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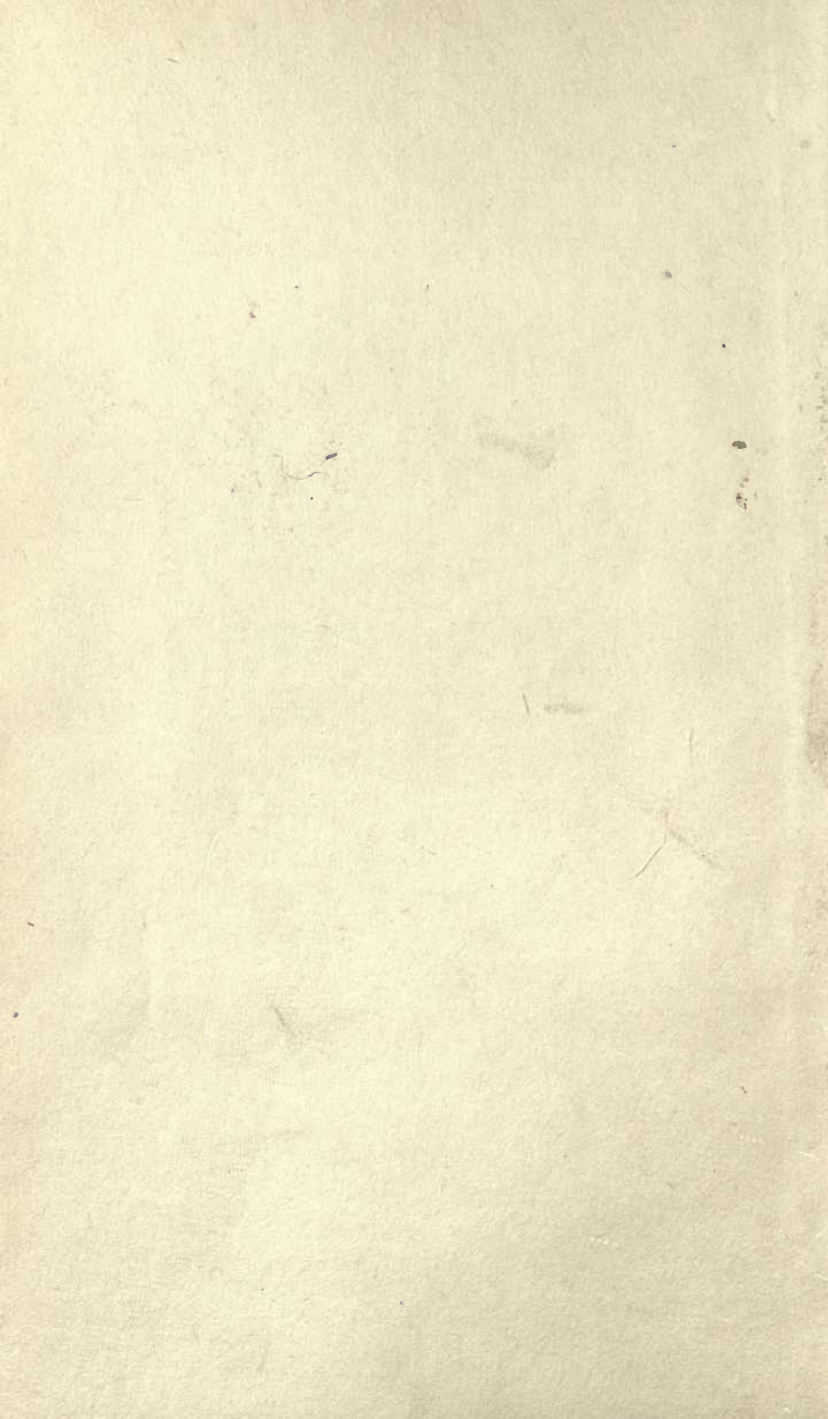
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SCARCE MONOGRAPHS.—MODERN SERIES.

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AN INAUGURAL DISSERTATION,

CONTAINING

SOME OBSERVATIONS

ON THE

PELVIS OF THE MAMMALIA,

WHICH, UNDER THE

PRESIDENCY OF J. F. H. AUTENREITH,

PROFESSOR OF ANATOMY AND SURGERY,

WAS OFFERED FOR PUBLIC EXAMINATION

BY JOHN FISCHER,

A CANDIDATE FOR THE DEGREE OF DOCTOR OF MEDICINE,  
TUBINGEN, SEPTEMBER, 1798.

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DEDICATION.

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TO THE ILLUSTRIOUS  
FREDERIC ALEXANDER VON HUMBOLDT,

ETC., ETC.

TRANSLATED BY ROBERT KNOX, Esq., M. D., F. R. S.,

EXPRESSLY FOR THE

“BRITISH RECORD OF OBSTETRIC MEDICINE AND SURGERY,”

EDITED BY CHAS. CLAY, M. D., MANCHESTER.

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As the first of our series of Modern Monographs, we offer no apology in presenting to our readers the celebrated Inaugural Dissertation of J. Fischer, on the Pelvis of the Mammalia,—a work of great value, and extreme rarity. In order to give the author's ideas with the greatest possible exactness, we esteem ourselves happy in presenting a translation expressly prepared for the British Record of Obstetric Medicine and Surgery, by ROBERT KNOX, Esq., M. D., F. R. S., &c., &c.; and have no doubt, under his able superintendence, it will form a Monographic gem of the highest interest and value.

CHARLES CLAY, M. D., MANCHESTER.

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THE PRESIDENT  
TO THE  
DISTINGUISHED CANDIDATE,  
S. P. D.

I return to you, unchanged, the dissertation you presented to me, adding to it but a few observations, expressed in a different type, lest, any thing unpleasant in the annotations might be attributed to you. This academical dissertation is not only highly creditable to your learning, but proves your mind to be untrammelled by the narrow limits of mere practical art and doctrine, and therefore equal to the advancement of science. Permit me, however, merely to remark to you, that you have neglected taking an enlarged view of the whole material collected by you, although individual parts are perfectly illustrated; thus leaving to the reader the troublesome task of discovering the fruit all the more difficult amidst a material by no means trite or common. The following is all which a want of leisure and opportunity permit me to effect towards remedying this difficulty.

There are two circumstances in which the pelvis of the mammalia chiefly differs from the human; first, the symphysis of the pubes is elongated backwards, so that the inferior wall of the smaller or true pelvis, forms a semi-canal, extending much beyond the posterior termination of the bones of the sacrum, and covered superiorly by the moveable and slender coxygeal bones only. I shall consider a little farther on the value and the importance of this structure in the pelvis of the quadruped, in facilitating the efforts of birth. In this place I shall consider the second peculiarity alluded to above; this has reference to the *ossa ilium*. It is known in man that a small portion of the bone of the ilium extends upwards and backwards, above the level of the base of the sacrum, giving an attachment by its inner surface to the common origin of the long muscles of the trunk; but that on the other hand, the anterior portion of this bone, which is by much the larger portion, is extended by its lateral anterior margin forwards, anterior to the sacrum; covered by the iliac muscle, it supports the intestines firmly with the opposite bone and the basis of the sacrum, the larger or so called upper or false pelvis. The margin or crest of the ilium is angular mesially from the spot where the ligament proceeds from it to the lumbar vertebra. But the superior anterior ligament of the pelvis, which unites this angle of the crest to the transverse process of the fifth lumbar vertebra, and another ligament placed lower down, the anterior inferior ligament of the pelvis, establish the same distinction superiorly between the abdominal anterior portion of the inner surface of the ilium and its posterior dorsal and smaller portion, which lower down the broad symphysis called *sacro-iliac* has constituted. On the other hand, many of the smaller animals want all that abdominal portion

of the os ilium which forms the larger or upper pelvis, but have that portion which towards the back projects beyond the os sacrum, long, although narrower, and more parallel with the os sacrum. This is the reason chiefly why the larger os ilium of the mammalia is so much narrower than the same bone in man, and its crest especially narrow. Hence the greatest distinction arises in the ratio of the muscles of the pelvis and trunk ; for instance, the dorsal muscles are very large in the rabbit, and the quadratus lumborum and psoas muscles of that animal which lie anteriorly on the longest transverse processes. These muscles, on both sides, completely hide the anterior aspect of the bodies of the lumbar vertebræ. There is no iliacus muscle, as there is evidently no room for it ; but the quadratus lumborum being left on the lateral and superior margin of the pelvis, it ascends above that, resting almost on the anterior and lateral margin of the sacrum ; posteriorly it appears to be joined in a manner to the pyriformus muscle of the true pelvis. The abdominal muscles are inserted into the anterior elongated margin of the ilium, Poupart's ligaments being placed more at the side than in man, on account of the very broad symphysis of the bones of the pubes and thigh bones coming out from the sides of the pelvis, and placed chiefly in an oblique position.

On account of the narrowness of the ilium, these ligaments almost touched the inferior insertion of the quadratus lumborum, unless the psoas muscle came between them. All the crest of the ilium rises backwards above the os sacrum in the rabbits, and gives insertion to the dorsal muscles ; hence the false pelvis is evidently wanting in that animal, and only the true pelvis is present. In other mammalia, as in the moles, not even by its margin does the os ilium look towards the cavity of the abdomen, the whole bone being retracted towards the back superiorly ; other quadrupeds, as the horse, &c., at least possess some abdominal portion of the ilium ; others truly, as the elephant, possess a very large portion, and which on this account resemble man ; but I shall treat of these afterwards.

This absence of the false pelvis in most of the smaller animals, and the very narrow os ilium, render the extremity of the body posteriorly so narrow when compared to man, and by denying a broader place of insertion for the gluteal muscles, render the haunches of mammalia very slender. The first cause, in connection with the horizontal position of the trunk, easily explains why herniæ, which are of very frequent occurrence in man, are *very rare* among quadruped mammals ; why no congenital hernia can occur in the rabbit, although the processes of peritonæum, which lead the testicle into the scrotum, remain open even in the adult animal, so that the testicles can very easily pass and re-pass from the cavity of the abdomen : why, moreover, herniæ are of more frequent occurrence among those animals which have a certain kind of false pelvis, (as the horse,) which therefore have Poupart's ligaments and the abdominal rings more transverse, and less situated at the side. It happens, indeed, that the thighs are bent towards the abdomen in almost all mammals, and the bony symphysis of the pubes is broader than in man ; therefore, the lowest part of the abdomen is better protected, while the abdominal rings are at a greater distance from each other.

It is here worthy of remark, that the infant in the human race has the



pelvis in reality narrow, as in most quadrupeds ; the abdomen elevated, or amalgamated as it were, with the chest, and the umbilical region very broad or ample. In the infant, also, I have found the abdominal portion of the bones of the ilium much less than in the adult, as compared with the dorsal portion, and that the ratio of the length of the dorsal portion to the abdominal, was, in the infant not quite two years old, as ten to eleven, up to fourteen ; whilst in the adult the ratio was as eleven to sixteen, up to twenty-two. This narrowness in the pelvis of the infant explains the greater frequency in them of umbilical and inguinal herniæ to crural : as, on the other hand, the breadth of the pelvis in grown women renders easy of explanation their greater liability to crural herniæ (and to herniæ of the foramen ovale ! ) ; and, generally, why it happens that herniæ most frequently appear at a time when the osseous pelvis has acquired its full development, than in early years when the pelvis is still narrow. To this observation there is the exception of congenital and umbilical herniæ. The strength of the dorsal muscles in the mammalia, seems to assist the slenderness of the glutei. The more any animal is fitted for leaping, and therefore for a more rapid elevation of the trunk, in it do we find a larger portion of the os ilium surpassing the os sacrum towards the back, and destined for the insertion of the dorsal muscles. I have measured the pelvis of fifteen mammals, in their whole length : then from the summit of the crest of the os ilium, as far as the anterior extremity of the tuberosity of the os ischium ; then I multiplied the length of that part of the os ilium (in its longest diameter), which passes beyond the os sacrum, with the breadth of the same part measured in its middle height or depth, and thus discovered the proportion of these numbers. The mole, unable to raise its prostrate body from the ground, has the least space for the insertion of the dorsal muscles ; the bat follows it, which cannot raise itself so far on its abdominal extremities as to afford space for the unfolding of its pectoral limbs ; the sluggish hedgehog follows the bat ; the mouse and weasel the hedgehog ; next the rat ; then the stoat ; the squirrel ; the rabbit ; then the martin cats ; the genus felis (cats) followed the martin, already remarkable for its leaping, and its swiftness of motion ; then the short-haired dog ; next the fox : the hare already excels the swift fox, living in the open air, and on this head differing most widely from its co-gener, the troglodytic rabbit. It is necessary merely to caution any one about to contemplate this series, that in an absolutely larger animal, the osseous surface for the insertion of the muscles, must not only be absolutely, but relatively larger.

In the skeleton of a certain cercopithecus, with a face resembling the human, but with a very long tail, and measuring, from the vertex to the calcaneum sixteen French inches, I found that portion of the os ilium which projects beyond the level of the sacrum to be very small, although it had not, properly speaking, any abdominal portion. Its place therefore in the series, was between the bat and the hedgehog.

Nor is man himself remarkable for any great strength of the dorsal muscles ; whilst resting on all four limbs, he cannot raise the trunk by leaps, unless the knees be first under the abdomen, as in the case of the quadruped. His dorsal muscles seem rather calculated to retain the trunk in its erect position, than at every step to raise again the horizontal, (that is, to raise the trunk

rom the horizontal to the erect position, with the same ease as they retain it when erect); the hands seem mainly given to him, as to the simiæ, for assisting in raising the trunk.

The proportion of the numbers obtained by multiplying the length of the dorsal portion of the ilium into the breadth of its middle portion, was to the square of the whole length of the whole pelvis :—In the

|                |                 |                  |                  |
|----------------|-----------------|------------------|------------------|
| Mole,          | as 72 to 10,000 | Squirrel,        | as 383 to 10,000 |
| Bat,           | ... 124 ... ..  | Rabbit,          | ... 422 ... ..   |
| Cercopithecus, | ... 149 ... ..  | Martin,          | ... 467 ... ..   |
| Hedgehog,      | ... 179 ... ..  | Cat,             | ... 538 ... ..   |
| Mouse,         | ... 183 ... ..  | Short-haired dog | ... 646 ... ..   |
| Weasel,        | ... 204 ... ..  | Fox,             | ... 715 ... ..   |
| Rat,           | ... 227 ... ..  | Hare,            | ... 737 ... ..   |
| Stoat,         | ... 309 ... ..  |                  |                  |

I next measured several human pelves by a straight line, from the anterior superior spine of the crest of the ilium to the angle which this crest makes inwardly in that spot, where, by means of a ligament, it is joined to the transverse process of the last lumbar vertebra; and then leading the string or cord from this angle to the posterior superior tubercle in which the dorsal portion of the crest terminates; by these measurements I found, for the most part, that the dorsal portion was absolutely larger in those pelves in which the abdominal part was smallest; and, vice versa, the promontory (or rather the last lumbar vertebra) projected more into the cavity of the pelvis the longer the dorsal portion of the crest of the ilium really was. In a female pelvis, for example, the abdominal portion was sixty-seven lines in length, in another only fifty and a third; in the former, the dorsal portion was only twenty-six lines and two-thirds in length; in the latter, it was thirty-two and a half. The length of the whole crest was thus in both nearly the same; for twenty-six and two-thirds added to sixty-one make eighty-seven and two-thirds; and fifty-two and one-third added to thirty-two and a half give nearly eighty-five. The *fossa*, or depression, moreover, between the dorsal portion of the crest of the ilium, and the summits of the spinous processes of the lumbar vertebræ, was less marked in that pelvis in which the dorsal portion was least, and in which the promontory projected less acutely into the cavity of the pelvis; but it was deeper or better marked in that pelvis in which the promontory projected more acutely into the cavity of the pelvis, and in which the dorsal portion was larger. In the former pelvis this *fossa*, or depression, had a depth of nine and one-third lines; in the latter it equalled eleven and a quarter.

These observations seem to me to throw new light on an observation of the distinguished Osiander,\* who observed that “in women who, from their earliest years were accustomed to carry burdens on their backs, the angle which the conjugate diameter of the pelvis makes with the horizon becomes much nearer the perpendicular, than in those accustomed to carry burdens in any other way; and that this greater inclination of the conjugate diameter is a frequent cause of difficult parturition. For not only does this greater obli-

\* Denkwürdigkeiten für die Heilkunde und Geburtshilfe, Zweyter Band; Gotting., 1795; p. 340.

quity of the conjugate diameter, arising from the flexion of the loins forward, render parturition more difficult, but the strength, likewise, of the dorsal muscles, increased by exercise, seems to be equal to the drawing backwards the pelvis of a young person of tender years, and of forcing the promontory inwards, and in this way to alter the form of the pelvis, and to render it narrower." At all events, the conjugate diameter of that pelvis whose dorsal portion was the largest, was shorter by six lines than the conjugate of that pelvis in which the dorsal *fossa* (already described) was least. Perhaps it is hurtful, therefore, to women to carry heavy weights on their backs; or even, perhaps, to affect too upright a style of walking, wherein the back and shoulders are drawn backwards, and the os sacrum elevated by the great vigour of the dorsal muscles. The chests of females, also, rendered stiff with whalebone, perhaps injure them in a similar way; nor is it only the narrowing of the pelvis from side to side, or transversely, which ought to be attended to when female clothing is considered, or the application of machines to the body; its impression from before backwards ought also to be attended to.

The dorsal portion of the crest of the ilium seems, for the most part, absolutely larger in men than in women, and the abdominal portion smaller; but the strength of the muscles is greater in man than in woman.

I come now to the next remarkable difference between the pelvis of man and other mammals, namely, the elongation of the symphysis of the pubis, elongated into a semicanal, and to which Daubenton gave a proper name; and to the consideration of the fact of the inferior exit of the pelvis in quadrupeds being directly opposed, or opposite, to the superior entrance or opening. In the erect position, the human os sacrum is again bent forwards, which, from its basis, on account of that very inclination of the superior aperture of the pelvis, is curved backwards; the coccygeal bones follow the forward curve of the os sacrum, and complete it; in this way the pendens of the pelvis is supported, the rectum and the vagina curved forwards, and a security is offered against a prolapse, during any more violent effort. But the inferior aperture of the pelvis would be too much narrowed by this curvature, were the symphysis of the pubis not shortened, so that this shortest anterior wall might be opposite to the longer curved wall; together with this, the plane of the superior aperture of the pelvis in man, is elevated much nearer to the glance of the horizon than in the erect animal. Now the globular form of the foetal head alone enables it to pass through this curved route, which leads outwards around the symphysis of the pubis, as around an axis in the concavity of the sacrum, from the superior or upper pelvis, through the inferior exit; and indeed so only that the short excavation of the *mucha* correspond to the narrow symphysis of the os pubis; and the long convexity of the head, from the chin extending over the face to the vertex, correspond to the long excavation of the pelvis, extending from the promontory to the apex of the coccyx. The promontory which it must be admitted exists in infants, and even in the foetus, though very obtuse and scarcely conspicuous, seems attributable in point at least to the erect position of man, and to the continuous efforts of the dorsal muscles. This promontory, narrowing or diminishing the conjugate diameter, and by its impression, as it would seem, rendering the oblique diameter the larger, forces the head of the child to

enter the excavation of the pelvis obliquely ; and this indeed happens more frequently with the occiput turned towards the left than the right acetabulum, because the uterus in the commencement of pregnancy inclines sensibly more and more towards the right side than the rectum, which is rather placed towards the left side, proved perfectly by the examination of the bodies of female infants. Now it was necessary that the head of the fœtus, after it had entered the cavern, or cavity of the true pelvis, should again slightly rotate ; because, as my measurements have at least taught me, the diameter of the smaller pelvis extending from the middle of the os sacrum to the middle length of the symphysis of the pubis, is a little longer than the transverse diameter, measured in the same place ; which is otherwise in the superior aperture of the true pelvis. The dimensions of the child's head beautifully correspond to these diameters, for its transverse diameter through the temples is shorter than its anterior posterior one. The lateral walls also of the true pelvis, and especially the spine of the ischium, if examined carefully, seem so bent that the head of the child may of necessity be moved in the manner just described. The human birth then is accomplished, as all are agreed on, whilst the head of the child is turned in the pelvis by a semigravitation, resembling the whirl of a univalve shell, and so escapes. But since the effort which expels the child acts in a right line, and the immovable walls of the pelvis at last produce these curved lines from a rectilinear motion, it readily appears how much of the propelling force must be lost against the walls by this oblique action, and how, from this cause, the human birth must be difficult ; but this detriment is made up for by the erect stature, the rounded head and larger brain of man, and by his elevated position above the order of mammals.

All these things are quite differently arranged in animals ; it was necessary that by far the greater number of them should walk on four feet, the pelvis, in consequence, by no means supports the intestines ; on the contrary, the bowels descend rather from the pelvis towards the deepest part of the umbilical region, so that, in the smaller animals at least, when they are opened in a supine position, the intestines are never found filling the cavity of the pelvis, as in man, but are found rolled up, and occupying the middle of the abdomen. Hence it happened that the os sacrum might be narrower, and very narrow it is in most of them, and seems to have such a curve with the coccygeal bones as the weight of the tail requires. There is not even so much of a promontory as we find in the human fœtus. The head of the fœtus also, which in animals is not spherical as in man, but straight and elongated, corresponds to the straight course through the pelvis ; and it easily escapes through it, expeditiously propelled, the propelling forces meeting with no resistance from its walls. In the gravid quadruped the fundus of the uterus inclines downwards by its own weight ; and its orifice looking towards the pelvis, rises somewhat upwards ; but in quadrupeds also, the posterior aperture of the pelvis leads chiefly upwards, and is there covered by a very moveable and narrow sacrum and coccyx, composed of several distinct and separate vertebrae. That the fœtus of the lower animals escapes from the pelvis chiefly by the yielding of the bones of the coccyx upwards, also become more moveable at the period of parturition, is known to every country woman, who

foretells the time of parturition in the cow by the greater mobility of the anterior coccygeal vertebræ, though concealed by their intimate relation to the abdomen, and by the elevation of these bones. Harvey already had said in the chapter on the exterior part of the uterus of the fowl, "in animals with tails, the birth cannot take place without the elevation of the tail;" these circumstances, however, in women, merely render the birth easier; but a deficiency in this respect can in no way impede the birth in her. The elongated head of the fœtus in the lower mammals, its lengthened form generally, not enclosed in spherical, but in a lengthened cylindrical shaped uterus, seems to be the cause why the smaller pelvis of quadrupeds forms a semi-canal in many species, the symphysis of the pubis being much prolonged, presenting merely a smooth (inconsiderable) incision or fissure between the tuberosities of the bones of the ischium to the chin (bent downwards) of the coming fœtus. In the genus *mus* the fœtus is gross or thickheaded, and its general form is also less elongated than in some other animals; but in this genus it also happens that the symphysis of the smaller pelvis is very short, and the so called ascending branches of the *os ischium* are in it united at a right angle to the descending branches of the *os pubis*, so that the smaller pelvis looks as if it had been cut across with a knife, and to have attained to only a half of its usual size.

It now remains that I say a few words regarding the narrow and elongated bones of the *ilium*, and which are more nearly parallel to the *os sacrum* in their length than in man, present in those species of animals in which the anterior wall of the pelvis is very short, as in the genus *mus*, hedgehog, etc.; and which are found even in those animals which walk like man, supported on two feet, as in the gigantic *Didelphis*. On the other hand, the elephant has the bones of the *ilium* very short, but very broad, and strongly resembling the human. The elephant and mankind agree not only in this respect, but also in this other circumstance, that the fœtus in both has a very large rounded head, in which the jaws are withdrawn as it were beneath the basis of the cranium, an arrangement of structure calculated to influence greatly the form of the uterus, and hence perhaps rendering this form of pelvis necessary; but these two wisest of animals agree also in this, that they both have the thigh bones disengaged or free of the trunk and straight, whilst in most other animals these bones lie hid, as it were, enclosed entirely or partially within the abdominal region, compressed and bent; this happens even in the gigantic *Didelphis*. The bear, in whom the thigh bones are more disengaged from the trunk than in the other *fervæ*, has the *os ilium* also broader than they have. The muscles which proceed from the external surface of the *os ilium* to the *trochanter major* of the femur, would either be too tense (as the remotest portion of the *gluteus maximus*), or would sometimes be too short when contracted, sometimes too long in extension of the thigh (as the *gluteus medius*), if the *os ilium* of animals, broad as in man, should, notwithstanding, coincide with a thigh bone hid as it were in the abdominal region and bent as in them, no alteration having taken place in the insertion of the muscles. But an elongated and narrow *os ilium*, with its abdominal or inferior portion as it were entirely wanting or deficient, does not interfere with this bent position of the thigh bones. Moreover these bent, compressed, very broad, and closely approxi-

mated thighs, as they exist in the lower mammals, support the remote portion of the lower belly, and no less prevent too forcible a protrusion of the intestines against the abdominal walls, than do immoveable bones themselves; so also in man, it is safest when vomiting is about to occur, to bend the thighs towards the abdomen, lest the effort of vomiting should give rise to a hernia, through the abdominal rings or under Poupart's ligament. Hence also it seems ill advised to extend with bandages the thighs of recently born children, in whom the peritoneal processes leading into the scrotum have not yet become contracted or closed. Nature has already taught them at that age to draw the thighs towards the abdomen, and this may be the main prevention against the passage of the intestines, through the abdominal rings, along with the testes in children, whilst enclosed in the uterus. The lower an animal walks with bended thighs, the narrower will be, in that animal, the os ilium, and the more does it seem pressed hard as it were against the sacrum throughout its whole length; so that a series, perhaps uninterrupted, might be formed or admitted, from man, in whom the broadest os ilium comparatively is united with the os sacrum almost at a right angle, to the mole, in which animal an extremely narrow os ilium evidently unites throughout its whole length with the lateral margin of the os sacrum, the great ischiatic notch having entirely disappeared.

I shall here stop, reserving all further observations for the distinct heads of your dissertation, to which they may refer. It remains for me to express hopes for your enjoyment of health; that many may owe their health to you; and that you remain a steady cultivator of the sciences especially requiring support in these times of trouble, commotion, and dreadful wars. Farewell.

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## FISCHER ON THE PELVIS OF THE MAMMALIA.

*1st—Man. Section 1.*—Nature has given to the human race the broadest and most depressed pelvis of any animal, seemingly required by his erect position, and by the size of the head of the fœtus; by the spreading out of the ossa ilium the intestines are supported, and by the capacity of the female pelvis, a ready exit is provided for the fully grown fœtus.

*Section 2.*—The pelvis of other mammals is longer and narrower than the human; and the bones of the ilium scarcely diverge, but ascend almost straight, or parallel.

*Section 3.*—In mankind, the superior aperture of the smaller, or true, pelvis, presents a plane, nearer the horizontal; whilst in other animals, the line drawn from the promontory of the os sacrum to the superior angle of the symphysis of the pubis, called the conjugate diameter, descends more perpendicularly; hence, in mankind, the transverse is larger than the conjugate diameter; in other mammals it is less, with a few exceptions, as in the pelvis of the horse, the buffalo, and the dromedary.

*Section 4.*—The quadrumana most nearly resemble the human structure, and this holds also of the pelvis, and amongst these, chiefly the simia satyrus. The Bellua follow these, chiefly the Elephant, &c.; then the solidungula,

(horses); pecora (cattle, deer, &c.); bradipoda (ant eaters); cheiroptera, (bats). The savage, or flesh-eating animals (carnivora), follow these; and last of all, the rodents. *Note.* The reader is cautioned here, that I adopt the classification of my illustrious teacher, Blumenbach, as contained in his Compendium of Natural History, fifth edition, Gottingen, 1797; and in measuring the pelvis, I have used the Parisian foot.

*2nd—Quadrumanæ. Section 5.*—The os sacrum is narrower and plainer in all the quadrumanæ than in mankind. Its external margins do not, as in the latter, converge downwards, but continue parallel with itself. The excavation of the pelvis in the quadrumanæ is less spherical than in the human race, which seems to be proved by the observations just mentioned; and that apes, so like us in other respects, are ill adapted for the upright position in walking; and that the head of the fœtus of the quadrumanæ is already more elongated, after the manner of the brute animal, than globose, or rounded, as in *man*. Even in the quadrumanæ, then, the pelvis has already assumed a character wholly animal. That cercopithecus, mentioned above, shews a sacrum composed of three vertebræ distinctly separated from each other, and evidently resembling those of the loins, and first coccygeal vertebræ, with the exception of the lateral appendages. The os ilium is elongated, its abdominal portion obviously defective, or wanting, unless you feel disposed to take for it the broad anterior margin of the bone. The symphysis of the pubis is elongated, and the tuberosities of the ischion bent outwards, so that the true pelvis already shews that the fully formed semicanal, of which we have taken notice above, and the entire pelvis, already strikingly resembles that of a small carnivorous animal, or of a squirrel. It is worth while recollecting how the mode in this order of animals is changed, as regards the birth of the fœtus, which, in mankind, presents by the occiput; in the mere animal, by the face\*. The spinous processes in man are not so prominent, neither do they run together. In the quadrumanæ, they project more than in man, and incline downwards. The number of sacral vertebræ varies in the quadrumanæ—two in the cercopithecus paniscus; three in the cercopithecus jacko; three also in the simia lar, sylvanus †, the papio mormon, and maimon, the lemur mongom, the simia sajou, apella (Lin.), have each respectively four ‡; The simia troglodytes has five. ||; and the sai, capucina (L), is said to have six. The simia troglodytes then, as regards the sacrum, most resembles *man*. The sacral foramina differ in number according to the varying number of the vertebræ.

*Section 6.—Os Coccygis.* In respect of the number of coccygeal vertebræ, the order simiæ, they may be divided into those with tails and those without. The simia jannus has two coccygeal vertebræ; the sylvanus and the lar three each; the troglodytes and the satyrus four each, which is the number in *man*; but these vertebræ are broader and larger than the human, excepting the first, which unites with the last vertebræ of the sacrum: nor do they incline so much towards the cavity of the pelvis, but descend more directly,

\* Ed. Tyson. Anat. Pigmy. Lond. 1699. 4. † P. Camper. Dusseldorf, 1791. 4 Tab. 3, fig. 7. Galen, Liber de ossib. Cap. xi., in which book he has substituted the anatomy of the ape to that of man. ‡ W. Josephi. Anatom. &c. Gotting., 1787. Tab. 5, fig. 2 || Tyson l. c. p. 89.

and hence, according to Tyson, it arises that the coccyx in the troglodytes forms a protuberance under the skin (in this respect) the human embryo strongly resembles the simiæ.\* The Lemur tardigradus has five coccygeal vertebræ; the papio mormon eight; the papio maimon twenty; the circo-pithecus jacho twenty-seven; the lemur mongoz and cercopithecus saniscus thirty-three. The number of coccygeal vertebræ is never so constant as in man; whence it happens that the numbers observed by different persons vary, often very much even in the same species. "The reason of this variation is to be sought for in the observers themselves, not in the animals; and to be contained in the difficulty of deciding amongst the separate vertebræ of the pelvis, what vertebræ are to be assigned to the sacrum, and what to the coccyx. Three vertebræ only in the cercopithecus I have described can be assigned to the sacrum. The wing-shaped portion of the first vertebræ on each side is the only one which has a distinct union with the os ilium, quite otherwise therefore than in man, in whom the symphysis with the ilium extends as far as and includes the first, second, and third, spurious, that is sacral vertebræ. The two vertebræ which in the circo-pithecus now follow, and which form with the first coccygeal vertebræ a kind of obtuse promontary in the middle of the pelvis, have broad thin transverse processes, truncated at their extremities, which unite with each other and with the first vertebræ by the angles of their apices, or summits, and by means of a cartilaginous substance and a ligamentous expansion; the same is effected by an osseous substance in the schunk, musteta, &c. Next come four coccygeal vertebræ perforated, short, with narrow transverse processes and oblique processes still rather large, the first of which has still a vestige of the dorsal spinous process, but the second first shews the abdominal spinous process to be described below. The sixth coccygeal vertebræ still shows on its upper surface the remains of the excavation (foramen pro medulla spinali) which almost immediately ceases."—*Autenreith.*

The first six vertebræ of the coccyx in the cercopithecus-jacho, paniscus, papio maimon, lemur mongoz, and briefly, in all the long-tailed quadrumana, have true spinous processes which tend somewhat obliquely upwards; from the same there proceed obliquely upwards on either side ascending oblique processes, the rounded extremity of which is united to the posterior surface of the descending oblique processes of the vertebræ above. Their transverse processes are sufficiently long, inclining downwards and backwards. These six superior vertebræ of the coccyx are perforated, which holds also in the tail-less apes, in whom for the most part the os coccygis is composed of three vertebræ, the simia troglodytes and satyrus excepted. In the last perforated vertebræ of the coccyx exists the end of the canal for the spinal marrow, which Galen asserted also of man; † but already this error had been exposed by Vasalius, ‡ who shewed that in man the canal for the spinal marrow extended no farther than the os sacrum. The remaining coccygeal vertebræ are longer, but towards the terminations they again become shorter and more slender. The longest vertebræ of this region in the papio maimon

\* P. Camper; l. c. p. 186.

† Galen. Lib. de Ossibus. C. xi.

‡ Vasalii de corp. human. fabrica. Basil, 1555. Ejus epistola rationem modamque, &c., &c. Basil, 1546, p. p. 49.



is 5''; in the cercopithecus paniscus, 1'' 3''; in the lemur mongoz, 1'' 6''. Each vertebræ may be divided into a body, an inferior and a superior extremity. The body is oblong, and includes four unequal surfaces. The upper extremity, thicker than the inferior, has a rounded articular surface, uniting to itself the preceding vertebræ. Around this surface there are tuberculous processes. Two of these processes are divided, so that in the terminating vertebræ there are six processes present. The lower extremity of the vertebræ ends in an articular surface, around which three processes only are placed. The tuberosities, placed around the joints or articulations, looking upwards, evidently correspond to, or originate in, the oblique and transverse processes of the superior vertebræ, altered in their form.

In the cercopithecus, already so often mentioned, the elongated vertebræ of the os coccygis are evidently similar to those described in the former paragraph, at that place where they rise above the posterior margin of the pelvis. In the tubercle placed around the superior articular surface, itself inferior and bifid, the two first vertebræ of the more distinct portion of the tail, properly so called, as well as the three other vertebræ, placed between the beginning of the distinct tail, and the sacral vertebræ, have a spinous process, quite similar to that which, in the dorsal vertebræ, looks backwards. This little bone is forked with two diverging crura, leaving between them a foramen, resting on the tubercles around the articulation, and looking towards the abdomen with the apex downwards. These abdominal spinous processes are united to the bodies of the vertebræ by a cartilage, or rather to the intermediate fibro-cartilage than to the vertebræ themselves. It is worthy of being mentioned, that these same abdominal spinous processes are not only found in the mus and the mustela, but also in the dolphin. Tyson, in his work on the Anatomy of the Porpoise, describes them in these words—"Besides the processes already mentioned, I find on the abdominal aspect of the vertebræ, other processes opposite to the dorsal spinous processes, connected with their intermediate fibro-cartilages. They consist of two slender little bones, joined at one extremity, and separated at the other, so that their bases form a series of foramina, through which run a number of blood vessels, in a manner quite similar to the medulla spinalis in the canal formed by the dorsal spinous processes. These processes, like all others of the vertebræ, gradually decrease as they approach the first caudal vertebræ, until at last they entirely disappear.—*Autenreith*.

*Section 7.—Ossa innominata.* These bones, before they reach the adult state, are composed, as all agree, each of three bones,—first, the os ilium; second, the os pubis; third, the os ischium. 1. The os ilium, in the quadrumana differs widely from that of man.\* For these bones do not diverge so much, nor do they form a cavity so large and distinct as in man, but ascend, diverging only a little as it were, upwards from the middle of the acetabulum; they have a triangular form, and are slender and much longer than in man. The body of the os ilium, or at least that portion of it which, with the os ischium and the pubis, assists in forming the acetabulum, is broader in the quadrumana than in man, when compared with the superior crest, for the crest in the quadrumana is broader than the body only by some lines; whereas in

\* W. Josephi l. c., Tab. v, Fig. 2. P. Camper l. c., Tab. iii., Fig. 7.

man the crest is 7'' 6''' broad, the body only 2'' 6'''. The external surface is broad in man, and marked with separated fluctuating lines; in the quadrumana it is narrow, almost perpendicular, and deeply excavated, especially forwards behind the anterior margin; this happens especially in the simia sajou and sylvanus. The internal surface is composed, in many quadrumana, of three smaller ones—first, an anterior; second, a posterior and inferior; and third, a superior and posterior. The superior anterior surface is situated quite anteriorly (this is the rudiment of the larger pelvis.—*Autenreith.*) The posterior and inferior surface looks more inwards, (and assists in forming a smaller pelvis.—*Autenreith.*) The posterior and superior surface, rough and unequal, forms the articular plane by which the os ilium is united to the os sacrum, and embraces the superior, posterior, and broadest portion of the internal surface. (In this surface is to be included that small portion which, at the back, overtops the os sacrum.—*Autenreith.*) In man, three margins are assigned to the os ilium, an anterior, a superior, and an inferior posterior; in the quadrumana also, three are present, the anterior, the superior and posterior, which is indeed the inferior margin in man, though being more parallel to the anterior, ought rather to be called the posterior. The anterior margin is comparatively longer than in man, and as long again as the superior. The superior margin, which is very short, runs from the anterior to the posterior spine; this spine touches, superiorly, the os sacrum; it is straighter in the simiæ, in some almost horizontal, in others somewhat convex, as in the simia satyrus.\* (In the cercopithecus, the superior margin posteriorly is strongly curved downwards, anteriorly making almost a straight line, and passing into the anterior margin of the os ilium almost at a right angle; as if with a knife you had divided the human os ilium in the middle.—*Autenreith.*) From the posterior spine there next descends the posterior margin; this is very long and composed of two equal parts, the superior of which is perpendicular and joins the sacrum; where this articulation ceases the inferior portion of the posterior margin commences, and is first curved anteriorly, then assumes a perpendicular direction as far as the junction with the os ischium, and thus forms the incisura which in man is called the superior ischiatic notch, without the aid of this bone. The varieties in height, length, and breadth of the os ilium in different species of the quadrumana, may be seen in the annexed table of measurements.

*Section 8.—2.* The os pubis does not differ so much in the simiæ from the same bone in man as the os ilium. It is also divided into a horizontal and a descending branch. The horizontal branch, extending from the anterior part of the acetabulum to the spinous tubercle of the symphysis pubis inclusive, is in man longer than the descending branch; in the quadrumana, however, it is shorter, and on its external surface has no crest or fissure. The descending branch commencing at the spinous tuberosity or tubercle, descends, and, with its fellow forms the symphysis pubis, is in the quadrumana much longer; the symphysis pubis is increased, and at the same time the depth of the pelvis, for the bones of the pubis are connected, not merely by the angles between the descending and horizontal branches, but the descending branches themselves are united throughout their whole length; nevertheless this structure does not prevail in all, for in the lemur tardigradus they meet only by the angles. By this junction there arises in some that keel formed projection, which is clearly

\* Camper l. c., Tab. iii., Fig. 7. A.B.C.D.

wanting in man. The greater length of the os ilium makes the conjugate diameter of the pelvis greater than the transverse.

*Section 9.*—3. The *os ischium* in them also consists of an ascending and a descending ramus. In man, the ischiatic spine is in the descending ramus, which according to Meyer,\* and Josephi,† the quadrumana have not, but in its place a rough protuberance (as perhaps in all animals.—*Autenreith.*) The tuberosity of the ischium, on the other hand, is longer and broader in the quadrumana, projecting more outwards and anteriorly, and especially remarkable in the simia lar, the sylvanus, and the papio marmon. The ascending ramus is more slender and narrower; it ascends to the union with the os pubis at a wider angle than in man.

*Section 10.*—The acetabulum is composed of these three bones, the greater part by the ilium and ischium, the smaller part by the pubis, and therefore it might happen that, in some species, the os pubis has no share in the formation of the acetabulum. This fact is contended for by Cunauld ‡ and Meyer, || but Josephi § doubts their opinion. (In the cercopithecus alluded to, the os pubis distinctly forms a portion of the acetabulum.—*Autenreith.*) The acetabulum in the quadrumana is much more distant from the crest of the os ilium and nearer to the sacrum, (as in all animals, *Autenreith*), but in other respects differs little from the human, unless it be that the incisura of the acetabulum is deeper and extends further towards the os ischium.

*Section 11.*—Behind the acetabulum forwards, and downwards, the foramen ovale is formed by the union of the os pubis and ischium. This foramen in the quadrumana, with reference to the whole animal, is more and more oblong, and is largest and almost round in the cercopithecus jaccho. The foramen ovale can only be said to be larger in the quadrumana than in man, when the cavity of the pelvis is compared with the area of the foramen, but it is less, if the size of the whole animal be compared to it. Of all mammalia, man has the largest pelvis, compared with the size of the whole body, and hence also it may arise that he has the largest foramen ovale. It is still larger in woman, although shorter than in man. In a male skeleton of elevated stature, I found the superficies of the foramen ovale to be to the total length of the skeleton

|                                                   |                  |
|---------------------------------------------------|------------------|
|                                                   | as 991 to 1000;  |
| In the female skeleton equally regular,           | as 1101 to 1000; |
| In the cercopithecus, already so often mentioned, | as 357 to 1000;  |
| In the rabbit, almost of the same size,           | as 392 to 1000.  |

It may be conjectured from these measurements by how much the smaller pelvis in man exceeds that of animals, passing over here in silence the larger pelvis; this appears to be necessary, as well from his erect position as from the larger size and rounder form of the foetal head.—*Autenreith.*)

*Section 12.*—4. *Bradypoda.* The *os sacrum* of the bradypi-didactylus, and myrmecophagus didactylus, is composed of four vertebræ. In the myrmecophagus didactylus (L.) the spinous processes of the sacrum are of the same

\* Augenehmer und nützlicher Zeitbertreib mit Betrachtung curioser Vorstellungen allerhand Thiere, sowal nach ihrer gestalt als auch nach der Accuratess davon verfertigte Struktur ihrer Scelete von Joh. Dan. Meyer, Miniaturmahler. Nürnberg, 1748. 36. iii. Thle. fol. p. 17.

† W. Josephi, A. D. S., p. 302.    ‡ Memoires de l'acad. d. Scienc. de Paris. Anno 1735, p. 383.    || Meyer l. c., p.    § Josephi l. c., p. 305.

height and thickness as those of the lumbar and dorsal vertebræ, so that the passage of the one into the other cannot be perceived. The nine-banded Tatu has three sacral vertebræ.

*Section 13.*—The *os coccygis* of the bradypidi-didactylus has eight vertebræ; the nine-banded tatu, 28; the myrmecophega didactylus, 42.

*Section 14.*—*Ossa innominata.* The internal surface of the os ilium is curved in the middle, and has three smaller surfaces, a superior, inferior, and internal; the former are broad, the internal narrow. The external surface is concave. The pubic bones of the myrmecophega didactylus have an opening between them of a line and a half in extent. (Whether this hiatus, spoken of as occupying the place of the symphysis pubis be real or not, is still to me very doubtful; in the skeleton of the European hedgehog, when freed of all soft matter, the bones of the pubis have a gap between them of two lines and more, but along a slender cartilage, which placed transversely forms the symphysis in that animal, cannot escape the notice of the more careful observer. The pelvis of the leasypus shows another form of the pelvis meriting notice, and which will be described a little further on.—*Autenreith.*)

*Section 15.*—4. *Chiroptera.* The vespertilio caninus, and the murinus, have each four sacral vertebræ, but the caninus has three coccygeal vertebræ, the murinus has ten. The seventh of these is larger than the others, and is four lines long. Pallas \* says of the vespertilio cephaloteide, that the bones of the pelvis are slender, and do not meet at the pubis, lest this narrowness interfere with the birth. In the caninus the os ilium is not three sided, as in the murinus, but its external surface is very convex. Above the acetabulum there is a very large spine. In the caninus the ossa pubis are slender, and meet each other; it is the same in the murinus. In the caninus the foramina ovalia are broader than long. The bodies (tuberosities?) of the bones of the ischium in the vespertilio vampyre are plain, with cleft margins united together; thus the posterior aperture of the pelvis shut in by a continuous margin, is oval, the horizontal branches of the bones of the pubis alone (*angles between the horizontal and descending branches alone? A.*) forming the symphysis and uniting into a half circle. † The pelvis of the vespertilio murinus is remarkable for the spinous tubercle of the os pubis extended into a very long spine. According to the drawing of Meyer this spine ascends still higher, so as to seem to form a complete foramen, with a horizontal ramus of the os pubis, perhaps joined by a ligament to the os ilium by its apex. To the spine the ligament of Poupart is admitted by all to be attached. I could find neither this ligament nor the perfect abdominal ring in the male masupialis didelphis; the vessels and crural nerves proceeded unprotected beneath the small accessory bones and the margin of the acetabulum; so that that little bone, which shuts in the abdominal pouch in the didelphis, seems to me nothing else than the spine of the pubis, composed of that little bone itself and its articulation with the horizontal ramus of the pubis joined together. But this spine of the pubis seems to arise simply from the ossification of the end of the ligament of Poupart, as the tendons become ossified in the feet of birds, and so are united to the

\* P. S. Pallas spicilegia zoologica. Fasc 3. Berol, 1787, p. 23.

† Cfr. G. F. Herman Disser. Observationes et anecdota ex osteol, comp. Argent, 1792, 4. p. 12.

bone without a distinct termination. Perhaps it is not to be wondered at, that the same abdominal pouch, which had hitherto been noticed only in the genus *didelphis*, has lately been detected in a species of New Holland Bat, since this genus has such distinct spines of the os pubis. The skin seems to gape in these species between the spines, as it does in the human monstrosities, in whom the bones of the pubis gapes, being united by no symphysis; as likewise happens to those with hare lips, in whom the maxillary bones are not united; the skin of the head is also wanting in those fœtuses, in which a great portion of the vault of the cranium is deficient. Since it so happens that in almost all animals the teats are placed in the lower part of the abdomen, it may be the more readily comprehended why they are placed in the abdominal pouch. Nevertheless, all these considerations offer no sufficient explanation of the peculiarities in the structure of the internal genital organs in the *didelphis*.

Very broad, slender, and almost papyraceous ascending and descending rami of the os ischium still further distinguish the pelvis of the *vespertilio murinus*; like that large osseous lamina in the situation of the manubrium of the sternum, and like the broad osseous terminations of the inferior ribs at their sternal extremities. The foramen ovale is very small, but truly oval; the conjugate diameter is very long and oblique; the bones of the ilium, elongated and linear, are inclined backwards, triangular, with margins slightly winged; of the three surfaces of this bone, the anterior is the only one between which the bodies of the sacral vertebræ project; the other posterior is internal, the third posterior external. The symphysis of the pubis is very short; the descending branches of this bone, and the ascending ramii of the ischium, proceed as in man. Between those branches the inferior aperture of the pelvis is narrow, perhaps in the male, but the greater pelvis, always broader, ascends backwards, covered only by the very narrow sacrum and the still narrower os coccyx, or perhaps rather longitudinally divided into a right and a left portion. The anterior coccygeal vertebræ have very short and broad transverse processes, cut short at the apex and the margins almost running together; the vertebræ of the distinct portion of the tail are elongated, very slender and simple. The pelvis viewed generally, with a reference to the thorax, is very small; can it be that the pelvis of the female bat is so narrow, lest the weight of a broader pelvis should interfere with her flight! or, that the mother may more easily carry along with her in her flight the young, adhering to the mammæ upon her broad breast? also; in a manner, as the young of the *didelphis* born in an imperfect state, are finally developed after birth, whilst adhering to the mammæ.—*Autenreith*.

*Section 16.*—5. *Glires. Rodentia, or Gnawers.* In very many rodents the os sacrum is composed of three vertebræ, as in the common mouse, the rat, the woodmouse, the common squirrel, &c.; four in the hare, the guinea-pig, the aguti, and the crested porcupine; five in the alpine marmot, and in the beaver. In this order of the mammalia the lumbar vertebræ pass gradually into the sacral, and the sacral into the coccygeal. The posterior portion of the os sacrum is somewhat more slender than the anterior, yet in some, as in the mouse, both portions have the same breadth.

*Section 17.*—In this natural family of animals, the *coccygeal vertebræ* are numerous; the guinea-pig has six, the crested porcupine ten, the hare sixteen

the common squirrel twenty-one, the field-mouse twenty-four, the common mouse twenty-eight, and the rat thirty-six.\*

The very great diversity which affects the forms of the pelvis in this order of animals, enjoins the necessity of separating animals of the hare from those of the mouse and squirrel tribe, which are intermediate between each order. The hare and the rabbit have the sacrum commencing by a broad vertebra, then indeed already towards the second vertebra becoming acuminate and extremely narrow throughout the rest of the vertebræ, sacral and coccygeal. The transverse processes of the sacral vertebræ are deficient, and in their place on each side a short-winged margin, unbroken, accompanies all these vertebræ. The sacral vertebræ in the hare readily run together. The sacrum of the hare is more curved than that of the rabbit, and looks backwards. In the rat, however, and in the mouse, the os sacrum is straight; and although it be very narrow, it yet, by its broad and confluent transverse processes, forms a covering for the pelvis, completed by the ligamentous expansions, so that, at the side, there scarcely remains a vestige of the great sciatic notch. The transverse processes of the three anterior sacral vertebræ in the mouse and the rat are nearly equal, excepting that the process of the first vertebra is thicker and stronger than the others, and unites with the os ilium. The transverse processes of the second and third sacral vertebræ are broad, thin, and truncated, and they run together by the angles of their extremities. The transverse processes of the six coccygeal vertebræ following the last sacral are narrower, slender, free at their summits, enlarged, and bent forwards. The elongated vertebræ of the distinct tail have much in common with the coccygeal vertebræ of the cercopithecæ. Between the third and fourth, fourth and fifth, fifth and sixth, sixth and seventh coccygeal vertebræ, abdominal spinous processes are also found in the rat and in the mouse; these are formed of a small hollow bone, having the figure of a pole-axe or halbert. The squirrel, as regards the os sacrum, holds, as it were, a middle place between the hare and the mouse; for the transverse processes of its three sacral vertebræ do not run together into a continuous margin, as in the hare, nor, has the os sacrum so great a breadth as in the mouse genus; but although it be acuminate backwards, it does not become so narrow. It agrees, then, with the rat in this respect, that the transverse processes of the first, and in the squirrel of the first three coccygeal vertebræ, are broad, and so assist in completing the covering of the pelvis: on the other hand, they agree with the rabbit in this, that transverse processes appear in some of the coccygeal vertebræ in that place, where finally the tail becomes distinct.—*Autenreith*.

*Section 18.*—The *ossa innominata* of the rodents are very long. The superficies of the os ilium in the beaver presents three surfaces, of which one, the superior, is very broad; a second, inferior and internal, is concave; a third, inferior, is external. The os ilium of the alpine marmot has also three surfaces—an internal and two external.

Concerning the bones of the mouse consult Merres.† “Das Darmbein ist sehr lang und schmal, und hat an seiner obern Fläche einen erhabenen Strich der gerade bis zum Hüftbein fortläuft, und daselbst über der Pfanne des Schenkelbeins eine kleine stumpfe Erhabenheit bildet. Das Hüftbein wird

\* Blasius Merrem *vermischte Abhandlungen aus der Thiergeschichte*. Gott. 1781, p. 61.

† Bl. Merrem, l. c.

nachher sehr breit und bildet mit dem schmalen Schambeine eine sehr grosse Inghichte Oeffnung.”

The symphysis of the pubis is always osseous in the beaver (the symphysis of the bones of the pubis is sometimes found osseous not only in the horse, but also in the aged dog, and in the fox, which seems to prove that in these animals, during parturition, there is no force acting against this symphysis as in woman.—*Autenreith*.) The foramina ovalia are very large in this order, especially in the common squirrel. The ossa innominata in the glires sufficiently resemble each other, in as far as regards the os ilium: for they are narrow, convex on their external surface, so as to appear obtusely carinated, with an internal concave surface, almost canaliculated towards the apex, and bent outwards with a rounded subacute summit. The hare alone has the superior extremity of the os ilium larger and less convex than the rest. The os ilium of the rabbit is shorter, but broader, according to the size of the animal. There exists, however, this principal difference: that in the hare and in the rabbit the symphysis of the pubis is very long, so as to form a semi-canal, in the hare but little turned upwards; and that the branches of the os ischium meet under an acute angle, and the three-sided tuberosities of the os ischium much extended backwards, so that there is a deep fissure of the pelvis between them. On the other hand, as has been mentioned above, the *mures* have a very short symphysis, and the branches of the os ischium not only unite at a right angle in a very slender tuberosity, but also almost at the same angle with the descending branches of the os pubis. The squirrel holds, as it were, a medium between the mus and the hare; it has a distinct tuberosity of the os ischium, but like the rat, it has the branches of the os ischium meeting almost at a right angle.—*Autenreith*.

*Section 19.—6. Feræ.* The greatest variety of the bones of the pelvis exists in this artificial order of animals, both as regards size, as between the shrew (*sorex fodiens*) and the polar bear; and as regards form, as between the european mole, the lion, and the gigantic didelphis. The os sacrum is composed in most of the feræ of three vertebræ, which number is by no means so constant and frequent in any other order; in some species, however, there are exceptions, as in the didelphis opposum, and gigantea, in which the sacrum has two vertebræ; in the european mole, and in the *ursus arctos*, the os sacrum five vertebræ. Blumenbach † says of the os sacrum of the european mole—“Beim Maulwurf hat es längst seiner Hinterseite statt der Dornfortsätze einen ununterbrochenen schneidenden Rücken, der dem kleinen Thiere bei seiner unterirdischen Lebenstart besonders aber bei der Weise, wieer die mit den Vorderfüßen losgegrabene Erde mit den Hinterfüßen hinter sich wirft, sehr zu statten Kommt.” Daubenton ‡ says—“The first vertebra of the sacrum has no spinous process; those of the remaining four are united to each other, forming an osseous crest.”

*Section 20.—*In nearly all the feræ the tail is long, and the coccygeal vertebræ are numerous; the European mole has 12, the common weasel 14, the stoat 16, the fox and the shrew 19, the civet cat 22, the common cat and the leopard 23, the common otter 25, the genet cat 28, and the opposum 29. The superior of these vertebræ are perforated by a canal for the spinal mar-

† T. F. Blumenbach, Beschreibung der Knochen. p. 305.

‡ Histoire Naturelle, Tom. viii. 4, p. 103.

row. The middle vertebræ are the longest, especially 7 of them; in the lion the length of the longest vertebra is 2", 2"', in the leopard 1", 2"', in the didelphis opossum 10"', in the common weasel (*mustela vulgaris*) 2"'. The *mustela vulgaris* has abdominal spinous processes, like those of the rat, but the *mustela putorius* has short broad abdominal spinous processes between the first caudal vertebræ; these processes have the summit bifid. The hedgehog seems rather to have sesamoid bones at the joints of the coccygeal vertebræ, than true abdominal spinous processes.—*Autenreith*.

*Section 21.—Ossa innominata.* As the length and proportions of these bones, whether compared with each other or with the other bones of the pelvis, may be best seen by inspecting the table of dimensions at the end of the dissertation, I shall here only speak of what seems most worthy of notice. The pelvis of the genus didelphis, in addition to the usual number of bones, has two which all other animals want. The didelphis, as is well known, has a pouch in the lower part of the abdomen, in which the young live after they are born until they have attained a fitting age. This pouch is supported by two bones, which may be called its janitors. Edward Tyson† has left us an excellent description of these bones of the pelvis in the opossum. "These marsupial bones, or janitores marsupii, are two strong bones, in length about two inches, and so united to the superior and inferior margins of the bones of the pubis, that at their base, where they unite with the bones of the pubis, they touch each other, whilst at their other extremity they are distant from each other by about two and a half inches. At the basis, two heads may be seen, about half an inch broad; the larger one turned towards the symphysis of the os pubis, the other, the smaller one, towards the haunch bone, together with an intermediate sinus between these heads, in which is received a certain protuberance of the os pubis. (In the didelphis, the protuberance of the os pubis does not correspond to the marsupial sinus, but a certain obtuse notch of the margin of the os pubis corresponds to it.—*Autenreith*.) These bones, which as they ascend from the bones of the pubis become more slender, and about the middle do not exceed a quarter of an inch in length, cannot be moved towards each other, nor from each other, but inwards, as it were towards the spine, and outwards from it." Whilst, however, they are moved outwards, they are of necessity widened, whilst inwards they are closed, because their bases by turns form an angle. The bones of the pubis and of the ischium are very large and long in the gigantic didelphis; the os ischium is likewise as long as the os ilium. The rami of the os pubis and ischium are so united that no angle exists between the branches of the os ischium in the inferior aperture of the pelvis. The foramina ovalia are very long, and the acetabulum placed in the middle length of the pelvis has no notch. The ossa pubis of the European mole are separated from each other; in the shrew the distance is three lines. Blumenbach‡ says—"Unter den vierfüssigen säugthieren hat der Maulwurf wol eins der sonderbarsten Beken. Es ist so eng und schmal, dass es ausser einigen schlanken Muskeln, blos Nerven und Blutgefässe zu fassen, im stande

+ Mich. Bernh. Valentini amphitheatrum Zootomicum. Gesse 1720, fol. p. 132, et delineatio horum ossium in Tab. xxvi., Fig. 5. Præstantissimam delineationem pelvis didelphidis giganteæ dedit E. Horne, in commentatione sua: Observations on the mode of generation of the Kangaroo in Philosophical Transactions, 1795; 4 Tab., xxi.

‡ T. F. Blumenbach, Geschichte und Beschreibung der Knochen, p. 328.



ist, hingegen die Geburtstheile *oberhalb* der Schambeine sich öffnen müssen. The genital organs of the European mole by no means open above the symphysis of the pubis, but beneath it, as in all other mammals. There is this important difference, however, that not only the vagina and urethra, but likewise the whole urinary bladder and the rectum, are placed beyond (*extra*) this symphysis of the pubis; almost as in those human monstrosities wherein the ossa pubis not meeting mesially, the urinary bladder hangs beyond the symphysis. The ossa ilium of the mole, as has been already mentioned, are united throughout their whole length to the os sacrum; but where the acetabula are placed there commences a very narrow and scarcely perforated excavation of the pelvis. The symphysis of the bones of the pubis, united, however, by no intermediate cartilage, is there found behind the intestinum rectum. From this incomplete symphysis, which is either very short or very long, the rami of the bones of the pubis descend, gradually widening and becoming more distant from the coccyx. There arises an oblong cavity anteriorly very narrow, ample posteriorly, open inferiorly, in the exit of the pelvis, between the bones which on each side form the foramina ovalia. Into this excavation there descends the intestinum rectum after it has passed over and beyond the symphysis of the pubis, and in the same excavation there lie a long vagina and double horned uterus, with lenticular-shaped ovaria, all of which organs in the unimpregnated state are very small; the urinary bladder with the urethra lies over them. The recti muscles of the abdomen, divided as it were towards their pelvic extremity, surround the neck of the bladder, and at their insertion into the pelvis provide, as it were, a place for it. The angle which the descending rami of the os pubis form with the ischium, differs from that of other mammals, being acute, and descends much lower than the position of the tuberosities of the os ischium. (The pelvis of the *sorex* is very similar to that of the mole, but its symphysis is still more open, and the pelvic excavation is larger, as if to afford a space for containing the internal genital organs as in other mammals.—*Autenreith*.) The following description of the ossa innominata of the hyena, has been taken from Daubenton. † “The haunchbone of the wolf is proportionally shorter and larger anteriorly than that of the leopard, but the same bone in the hyena, is still shorter and larger than that of the wolf; the inferior part of this anterior extremity is greatly extended and spread outwards. The foramina ovalia differ from those of the leopard in this respect, that they are as wide as long. The groove formed by the reunion of the bones of the pubis, and of the ischium on each side, is proportionally shorter than in the leopard, and even than in the wolf.” The structure of the pelvis might safely be taken as a means for dividing the class *feræ* into two more natural classes. The larger *feræ*, and which are truly carnivorous, as the *felis*, *canis*, *viverra*, and *mustela*, have the ossa ilia smooth, excavated on their external surface, and joined to the os sacrum by a very small portion on their inner surface; the symphysis of the bones of the pubis is in them elongated. But in the smaller *feræ* living on a variety of food, vegetable as well as animal, as in the opossum, hedgehog, *sorex*, mole, and bat, which are all distinguished by their anterior teeth from the former, in these the ossa ilium are three-sided, stick-shaped, and joined to the sacrum by almost their whole length.

† Daubenton, *Histoire nat.* T. ix., p. 294.

The symphysis of the pubis is in them, with the exception of the didelphis, either very short or sometimes evidently wanting; the bones of the ischium, as in the genus mus, are flattened, very broad, thin, and the position of the tuberosities is nearer to the promontary, than are the angles in which the descending rami of the pubis meet with those of the ischium. The pelvis of the hedgehog, at the symphysis of the pubis, is remarkable for a wide hiatus between the bones, nor is this opposite to the acetabulum, but much lower down, and seems to arise from a very acute union of the rami of the pubis and ischium; it remarkably resembles in form the pelvis of birds, as of the pigeon, &c.; on the other hand, the pelvis of the mole, by the union of the os sacrum and ilium into a single osseous lamina, seems also to pass partly into the form of the pelvis of the bird. We have already noticed the distinguishing characters in the pelvis of the bats (*Autenreith*).

*Section 22.—7. Solidungula.* As the horse is the most important of all the animals connected with the veterinary art, I shall dwell longer on the description of its pelvis. Five vertebræ compose the os sacrum, which in youth are both separated and connected by cartilages; by degrees, however, as the cartilages ossify they become contiguous, so that at last no vestiges of their original separation remain. The os sacrum shows two margins, and two surfaces—a superior or external, and an inferior or internal; also a base and apex to be considered separately. The broad margins anteriorly show a considerable surface, full of tuberosities and little depressions, serving to unite it with the os ilium; this surface of the margins is called by some the sigmoid or semilunar aspect. The external, or superior convex surface, is tuberos, and furnished with several prominences: in the middle there arise five separate and distinct spinous processes; the second of these is the longest, but it is also the slenderest: the rest gradually decrease in size and thickness, terminating in a quadrangular little head in the apex. I have often found these spinous processes united together. Between the bases of these processes there are four foramina, communicating with the vertebral canal. Close to these, on each side, there are other four foramina, which also lead into the vertebral canal. The inner, or inferior surface of the sacrum, is concave and without tubercles. Near the margins it is perforated by four foramina; between each pair of these holes there is an elevated transverse line, the remains of the former intermediate cartilages. The anterior portion of the base of the sacrum is the broadest; in the middle of this base is a broad, oval, articular surface. Above this articular surface, is the triangular opening of the canal of the sacrum passing throughout its whole length; this is a continuation of the vertebral canal. Close to the aperture of this canal, there arise two oblique processes each an inch long, and having the same direction as the corresponding processes of the lumbar vertebræ. On each side of the sacrum, and towards the side of the articular surface, there arise two large prominences which unite with the transverse processes of the last lumbar vertebra; by some these are called the articular tuberosities. On the apex of the os sacrum may be observed a small, oval, articular surface, connecting this bone to the first coccygeal vertebra.

*Section 23.—*The coccygeal vertebræ vary much in number. The usual

number is 18; the eight anterior are the longest. The first and second coccygeal vertebræ are composed of a body, a spinous process, and two prominent transverse processes. Through these, and through the third, fourth, and fifth vertebræ, the vertebral canal is prolonged, and there it terminates. The last vertebræ have no spinous processes, but only small tubercles in their place. The coccygeal vertebræ ought to be divided into two distinct classes, not only in the genus *Equus* and *Simia*, but in all mammal quadrupeds: into the perforated, which contribute to the formation of the pelvis and contain the termination of the medulla; and the imperforated, which form the more distinct tail. The former are shorter than the latter, but for the most part have spinous processes, often transverse processes, and always oblique processes; the posterior coccygeal vertebræ are elongated, and in place of processes, in every genus of animals with tails, have merely tubercles around the articular surfaces. Man evidently wants the first kind and has the second.

—(*Autenreith.*)

*Section 24.—Ossa innominata.* These bones in the young horse, as in all other mammals, are composed of three—the os ilium, ischium, and pubis. The os ilium is triangular, and outwards from that angle which is distant from the sacrum, is bent; the external aspect is concave and without tubercles: the internal on the other hand, regarded as a whole, is convex, and hence from the middle of the crest of the ilium, as far as the superior spine, it is full of tuberosities and impressions; at this part the os ilium unites with the sacrum. Towards the lower part of the os ilium, almost about the middle of its inner surface, a line begins to be formed, which passes obliquely as far as the inner surface of the os pubis, and there terminates; by which line the pelvis is divided into a greater, or anterior, and a smaller, or posterior, according to the nomenclature of these parts in man. In the horse, the abdominal portion of the os ilium is so small, that the greater pelvis can scarcely be described in that animal.—(*Autenreith.*) The crest of the os ilium is not convex, but runs almost in a straight line as far as the two tubercles, then suddenly contracts, and descending again terminates in other two tubercles. The superior and inferior margins of the os ilium are much excavated. The os ilium of the horse is remarkable for its length, when compared with the horizontal branches of the pubis which form the inferior margin of the pelvis, hence it happens that in this very ample pelvis the acetabula and thigh-bones are nevertheless sufficiently near each other, and in this large animal a small space only is observed between the thighs towards the lower part of the belly.—(*Autenreith.*) The external surface of the os pubis is convex, the internal, concave. It is divided into an anterior branch and a posterior. The anterior ramus has a prominent line on its anterior margin, but more towards its internal surface, however, which is called the crest of the pubis. In the anterior margin there also arise on each side two prominences, which are called the spines of the pubis. The posterior margin of the anterior ramus assists in the formation of the foramen ovale. The external surface of the posterior ramus is convex, the internal, concave; the external margin of this ramus forms the largest portion of the foramen ovale. The os ischium may be divided into a body and two branches, and it is very large when compared with the os pubis; its upper ramus forms by its internal concave margin the external border of the foramen ovale.

The inferior rami of the os ischium are often united together by a symphysis, which is frequently ossified; its internal surface is concave, its external, convex. The rami of the os ischium posteriorly form together an obtuse angle, which is named "the angle" of the bones of the ischium, and they end in a protuberance about an inch long, called the tuberosity of the ischium. The acetabulum is oval, and deeply notched towards the anterior margin of the foramen ovale; formed as usual of the three pelvic bones, the os ilium, however contributing the largest portion. The foramen ovale is formed by the os pubis and os ischium, chiefly however by the latter.\*

*Section 25.—8. Pecora.* In this order, or natural family, the os sacrum does not present any great variety: in many species it is composed of four vertebræ, as in the camelus, dromedarius, the cervus clephus, the antilope dorcasete: in others, however, it has five vertebræ, as in the bos taurus, antilope cupricapra, cervus dama, &c.

The external surface of the os sacrum in the ox is less convex; its spinous processes incline forward, and are united together, excepting the fifth, which is very short, its length being only 9''' , whilst the first of these processes measures 2'' 6''' . The anterior portion of the os sacrum is not so broad as in the horse; moreover, it is not united to the transverse processes of the last lumbar vertebra, for which reason it has no articular tuberosity.

*Section 26.—*The coccygeal vertebræ are not so numerous in this class of animals as in the preceding; the antilope rupricapra (chamois) and the dorcas have each ten vertebræ in the coccyx; the goat twelve, according to Allamand; † in the giraffe there are eighteen; in the buffalo fifteen, and in the ox eighteen. In the ox the spinous processes, and on each side two transverse processes of the seven anterior coccygeal vertebræ, are abated or withdrawn. The canal for the spinal marrow extends in the ox to the eighth coccygeal vertebra.

*Section 27.—*The ossa innominata of the ox differ widely from those of the horse; the superior crest (*angular process*) of the os ilium is larger, and terminates externally in a large tuberosity, which is especially evident in lean cows. This spine (angular process) in the ox approaches nearer to the transverse processes of the lumbar vertebræ, and therefore the distance between them is not so great in the ox as in the horse. The bones of the ischion are larger than those of the horse, both in length and breadth, and are so connected together that the angle is more obtuse, for the distance between the tuberosities of the bones of the ischion is 4'' 6''' , and the incisura shews 2'' 4''' . The symphysis of the ossa pubis terminates in an eminence, called the spine of the bones of the pubis. ‡ The posterior superior branches of the bones of the ischion terminate in two tuberosities—an upper one, to which is attached the sacro-ischiatic ligament; and an inferior, which is larger. I need not speak of the other parts of the pelvis of the ox, as they so much resemble those of the horse. The remaining group of this order have the

\* Delineationes ossium pelvis equini, vide, Ruini, Anatomia del Cavallo, Conf. Snape; The Anatomy of the Horse; London, 1686, fol.—W. Gibson. Cf. New Treatise on the Diseases of Horses; London, 1751, 4to.—G. Stubbs; The Anatomy of the Horse. London, 1766, fol.—La Fosse; Cours d'Hippiat. que. Paris, 1772, fol. Tab. 9. Figures 24, 25, 26, 41, 42.

† In Buffon. Hist. Nat. Supplem. T. vii. 4, p. 356.

‡ Vitet. Med. Veterin. Lyon 1771-3, Tom. i., p. 83.

pelvis of a form greatly resembling that of the ox. I shall copy merely some examples from Daubenton, who thus speaks of the buffalo:—"Of the three tuberosities formed by the posterior part of each os ischium, the inferior is much longer from above downwards than the two superior, the more anterior of which (upper tuberosities) is placed higher than the corresponding one in the ox, and which has been called a spine." Again, Daubenton speaking of the dromedary, says—"The upper part of the haunch bone is very large, and forms an acute angle by its anterior extremity; the foramina ovalia are nearly round." The pelvis of the goat presents some peculiarities worthy of notice: the symphysis of the pubis, elongated, is somewhat bent in the middle into a distinct angle superiorly, so that the exit of the true pelvis in this animal is directly the opposite to what it is in man, in whom it bends forward, towards the abdomen. The os sacrum of the fallow deer greatly resembles the narrow sacral bone of the hare, in which there also exists a similar though less conspicuous flexion of the pelvic semi-canal, towards the coccygeal bones. In this flexion may, perhaps, be found the reason why amongst the glires (rodents) animals are generally provided with lengthened tails; the hare, and amongst cattle, the deer, have the tail short; both animals are remarkable for their extraordinary leaps, in performing which the middle of the back is bent downwards. The portion of the os ilium, which in the goat overtops the plane of the os sacrum, is bent outwards, or externally is short, somewhat broad, and with a sub-acute apex.

*Section 28.*—9. *Bellua.* The os sacrum of the elephant is composed of three vertebræ, separated by large intermediate cartilages, which late in life evidently become ossified. The os sacrum of the pig is composed of four vertebræ, having very small spinous processes, and separated from each other by large intervals. The os sacrum of the sus tajarsu has five vertebræ.

*Section 29.*—The coccyx of the sus tajarsu has seven vertebræ; that of the common pig, sus scrofu, and of the elephant, thirty-one.\*

*Section 30.*—The ossa ilia of the common pig greatly resemble those of the ox; the bones of the pubis and of the ischium are broader, hence the foramina ovalia, and indeed the whole pelvis is wider than that of the ox, comparatively, that is, regard being had to the difference in bulk of the animals. The ossa inominata of the elephant greatly resemble the corresponding human bones, especially the ossa ilia, which in the elephant are very broad, and not elongated, as in other mammals; they reach merely the last lumbar vertebra. Their inner surface is concave, their outer convex, as in man; but the inferior spine of the crest of the os ilium is terminated by a very large tuberosity; the diameter from one to the other, according to Perrault, † in an elephant seventeen years of age, was nearly 2'; according to Blair, ‡ in an elephant twenty-six years old, 3' 6" English feet; and in the pelvis of an elephant eleven years old, preserved in the Museum of Hesse-Cassel, I found the measurement to be two feet four inches.

The annexed table of measurements has been compiled from the observations of Daubenton, Pallas, Merrem, Allemand, Blair, and my own:—

\* Perrault. Mem. Paris. 1671-1676, fol. T 2.

† Mem., p. 5. Hist. Nat.

‡ P. Blair on the Anat. of the Elephant. Philos.

Tr., vol. 5, Lond. 1732, p. 82.

TABLE OF DIMENSIONS OF DIFFERENT PARTS OF THE PELVIS.

| NAMES OF ANIMALS.               | Breadth of the anterior | Length of the os ilium, | from the acetabulum to the upper portion of the crest of the ilium. | Diameter of the | Acetabulum. | Length of the ischium from the post: angle of the foramen ovale to the tuber: Ischi. | Breadth from the sup: margin of the ischium, to the other margin in the middle. | Depth of the excava: tion between the sup: margins of the bones of the ischium. | Depth of the angle of the bones of the ischium. | Length of the foram: ina ovalia. | Breadth of the foram: ina ovalia. | Length of the Sacrum. | Breadth of the ante: rior part of the Sacrum. | Breadth of the post: part of the Sacrum. | Transverse diameter of the cavity of the Pelvis. | Conjugate diameter of the Pelvis. |
|---------------------------------|-------------------------|-------------------------|---------------------------------------------------------------------|-----------------|-------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------|-----------------------------------|-----------------------|-----------------------------------------------|------------------------------------------|--------------------------------------------------|-----------------------------------|
|                                 | " "                     | " "                     | " "                                                                 | " "             | " "         | " "                                                                                  | " "                                                                             | " "                                                                             | " "                                             | " "                              | " "                               | " "                   | " "                                           | " "                                      | " "                                              | " "                               |
| II. <i>Quadrupeda.</i>          |                         |                         |                                                                     |                 |             |                                                                                      |                                                                                 |                                                                                 |                                                 |                                  |                                   |                       |                                               |                                          |                                                  |                                   |
| <i>Simia troglodytes</i> -      | 2 4                     | 4 4                     | 4 4                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 1 2                              | 10                                | ...                   | ...                                           | ...                                      | 1 11                                             | 3 4                               |
| — lar -                         | 1 3                     | 3 2½                    | 3 2½                                                                | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 9½                               | 6½                                | ...                   | ...                                           | ...                                      | 1 6½                                             | 2 5                               |
| — sylvanus                      | 11                      | 4                       | 4                                                                   | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 1 2                              | 9½                                | ...                   | ...                                           | ...                                      | 2 9                                              | 2 9                               |
| — cynomolgus                    | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 1                                | 6½                                | ...                   | ...                                           | ...                                      | 1 7                                              | 2 2                               |
| <i>Papio mormon</i> -           | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | ...                              | ...                               | ...                   | ...                                           | ...                                      | 2 5                                              | 2 7                               |
| — maimon                        | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | ...                              | ...                               | ...                   | ...                                           | ...                                      | 2 3                                              | 2 9                               |
| <i>Cercopithecus panisus</i> -  | 3                       | 1 1                     | 1 1                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 2½                               | 3                                 | ...                   | ...                                           | ...                                      | 1 4                                              | 2 3                               |
| <i>Lemur tardigradus</i> -      | 7                       | 2                       | 2                                                                   | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 7                                | 6                                 | ...                   | ...                                           | ...                                      | 5                                                | 8                                 |
| — mongoz                        | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | ...                              | ...                               | ...                   | ...                                           | ...                                      | 11                                               | 1 6                               |
| III. <i>Bradypoda.</i>          |                         |                         |                                                                     |                 |             |                                                                                      |                                                                                 |                                                                                 |                                                 |                                  |                                   |                       |                                               |                                          |                                                  |                                   |
| <i>Myrmecophaga didactyla</i> - | 2                       | 9                       | 9                                                                   | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 4½                               | 2                                 | 8                     | 5                                             | ...                                      | ...                                              | ...                               |
| <i>Tatu novem cinctus</i> -     | 4½                      | 1 8                     | 1 8                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 9                                | 5                                 | ...                   | ...                                           | ...                                      | 9½                                               | 1 10                              |
| IV. <i>Chiroptera.</i>          |                         |                         |                                                                     |                 |             |                                                                                      |                                                                                 |                                                                                 |                                                 |                                  |                                   |                       |                                               |                                          |                                                  |                                   |
| <i>Vespertilio murinus</i> -    | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 2                                | 1½                                | 4½                    | 1                                             | 1½                                       | 2½                                               | ...                               |
| — caninus                       | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 4                                | 5½                                | ...                   | ...                                           | ...                                      | 6½                                               | 1 0½                              |
| V. <i>Glires.</i>               |                         |                         |                                                                     |                 |             |                                                                                      |                                                                                 |                                                                                 |                                                 |                                  |                                   |                       |                                               |                                          |                                                  |                                   |
| <i>Sciurus volans</i> -         | 1½                      | 6½                      | 6½                                                                  | 1               | 3½          | 2½                                                                                   | 3½                                                                              | 2½                                                                              | ...                                             | 3½                               | 2                                 | 4                     | 2½                                            | ...                                      | 3½                                               | 6                                 |
| — vulgaris                      | 3                       | 9½                      | 9½                                                                  | 2               | 4           | 5                                                                                    | 5½                                                                              | 5                                                                               | ...                                             | 5                                | 3½                                | 9                     | 6                                             | 4                                        | 6½                                               | 6½                                |
| <i>Glis esculentus</i> -        | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 3                                | 2                                 | 5½                    | 3                                             | 2½                                       | 3½                                               | 4                                 |
| <i>Mus silvaticus</i> -         | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 3                                | 2                                 | 4                     | 2                                             | 2½                                       | 2½                                               | 4                                 |
| — musculus                      | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 2                                | 1                                 | 3½                    | 2                                             | 2½                                       | 2½                                               | 5                                 |
| — rattus                        | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 5                                | 5                                 | 8                     | 5                                             | 5½                                       | 5                                                | 9                                 |
| <i>Marmotta alpina</i> -        | 4½                      | 9                       | 9                                                                   | 4½              | 8           | 11                                                                                   | 11                                                                              | 19                                                                              | ...                                             | 10½                              | 7                                 | 11                    | 1                                             | 16                                       | 11                                               | 1 1                               |
| — eriectus                      | ...                     | ...                     | ...                                                                 | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 4                                | 2½                                | 8                     | 5                                             | 4½                                       | 4½                                               | 8                                 |
| <i>Sciavia porcellus</i> -      | 6                       | 2½                      | 2½                                                                  | 2               | 5           | 6                                                                                    | 6                                                                               | 6½                                                                              | ...                                             | 6                                | 3½                                | 2                     | 3                                             | 1                                        | 6                                                | 10                                |
| — aguti                         | 9                       | 2                       | 2                                                                   | 4               | 1 4         | 8                                                                                    | 8                                                                               | 6                                                                               | 1                                               | 11                               | 11                                | 11                    | 1                                             | 3                                        | 10                                               | 11                                |
| <i>Lepus timidus</i> -          | 1 7                     | 1 6                     | 1 6                                                                 | 5               | 1 1         | 11                                                                                   | 11                                                                              | 10                                                                              | 6                                               | 6½                               | 2                                 | 3                     | 1 6                                           | 1 1                                      | 1 2                                              | 1 1                               |
| — cuniculus                     | 1 1                     | 2 8                     | 2 8                                                                 | 3               | 9           | 7                                                                                    | 6                                                                               | 6                                                                               | 6                                               | 5                                | 5                                 | 6                     | 11                                            | 1 1                                      | 9                                                | 10                                |
| <i>Castor fiber</i> -           | 1 1                     | 2 8                     | 2 8                                                                 | 7½              | 1 1½        | 2 3                                                                                  | 1 6                                                                             | 1 6                                                                             | 1 6                                             | 1                                | 8                                 | 2                     | 1 10                                          | 2                                        | 1 5                                              | 1 8                               |
| <i>Hystrix cristata</i> -       | 1 7                     | 2 10                    | 2 10                                                                | ...             | ...         | ...                                                                                  | ...                                                                             | ...                                                                             | ...                                             | 1                                | 4                                 | 11                    | 1                                             | 3                                        | 1                                                | 2 3                               |

|                           |       |       |      |        |      |      |       |         |      |      |     |      |       |
|---------------------------|-------|-------|------|--------|------|------|-------|---------|------|------|-----|------|-------|
| Eriaceus europæus         | 3½    | 1 4   | 2½   | 2      | 6    | 10   | 4     | 3       | 9    | 4½   | 1½  | 7    | 1 2   |
| Sorex fodiens             | ...   | 7''   | 1''' | ...    | ...  | ...  | 2½    | 1       | 3    | 1½   | 1½  | 1½   | ...   |
| Talpa Europæa             | 3½    | 1 8   | 6    | 1 6    | 11½  | 7    | 4½    | 4½      | 10   | 2½   | 1   | 10   | 1 2   |
| Didelphis opossum         | 1     | 2 3   | 3½   | 1 9    | 1 9  | 10   | 6½    | 8½      | 7 1  | 4    | ... | 1 5  | 1 9   |
| Viverra zibetha           | 5     | 1 2   | 3½   | ...    | ...  | 8    | 6½    | 5½      | 11   | 9    | ... | 9½   | 11    |
| — genetta                 | 5     | 1 3   | 3½   | ...    | ...  | ...  | 8     | 5½      | 10   | 10   | ... | 9    | 10½   |
| Mustela foina             | 11½   | 1 5½  | 3½   | ...    | ...  | ...  | 2     | 1½      | 3    | 2½   | ... | 3    | 4     |
| — vulgaris                | 7     | 1 11  | 3½   | ...    | ...  | ...  | 10    | 7       | 6    | 1    | ... | 11   | 1 4   |
| Lutra vulgaris            | 4 7   | 6 5   | 2    | 3 9    | 3 6  | 2 9  | 6     | 1       | 3 3  | 10 1 | 8   | 3    | 3 10  |
| Ursus arctos              | 1 1   | 2 5   | 7    | ...    | ...  | ...  | 2     | 7 1     | 4 1  | 9    | 11  | 1 5  | 1 6   |
| — taxus                   | 11    | 2 3   | 6½   | ...    | ...  | ...  | 11½   | 8 1     | 4 1  | 3    | 10  | 2 2  | 2 6   |
| Canis familiaris          | 2 2   | 4     | 9    | 1 6    | 3    | 9    | 1     | 10 1    | 7 2  | 1    | 6   | 2 2  | 2 6   |
| — lupus                   | 2 3   | 4 1   | 1 5  | ...    | ...  | ...  | 1 5   | 1 1     | 8 1  | 9 1  | 5   | 2 2  | 2 8   |
| — vulpes                  | 1 1   | 1 11  | 5    | ...    | ...  | ...  | 4     | 7       | 10 1 | 2    | 11  | 1 2  | 1 3   |
| Canis hyæna               | 2 11  | 3 4   | 11 1 | 6 1    | 10 1 | 11   | 8     | 1       | 7 2  | 4    | ... | 2 4  | 2 5   |
| Felis leo                 | 2 5   | 6 9   | ...  | 4 6 3  | 3 2  | 3 1  | 3 2   | 8 1     | 6 3  | 1 2  | 8   | 3 2  | 3 9   |
| — tigris                  | 2 7   | 6 6   | 1    | 6 4    | 3 2  | 3 1  | 3 2   | 6 1     | 6 4  | 2 3  | ... | 3 2  | 3 8   |
| — leopardus               | 1 6   | 4 11  | 1    | 1 3    | 3 2  | 2 1  | 1 1   | 1 1     | 2 3  | 2 2  | ... | 2 2  | 2 11  |
| — lynx                    | 1 11  | 2 9   | ...  | 1 8 1  | 2    | 9    | 1 1   | 1 1     | 7 1  | 5    | 10  | 1 3  | 1 6   |
| — catus                   | 6     | 1 10  | 5 1  | 4 1    | 6    | 6    | 9     | 6       | 10 1 | 5    | 3   | 1    | 1 2   |
| VII. <i>Solidungula</i> . |       |       |      |        |      |      |       |         |      |      |     |      |       |
| Equus caballus            | 10 6  | 10 6  | 2    | 6 5    | 3 3  | 6 2  | 6 3   | 2       | 3 7  | 8    | 2 6 | 9    | 8 6   |
| VIII. <i>Pecora</i> .     |       |       |      |        |      |      |       |         |      |      |     |      |       |
| Camelus dromedarius       | 9 2   | 9 6   | 2    | 1 6 5  | 6 1  | 10   | 2     | 2½      | 2    | 8    | 2 2 | 11   | 6 8   |
| Capra ovis                | 2 4   | 3 6   | 9    | 1 1    | ...  | ...  | ...   | 1 1     | 3    | 8 3  | 6 2 | 1    | 2 8   |
| — hircus                  | 2 9   | 4 10  | 1    | 2 10 1 | 10 1 | 1    | 1 1 1 | 8       | 7 3  | 10 4 | 1 1 | 2 8  | 3 10  |
| — hircus                  | ...   | 3 6   | ...  | ...    | ...  | ...  | ...   | ...     | 4 2  | 2    | 9   | 2 2  | 2 6   |
| Antilope dorcas           | 6 8   | 9     | 2    | 4 6 4  | ...  | ...  | ...   | 2 2     | 1 3  | 6 6  | 3 2 | 9    | 5 4   |
| Bos taurus                | 10 4  | 11    | 2    | 3 5    | 6 3  | 2 3  | 4 2   | 3 8     | 3 7  | 7 7  | 5   | 7 10 | 6 9   |
| — buffelus                | 8 5   | 10 6  | 2    | 5 4 5  | 4 3  | 3    | 1 1 3 | 1 1 1   | 6 9  | 3    | 2   | 5 9  | 7 8   |
| — bonasus                 | 1 4 3 | ...   | 3    | ...    | ...  | ...  | ...   | ...     | 4 9  | ...  | ... | 10 1 | 1 1 6 |
| Giraffa camelopardalis    | 4 1   | 5 1   | 1    | 2 6    | 1    | 6 1  | 9 1   | 8 2     | 1    | 4 5  | 11  | 2 7  | 3 4   |
| Cervus dama               | 5 3   | 7 4   | 1    | 6 4    | 3    | 7 2  | 4 2   | 5 1     | 6 5  | 2 1  | 6   | 4 4  | 5 5   |
| — elaphus                 | 2 3   | 3 6   | 8 2  | 1 8    | 11   | 9 1  | 2     | 9 3     | 2 2  | 3    | 9   | 1 10 | 2 6   |
| — capreolus               |       |       |      |        |      |      |       |         |      |      |     |      |       |
| IX. <i>Belluæ</i> .       |       |       |      |        |      |      |       |         |      |      |     |      |       |
| Sus scrofa                | 1 10  | 5 9   | 1    | 1 3    | 3 2  | 3 1  | 1 1 1 | 10 1    | 4 4  | 10 3 | 5   | 11   | 3 10  |
| — tajassu                 | 1 7   | 3 9   | ...  | 2 1    | ...  | ...  | ...   | 1 2     | 8 3  | 6 2  | 8½  | 1 9  | 2 5   |
| Elephas*                  | 1 1   | 1 10  | 10   | 2      | 17   | ...  | ...   | 5 6 4   | 11   | ...  | ... | 1 5  | 1 6   |
| Elephas†                  | 8 8   | 1 7 9 | 4    | 7 10   | 10 6 | 11 4 | 8     | 4 1 1 2 | 11 6 | 10 6 | 5 2 | 3 1  | 1 2 8 |
| Elephas                   | 1 9   | 1 6   | 7    | 10     | 6    | 5    | ...   | 5 3 3   | 6 7  | ...  | ... | 3 1  | 1 3 6 |

\* Eleph: 26 ann. erat; mens. secund. ped. angl. v. Blair. Phil: Trans v. 5. p. 82.  
 || 11. Ann. in museo Hass. Cassel. emen. tum. † 17. Ann. v. Daubenton. Tom. 13.

*Section 31.—10. Cetaceæ.* The pelvis of the cetaceæ seems rather a rudiment, and the last phalanx in the series of the diverse forms of the pelvis, in like manner as the rudiment of the pelvis, in the *anguis fragilis* (slow-worm) is said to connect the lizard tribe to serpents.

Merk,|| at least, does not venture to give a description of the pelvis of the cetaceæ, without adding delineations to it, on account of the simplicity of the structure. I have myself observed, during the coarse dissection of sailors, that the *delphinus phocæna* (porpess dolphin) has a pelvis, or at least a bone, which shuts in, as it were, the abdomen, in the situation of the bones of the pubis. A.)

‡ Hessische, Beytr. zur Gelchrs. und Kunst. 1. Band, 6, Stük.





