Obstetrics: The Science and the Art - Part I. Anatomy of the Parts Concerned In Reproduction; Chapter I. Of the Pelvis

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PART I.
ANATOMY OF THE PARTS CONCERNED IN THE ACTS OF REPRODUCTION.

CHAPTER I.

THE PELVIS.

The pelvis, anatomically considered, is a structure composed by the union of several bones that are respectively denominated sacrum, coccyx, ilium, ischium, and pubis, all which, being arranged in their proper places, and bound together by cartilages and ligaments, covered with tissues of various kinds and provided with certain important viscera within, and with other organs on the exterior, require no little study and reflection by those who design to learn obstetrics in order to acquire a competent knowledge of the art of midwifery. It is the duty of the anatomist to particularly describe all those parts, and point out their relations to each other and to the whole economy; but, in the view of the obstetrician and accoucheur, the pelvis is seen to be a bony and fleshy canal, designed to contain, support and protect the organs of generation, and give passage to the fruit of the womb.

It is owing to the peculiarly complicated forms of the pelvic canal, that the act of parturition in women is more difficult, painful, and dangerous than in other mammiferous beings, for it is to the peculiarities of that canal that is due the power possessed by women to give birth to their children by what is called a vertex presentation, a thing impossible in all other mammifers, even those most nearly allied by form to the human family. There is not one of them that does not present its offspring in what is called the face presentation, the muzzle and not the back of the head, or vertex, being the presenting part. In our race the ratio of volumes of the foetus and pelvis ought to be carefully studied by every conscientious student, who can never duly comprehend them until he has first become
acquainted with every bone that makes part of this interesting and curious organ. Hippocrates long ago compared the child in its mother's womb to an olive in a narrow-necked bottle: If one of the poles of the olive presents itself to the opening, it can readily pass out; but if it presents itself transversely, its position must first be changed before it can come forth, or else the olive or the bottle must be broken for its extrication. Hence the subject of presentations is a most important one in relation to the study of the pelvis.

If the pelvis does offer the most considerable of those obstructions and embarrassments that are met with in the practice of Midwifery, and if the relation of it to the child is of such vital importance in our proceedings, then every just, wise, and earnest student of obstetrics will feel himself bound to carefully inquire into its nature and properties, and he will, I am sure, discover that, while dry and uninviting in its particular details, it is, as a whole, clothed with the very highest interest. This lively interest in the study of the pelvis is, however, not confined to its mere midwifery connections: for, as all the organs of reproduction in the female are laid either within or upon the pelvic bones, so their whole life, power, and offices, as well as their places and positions, are inseparably allied to, and dependent upon their osseous basis, without which they could never be developed nor exist. A professional man ought to know these parts so well as to have attained to the possession of a perfect ideal of them, having them intellectually or spiritually drawn on the tables of his mind as an ever present model with which to compare every medical case in the category presented for his opinion and judgment. With such an intellectual ideal model ever at hand, he could measure every faulty form, crasis, or function, and every deviation in place, and so become, as it were, incapable of making mistakes in diagnosis or action; his ideal pelvis, and its apparatus, would for him be the norm, all that should agree with it being normal and all others abnormalities.

The word is derived from the Greek πελίς, which corresponds to our English word basin. The Latin word pelvis has become a part of our technical, and indeed of our ordinary language, as it is of the French didactic language, according to Prof. Dubois. Its true interpretation is hips or hip-bones, or haunch or haunch-bones. We do not usually employ, to express its idea, the English word basin, while the French mostly call it le bassin. Italians speak of it as il bacino, the basin; Germans denominate it das becken, the basin; Spaniards, la pelvis, the basin; and Swedes call it backenet, the basin; whence it appears that the idea of a pelvis has some connection with the idea of a basin in all the above named languages.
The annexed figure (Fig. 1), which represents a well-formed female pelvis, drawn in outline, exhibits this resemblance to a basin, though faintly, and the fainter, indeed, because the whole upper edge or front side of the bowl seems to be broken away, both above the front or pubic bone, and below it at what is called the arch of the pubis. The great upper vacuity is seen in the drawing between the two angular points, one on the right and the other on the left side of the drawing—projections that are known as the anterior-superior spinous processes of the ossa ilia. Beneath the front bone, or pubis, as it is called, there is another great vacuity, shaped like an arch, which is called arch of the pubis; and, indeed, the whole bottom of the bowl or basin is wanting in the dried specimen. Not so, however, in the recent subject.

But, while the whole profession everywhere agree to regard this organ as πελή, pelvis, bacino, backenet, bassin, becken, basin, &c., they are equally agreed to call it two pelves—an upper and lower, a greater and lesser, or a true and false pelvis; and they divide these two pelves from each other at the brim, entrance, inlet or strait, as it is variously denominated. The student will observe, in Fig. 2, that I have cut the pelvis transversely by a vertical section, and I present it here in order that he may see how naturally the writers have been led thus to divide the pelvis into a greater one above and a lesser one below, for it is evident that the lower portion of the drawing...
represents a form or a cavity very different from the broad and expanded portion above. Fig. 3 shows the front segment of this same divided pelvis, and exhibits the shape of the front inner wall of the true or lower pelvis. If the two segments should be realigned, they would reproduce the pelvis of Fig. 1. These two figures ought to instruct the student as to the real canal of the pelvis, and show him that if any difficulties should arise in the course of a labor, on account of the bony canal, those difficulties would be connected with this true, or lower or lesser basin, and not with the great or superior basin, which is so capacious that obstruction could hardly arise within its walls. Hence he ought carefully to study the conformation and properties of this lower basin, if he would make himself equal to the responsibilities of obstetrical practice.

As the sacral bone has its sacro-lumbar facet cut so obliquely that the sacrum descends in a backward as well as downward direction, producing the projection, promontory of the sacrum, or sacro-vertebral angle, the entrance or inlet of the pelvis is rendered, by the promontory, narrower from front to rear than it is when measured either transversely or obliquely, this sharp angle of the promontory being the posterior limit of the brim. From the promontory there is a sort of raised line or ledge running round the pelvis, left and right, to stop at the top of the ossa pubis (Fig. 1), and because this raised line runs along both the ilium and the pubis, it is called the ilio-pubal line, or ilio-pectineal line. The Romans called the pubic region pecten, hence linea ilio-pectinea; for, as the pudenda is clothed with hair, the term pecten was applied to that region, and the bone of the pubis has been called the os pectinis. Juvenal speaks of the pecten in Sat. vi. 370.

Inguina traduntur medicis jam pectine nigro.

Now this linea ilio-pectinea serves as a sort of stricture band, to make the pelvis small at the inlet, and produce a narrowing there. This narrow passage, from the greater down into the lesser basin, is called the superior strait of the pelvis; all that is above it being upper basin, and all that is below it being lower pelvis, lower basin,
pelvic canal, excavation, cavity or true pelvis; for, by so many different names is it known in the profession. Hence, let him learn what the superior strait is—its form, and its dimensions; let him well and truly learn the shape and size of the true pelvis, and the student will find that while it has an inlet or abdominal or superior strait, it also has an outlet, inferior, or perineal strait—the former at the beginning, and the latter at the end of the pelvic canal—all of which requires his careful study.

These two straits of the pelvis differ from each other very much in shape and direction, as may be discovered by inspection of the Figs. 4 and 5, which represent the superior and inferior straits of the pelvis.

In Fig. 4, one is looking downwards into the pelvis, and in Fig. 5 upwards through its inferior strait. In Fig. 4, the distance from promontory to pubis ought to be at least 4 inches from a to b. The distance across the opening from e to f, should be 4½ inches; and the two oblique diameters, c g, c g, should be five inches each. In Fig. 5, however, the longest line is that from front to rear, and not the transverse or oblique ones, so that the longest diameters of the two straits do not coincide, which renders it necessary for the child to make a spiral turn or revolution as it descends from above, to be born—a turn that is technically called rotation of the fetus. I shall, in another page, speak of the lower strait, as consisting of a double plane.

Most of the bony resistance experienced in labors, is resistance met with at one or the other of these straits, though it is true that we sometimes meet with cases in which the excavation itself does offer very great obstruction to the birth of the child.
I have pointed out the ilio-pectineal or ilio-pubic line, and I wish to say that it is the boundary or margin of the superior strait. Let it be occupied with an imaginary superficies, and call that superficies the plane of the superior strait. A line falling perpendicularly upon this plane just midway between the pubis and the sacrum and in the middle of the transverse diameter, is the axis of the superior strait; or, to speak more precisely, it is the axis of the plane of the superior strait. Now, as such perpendicular line does not correspond with the long axis of the trunk of the body, but comes out of the trunk at or near to the umbilicus, and touches the lower end of the sacrum within the pelvis, the plane of the strait is an inclined plane, and it is inclined more or less according to the posture assumed by the patient or the subject. In general, the inclination of this plane is about 50°. If the individual stretches herself upwards, and leans backwards as far as possible, the plane of the strait inclines the more; but if she bows herself forward, she may bend the trunk over the strait so far as to make the opening wholly lose its inclination, and take an adjustment at right angles to the body. The annexed figure (Fig. 6) represents a pelvis and spine, with the right lumbar extremities. If the subject lies on the back, with the knee-joint flexed, the plane of the strait \((f\ b)\) will make, with the axis of the trunk \((a)\), an angle of 140°; or, in other words, the inclination would be 50° below the horizon if the individual were standing up. But if the trunk should be raised up to \(c\), or even carried forwards to \(d\), the inclination would, at \(c\), be 22° 30, and at \(d\) nothing at all; for at \(d\) the plane would be at right angles to the trunk.

It is very well worth while for the student to note these things, because the ease or difficulty, the celerity or slowness of a labor may depend upon the degree of this inclination, and on nothing else, and
he can understand why a woman who stretches her limbs quite straight out in the bed, and bends her trunk backwards by means of a pillow under the loins, should fail to drive the child's head right through the inlet, and rather force it against the top of the pubis than into the opening; whereas, if she should bend the trunk forwards in a proper manner, she would at once thrust the infant's head through the aperture and drive it down to the very bottom of the excavation. The knowledge of these circumstances, and a vigilant attention to all the details of his duty, enable a practitioner to obviate much suffering for the poor female, tormented with the pains and anxieties that attend upon the parturition of human beings; for the physician may direct the woman to take such a position as to adjust the inclination as he pleases. Indeed, it is an instinctive knowledge that induces almost all women in labor to bow themselves forwards, and a long experience leads the wise matrons, who come to her help, to frequently advise and exhort her to "bend forwards, my dear; bend well forward to the knees."

I shall conclude this part of my subject, by proposing the question: what is the superior strait, and by the answer—the superior strait is the narrow pass from the greater, downwards into the lesser basin or pelvis; it is bounded by the linea ilio-pectinea, and its plane, which is an imaginary superficies, is inclined about 50° in a person standing upright—some authors say 60°; it is 4 inches from front to rear, 4½ inches from side to side, and 5 inches in its two oblique diameters; and such are the diameters of the superior strait. I mean to say that a superior strait, possessing these dimensions, ought to be pronounced perfect all the world over, and that while it is true that we meet with many that are larger, we also meet with many that are smaller. A pelvis is large enough when it is as large as the above proposed model. Let the student, however, remember that the larger it is the less the obstruction and difficulty it can give rise to in parturition, and vice versa.

When two ossa coxalia are correctly adjusted in their places upon a sacrum the pelvis is reconstructed, and we see the pubic arch, the great vacuity above the pubis betwixt the two anterior superior spines of the ilia, the vacuity behind between the posterior parts of the ilia, and a great notch on either side, between the wings of the sacrum and the ossa ischia, and which is called the sacro-sciatic notch. All this, as I before said, gives the idea of a broken basin; but not so in the living subject, for there the upper vacuity is occupied by the tendons of the external oblique muscles, by the recti and pyramidales, and by the abdominal fascia and integuments. On the posterior part, the great basin is made complete by the lower lumbar vertebrae which rise
up from the base of the sacrum; by the ilio-sacral and sacro-lumbar ligaments, and by the muscular and tegumentary tissues that complete the round in that direction.

Inferiorly, the pubal arch is closed by the genitalia; the sacro-sciatic notches are occupied with ligament and muscle, &c., and the perineal strait is closed by the tissues of the perineum, &c., which thus complete the basin or pelvis, and give it a right to be so called, while it is difficult to see any likeness to a basin in the dried osseous specimen alone.

Having now taken a general view of the pelvis, let us proceed to its analysis, or to an examination of the several bones by whose union it is composed; and this, perhaps, is the only way in which we can correctly compass the important study.

The question that first arises, is: Of how many pieces does a pelvis consist? and the student may properly reply that it is composed of four separate bones, which are: 1st. A sacrum; 2d. A coccyx; 3d. A right, and 4th, a left os innominatum. It would, however, be equally true to say that a pelvis is composed of eight bones, that may be enumerated as follows, videl.: 1. A Sacrum. 2. A coccyx. 3 and 4. A right and left pubis. 5 and 6. A right and left ischium. 7 and 8. A right and left ilium; and if he should choose to say that a coccyx consists of three pieces, he would enumerate ten instead of only four or only eight separate members of a pelvis.

The Sacrum.—The most important bone of the pelvis is the sacrum, because all the others are dependencies of it, and take their character and proportions from it. Indeed, they could not exist without it, as the limb could not exist without the trunk of the tree from which it arises.

In its origin, a sacrum consists of the elements of five vertebrae, which, in the process of growth, become consolidated or anchylosed into one firm sacrum, and each of the several vertebrae was formed by five points of ossification, that are here represented in Fig. 7, in which a is the original body of the vertebra; c c, the right and the left transverse processes; and b b, the rudiments of the spinous process, which also form the bridge or spinal canal. Even so late as the period of birth, and long after the season of viability of the fetus is passed, the five separate members of each sacral piece are still unconsolidated, and fall apart on being macerated or boiled. But, as the child grows in volume and stature, the bodies of the vertebrae and their transverse and spinous processes
or bridges unite with each other, and the whole of the five vertebrae become fused or soldered, so to speak, into one piece—the bodies making up a sort of central columnar portion—the transverse processes converting themselves by fusion into the bony wings or sides of the sacrum, and the bridges and spinous apophyses becoming the sacral canal and the spinous ridge of the bone. As the transverse processes blend themselves together in regular succession, from top to bottom, they necessarily leave apertures which could not close because the terminal brush of the spinal cord sends out the sacral nerves to make the internal sacral plexus, the origin of the great sciatic nerves that pass outwards through the incisura or sacro-sciatic notch to be distributed on the lower limbs, and thus it is necessary that the sacral holes remain open.

The consolidation of the several sacral pieces has communicated to the sacrum the shape of a three-sided pyramid, whose apex is turned downwards and its base upwards, forming a seat on which the lowest lumbar vertebra rests. The spines or spinous apophyses and the bridges divide the posterior aspect of the sacrum into two smaller faces, while the whole front of the bone makes one large triangular face of four inches to the side (see Fig. 8). This front face, or side of the pyramid, is not plane, but bent or curved so as to make the face quite concave, and give rise to what is called the hollow of the sacrum. The degree of this curve differs in different subjects, but is generally half an inch or more in depth.

In studying the sacrum, it is usual to regard it as having an apex or point (Fig. 8); a base or top; an anterior face or hollow; two posterior faces, each a right-angled triangle; two wings or sides, behind each of which, at the top, is an ear-shaped articulating surface or auricular facette; also ten sacral foramina, or holes for the transmission of internal sacral nerves. These holes are arranged in two upright rows of five holes for each row, which are on each side of the central columnar portion, or bodies of the false vertebrae. The apex terminates in an elliptical convexity, at which the sacrum touches the coccyx at the sacro-coccygeal joint.

At the base or top, is seen an oval-shaped articular surface, which
is the caput upon which the lowest lumbar vertebra rests, and from which, as from a plinth, rises upwards the tall spinal column. This sacro-vertebral facette being cut obliquely backwards causes the sacrum to deviate from the vertical line and retreat or go backwards and downwards behind the spinal column, and thus cause the appearance of a projection in front, overhanging the inlet or superior aperture of the basin, as in the annexed cut (Fig. 9), in which the finger is touching the promontory of the sacrum or sacro-vertebral angle, or projection of the sacrum, for it has all these names.

The anterior face of the sacrum is nearly an equilateral triangle, of four inches to the sides, and its concavity is deep enough, the foramina being stopped with cement, to hold an ounce or even an ounce and a half of water. It is of great moment that this curve should be just right, as too great or too small a depth is equal to a deformity, and is attended with increased pain, delay, and danger to the laborant. The child, in being born, executes a spiral turn on its long axis, a motion that is known as the rotation of the child, and which, though easy enough in a well-formed hollow, becomes very difficult, or even impossible, in a case where the curve is deficient. Excessive curvature is, also, to be deprecated, as it cannot exist without injury to an antero-posterior diameter.

Both of the posterior faces are convex, very rough, separated from each other by the bridges and spinous process of the sacrum, and provided, like the front, with, each, five sacral foramina for the passage of nerves to the exterior of the pelvis.

The five bodies of the sacral vertebrae have, by anchylosis or fusion, become consolidated into one columnar piece, out of which has been constituted the column or columnar portion of the bone, while the fusion of the ends of the transverse processes together, has converted those processes into wings. It is right to consider the wings as extending along the sides from top to bottom, and not right to limit the idea of wings, to the united transverse processes of the three upper pieces only, as seems to be the intention of Dr. A. F. Hohl, in his new valuable work, *Lehrbuch der Geburtshülfe*, 1855, p. 30; and in his excellent quarto, *Zur Pathol. des Beckens*, p. 6.

I said the sacrum was the most important bone of the whole collection, because it may be considered as the basis or parent of all the others. Now, as the sacrum, while growing, touches the innominatum
by its three upper segments, and by them only, the two bones, sacrum and innominatum, there indent each other mutually and thus give rise to an ear-shaped joint-surface, which is called the auricular facet, in each of them. This auricular facet has, therefore, nothing to do with the fourth and fifth segments of the sacrum, for they nowhere touch the innominata, but are separated from them by the incisura, deep cut, or sacro-sciatic notch.

If, in any sacrum, the wings are correctly developed, the superior strait cannot be deformed in such a way as to produce what is called the oblique ovate pelvis, for the curve or round of the linea ilio-pectinea must be, in such case, correctly drawn; but if one of the wings, which ought to be about fourteen-tenths of an inch, should be only five-tenths of an inch long, the pelvis must of necessity be deformed or crooked, having the pubal symphysis cast far over to the right if the fault is in the left, and far over to the left of the mesial line if the right wing is too short.

As the concavity of the wing determines the shape of the inner wall of the pelvis there, it is evident that too short a wing will cause the change of form above mentioned, and determine the existence of the oblique ovate deformity. I should think this too evident to require any further illustration than that of the subjoined Fig. 10, which is a camera-lucida drawing from an oblique ovate pelvis in my museum at Jefferson College. The left wing is seen to be the contracted or faulty one, whose shortness has caused the symphysis pubis to be placed awry, or far over to the right. The fault is connected with a bony anchylosis of the left sacro-iliac synchondrosis—a circumstance common in these oblique ovate deformities.

Great attention has, of late years, been paid to the influence of the sacrum in producing horizontal deviations of form in the pelvis, and our modern information on the subject is principally due to the care of the late eminent Prof. Naegelé, of Heidelberg, in giving to us his work *Das Schraag Verengtes Beckens*. Dr. E. Gurlt, also, in his *Ueber
Einige durch Erkrankung der Gelenksverbindungen Verursachte Missstellen des Menschlichen Beckens, furnishes us with copious notices of what has been done for our science in this particular up to a late date. While it is to Dr. Anton. F. Hohl, in his Zur Pathologie des Beckens, 4to., 1852, that we are indebted for the fullest and clearest accounts of the matter of oblique oval deformations. Prof. Rokitansky's 3d vol., Manual of Path. Anat., p. 250, furnishes that teacher's views of the deformity, which he attributes, in some cases, to congenital, and in those that occur after birth, to rachitic causes; as does also Scanzoni, p. 149, Lehrbuch der Geburtshilfe, 11 Band. For the present it may suffice for the student to reflect that faults in the wings of the sacrum cannot but bring about great faults of form in the female pelvis—the nature of which he will, from the foregoing, readily comprehend.

I beg the student to examine the ten holes called sacral foramina, which he will find in the front or hollow of the sacrum (Fig. 8), that he may inspect the grooves there to be seen. As those holes give passage to large nervous cords that go to make up the right and left sciatics, let him notice, in these grooves of the sacral foramina, provision against dangerous pressure and contusion of those important nerves by the passing head of the child. Even with the protection of those grooves, serving, as it were, half to bury or hide the nerves in their hollows, few women having labor pains fail in some one of the stages of parturition to admit of a severe pressure of the nervous cords, and when the hard bony head of the foetus is jammed with considerable force upon the sensitive substance, the laborant is heard to cry out that she has cramp in the thigh, or the leg, or the foot. For a woman in labor, the natural labor pains are as much as she can well bear; and she can bear them well if she be of a firm courage and blessed with patience and hope; but if some abnormal and extrinsical pain comes to attack her, the course of nature seems to be turned aside or prevented, and the labor stops. Hence it is that a severe pressure on one or more of these sacral nerves, may wholly arrest the progress of a child-birth, and eventually compel the practitioner to interfere by means of instruments.

I think one of the most fearful instances of human agony that my eyes have ever witnessed, was that of a lady in North Sixth Street, Mrs. Th. S——y, who, being in labor of her first child, and making rapid progress towards a delivery, began suddenly to scream, with the greatest violence, often uttering the words, "Oh, the cramp! the cramp! the cramp!" She was indescribably agitated, her countenance assumed the wildest expression, and all the persons in her chamber became much alarmed on account of the extreme degree of anguish, or rather
agony, which was depicted in her countenance and expressed by her shrieks. I had, for many years, been accustomed to the cries of puerperal women, to which I had become habitually indifferent, but this case deserved to be called terrible. The cramp affected the muscles of her right leg. I explained to her that the cramp was caused by the pressure of the child's head upon one of the right sacral nerves, and though the appearance of the case was appalling, I exhorted her to bear down, hoping a few vigorous efforts would push the head lower than the point of pressure and relieve her from the misery. I was disappointed: the cries ceased with the relaxation of the throe, only to return with every renewal of the contraction. So intense was her distress, that she began soon to show signs of exhaustion of nerve-force, and I have now no doubt that she was in imminent danger of death from the excess of pain. The labor, as to its progress, was arrested with every renewal of the labor-pains; and it appeared that her whole life-force and perceptions were occupied with that sole agony. I was three-fourths of a mile from home; and while her husband was gone for my forceps, for which I immediately sent him, she renewed her cries about every four minutes. I think she would have died in half an hour. Upon receiving the instrument, I speedily applied it and drew the head below the compressed point, and she bore the extraction of it without a murmur, for the nerve was set at liberty as soon as I had drawn the head below it. During more than a fortnight after the labor, there was a partial paralysis of the limb, following the pinch the nerve had suffered betwixt the foetal head and the bony pelvis. It did not wholly disappear for many days. Two years later I encountered a similar scene in the same apartment. She seemed to dread nothing in the approaching labor but the "cramp!" and engaged me to be prepared with my forceps, which I unfortunately declined to do. When the head descended into the pelvis, she was seized with precisely the same kind and degree of pain; the forceps were brought to me from the same distance, and she was again as speedily relieved. In this labor, as in the former, a partial paralysis and numbness of the leg followed the parturition, and did not disappear until the month was out.

In a third labor, during which I was confined to my house by sickness, she came under the care of my able colleague, Dr. R. M. Huston, well known for his skill as an obstetrician. The same scene was renewed in this third case, and the Doctor felt obliged to relieve her by extracting the head with the forceps. I have attended her in a sixth labor in the year 1846, and in a seventh on the 1st November, 1852, in which the position of the child was such as to avoid the pressure,
and she gave birth to the infant without cramp, or any uncommon pain.

I was in attendance upon a lady living in Turner's Lane, two and a half miles from my house. The labor had proceeded very towardly until the head got well down into the pelvis. I was in a lower parlor conversing with her husband when we were both startled by the sudden, sharp screams of the patient from her chamber in the second story. We both hastened to the apartment, where I recognized a scene in all respects like those witnessed in the accouchement of Mrs. S—y. After vainly exhorting my patient to bear down and push the child lower than the nerve, I engaged Mr. — to wake his servant, for it was night, and send him on the fastest horse to the city for my forceps. Her agony was indescribable during the whole period of his absence. He had a ride of five miles—out and in. I got the instrument, and the child was delivered within two or three minutes after it was placed in my hands. No evil consequences followed the pressure in this case. She had had several children, but in none of the labors had the nerve got so severe a pinch.

Here, then, are six cases of forceps operations rendered indispensible by pressure on the sacral nerves. I have seen no accounts of similar instances in the books. I have met with many hundred labors in which cramp was more or less violent; but these cases, above mentioned, were really frightful, and I have no doubt that both the distress and the danger were sufficient warrants for the instrumental assistance.

Very violent cramp in the leg or thigh sometimes attends upon awkward attempts to introduce the forceps, because the ignorant or careless operator suffers the end of the blade to press upon one of these sacral nerves, as it emerges from its foramen and passes along its groove. Any one who is causing this pain with his ignorantly directed instrument is, at the same time, in imminent danger of tearing open the thin postero-lateral wall of the vagina, and plunging the point of the clamp into the sack of the peritoneum; let him tremble for his rashness, and instantly desist from so wrongful a proceeding. While the forceps is passing upwards, the chamber should be kept very still, no one being allowed to talk, so that the operator may immediately know, by the woman's expressions or silence, that the blade is passing in the right direction.

Os Coccygis.—I here present a figure that represents the terminal or caudal extremity of the spinal column, of the natural size. It is called the os coccygis or cuckoo-bone, in vulgar language the crupper-
bone. It consists of three pieces, altogether about an inch and a half long, that are separable in the young, but become ankylosed into one solid piece as advance is made in years. Two styloid processes ascend from the posterior lateral surfaces to rest upon the back part of the apex of the sacrum, and prevent the point of the coccyx from being driven too far backwards by the displacing pressure of the fetus in labor. The cornua, however, are not strong enough always to resist, and they occasionally break off with a loud sound. The sound may be heard at the distance of many feet from the woman in travail. In general, no very great inconvenience is produced by this fracture; although there are met with some instances in which a long-continued pain follows the accident.

In young women, the articulation of the coccyx and sacrum is a movable one; ankylosis takes place only in those who begin to grow old, in advancing beyond the youthful season of bloom and beauty. Hence, it is better that a woman should have her first child before this bony ankylosis takes place, inasmuch as, when the sacrum and coccyx have become immovably joined together, the point of the little bone may arrest or distressingly retard the acts of childbirth.

The movableness of the coccyx upon the sacrum is much relied upon as a means of amplifying the antero-posterior diameter of the lower strait of the pelvis; but I do not think that the point of the coccyx usually recedes much during the transit of the fetal head in parturition. Though most writers attribute to the coccyx a power to recede very considerably, my own observation has led me to regard this recession as less than it is generally reputed to be, and inspection confirms this doubt. The point cannot go very far backwards but at the expense of a fracture of the cornua and of the lesser sacro-sciatic ligaments, which tie it firmly in a certain proximity to the tuberosities of the ischia.

The Os Innominatum.—The side bones, which are technically known as the osse innominata, or nameless bones; and also osse coxalia, or hip-bones, by touching each other in front, and by resting at their posterior extremities upon the wings of the sacrum, serve to complete the whole pelvis, except the small os coccygis at the apex of the sacrum, which has been already described.

An os innominatum is so irregular in its shape, that I do not think
there is any person who could describe it so as to be understood, unless aided by a specimen, or a drawing. I therefore annex the figure (12) that represents an outside view of the bone, near the middle of which is seen a cup-like cavity, $l$, which receives the round head of the thigh-bone. This socket, or cup, is known as the acetabulum, a word often used in midwifery, though the acetabulum is on the outer surface of the pelvis; hence, when the word acetabulum is used in our art, let it be understood as meaning the smooth surface on the inside of the pelvis opposite to the acetabulum, which is on the outside. It would be far better to say acetabular region, than acetabulum in midwifery, for that would express our real meaning, which the other does not, as there is no acetabulum within the excavation.

The figure (12) shows the left os innominatum, corresponding with the left half of Fig. 13. On its right is seen the broad expanded iliac portion of it, $a$, exhibiting its dorsum, bounded above by the crista or crest of the ilium, $b$, with its anterior superior spinous process, $c$, on the left, and its anterior inferior spinous process, $d$, a little lower down. The posterior superior, and the posterior inferior spinous processes are at the bottom of the drawing on the right, $e, f$, while just behind the acetabulum may be seen projecting backwards the spine of the ischium. At $h$ is the tuberosity of the ischium, and the pubis (at $i$), whose descending ramus drops downwards to meet and unite with the ascending branch of the ischium. $k$ is the foramen ovale, foramen thyroidean, or obturator foramen; $l$, in the bottom of the cup, is the acetabulum; $g$ is the spina ischi. 

I now present an inside view of the right os innominatum, in Fig. 13. Here the letter $a$ is placed on the symphyseal end of the os pubis, which, when joined to the left os coxale, makes the pubic symphysis; $b$ is the body of the pubis running backwards to the dotted line on the acetabulum, where it ends; $c$ is the descending ramus pubis, and $d$ the ascending ramus ischii. The letter $e$ is on the plane of the ischium, and $f$ on the iliac fossa or venter; $g$, the anterior superior spinous process of the ilium; $h$, its anterior inferior spinous process;
while \( i \) and \( k \) respectively indicate the posterior superior and the posterior inferior spinous processes of the os ilium. Towards the right side of the drawing may be seen, at \( i \), the ear-shaped surface that is denominated the auricular facette, which, being covered with fibro-cartilage, and united to a similar facette on the sacrum, composes the sacro-iliac joint. The Student will please to note the three dotted lines in the middle of the figure, which indicate the respective limits of pubis, ischium, and ilium in that direction, and he will see that one-fifth of the acetabulum belongs to the pubis; that two-fifths of it are contributed by the ischium; while the upper and outer two-fifths are formed out of the os ilium. By examining these dotted lines, he will learn what parts of the os innominatum belong to each of its three constituent members. In fact, the os innominatum, as has been already seen, was originally three separate bones; which at or about the period of puberty become consolidated by bony ankylosis, or union, into one solid os coxale, hip-bone, or side-bone.

If an os innominatum be taken from a subject under twelve or fourteen years of age, and macerated or boiled in water, it readily separates into three pieces; and the separation takes place because the pieces, in an under age, are not consolidated or become one firm bone. The separation will occur in the acetabular region, where the several pieces are as yet not firmly united by ossific fusion; a union that cannot become complete until the body has acquired such a development as to fit it to undergo the fatigue of gestation, which rarely occurs until the fifteenth year. A bone, taken from the os innominatum of a subject about twelve years old, serves to show the Student the propriety of preserving for the adult skeleton the names of the three separate pieces; for he will learn therefrom that it is very convenient to refer to them in many cases where we desire to direct the attention accurately to a certain point of the pelvis, of which we can then speak, as its ischial, pubic, or iliac portion.

In respect to the acetabular region, or as it is for shortness called the acetabulum, I wish the Student to observe that it is one of the cardinal points in the circumference of the pelvis, and it is highly re-
quisite that he should know that the left acetabulum is agreed upon by the profession to be considered as the cardinal point on the female pelvis. There are various cardinal points also upon the foetus, as, for example, the vertex or point of the head, &c. Now, when the vertex, in the head presentation, is found to be at the left acetabulum, it is said to be in the first position; and if it is at the right acetabulum, it is in the second position, and so on; from which it appears that positions are classed numerically, and are, in fact, expressed as numerical relations of some cardinal point upon the child to the cardinal point of the pelvis. Thus, if, in a consultation upon the case, the question should be asked, what is the position? The answer might be, it is the first, or the fifth, or the third, and so forth, which would express the numerical relation of the vertex to the left acetabulum.

The whole pelvis is now seen to consist of a sacrum and coccyx, and of two ossa innominata, and the innominata themselves to consist, in fact, each of a pubis, an ischium, and an ilium. It has been divided into two basins that are called the greater and the lesser, or the superior and the inferior pelvis, that are separated from each other by the inlet, the entrance, the narrows or superior strait.

It is to the hollow of the sacrum that is due the cavity, or, as I am accustomed to call it, the excavation, for the sides and front of that excavation would, if the form depended upon them alone, render the pelvis a cone, which it is not, and indeed far from it, for it is an expanded cavity in which there is abundant room to effect those curious spiral movements of the child that are known as rotation—movements that could not be possible, were it not that the curve of the sacrum gives a sort of balloon-like shape to all that part of the organ that lies between the superior and the inferior straits.

As to the symphysis pubis, we may say that its inner aspect is convex rather than hollow, and as to the two ossa ischia, their inner faces are plane, and not only so, but these planes approach each other as they descend on each side of the basin or canal, so that a body that can lie between the planes at the top can by no means do so at the bottom of them, because at the top the planes are 4 ½ inches asunder, while they are only 4 inches apart at the bottom. The Student will please examine his specimen, or the Fig. 13, to see the shape of this famous plane of the ischium. I am truly desirous that he should get a complete idea of it on account of the influence it has in the mechanism of labors, for the spiral movement of the child is in a good measure due to this very plane, whose form and inclination compel it to rotate or make the spiral turn, which the hollow of the sacrum only allows, but does not compel it to do.
I refer the Student here to a drawing (Fig. 14), which exhibits, on the left hand, a bisected sacrum, and on the right side a section of the pubis. The line $mn$ is the horizon, $ab$ the plane of the superior strait, and $oi$ the plane of the inferior strait. The lines $pc, qc, rc, sc$, and $tc$ also represent planes within the true pelvis, and it is evident by inspection that $ab$ and $oi$ are shorter than the lines $pc$ to $tc$, because the sacrum is hollow, and is nearer to the pubis at its inlet and outlet than anywhere else. In this figure, the line $ef$ is the axis of the superior strait, not the axis of the pelvis. The artist attempted to represent the axis of the pelvis by the line $gk$, which cuts all the planes in their centres. This is perhaps a very correct method of representation, but I greatly prefer that of Professor Carus.

**Carus's Curve.**—A far preferable method of describing and understanding the axis of the pelvis is that proposed by Dr. Carl. Gustav Carus, Prof. of Midwifery in the Medico-Chir. Acad. of Dresden. His views are stated in his *Lehrbuch der Gynäkologie*, etc., Part I. p. 33, § 44.

Professor Carus directs that one leg of a pair of compasses should be set in the middle of the posterior edge of the symphysis pubis in a bisected pelvis, as in the figure 15, which I have copied from his plate—the other leg of the compass being opened two and a quarter inches (I propose two inches only), which is half the antero-posterior diameter of the pelvis. A circle may now be drawn downwards, commencing at the plane of the superior strait, and continued through $gf, ge$, and $ga$ to the point of departure. This is Carus's circle, a segment of which represents, within the excavation, the axis of the pelvis. This
THE PELVIS.

curve of Carus, which is the bent axis of the pelvis, is an imaginary curved line in coincidence with which the centre of the foetal encephalon moves as it passes from the upper pelvis through the excavation, the inferior strait, and the produced genital aperture, in the act of being born. If the head of the child in a labor should continue to move, after its birth, in the same curve it moved in while within the pelvis, the head would come back to the point of departure at the centre of the plane of the superior strait. The line $ab$ is the axis of the plane of the superior strait, and the line $gc$ is that of the plane of the inferior strait.

Such is Carus's curve, which is the bent axis of the pelvic canal—an important item of midwifery knowledge; one without which a practitioner is incompetent scientifically to deliver a placenta, and far less to extract a child by turning, or to apply and deliver with the forceps or the crotchet. I caution the Student not to fail in understanding this point very perfectly. If he should make himself perfectly familiar with this curve of Carus, I see not how he could make any mistake as to the appropriate direction of his efforts in any act of delivery, whether with the hand alone, or with instruments.

Prof. Dubois, in his *Traité Complet de l'Art des Accouchemens*, p. 66, after speaking of Carus's curve and commending it as being very simple and at the same time very ingenious, says, it has the fault of giving a not exact idea of the central line of the pelvis; but I consider that for all practical purposes it is far superior to any other, and I believe that the Student who well understands Carus's curve will always act correctly in his manner of adjusting the forceps and other instruments, as well as in operating with them, or with the hand alone, in extracting the head or other parts of the child, because he will clearly apprehend the line in which all movements ought to proceed.

The straits, diameters, planes, axes, and curves of the pelvis are, in an obstetrical regard, related to a certain form, magnitude, and position of the presenting part of the child, which, in its passage through the pelvis, performs certain movements that are spoken of as the mechanism of the labor, and which I shall proceed to explain after I shall have first spoken of the recent pelvis, and of the child in utero.

The transverse diameter of the superior strait has already been seen to be four and a half inches, and that of the inferior strait only four inches, so that a series of planes superimposed from the lower to the upper strait would be wider and wider as they approach the top, being four and a half at top, and only four inches wide at the bottom.
The inclination of the sides of the pelvis, due to the position of the planes of the ischia, makes it inevitable for the head, when it happens to present transversely, to spin on its axis and direct its longest diameter at last to the pubis in front and the sacrum behind. If it were not that the ischial planes are thus inclined, there would be no rotation, nor any need for it; but as it is, rotation is almost indispensable. A gestation would hardly go to term but for this inclination: without it, the fruit of the womb would continually tend to drop down and be lost, in consequence of the upright attitude of the woman. It makes her parturitions more painful than that of other creatures, but her compensation is found in the Ovidian privilege of the os sublime.

A providential care has been manifested not only in this law of the inclination of the ischial planes, but is equally apparent in the planes of the pelvic canal. The Student has already been advertised that he ought not to adopt the notion that the pelvis has but the two planes; 1st. of the superior, and 2d. of the inferior strait; but rather, conceive of the entire pelvic canal from inlet to outlet as occupied with innumerable imaginary planes. Dr. Tyler Smith, in his Lectures on the Theory and Pract. of Midwifery, Lancet, No. XIX., vol. i. 1856, after remarking that only the upper and lower planes have generally been deemed worthy of particular attention, says, “but it is necessary to consider a third plane situated between the other two, and which may be termed the mid-plane,” and he imagines this “mid-plane” to be specially interesting, as being the point “where the rotations of the head are impressed upon it.” I have always considered that the flexed head in descending, commences its spiral or rotatory motion as soon as the occipito-frontal diameter begins to rest on opposite sides of the pelvic wall; that it descends rotating, and continues to do so until the crown of the head is pressed against the floor of the pelvis, when the rotation is, or rather, ought to be complete. Hence, I do not admit that there is, within the pelvis, any special plane, whether mid-plane or other that compels rotation. Indeed the whole trunk of the child, as well as the head, undergoes the spiral or rotatory motion, and it cannot be that so important a portion of the pelvic function depends upon the so-called mid-plane. I present in Fig. 16 an illustration to show that the child is packed up in shape like an olive, and presents its cephalic or head-pole to the opening. If the head must of necessity suffer rotation in its progress, the trunk must do so no less, for it is true that this olive-shaped mass, about to be driven through the pelvic canal, is some twelve inches in length by a little less than four inches in its transverse diameter. For many years
past, I have taught at the Jefferson College that the planes of the pelvis are innumerable, and that each and every one of them must be traversed by the descending foetus, at right angles to their superficies, and I am greatly obliged to Professor Carus for his simple and illustrative idea of the Carus curve, which saves me the useless trouble of calculating the places of the planes, and fully answers the demands of the age in the question, What is the axis of the pelvis? a question to which I have taught many thousands of American physicians to answer, it is Carus's curve, which is an arc of a vertical circle projected midway between pubis and sacrum, and which is the track in which the centre of the encephalon, or of the trunk of the foetus moves in being born. It might well be called the pelvic orbit.

In my view it is pragmatical to pretend to lay down the absolute course of a line that should pass perpendicularly through an imaginary million of imaginary pelvic planes, and always in their exact centres. Such particularity is both useless and impracticable. The operator who adopts the idea of Carus's, or Camper's curve, when in the act of delivering, whether by turning, or with any instrument, has only to keep before him a clear view of Carus's arc, to be sure he is right in his direction of traction, and that, whether he be drawing the cranium through the plane of the superior strait, or through any one of the other planes that are inside of the pelvic canal, or in the extended, produced tube of the vagina, in which sometimes the head is still detained after clearing the lower strait. The accoucheur can always do this operation well, provided he has attained to a correct ideal of the pelvic canal, which he will know is in length equal to the height of the plane of the ischium, or about three inches and a half in all; for that is the measure of Carus's arc of a vertical circle projected within the pelvis midway between the pubis and the sacrum.

I must be allowed here to say a word concerning the plane of the inferior strait, as it is denominated. I myself have already used this word, and shall do so again, and many times, because I cannot escape
from under the tyranny of custom and language. I wish, however, to protest now against the doctrine of a plane of the outlet as taught by most writers and public lecturers. The author just referred to, *loc. cit.*, speaks, as has been seen, of an upper or lower, and a mid-plane, but there is no such lower plane in fact; on the contrary, the outlet or lower strait is so shaped that there are two planes belonging to it, each nearly an equilateral triangle, and these two planes touch each other at an angle of 90° along the transverse diameter of the inferior strait. The posterior plane descends forwards from the point of the coccyx, its two sides being bounded by the inner lips of the sacro-sciatic ligaments as far as the transverse diameter. The anterior plane descends backwards from the crown of the pubal arch until it meets its fellow, and forms with it, as I said, an angle of about ninety degrees. The child, in being born, displaces these planes, if one might suppose such a thing, pressing the anterior margin of the posterior plane downwards, and dividing the anterior one into two rectangular triangles that yield or open in the middle like winged valves to admit of the child's escape, and then close again. It seems to me that as I have a right to imagine a plane or planes of the inferior strait, there is an attached privilege to conceive of them as valvular.

**Ligaments of the Pelvis.**—The two symphyseal ends of the pubes are, as I said, united by a fibro-cartilage, passing interchangeably from one bone to the other. The lower edge of this ligament is called the triangular ligament. It serves both to strengthen the joint and to depress the crown of the pubic arch, which arch is thus made cushion-like and lower, and elastic. If the head were pressed immediately against the bony structure, that structure, from its inelastic hardness, would contuse the soft parts of the woman or those of the child; whereas the ligament is of the nature of a soft and elastic cushion.

In dividing the symphysis, there is sometimes, not always, found in the centre of it a very small synovial sac.

The ligaments of the pelvis are of very great importance, for the firmness of the pelvis as an organ for transmitting the weight of the trunk to the lower extremities, and propagating their motion inversely to the trunk and upper limbs, is dependent upon the ligaments. I shall present the reader here with a view of them taken from a distinguished author, who, I hope, will not object to my exhibiting to the American Student a copy of his beautiful drawing. I refer to Dr. Frederick Arnold, from whose *Tabulæ Anatomicae*, Fasciculus IV. Pars II. *Continens Icones Articulorum et Ligamentorum*, fol. Stuttgard, 1843, I have taken Fig. 17.
In this figure the letter G is the sacrum; s s s the posterior sacral foramina; H the os coccygis, J the right os innominatum, of which a portion has been removed, O the posterior superior spinous process of the ilium, B the greater sciatic notch; 10 the superior ilio-lumbar liga-

Fig. 17.

ment; 11 inferior ilio-lumbar ligament; 12 superior sacro-iliac ligament; 13 the posterior superficial sacro-iliac ligament; 15 sacro-sciatic ligament; 16 the sacro-spinous ligament; 17 the sacro-tuberos ligament.

From a mere inspection of Dr. Arnold's figures it is evident that the chief ligamentous strength of the sacro-iliac junction depends, 1st, upon the powerful ligaments on the back part of the pelvis, outside of the excavation; and 2d, on the firm cohesion of the two ossa pubis by means of the strong inter-pubic ligament. The auricular or sacro-iliac cartilage, which is not represented, is so strong that I have been much foiled in endeavoring, before my class, to tear open the sacro-iliac joint by pulling asunder the ossa pubis after I had performed the section of the pubic ligaments: the origin or insertion of the auricular cartilage must be torn out from the bone before it will yield, for the fibres will not break: they can only be torn out by the roots.

Opening of the Joints.—Many people among the mass of society suppose that in every labor the joints become relaxed in order to let
the child pass through the bones; and a good many ladies daily take a spoonful of oil of olives or castor oil, with a view to promote this desirable relaxation, as they esteem it to be. I have known a young thing take the trouble, nightly, to anoint the mons veneris for a long period with lily ointment, to soften the joint.

It is understood, however, by the anatomist, that these joints do not become open and relaxed as a normal effect of gestation, of labor, or of any endermic or therapeutical measures, resorted to for that end. Yet they do, in some persons, relax, to their great injury or inconvenience, and cases of this kind are recorded in the books, and will be met with by most persons extensively engaged in the practice of midwifery.

As to the symphysis pubis, I have on many occasions found it to be quite loosened, and admitting of motion. One of my patients, whom I have succored in many of her confinements, has generally suffered from the relaxation of the symphysis pubis during the several last weeks of her pregnancies. The articulation becomes so loose as to make a very considerable cracking sound whenever she would turn in bed, or walk; and she has been good enough, in order that I might verify the fact, to allow me to cause the motion by pressing with my hands on the opposite spinous processes of the iliac bones, by which means I could cause the two opposite pubes to approach or separate from each other, or ride up and down, passing each other in the direction of the length of the symphysis.

When the patient, in such a state of the inter-pubal ligament, stands on the right foot, the right pubis rises upwards, while the left descends, and vice versa—so that the act of walking is not only attended with pain, but with tottering and uncertainty.

The lady in question gives birth to children weighing ten and twelve pounds, but she has commonly recovered from the relaxation within about forty days after the birth of the child, and her pubic joint then remains perfectly strong and efficient, until, in the next gestation or lying-in, the pressure or the infiltration come to loosen and dispart the bones again.

This lady has been fourteen times pregnant, and has given birth to twelve children at term. The joint did not give way until the sixth accouchement, which occurred October 20, 1833. The child weighed upwards of twelve pounds. The motion of the symphysis was very obvious, and quite painful. She recovered from it, however, and did not feel it again until near the close of a pregnancy, which was concluded on the 12th December, 1835, by the birth of a son. In about a month the articulation was again as firm as ever. A daughter was
born October 30, 1837, which reproduced the relaxation. She soon got over this, and in the next pregnancy and confinement felt nothing of it: this labor was on the 2d of September, 1843. When the child was three months old, the relaxation took place, and was long troublesome. She was again pregnant in 1845, but had no return of the inconvenience in the gestation or lying-in, which occurred January 20, 1846. The joint gave way again soon after her last accouchement, August 17, 1847: she discovered it on the 20th day of the month, and it was so movable, that a cracking sound was produced by turning in bed.

The Student will readily perceive that a considerable relaxation of the pubal joint cannot fail to coincide with a relaxation, more or less considerable, of at least one of the sacro-iliac junctions, and that in such case the pain, weakness, or constitutional disturbances developed by the accident are readily accounted for, and can be treated wisely at least, if not fortunately. It appears to me that in articular maladies or accidents of this sort, there is but one sound principle of cure, and that is absolute rest in a recumbent position. A woman could hardly fail to recover if kept quiet in bed for a long time. She could hardly recover while taking usual exercise, which is wholly incompatible with the cure of the injured articulation. In those cases in which the joint has become positively inflamed and painful, it would be useful to apply leeches, cups, or blisters, or use anaesthetic topicals, as chloroform, belladonna, opium, or aconite. I have found every attempt at bandaging a failure, on account of the impossibility of well adjusting and properly retaining a bandage in place in this particular part of the body, so that I am obliged to conclude that the best thing that can be done is to go to a protracted rest in bed.

**Diameters of the Pelvis.**—As every woman’s hand, foot, or chin is not like every other woman’s, so there are, perhaps, no two pelves that are exactly alike. For the utilitarian purposes of clinical midwifery, it is enough, therefore, to know that as children’s heads and trunks are supposed to be of a mean weight and bigness, so ought the pelvic canal to be of an average capacity for their transmission. Different authors give us different means of these pelvic diameters, and it is, perhaps, of no very great importance that they should exactly agree together in their several estimates of size. In order to reach what would be the average of ten different pelves, I measured ten of those in my collection at Jefferson College, and the result was as follows in this tabular view, which I subjoin:
No. of Pelves. Superior Strait. Inferior Strait.

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1 4.2 6. 5.3 4. 4.3
2 4.4 5.5 5.5 3.6 4.4
3 3.9 4.8 4.7 2.7 4.2
4 3.5 5. 5. 2.9 4.3
5 4.2 5. 4.8 3.1 4.6
6 4.3 4.6 5.5 4.1 4.6
7 4.9 4.7 4.8 4.1 4.1
8 4.3 4.5 4.3 4.1 3.8
9 4.4 4.8 4.9 3.6 4.7
10 4.3 4.8 4.7 3.8 4.2

For the ten antero-posterior diameters in this table, the mean was a little more than four inches and two-tenths; the ten transverse diameters gave me 4.79 inches, and the oblique diameter 4.45 inches and one-tenth; and these may be taken as correct, because those diameters do not change much in drying. As to the inferior strait, which I measured from the point of the coccyx to the crown of the pubal arch, less correct results can be expected, because in drying it generally happens that the shrinking or contraction of the sacro-sciatic ligaments draws the point of the coccyx forwards towards the arch. Even with this consequence, the ten antero-posterior diameters gave a mean length of 3.7, whereas the true expression ought to be, as it is in the recent subject, more than four inches—say four and a half in some subjects, though rarely. The ten transverse diameters of the lower strait were 4.32. I shall not cite from the authors the collected tables of pelvic diameters, because I prefer not to load the Student's memory with such matters, feeling sure he will know how large a pelvis is, and ought to be, when he knows how large a child's head is or ought to be. For my own part, I do know that an American child's head ought to be three inches and eighty-eight hundredths wide, measured through the parietal protuberances; and such is its transverse diameter. Its occipito-frontal diameter should be four inches and ten-twelfths, and its occipito-mental diameter five inches and a half.

In order then that an American should be born in quite a normal way, his mother's superior strait ought to be four inches in antero-posterior, four and a half inches in transverse, and five inches in its oblique diameters. Such a pelvis as that is proper for easily transmitting any properly developed foetus, provided it should present itself aright in the labor.

Let the Student then learn that the superior strait has four diameters to be measured; one from the pubis to the promontory, which is four inches; one from the middle of the brim to the opposite brim, which is four inches and a half; and two others, called oblique diameters,
from each sacro-iliac junction to the opposite acetabulum, which are five inches long in each. For the inferior strait let him measure two diameters only, one from the pubal arch to the point of the coccyx, four and a half inches; and the other across the outlet from one tuberosity to its opposite fellow, which is four inches in length.

It is of great importance to have correct views of the depth of the female pelvis, and nothing is easier than to obtain them by considering that a symphysis pubis is from top to bottom an inch and a half long, which gives the depth of the pelvis behind its anterior wall as one inch and a half. The planes of the ischia are three and a half inches high, and, therefore, the depth of the pelvis at the side and all across to the other side—that is to say, its middle depth—is three inches and a half. The sacrum is four inches long, and the coccyx is an inch and a half, which equal five inches and a half, the depth of the pelvis on its posterior wall; so that the pelvis is an inch and a half deep in front, three and a half at the sides and in the middle, and five and a half inches deep behind. The magnitude or dimensions of all the things that are within the pelvis may be estimated by comparing them with these diameters, and as an object that is four inches high cannot be vertically placed within the pelvis except it be near its posterior wall, so, one only two and a quarter inches high can be, like the non-gravid womb, completely within the pelvis, no part of it rising or projecting above the plane at the strait.

The recent pelvis, which is represented in Fig. 18, is exhibited as a cross section, the body being cut in two from front to rear to show the relative positions and forms of the viscera.

The drawing has been reduced for this work from the admirable engraving that accompanies Dr. Kolrausch's work, entitled Zur Anatomie und Physiologie der Beckenorgane.

It appears to me that this is the most instructive illustration that I have ever met with in books on midwifery, and it is to be entirely confided in for its correctness. The subject was a young girl of 21 years of age, who committed suicide while menstruating. The specimen was prepared in such a way as to enable Dr. Kolrausch to see it while lying in a bath of alcohol covered with a glass plate. Looking downward through a dioptrc firmly fixed 24 inches above the glass plate, Dr. Kolrausch, using a pen dipped in printer's ink softened with oil of turpentine, drew every one of the lines with the utmost exactness on the intervening plate of glass—seeing them through the dioptrc; so that they could not, perhaps, be more correctly taken by a photograph. The copper-plate was copied from the drawing.

To the right is the buttock covering the bisected sacrum, in front of
which is the rectum, which has been opened by the incision. On the left, behind the os pubis, is the bladder of urine with its urethra.

Fig. 18.

Between the bladder and the rectum is the tube of the vagina surmounted by the uterus, whose summit or fundus does not rise quite so high as the plane of the superior strait. The womb rests upon the upper end of the vagina, which incloses its cervical or neck portion and keeps it up in its place by means of its connection with the bladder in front and the rectum behind, and more than all by means of two utero-sacral ligaments which tie the upper ends of the vagina and the womb to a certain place about an inch and a half in front of the apex of the sacrum. I may here say, that as long as the utero-sacral ligaments remain in a healthy state, preserving by their tone a due length, the womb cannot fall downwards or prolapse, because the cervix, being inclosed within the upper end of the canal of the vagina, it cannot
move down unless that upper end of the vagina move down also, which, as above said, it cannot do except the ligamenta utero-sacralia give way first. The length of the vagina determines the height of the womb's place in the pelvis. All these intro-pelvic organs are covered up beneath the serous peritoneal membrane as if they were enveloped in a napkin, but still exhibit their magnitudes and forms beneath its foldings.

In front the peritoneum covers the anterior hemisphere of the bladder, its top and part of its posterior surface, but not all of it. The lower or posterior part of the bladder lies in contact with the vagina, and is united to it by what is called the vesico-vaginal septum or partition. After leaving the vagina the peritoneum proceeds to invest about one-half of the anterior aspect of the womb, its fundus, and the whole of its posterior wall, as far down as to about the middle of the cervix, where it leaves it to continue its downward course, in which it invests about one-third of the uterine extremity of the vaginal canal; then turning upwards it mounts on the rectum to inclose that intestine in its serous coating, and so passes up above the brim or strait. In investing the bladder, the womb and vagina and the rectum, as above, the peritoneum sends off to the left side of the pelvis, and also to the right side, its two ligamenta lata or broad ligaments which serve to steady the uterus and keep it from falling against the sides of the excavation when the woman lies on this side or on that.

The same peritoneum sends two folds that serve as ligaments backwards from the upper and lateral parts of the vagina to be inserted into the face of the sacrum on either side of the rectum. Now, as the peritoneum, after covering the hinder surface of the womb, goes on to and rises up along the rectum and the face of the sacrum, these two peritoneal folds or utero-sacral ligaments form the sides of a cul-de-sac, that looks like a deep pocket between the gut and the womb, and which is called Douglas' cul-de-sac, a thing of much import because it is the place into which the fundus uteri falls when it is quite turned over backwards, or retroverted. Let the Student, therefore, comprehend that the hinder wall of Douglas' cul-de-sac is the rectum and sacrum; its front wall is the womb and upper posterior end of the vagina, and its right and left walls the right and left utero-sacral ligaments. I wish him to know this point well, on account of its concern in retroversio uteri and in prolapse of the bowels; but more particularly because I wish him to bear it in constant remembrance whenever he may be thrusting the blade of a forceps upwards at the risk of bursting a way into it; for when passing the forceps upwards, in a labor, he is very liable to force its point through the thin and dis-
tended vagina quite into the peritoneal sac, an accident that would be almost sure to kill his unfortunate patient.

Besides the organs now enumerated, the pelvis contains the obturator muscles and the large levator ani muscles, which descend like converging rays of a fan from the antero-lateral walls of the pelvis below the brim, and are inserted so as to lift or raise the end of the rectum and even the perineum upwards, so that not the rectum and perineum only, but the whole of the pelvic contents are directly or indirectly held up and sustained by these muscular organs. The stronger and more muscular the levatores ani the deeper is the sulcus betwixt the nates, and, in general, the better sustained are the contents of the basin. In the young and vigorous the sulcus is very deep; in the aged and the feeble it descends lower and lower or opens out, so that in very old or exhausted people the perineum becomes actually protuberant or convex.

Within the recent pelvis are numerous bloodvessels and nerves, supplying the contained organs, besides large bundles of nerves that come from the sacral foramina and soon leave the cavity, passing outwards through the ischiatic notches to form the great sciatic nerve.

Here also are contained the ureters; while, overhanging the brim, are seen the psoas muscles, which seem to lessen the transverse diameter of the upper strait. Let the Student be particular to note the place and appearance of the psoas muscles as they pass along the brim of the pelvis; and let him observe that, when a woman, who has recently been delivered, suffers from inflammation of the womb, she always experiences pain when she draws up the knees, because the overhanging bellies of the psoas muscles, in contracting to flex the thighs, press very painfully upon the inflamed globe of the uterus, which still juts up above the plane of the superior strait, filling up the whole of its transverse diameter.

Figure 19 may give some idea of the relation of parts in the recent pelvis. A is the aorta, and B the vena cava; C the internal iliac artery descending into the pelvic excavation; D and F are the external iliac artery and vein; F G the psoas muscles, H the rectum, I the womb, and K the bladder of urine.
I wish the Student to reflect that all the pelvic viscera are within, and not out of or beyond the pelvis; and I say so in this place to guard him against the very common mistake of supposing that any part of the womb—its fundus—is to be found jutting up above the plane of the superior strait. There are few drawings made to illustrate the inner genitalia in situ, that do not exhibit the fundus uteri on a level with or even higher than the plane of the strait. Kolrausch's most beautiful and admirable plate, the most perfect that has yet been produced, gives to all the internal organs their absolute right place. I assure the Student that whenever he shall find that he can feel the fundus uteri by pressing his hand upon the hypogastrium and pushing the teguments downwards and backwards, he may make sure that he is touching a womb enlarged by pregnancy or by some disease.