine, shewing structure of cortex, Medulla and Sinus.

(20.) Supra-renal Capsule of Cat. Vertical section. Transparent injection of bloodvessels shewing their arrangement in the cortex and Medulla.

(21.). Supra-renal Capsule of Guinea Pig. Transverse

or

or horizontal Section. Transparent injection of the bloodvessels shewing their distribution in cortex and medulla with their anastomoses. This preparation exhibits, under highly magnifying powers, the nucleated cells in the medullary meshes, also the pigmentary or inner layer of the cortex.

(22.). Supra-renal Capsule of Cat. Vertical oblique Section, shewing transparent injection of the bloodvessels.

B. Dissections.

Adult Series.

(1.). Human Supra-renal Capsule. (Left.)- Shewing the general anatomy of the organ. The Capsular vein is seen emerging from the hilus and is joined by the left inferior phrenic vein in this instance. The nodulated or furrowed appearance of the surface is seen, and at the inner end of the basal fissure there exists an accessory Supra-renal body.

(2). Human Supra-renal Capsule. (Right), shewing its

its general anatomy. It resembles a cocked hat in form. The right capsular vein emerges not far from the highest portion of the superior border, i.e. nearer the axis of the organ than in the case of the left organ. Hilus not so well marked as in the case of its fellow

II. β.

(II.) β. Human Supra-renal Capsule, (Left.) – shewing its general anatomy, its crescentic or semilunar form as contrasted with its fellow on the right side. It is suspended by the left phrenic artery which is seen giving off numerous capsular branches, the latter as well as the main artery being accompanied by veins. The left inferior phrenic vein joins the capsular vein in this instance.

(III.) Human Supra-renal Capsule. (Left.) – shewing general form of the organ. Hilus not well marked. Emergence of Vena Supra-renalis seen, wrinkled surface also. Basal cleft or furrow prettily developed in this specimen.

(IV.) Human Supra-renal Capsule, (portion of) from a girl æt: 8 years, mounted in glycerine and acetic

acetic acid. This organ was very free from adventitious fatty matter and was quite translucent. The section shews the cortical and medullary portions with their relations.

V. Human Supra-renal Capsule from man æt. circ. 40. Left organ in situ. The Aorta (stuffed) lies posteriorly passing between the two crura of the diaphragm. In front, in the centre, is seen the coeliac axis enveloped by the solar plexus. Left phrenic artery passing to its destination and giving off numerous capsular branches which are seen to be distributed to the anterior and posterior surfaces of the capsule. The vena supra-renalis joins the left renal vein which opens into the vena cava inferior.

The left great splanchnic nerve is seen to the left of the aorta, posteriorly, piercing the left crus of the diaphragm, it is accompanied by the lesser splanchnic nerve; the former joins the left semilunar ganglion which lies behind the inner and upper portion of the supra-renal capsule. The semilunar ganglion on the right side can be likewise

seen

seen above the junction of the Left renal vein with the inferior Vena Cava.

(Dissection unfinished.)

Fœtal Series.

(VI.). Human Supra-renal Capsules - fœtal, 6½ mos, injected from an umbilical artery. The vessels are seen ramifying upon the cortex beneath the peritoneum. Relative size of capsules and kidneys shewn. Deeply grooved hilus.

(VI.') Human Supra-renal Capsules - fœtal, 8 mos, uninjected. Peritoneum removed to disclose the exact relative size of the capsules and kidneys. Hilus well marked.

(VII.). Supra-renal Capsules of Fœtal Pig, circ. full time. Veins injected. Capsules are seen as two small elongated bodies surmounting the kidneys.

(VIII.). Supra-renal Capsule (left) of Fœtal Sheep, circ. full time. Capsule small and surmounting kidney. Relative size shewn. Vessels injected red.

(IX.) Supra-renal Capsules of Fœtal Rabbit. circ. full time. (Specimen inverted)
The organs are small, they were imbedded in a loose fatty capsule. (They are seen lying below the kidneys in the specimen).

(X.) Supra-renal Capsules of adult Napu Musk Deer. (Tragulus Javanicus) (Pallas.)
They are seen to be firm and smooth small bodies. They did not overlap the kidneys but were situated immediately above them. There were no fatty investments

(XI.) Supra-renal Capsules of Armadillo, (Dasypus sexcinctus) (Linnæus), (D. encoubert) (of Desmarcets.) Surfaces wrinkled. They lay above, but not overlapping, the kidneys, and had no fatty investments.

(XII.) Supra-renal Capsules of Anteater, (Tamandua tetradactyla) (Lesson) Surfaces wrinkled, and (the capsules were) not unlike the same organs in the Armadillo. They bore the same relation to the kidneys as in the other Edentate and had no fatty investments.

(XIII.). <u>Supra-renal Capsule of Cetacean,</u>
<u>(Lagenorhynchus albirostris)</u>(Gray.)
(Left). Wrinkled anterior surface. Section shewing internal structure. Vena supra-renalis filled out. Organ covered by the peritoneal investment.

(XIII'). <u>Right Capsule of the same.</u> It differs somewhat in form. Vena supra-renalis filled out. Peritoneum dissected off in part from the anterior surface.

(XIV.). <u>Supra-renal Capsule of Ox</u>- part of - shewing the general direction of the veins in the medullary meshes. Bristles are placed in the veins which are seen to pass into the central sinus which itself emerges ultimately as the great supra-renal vein.