On the coccygeal body / by W. Mitchell Banks.

ON THE

COCCYGEAL BODY.

BY

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Fig. 1.

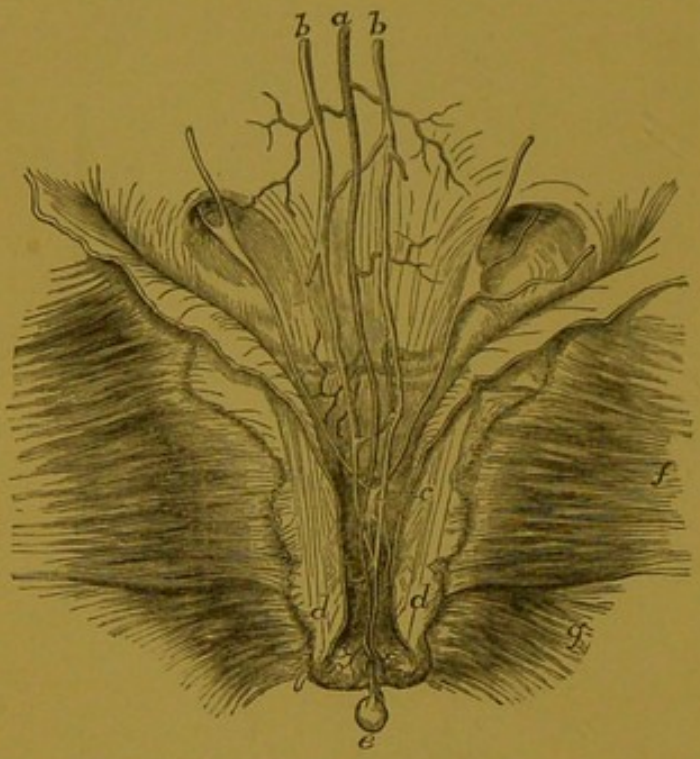


Fig. 2.

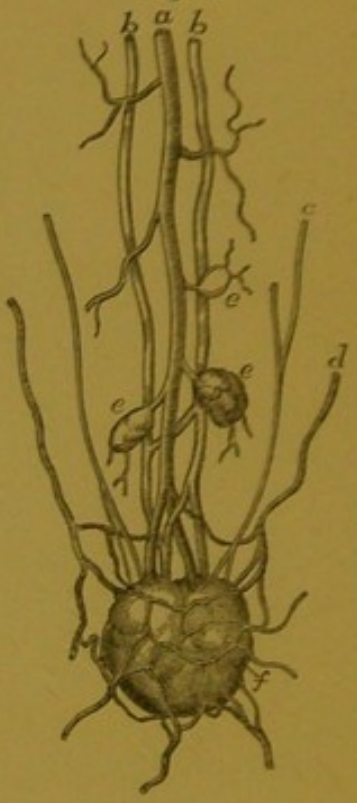


Fig. 3.

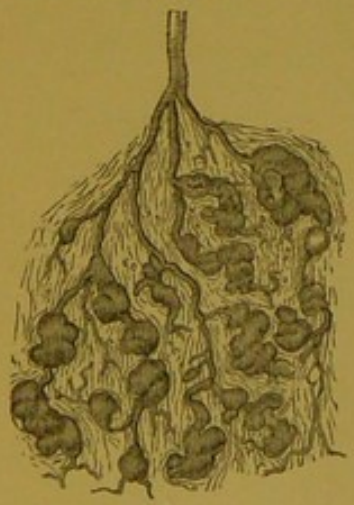
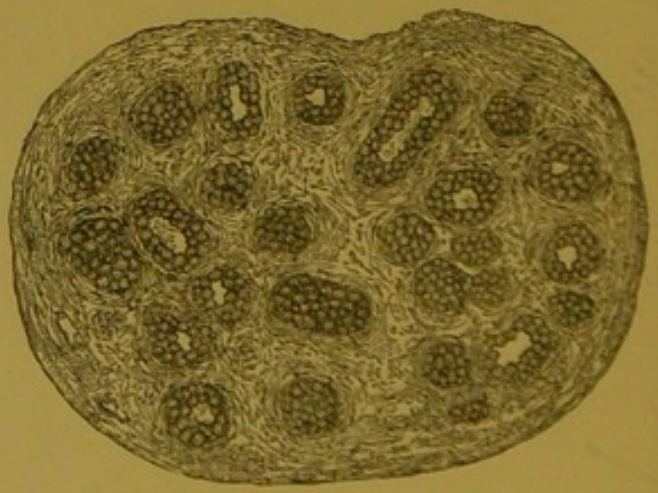


Fig. 4.



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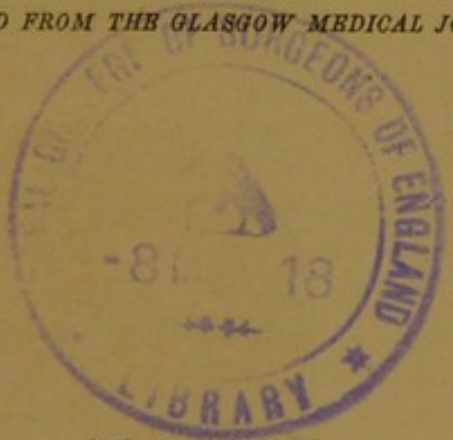

GLASGOW:

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1867.

ON THE COCCYGEAL BODY.

In 1859, Professor Luschka of Tübingen discovered the existence of a very peculiar little body seated at the tip of the coccyx, to which he gave the name of the coccygeal gland, and in the following year he gave a most elaborate description of it in a special memoir. He there stated that, from his investigations into the nature of the pituitary body, which lies at the upper end of the primitive medullary canal, he had been led to the belief that an analogous structure might possibly be found at the lower end of that canal, viz., somewhere about the coccyx, and that a careful examination of the parts in that neighbourhood confirmed this opinion by bringing to light the organ in question. He described it as having the form sometimes of a single round or oval corpuscle, at other times of a cluster of smaller but similar bodies situated at a little distance from the tip of the coccyx and connected with that bone by means of a pedicle, which was made up of fine twigs of the middle and lateral sacral arteries and filaments from the termination of the sympathetic nerves in the ganglion impar. As regards its structure, he considered the body as composed of a stroma of the nature of condensed connective tissue, in which were imbedded its peculiar glandular elements. These were of two kinds,—(1) Bladder-like sacs, sometimes quite circular, at other times oval and elongated, and often provided with fine, delicate tubular appendages or processes. (2) Tube-like structures of highly-varying shape, sometimes simple, at other times possessed of knob-like dilatations, or again highly contorted and with actual ramifications. Both these varieties of

"*Hohlgebilde,*" as he termed them, were closed cavities walled in by a basement membrane, and also encircled by concentric layers of nucleated fibrous or connective tissue. Their contents consisted of nucleated cells with granular contents, having very varying shapes, and showing a tendency towards the circumference of the cavities to form a sort of epithelial lining. Some of these cells seemed to be possessed of processes, while another very remarkable variety was actually furnished with cilia. Free nuclei were also scattered amongst them. The bloodvessels of the gland formed a capillary network which surrounded it, and was woven also around its component parts; and although he expressly mentions that some of the "*Hohlgebilde*" *seemed to be seated upon the walls of the vessels,* he did not believe that there was any further connection between them than that of mere position. The nerves, which were derived mainly from the coccygeal ganglion, consisted, for the most part, of the so-called gelatinous variety (though others of the usual kind were also found), and lost themselves in an indefinite manner in the parenchyma of the gland. Some of the twigs, however, as he imagined, ended in a pedunculated knob of a ganglionic nature, which was intimately connected with the interior of a gland-tube or gland-sac (!) He also notices isolated groups of ganglion cells scattered throughout the organ. From the nature of its cellular and nervous elements, Luschka was inclined to see a resemblance between the coccygeal body and the supra-renal capsules; but its intimate connection with the sympathetic system, and lower termination of the primitive medullary canal, induced him finally to consider it as the counterpart of the anterior lobe of the pituitary body. With regard to the pathological conditions of the organ, he believed that very probably the peculiar pain felt by many women in the region of the coccyx, which was first described by Sir J. Y. Simpson (1859) under the name of coccydynia, was due to an inflammatory affection of the coccygeal gland. Moreover, the various forms of cysts occasionally met with in the perineum, and more especially that variety termed *hygroma cysticum perineale,* probably took origin from this little body. He never could discover at the tip of the tail in animals any structure analogous to the gland, but mentions noticing something resembling it in the dog in the neighbourhood of the anus between the sacral muscles.

The next writer upon the subject was Krause, who confirmed the majority of Luschka's observations as to the position, size, and appearance of the coccygeal body, but stated that the concentric strata of fibres surrounding the contained sacs or tubes were not of the nature of connective tissue, but were smooth,

muscular fibres, having rod-shaped glancing nuclei, and that the "*Hohlgebilde*" were probably not completely closed structures, but communicated with each other. Furthermore, although he believed he could trace the nerves to the muscular layers of the gland-sacs and tubes, he totally rejected Luschka's view as to the ending of some of them in these structures by means of club-shaped ganglionic terminations, and was unable to recognise any ganglion-cells whatever in the organ. He could not discover any analogue in the animal kingdom, nor assign a meaning to the body at all, but regarded Luschka's theory of its resemblance to the anterior lobe of the pituitary body as quite imaginary and incorrect.

In 1864 Julius Arnold brought forward quite a different view as to the nature of the organ in question. He found that when injection was thrown into the middle sacral artery, it passed readily into the so-called gland, and completely filled its contained sacs and tubes, so that he considered the body as not of a truly glandular nature at all, but rather as connected with the termination of the above-mentioned artery. This vessel, he stated, ends by dividing into sundry small twigs, which undergo a series of sac-like dilatations (like a bunch of grapes), and these being all bound together by an investing tissue, constitute the coccygeal body. He was further strengthened in this opinion by observing that, connected by delicate branches with the artery as it runs down on the front of the coccyx, there is a number of little bodies, consisting of dilatations of these arterial twigs. They possess an epithelial lining, a basement membrane, and a thick muscular coating—in short, they reproduce exactly the normal constituents of the small arteries to which they belong. From the extremities and sides of these sacs or dilatations small capillaries pass out and lose themselves in the surrounding fat and connective tissue. The coccygeal body itself Arnold considered as just an agglomeration of these smaller structures, intertwined with each other, and seated at the end of the artery, and, consequently, a transverse section of it exhibited the cut ends of the vascular twigs and their dilated endings, which Luschka mistook for closed sacs and tubes of a glandular nature. He therefore proposed for the organ the name of "glomeruli arteriosi coccygei," in place of "coccygeal gland." As regards its morphology, he considered it as being of the same nature as the axillary hearts described by Leydig, or the caudal hearts and *retia mirabilia* found in many animals; and, finally, he quite disagreed with Luschka's view, that it might be the origin of cystic perineal tumours.

Lastly, in the *Zeitschrift für rationelle Medizin* for 1866, Krause, along with his pupil, Meyer, gave an account of their

re-investigations into the structure of the organ, which, in the main, agreed with Arnold's observations. Krause, however, announced its existence in the monkey *(macacus cynomolgus)*, and Meyer thought he saw it in young kittens; in both animals the body being situated on the front of the third or fourth caudal vertebra, in the neighbourhood of the anus. About the same time, before their communications appeared, and while Arnold's views were as yet unsupported, I made a careful investigation of the bodies in question, with the object of endeavouring to determine which was the correct opinion;—whether it was a glandular body, as Luschka declared, or a mere collection of arterial glomeruli, as was held by Arnold. The results of this investigation are as follows:—

Position and external appearance.—With regard to the position of the coccygeal body, it is situated in the middle line in close proximity to the tip of the coccyx. Along the margins of the lower part of that bone are attached some of the fibres of those portions of the levatores ani muscles, which lie posterior to the rectum, while certain prolongations from these fibres pass in front of the end of the coccyx, decussating to a certain extent with each other, and forming a sort of fibrous arch, between which and the bone runs the termination of the middle sacral artery. The remaining fibres of the muscles unite between the tip of the coccyx and the anus in the middle line, and being there tendinous form a membranous plate in that region. Tracing down the middle sacral artery we find it joined by the terminal portions of the lateral sacral vessels, and by sympathetic twigs from the ganglion impar, or from the loop which supplies its place when absent. These all run beneath the fibrous arch, on the front of the coccyx and emerging at the tip of the bone, constitute a pedicle to which the body is attached (Figs. 1 and 2). There is a sort of slit or aperture in the membranous plate above referred to, through which the pedicle passes, and in or immediately behind which the body is found. The easiest method of obtaining the body is (the subject being placed with the face downwards) to make an incision over the back of the lower part of the sacrum and the coccyx, and remove these parts entirely by sawing through the last sacral vertebra, carrying away also all the soft tissues around the tip of the coccyx for about an inch. Then pinning down the isolated bones and tracing down the sacralis media, the gland is reached, imbedded in the soft parts at the coccyx tip, in the position above indicated.

A very noticeable point is the remarkable constancy with which the organ occurs. This has been observed by the authors whom I have quoted, and, as regards my own experi-

ence, out of between forty and fifty bodies in which I have looked for it, I have almost never been unable to discover it. This, indeed, is one of the chief circumstances which give an interest to a structure otherwise so trifling in point of size.

The coccygeal body is found under two forms. It occurs either as a single roundish or oval body, about the size of a small shot, or a barley-corn, or in the form of several lesser granules, usually four or five in number, which lie close together. Occurring as a single body, it has, when perfectly fresh and not congested with blood, a clear gelatinous appearance, and is quite soft, but it hardens well in spirit or chromic acid. It is tolerably consistent and tough, but by teazing it with needles it can usually be separated into a few component parts (lobules as it were) showing that its primary or simple formation is that under which it often occurs, viz., isolated grains or corpuscles lying near each other. In what may be considered the more perfect state of the organ, these are bound together into a single body. Examining carefully the sacralis media for the last half inch or so of its course while it lies in front of the coccyx under the fibrous arch, there will be found in injected specimens, the little globular granules described by Arnold. They are connected by small branches with the main vessel. They vary a good deal in number. I have usually found only four or five, though Arnold mentions having once counted fifteen.

General appearance of a section.—Such being the position, frequency of occurrence and naked-eye appearances of the gland, its minute structure and that of the other small bodies attached to the sacral artery have now to be considered. I have examined the gland after being hardened in spirit and in chromic acid, and some specimens I prepared by first drying the body, next fastening it with gum to a piece of cork, for convenience of cutting, and then making sections which, when soaked in water with a little dilute acetic acid, swelled up again and showed the minute structure very well. It is absolutely necessary, however, to examine also injected specimens, the usual carmine and gelatine transparent injection being what I employed. The canula should be inserted into the sacralis media before it passes beneath the fibrous arch, and of course, the parts should be as little interfered with as possible, but, at the expense of losing a little injection through some of the small arterial twigs necessarily divided in the operation, the fibrous arch may be slit up and the gland exposed, and on the injection being forced in, the gland will be seen by the naked eye becoming filled with the fluid and coloured by it. In fœtuses and infants the sacralis media is too small to admit the canula and in that

case it is best to tie the common iliacs and insert the canula into the aorta, a little above its bifurcation. A section of the body shows it to be possessed of a sort of sheath or capsule, composed apparently of fibrous or connective tissue, which, although not very plainly defined itself, clearly marks off the organ from the loose fatty and cellular tissue surrounding it. The fibres composing this sheath have oval nuclei. They are somewhat wavy, but pursue a generally circular course round the organ, and, in sections embracing the whole body, prolongations of it are seen to pass into its substance and so separate (or, more correctly, bind together) its component corpuscles or lobules. A general view of a slice of the body, under a moderately high magnifying power, displays a series of variously-shaped cavities, seen in section, filled with cells and granules, and surrounded by nucleated fibres, disposed circularly around them (Fig 4). The shape of these cavities and their size vary exceedingly. Some are perfectly circular, and these seem to be what Luschka denominated "*Blasen*," while others are oval, or have an hour-glass shape, and many are very elongated, and have bulgings or dilatations upon them. Looking at a part of a section where several cavities of the circular form happen to be lying in close proximity to each other, the appearance is not very unlike that presented by a slice of bony tissue, with its Haversian canals, each surrounded by a series of circularly disposed lacunæ. Luschka, not having thought of injecting the organ, his error in supposing that it was of a glandular nature, and that the cell-filled portions were the sections of the closed cavities or sacs peculiar to it, is not to be wondered at; but a single glance at an injected specimen shows at once their true nature. The supposed sections of glandular cavities are then seen merely to be sections of tubes and saccular dilatations connected with them, and, as these are all convoluted and rolled up into a ball or glomerulus, a slice through this causes their cut ends to have a great variety of appearances, according to the angle at which the knife has come across them, those which have been cut at right angles to their axis being perfectly circular, while the others which have been divided slantingly present every variety of oval and elongated configuration. Again, when a saccular dilatation has been cut across at the point where one or more small vessels have been leaving it, and these also have been divided longitudinally for some little distance, the appearance is exactly that of a round closed cavity, seen in section, with fine appendages or prolongations from its side, as Luschka thought was actually the case. Injected specimens show very clearly the numerous fine capillaries which pass out from the sacculi and ramify in their

thick walls, while those of them coming from the saccules, at the very circumference of the organ, run into the surrounding subcutaneous tissues, and give rise to venous radicles, which probably end in the plexus of veins situated on the back of the coccyx. In some very successful injections the coloured fluid has been seen to pass into the body, fill its tubes and their dilatations, and pass by the efferent capillaries into the skin over the body, giving it a reddish colour to the eye.

Walls of the tubes and their saccular dilatations.—As mentioned previously, the whole body is encapsuled by a layer of fibres of the nature of connective tissue which also seems to send in processes between its component lobules, but in addition to this each section of a tube or of a sacculus is surrounded by distinct layers of fibres of considerable thickness, peculiar to itself and forming its wall. These fibres were considered by Luschka to be also connective tissue, but Krause, Arnold and Meyer hold the opinion that they are unstriped muscular fibres. They certainly differ in appearance from the fibres composing the enveloping capsule, and from their elongated fusiform shape, the possession of distinct wellshaped nuclei, and the regularity of their arrangement, the latter view seems to me to be the correct one.* In cases where the saccular dilatations have been cut across at right angles to their axis and where consequently their sections have a round shape, the muscular fibres are seen to be disposed circularly around them in concentric layers, but where an oval or elongated saccule has been cut longways in the direction of its course, muscular fibres can also be seen in many cases very distinctly running *parallel* to its axis, so that there are certainly two layers of these fibres traceable in such instances, one a circular, the other a longitudinal. In the majority of cases, however, only the circular variety is distinguishable. Running in all directions through this muscular mass, and forming a plexus in it, are the delicate capillaries which are given off from the sides of the saccules. Arnold has described a fine lining membrance internal to this wall of muscular tissue and consequently next the contents of the tube or its dilatation. He states that it is difficult to detect it from its close connection with the muscular stratum and from its very structureless appearance, but from this and from its power of refracting light, as well as from its elastic nature (which shews itself by the tendency of the membrane to curl up) he considers it to be comparable with the lining membrane of an artery. I regret that I have not been able clearly to make this out. With the utmost care I have never

* In this opinion, Professor Lister, whose writings on the subject of unstriped muscular fibre are well known, coincides.

been able to see any distinct lamina intervening between the innermost stratum of the involuntary muscular fibre and the cellular bodies which form the contents of the saccules. I would by no means, however, positively deny its existence, as one would, in the first place, naturally expect a membrane of some sort to be present; and in the second place, seeing that even on the smaller arteries it is very difficult indeed distinctly to define it, much more so must it be here.

Contents of the tubes and their saccules.—The great majority of the sections of the tubes, and the saccular dilatations connected with them, are seen to be completely filled by a granular looking mass, and when viewed with a high power this is found to consist of cells of considerable size, closely packed together and adhering to each other. These cells have a very delicate wall, and each contains a remarkably clear, round nucleus, very constant in size, and containing numerous granules or nucleoli. In addition to the cells are a great number of apparently free nuclei, around which no cell-wall can be detected, and here and there bodies looking like altered blood-corpuscles. Meyer states that when the mass is isolated from the interior of the cavity and broken up with needles, that some of the cells are seen to have tails or processes. I rather suspect that this caudate appearance is produced by the cell wall being pulled about and altered in shape by these manipulations, as I could not detect any distinct offshoots or processes in the cells while lying undisturbed in the cavities. On no occasion either was I able to see those ciliated epithelial cells which Luschka thought he observed. Towards the margins of the cavities the cells are decidedly more closely packed together than in the centre, and very frequently there is a distinct lumen or aperture visible in the centre of the mass, as if there was a channel running through it.

The exact nature and meaning of the cellular contents of the tubes and their saccules is somewhat difficult to explain. It was from the fact of the greater number of the sections of these structures being completely filled up by the cells and nuclei just described that Luschka was led to the conclusion that the organ was a gland composed of closed cavities or capsules filled with cells just as is seen in the case of the thyroid body. That it is not a gland has been shown from the fact of these supposed cavities being capable of injection and being in fact continuous with the middle sacral artery. The cells therefore cannot be of the nature of glandular or secreting cells. Arnold holds that we have merely to do with an exaggerated or hypertrophied condition of the usual epithelial layer of cells which might be expected to line canals of a vascular nature, such as

these evidently are. In favour of this view is to be noticed the fact that the cells are much more compactly united together round the circumference of the section of the tubes or saccules than towards their centres and that in many the centre is quite free of them, so as to leave a distinct lumen or aperture indicative of the existence of a clear channel through the tube or saccule. The injection, moreover, seems to meet with no opposition, but readily penetrates the tubes however apparently full of cells they may be. On the whole, this view seems to me to be the only tenable one and is perfectly consistent with the vascular nature of the coccygeal body. The circular muscular fibres previously described are thus to be considered as just an hypertrophied form of those which normally exist in the small branches of the sacralis media which enter the body, and which are continuous with the tubes and saccules forming it, while the cellular contents are in a similar manner to be considered as simply the normal epithelial lining membrane of these vessels which has here undergone a similar change. The fact that most of the tubes and saccules appear filled with cellular contents, does not by any means indicate that there is not a clear channel through them for the passage of fluid, as precisely the same appearance is presented by cross sections of kidney tubes in the adult, which generally seem quite blocked up with cellular matter, and yet through which there is necessarily a passage for the flow of the urine. It is only in the kidney of the fœtus that we find a clear lumen, with a distinct layer of epithelial cells lining the walls of the tubes. As before observed, the ready passage of injection is proof positive as to this point of the existence of a channel through all the tubes and their dilatations continuous with that of the middle sacral artery.

Small bodies on the sacralis media. A very interesting addition to our knowledge of the nature of the coccygeal body was made by Arnold, who observed that not only did the sacralis media end in that body but that for some little distance above its termination, and while it still lay in front of the coccyx, certain small appendages, usually from four to six in number, were connected with it, and were capable of injection from the artery just as the larger terminal body itself. They appear as small corpuscles visible to the naked eye, and under the microscope are found to present the same type of structure as the saccules of the main body. Some are mere sacs or dilatations of the little arterial twig which is connected with them, and they give off from some part of their side a little capillary or two which run into the surrounding tissue; others are more complex in form, that is to say, the afferent twig divides

into two branches with each of which a saccular dilatation is connected and from the other end of this passes out a vessel which again swells out into a second saccule. This produces a larger and more complicated corpuscle, and some again are still more intricate in their arrangement, owing to the afferent twig giving off more than two branches and consequently being connected with more saccules which are now rolled up into a little clump and spun round with layers of connective tissue and muscular fibres. The coccygeal body, then, is obviously merely an agglomeration of a few of these little clumps which spring from the very end of the artery, in place of from its sides, and are agglomerated so as to form one structure, and this is rendered quite certain from the fact that the body can be teazed out into several distinct portions or lobules and furthermore occasionally occurs not as a single organ but in the form of two or three distinct particles lying close beside each other (Fig 3).

The Nerves.—In the pedicle by which the coccygeal body is attached to the coccyx, there may be dissected out several fine nervous twigs, which proceed from the ganglion impar of the sympathetic, lying on the first joint of the bone. The ganglion is not infrequently absent, and in such cases a mere loop passing between the two sympathetic cords represents it. Even this may be wanting. The small twigs, whether coming from the ganglion or the loop, or the nerves themselves, can be traced down to the body quite readily, with the aid of needles and a lens. The mode of their ultimate termination in its interior has been variously explained. Luschka, while believing that most of them ended in the walls of what he imagined to be the hollow cavities of the gland, described, and gave an elaborate drawing of, a very peculiar mode of termination of some of them. He says: "I have, however, recognised with perfect certainty one form of ending in the parenchyma of this organ, and can convince others of it also. I found, namely, a primitive nerve tube, which branched off from a fine nerve-twig, and at once passed into a ganglionic cell. This latter had a pedunculated appearance, like a Pacinian body, was club-shaped, delicately granular, and furnished with a very distinct nucleus, which again enclosed a glancing nucleolus. This ganglion-celled nerve-knob was in immediate relation with the surface of the swollen end of a long, narrow gland-tube *(Schlauch).* On another occasion I saw a similar nerve structure, surrounded by nuclei and cells, in the interior of a gland-sac *(Blase).*" This extraordinary ending of the ultimate nerve-fibres in ganglion-cells, enclosed in the proper glandular cavities of the organ, has been seen by no one but Luschka himself, and,

I have no hesitation in saying, is purely mythical. In all probability he has traced a fine fibre up to the transverse section of some small vessel, which, being all but filled with cellular contents, has resembled a large granular ganglion-cell. Krause, Arnold, and Meyer all agree as to the existence of nerves in the general investing capsule of the body, where they form a sort of plexus, and have traced them inwards for a certain way also, but have not been able to recognize any ganglion cells in its interior. Meyer thinks the nerve fibres end in the muscular fibres. I have traced, with the aid of a high magnifying power, the nerves into the interior of the body, and they seem to me to pass into it along with the prolongations or septa of connective tissue fibres, derived from the investing capsule. They are next seen as pale smooth fibres running between the cut ends of the tubes and saccular dilatations, and often running close beside the capillaries which ramify in the muscular strata. It is to these muscular strata that I think, with Meyer, they are ultimately distributed. As to the existence of ganglion cells, I have, on two or three occasions, made out what I am almost certain were such, in distinct connection with the nerve fibrils.

Briefly then, to recapitulate, it will be seen from the description now given that, attached by small branches to the lower part of the middle sacral artery, are several minute bodies which, from the fact that they are capable of being injected, are essentially dilatations of the said branches, and are some of them, simple, and others complicated in their arrangement; that, at the *end* of the sacralis media, several of these seem to be rolled into one large glomerulus, hitherto named the coccygeal gland: finally, that a section of this structure shows that the tubes and the saccular dilatations composing it are surrounded by concentric layers of muscular fibre, and are nearly filled with large nucleated cells, more adherent at the sides than in the centre, which, in all probability represent the usual muscular and epithelial walls of the small arteries, with which the tubes and saccules are continuous.

In proceeding to determine upon the import of a body, about which little is known beyond its bare anatomical conformation, the most reasonable method is to enquire: (1) "Has the body a distinct physiological use? (2) If not, is it the remains of some body which *once* had a use—that is to say: is it the remains of a fœtal structure? (3) Is it the homologue of some structure in the lower animals? Small as the organ in question is, the fact of its almost invariably being present, and the uniform arrangement of its component parts, show that it is no mere accidental or abnormal occurrence, but has a definite significa-

tion, whatever that may be, so that, under one of the above three heads, some explanation of it should be found.

The question as to its having any specific function may be dismissed at once. Its trifling size and the position in which it lies are almost insuperable objections to this; now that the idea of its glandular nature has been disproved. Dr. Meyer, however, reasoning on the supposition that it is the homologue of the caudal heart which exists in some animals (and which is probably the truth), has gone a step further, and suggests that it may act somewhat similarly as a sort of heart in man, so as to *strengthen the circulation in the small vessels of the superjacent skin, and so render it less liable to sloughing from prolonged decubitus!* Apart from the innate absurdity of the organ acting as a heart, had Dr. Meyer considered for a minute that the tip of the coccyx is seated deeply in the cleft of the nates, and that consequently, very probably, the skin over it is never subjected to any pressure whatever, he would not have broached such a ridiculous idea. He even goes the length of suggesting that as Krause had found the body in the apes to be larger than in man, it might be so in them to answer their mode of life—squatting upon branches—which is apt to cause a resistance to the circulation of the blood in the capillaries of the sacralis media. I would suggest that this seems rather like straining a point in physiology.

It does not seem probable either that the coccygeal body is the vestigial remains of a fœtal organ. Connected with the heart, the liver, the intestines, and the generative viscera, are many little structures which are clearly of this nature: and are simply the atrophied remnants of blood-vessels, glands, &c., whose function has ceased with, or even before the birth of the child. But there is no such pre-existent gland or vessel to be found in the fœtus, in the neighbourhood of the coccygeal body, which might afford an origin to it. Luschka, it is true, held that it was probably derived from the lower end either of the chorda dorsalis, or of the primitive alimentary canal, and was thus comparable with the anterior lobe of the pituitary body. The latter view he believed to be the more correct one, as in the dog and monkey, in which the organ has been said to have been found, it did not lie at the tip of the tail, but in the immediate neighbourhood of the termination of the intestinal canal, behind (or above) the anal orifice. Considering, however, the intimate connection of the body with a specific artery, this theory is obviously erroneous, and has not been entertained by any one, except Luschka himself. Moreover, the body is found in a very perfect condition, even during fœtal life. I have injected it in several fœtuses from the fifth to the

ninth month, and though exceedingly minute, it was nevertheless distinctly recognisable when viewed with a good lens.

The theory which views the body as the homologue of some structure in the lower animals is by much the most likely one. Many years ago Dr. Marshall Hall in his work on the Circulation of the Blood, pointed out that in the eel, at the tip of the tail, there was to be found a pale elongated sac, into which several small vessels emptied themselves, and from which passed one which ran up along the spinal column in connection with the cord. This sac, which is visible even to the naked eye, pulsates, although its rhythm is not the same as that of the pulmonic heart, and the pulsation in it continues for some time after that in the other has ceased. This subject has since been investigated by Hyrtl. Again, on the axillary arteries of some animals small axillary hearts have been discovered by Leydig, and the peculiar vascular plexiform body connected with the carotid arteries of the batrachians has been long known. On the carotid of man even there exists a structure which has always gone under the name of the ganglion intercaroticum, or glandula carotica, but which Arnold has stated to be possessed of much the same conformation as the coccygeal body. To this class of structures, which may be considered appendages to arteries, varying in form and nature between the true additional heart and the mere *rete mirabile*, the coccygeal body most likely belongs, according to Arnold, Krause, and Meyer, and this, indeed, seems to me to be the only rational explanation of it.

With regard to the existence of the body in the lower animals, Luschka, as before stated, thought he recognised something like it in the dog, and Krause similarly in the ape. Meyer could not find it in the dog, rat, or mouse, but in young cats, in front of the 2nd or 3rd coccyx joint, near the anus, thought he discovered something resembling it, but could not state positively whether it was connected with the middle sacral artery or no. As this, however, involves the essence of the whole affair, and as, moreover, he could not find this said structure in old cats, his discovery seems somewhat questionable. I have several times made careful injections of the tails of horses, rabbits, dogs, and cats, and cannot say that I have met with anything which I could distinctly consider as the representative of the coccygeal body. Once only in a Manx cat—a genuinely acaudal one, without even the stump of a tail—I found a small body seated at the tip of the coccyx, and distinctly connected with the end of the sacralis media (that is to say, receiving branches from it), but it certainly did not present under the microscope the appearance of the coccygeal body, but seemed

to be a sort of minute multiple cyst. I have looked for the body also unsuccessfully in the monkey (macacus), but owing to the specimens which I examined having been long kept in spirit, the vessels were not injectable, and the fatty and connective tissues were so altered in appearance that I could not, with certainty, have recognised it had it been present. Nevertheless, I would not by any means, deny its existence in these animals, with only the amount of attention to the matter, which I have as yet given it, and perhaps future and more successful injections may yet bring it to light in them.

With regard to the pathology of the organ I can say nothing from personal observation. I should imagine, however, that it is not improbable that it may act as a starting-point for certain of those cysto-sarcomatous tumours which are occasionally found in the perineum. Its connection with the peculiar pain in the coccyx, experienced by some females, and termed coccydynia (or coccygodynia), is, I think, highly questionable. The method of cure which is often successful in these cases, viz., subcutaneous division of the ligamentous, and other structures attached along the margin of the coccyx, could have no effect upon any morbid condition of the body in question, and hence renders it improbable that it can be the *origo mali*.

I now append a general *resumé* of the facts concerning the coccygeal body, from which it will be seen that, after very careful examination, I agree entirely with Arnold in his view as to its being a vascular appendage of the middle sacral artery, in opposition to that of its discoverer, Luschka, that it is a gland:—

Resumé.—(1) Attached by small branches to the end of the arteria sacralis media are several small saccular bodies, some simple in their construction, others multiple, which receive a small afferent artery, and give off small capillaries from their sides.

(2) From the very end of the artery depends the coccygeal body, which is formed by a union into a glomerulus of from two to six clumps of small arterial twigs, with saccular dilatations upon them, the whole being bound into one mass by a sort of indefinite capsule of connective tissue, which sends in processes between them.

(3) A section of the body shows the cut ends of the tubes and their saccular dilatations, having every variety of shape, and each surrounded by concentric layers of smooth, muscular fibres, and filled, or nearly so, with large nucleated cells, which are arranged closely round the margin of the orifice, and loosely in the centre: often there is a distinct central lumen.

(4) Both the small appendages on the sides of the arteria

sacralis media and the coccygeal body itself are capable of being readily injected from that artery with which they are in fact continuous.

(5) Numerous fine nerves, derived from the sympathetic system, enter the body, and seem to be mainly distributed to the smooth muscular fibres. I have distinguished what I imagine to be ganglion cells in the interior of the organ.

(6) The body has no physiological functions, and is not the remains of a fœtal organ, but seems to belong to a class of structures, of which the caudal hearts of some animals, the axillary hearts of others, and the carotid appendages of man, and of the *batrachians*, are examples.

(7) It may possible give rise to perineal cysto-sarcomatous tumours, but does not seem likely to be connected with the peculiar pain in the region of the coccyx, known as coccydynia.

(8) With regard to its existence in the lower animals, Luschka believes he has recognised a body similar to it in the dog, Krause in the apes, and Meyer in young cats. My own observations have not been hitherto so successful.

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Explanation of Plates.

Fig. 1. Anterior surface of lower part of sacrum and of coccyx to show general position and connections of coccygeal body—

a. Middle sacral artery,
b.b. Its companion veins.
c. Ganglion impar with the sympathetic nerves uniting in it and giving branches to coccygeal body.
d.d. Fibrous arch on front of coccyx, under which runs middle sacral artery, slit open.
e. Coccygeal body.
f. Attached margin of coccygeus.
g. Do. of levator ani.

Fig. 2. Diagrammatic view of coccygeal body when isolated.

a. Middle sacral artery,
b.b. Its companion veins.
c.c. Twigs of sympathetic nerves.
d.d. Branches of lateral sacral arteries.
e.e.e. Small sacular bodies attached to sides of middle sacral artery.
f. Coccygeal body with small vessels running over its exterior.

Fig. 3. Diagrammatic view of a vertical section of the coccygeal body, to show the plan of its formation.

Fig. 4. Transverse section of the body seen under a moderately high magnifying power to show cut ends of the tubes and their dilatations, some completely filled with cellular contents, others with a distinct lumen and all surrounded with strata of circular muscular fibres. A general investing connective tissue capsule is seen.