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THE POSITION
OF THE
UTERUS AND FOETUS
AT THE
END OF PREGNANCY.

ILLUSTRATED BY SECTIONS THROUGH FROZEN BODIES

BY

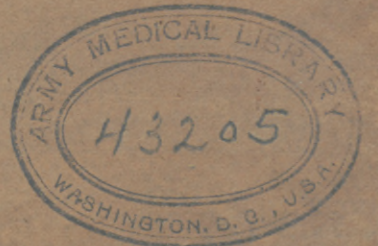
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PROFESSOR IN THE UNIVERSITY OF LEIPZIG.

DRAWN AFTER NATURE AND LITHOGRAPHED BY C. SCHMIEDEL. COLORED BY F. A. HAUPTVOGEL.

WITH ONE WOODCUT IN THE TEXT.

SUPPLEMENT TO THE AUTHOR'S „TOPOGRAPH.-ANATOM. ATLAS“.



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DAVID NUTT, WILLIAMS & NORGATE.
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LEIPZIG
VEIT & COMP.
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L. W. SCHMIDT, GERMAN BOOKSELLER.
24. BARRCLAY STREET.

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TAB. A. B.

The body which was brought to the dissecting room soon after death and still in a state of rigor mortis was that of a young woman 25 years of age who committed suicide by strangulation in the last month of her pregnancy. Except the very visible impression caused by the rope round the neck, there was no trace of external injury. The genital organs were in the state corresponding to that period of gestation—uniformly hyperaemic, and there was no evidence that they had suffered any external injury.

Though it was the month of March when the body was brought into the dissecting room, yet the weather being warmer than is usual in this season, it was judged advisable to employ an artificial freezing mixture composed of salt and ice, and in this mixture the body was kept for 6 days during which time the ice and salt were repeatedly renewed, the temperature being maintained at -10°R . So long a time was considered advisable in order to ensure the thorough congelation of all parts within the abdominal and pelvic cavities. And on sawing through the body it was actually found that the freezing had succeeded as well as could be desired.

In order to make accurate tracings of both halves of the body and correctly represent what was shown in the preparation, the work was carried on in a cool cellar. Each day before the body began to thaw, the drawing was discontinued and the parts were again put into the freezing mixture in which they remained during the night. During this time the parts were left in the same unaltered position and the drawings correctly executed.

The parts into which the foetus had been divided in sawing through the maternal body were at the last reunited, so that a view of the original position of the child within the body of the mother could be obtained. For that purpose I separated with the aid of a chisel the frozen foetal parts together with the liquor amnii from the left half of the uterus, moistened the cut surfaces with water and allowed them to freeze upon the right half of the foetus.

The apparently intact child now lying in the right half of the uterus was drawn in its entirety. After the removal of all the remains of the liquor amnii the left half of the maternal body was sketched so as to show the empty uterine cavity.

The foetus was in the second head position and was found to be a well developed female at term. The labia pudendi closed the vulva, the nails were well developed and projected beyond the fingers. The entire length of the foetus was $50\frac{1}{2}$ centimetres and its weight (without the umbilical cord) 3195 grammes. The umbilical cord divided in the longitudinal section passed between the head and the right arm to the placenta which was attached to the right side of the uterus somewhat low down.

As shown in the drawing of the section the greater part of the child was situated in the right half of the uterus. In making the section through the maternal body the foetal head was divided obliquely, the greater part being on the left side of the section. The left arm together with a part of the shoulder was almost longitudinally divided and the fore arm flexed at right angles was cut through transversely. One half of the right fore arm and a portion of the right leg together with almost the whole foot projected beyond the middle line to the left side. The left knee was just grazed. The back and the abdomen were within the right half of the uterus. The greater quantity of the liquor amnii remained on the left side of the uterus.

The uterus was in a relaxed state so that its anterior wall folded above the symphysis pubis formed a kind of excavation. The large and numerous veins of its substance appear in the anterior wall as simple stripes since they represent fissures which only become recognizable when their walls are drawn asunder. Only in the portio vaginalis and the adjoining portion of the vagina are they seen with wide openings. The portio vaginalis uteri was, relatively speaking, situated somewhat deeply down: the greater part of it being in the left half of the body, so that the section passed through its right half and opened only the terminal portion of the canal of the cervix uteri as seen in Tab. A. It was entirely filled up with tough mucus and opened into the uterine cavity $\frac{1}{2}$ centimetre below the cut surface, so that its upper portion could not be made visible in the drawing. Its length at the period of gestation

reached by the woman, as above mentioned, rendered it probable that she was not a primipara although the abdominal walls showed no linear markings and the internal os uteri was so narrow that only a small probe could be passed.

The large number and the varicose condition of the veins of the vagina were remarkable and the section was such, that its cavity could be well seen in the left half of the preparation (Tab. A). The cervical portion of the uterus was seen lying strikingly low down in the vagina dragging with it the empty and contracted bladder. The latter has slipped down so to speak from the inner surface of the symphysis and the urethra, which is seen divided in the left half, shows a kind of a bend. The external os uteri is here on a level with the lower edge of the symphysis pubis, whilst according to Moreau it is said to be on a level with the upper edge of the symphysis at the end of pregnancy; and B. Schultze figures it as situated still higher up. The height of the fundus uteri corresponds pretty nearly to that of the lower margin of the first lumbar vertebra. This cannot however be precisely stated as the uterus had not been cut through at its highest point, the fundus inclining a little to the right so that it reached a point somewhat higher up. And these parts having during the progress of the drawing begun to thaw, exact measurements on this point could not be taken. The fundus uteri however reaches the same point of the vertebral column as stated by Moreau, although according to B. Schultze's measurements (Wandtafeln, Plate 6) the second lumbar vertebra indicates the position of the fundus uteri at the end of pregnancy. The antero-posterior diameter of the uterine cavity and (in connection with it) that of the whole abdominal cavity, was less than is usually represented in drawings in, spite of the large and well developed child. It is not improbable that besides individual differences the various attitudes of the body have some influence in determining this inasmuch as, in the recumbent posture the uterus finds a point d'appui on the vertebral column, whilst in the erect position the yielding abdominal walls are pressed forward. It is also to be considered that in the dead subject generally speaking the antero-posterior diameter of the abdominal cavity is less than it is during life, on account of the more elevated position of the diaphragm. In the present case the distance between the lumbar vertebrae and the anterior abdominal walls was about two thirds of the antero-posterior diameter of the whole body, or the sagittal diameter of the highest point of the abdominal cavity, whilst in the female body which I examined, and which was in the second month of pregnancy, the column of the lumbar vertebrae projected a good deal beyond the middle of that diameter.

It should also be mentioned that the vessels of the maternal body were not injected, a circumstance which requires attention in estimating the thickness of the uterine walls, since almost all the veins of the uterine walls were empty.

In spite of the relatively small antero-posterior diameter the abdominal cavity extended farther upwards. The diaphragm reached with its highest point the 7th. dorsal vertebra, whilst in men and middle aged non pregnant women it usually stands on a level with the 9th. dorsal vertebra.

The bulk of the intestines was pressed upwards and was chiefly in the left upper portion of the abdominal cavity. The stomach, much distended with food, was bent in its pyloric portion at a sharp angle backwards and to the left so that it was cut through twice.

The upper horizontal portion of the duodenum went directly backwards. In the drawing of the left half of the body the contracted pylorus is seen with the duodenum, and somewhat distant from it the opening of the pancreatic and common bile ducts, which latter coming from the right above the duodenum, is seen in the section. Beneath the duodenum the pancreas is situated.

The liver and spleen were not enlarged; the latter measured 14.0 centimetres in length, 8 cm. in breadth and 5 cm. in depth. The duodenum and pyloric portions of the stomach were together with the rest of the intestines pushed over to the left owing to the fundus of the uterus inclining to the right. The rectum which was rather distended passed into the sigmoid flexure within the pelvic cavity. The commence-

ment of the sigmoid flexure was situated to the right and was consequently divided. Between the rectum (the folds of which on the right side were so situated as to be mistaken in the drawing for valvulae conniventes) and the uterus, there was a coil of the small intestine, the lowest part of the ileum which joins the colon ascendens. Such a state is said to occur, in the unimpregnated uterus, only in cases of anteversion.

To define the limits of the pelvic peritoneum care must be taken that it is not mistaken for the fascia (rather strongly marked in the drawing) which descends for some distance between the uterus, bladder, and rectum. The peritoneum passes for a short distance only over the posterior wall of the vagina, and covers the half of the posterior wall of the contracted bladder, whilst the fascia (including loose and easily moveable connective tissue) descends nearly to the internal orifice of the urethra in front and close to the termination of the rectum behind.

The length of the thoracic cavity appears on account of the high position of the diaphragm to be relatively short, but the antero-posterior diameter somewhat long. This is especially seen by comparing the present preparation with the section of the female body which I figured in my Atlas, Tab. II. From it alone an enlargement of the base of the thorax during pregnancy cannot be assumed since measures taken before pregnancy are wanting for comparison with those taken after.

The unchanged spirometric capacity of the thorax in pregnancy may be explained thus looking at it from an anatomical point of view though these relations have not as yet been clearly demonstrated. The longitudinal diameter of the thorax diminished by the pressing upward of the diaphragm, is compensated for by the increase of the antero-posterior diameter through tension of the abdominal muscles (acting over the enlarged uterus as a pulley) on the base of the thorax.

Gerhard moreover found on examining 42 pregnant women at term, that in 36 the diaphragm maintained its normal position, in 5 it was slightly lower and in 1 only was it higher. Dorn found as the result of measurement taken by the Cyrtometer on pregnant women at term and the same after delivery, that in the great number of cases the transverse diameter of the base of the thorax was greater during pregnancy than after delivery, whilst the antero-posterior was diminished.

With the emptying of the uterine cavity this proportion became reversed—the sides of the thorax collapsed so to speak, the transverse diameter became diminished, the antero-posterior increased. (Bericht über die Naturforscherversammlung zu Giessen, 1865 p. 236.)

In the thoracic cavity the section deviated from the middle line to the right chiefly on account of the lateral curvature of the vertebral column, and passing through the calibres of the superior and inferior venae cavae divided the right auricle and the root of the right lung. Thus the opening of both veins into the heart was very clearly seen. The inferior vena cava which shortly before entering the heart receives the hepatic veins, opens into the right auricle from behind whilst the superior vena cava opens into it considerably more in front. Thus the axes of the two venae cavae form an angle which is rounded off by the prominence of the auricular septum.

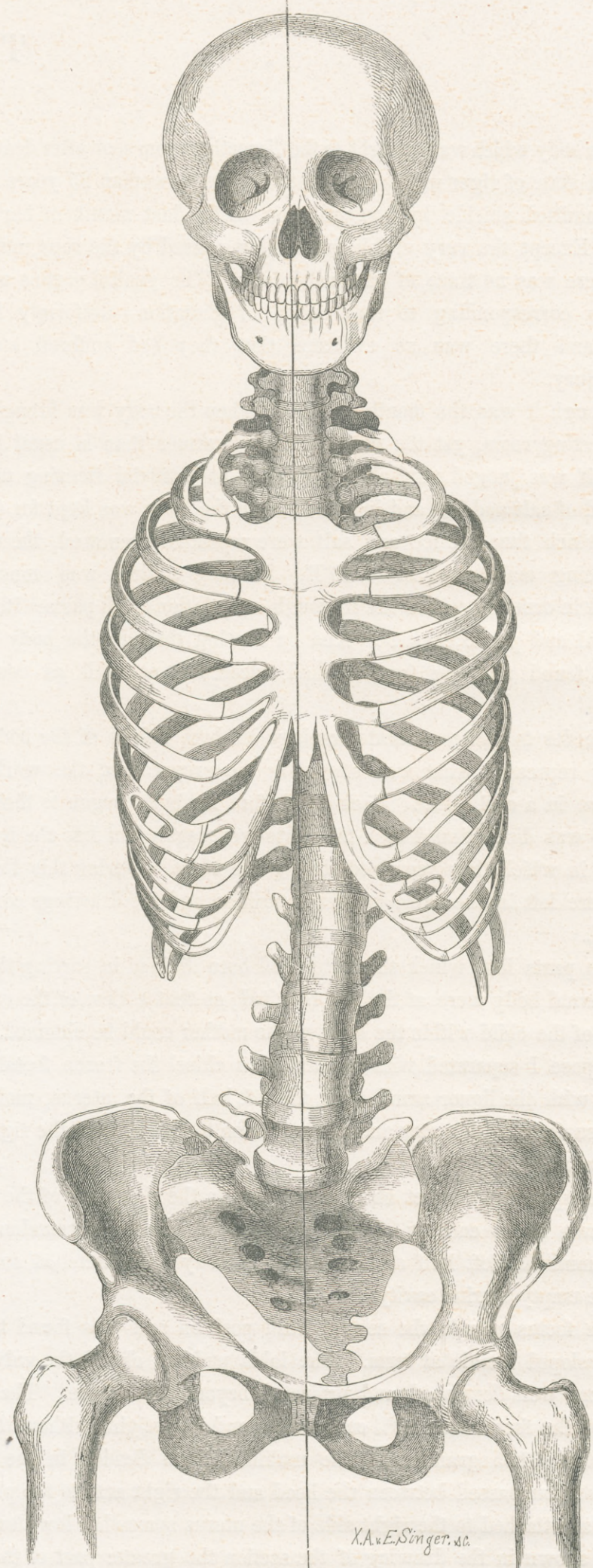
The prominence beneath which the left auricle is situated is the tubercle of Lower. In the right half the external wall of the right auricle is seen, whilst in the left the right ventricle is opened up at the orifice of which a piece of the rudimentary Eustachian valve is still situated. This rudimentary valve limits the posterior portion of the right auricle in which the position of the foramen ovale may still be recognised. In the anterior part of the auricle to which the superior vena cava points, the bulb of the aorta forms a slight projection. The aorta itself was not divided but a portion of it exposed. It passes upwards in front of the superior vena cava and disappears under it as the vein passes into the left innominate.

The section passed through the right lung so that portions of it are seen in both plates.

The soft parts of the neck were pushed far towards the left side by the greatly enlarged thyroid gland. The trachea was situated so much to the left that a piece of the thyroid cartilage was cut off. Of the oesophagus nothing is to be seen.

The parts of the head are rendered sufficiently intelligible by the marks which are placed upon all the drawings. The brain was also divided through its right half. The radiation of the fibres into the corpus striatum is shown. Beneath the latter the inferior cornu of the right ventricle passes containing the elevation of the pes hippocampi. In the drawing of the right half a portion of the Gasserian ganglion is seen lying beneath the dura mater together with a portion of the fibres of the trigeminus.

The anatomical conditions of the skeleton are of special importance. After the drawings were completed the halves of the skeleton were macerated and then joined as accurately as possible. The accompanying wood-cut gives a view of it on a smaller scale. It will be seen that



the pelvis is slightly skoliotic as well as the vertebral column. But it may also be seen that the deviation of the sections from the middle line is not so considerable as may be supposed from the drawings.

From the pelvis which was pretty accurately divided in the middle line, the section extends upwards to the right of the bodies of the vertebrae.

In the dorsal region the articulations of the ribs are divided and it is not till the cervical region that the section again passes through the middle of the bodies of the vertebrae.

In the head the line of the section gradually deviates to the right. Besides the lateral curvature it is noteworthy that there were present two cervical ribs, the one on the right side perfectly developed, that on the left rudimentary attached to the cervical vertebrae. There were 7 cervical, only 11 dorsal and 5 lumbar vertebrae. To the 5th. lumbar vertebra was attached a rudimentary vertebra; this was situated on the upper portion of the sacrum, forming a kind of accessory to the existing 5 sacral vertebrae.

The pelvic diameters were as follows: conjugate 9,5 cm. (at the narrowest point of the pelvis 9,2); right sacro-cotyloid 6,5 left 8, transverse 14,5 left oblique diameter 12,7 right oblique diam. 14 cm. The sacrum was 11 cm. high and 11,8 broad. It was therefore a somewhat obliquely distorted pelvis which however had such dimensions that it may be assumed delivery could have taken place without operative interference.

TAB. C. D.

In the month of May 1870 the body of another woman pregnant at term was brought to the dissecting room. The rigor mortis was still persisting. The woman had, as was found out afterwards, drowned herself during labour. She was tall, and to judge from her powerful frame and callous hands, a working woman of about 35 years of age. Except the curvature of the dorsal vertebrae to be mentioned hereafter, all the other organs were perfectly normal. The uterus reaching above the umbilicus could be well felt through the very prominent abdomen. The head of the foetus was impacted in the pelvis. On examination of the genital organs it was found that the liquor amnii had not yet escaped and that the bag of waters of the size of an apple was still intact in the vagina.

Without injecting the vessels, which would have caused only delay and perhaps troublesome extravasations, the body was immediately enclosed in a tin case. It was placed in the dorsal posture as evenly as possible and no support given to either head or extremities. After the deep cellar in which the freezing mixture was prepared had been thoroughly cooled by large masses of ice and salt, the body was allowed to freeze; 180 g . of ice and 60 g . of salt were required and distributed in four successive freezing mixtures. A thermometer introduced through a tin pipe into the case showed the temperature of the mass of ice and its rise indicated the time when it became necessary to renew the freezing mixture. The whole mass, from which the water could freely flow off, was covered in by straw and plank. The cellar was so closed everywhere that no external air could enter to raise the temperature. For eight days the body was kept in a temperature of -12°R . and this time was perfectly sufficient to allow the body to freeze as hard as bone. The sawing through was done in the usual way and the parts preserved for the purpose of tracing and drawing in the same manner as was done with the subject of the preceding plates.

For almost four weeks the thawing had to be prevented by fresh freezing mixture, as so long a time was required to complete the drawings. The section passed pretty accurately through the middle line from below upwards; only in the symphysis the middle line was not perfectly kept, but the deviation was so slight (the cavity of the articulation being only one line beneath the cut surface), that it need not enter into consideration. After the tracing and drawing of the right half had been entirely finished, (which not only required three weeks of hard work but during which time also the right as well as the left half had to be kept uniformly frozen), the maternal parts were chiseled off from the left half, in order to obtain that half of the child intact and in an unaltered position. It could not however be expected that the foetal parts could be got out from the tightly grasping uterus without any change of their position occurring. Therefore a drawing of the left half of the mother as well as of the child could not be made in the same way as succeeded in the first body. Now the hard frozen foetal half which was obtained quite intact, was made to freeze upon the right one and thus a correct drawing of the entire child made. Then the whole child was removed from the right maternal half, which was effected by thawing the abdominal wall and bending that of the uterus; it thus became possible to make a drawing of the empty right half of the uterine cavity and, although it cannot be pronounced perfectly correct as regards the inner surface of the fundus, yet it represents quite faithfully the position of the internal os and cervix uteri. In the same way the depth of the uterine cavity could be measured pretty accurately from the cut surface and also the position of the right Fallopian tube.

At last the child, which had been kept frozen for a long time without much trouble and expense, was drawn of natural size from behind in order to show the observed axial turning of its body. (Tab. D.)

Thus the five plates were made to represent the essential relations as faithfully as possible.

The child was a well developed male at term weighing 3319.2 grammes. In this the umbilical cord was included. For this passed downward beneath the left leg, there it turned in order to reascend over the joint of the left foot and at the abdomen it sharply turned to the placenta which was situated in the upper portion of the uterus. Now in removing the left half of the child the umbilical cord had to be divided since its placental insertion was in the left half of the maternal

body. I cut it off close to its insertion because it lay so tightly compressed upon the child, that it could only have been removed with difficulty and not without altering the position of the left lower extremity.

Before labour began, the child whose whole figure is seen, was probably in the second head position. But at the death of the mother it was, as seen in the preparation, at the beginning of the stage of expulsion. The natural rotation of the head within the pelvis had commenced and the head especially was rotated more to the right than the trunk. And whilst the shoulders were as yet entirely in the false pelvis, the head had already entered the true. The force which had pushed it downwards must have been considerable. The head was large and the pelvis not very roomy. The effect of that force can still be recognised in the shape of the head. The occiput is pyriform and pointed and, as found on examination, a somewhat extensive caput succedaneum had formed on the skull.

Through the close embrace of the uterus the foetal limbs nowhere showed the round form and usual easy flexure of the extremities. In the present case the child was tightly packed up into the narrowest possible space. Into the space between the two feet and the right gluteal region the scrotum was pressed like a narrow wedge. The skin showed many striae and portions of it were firmly compressed into prominent ridges. The nape of the neck appeared as a narrow fissure between the closely folded skin of the back and occiput. Especially remarkable is the impression upon the child's head in the left mastoid region. It was caused by the pressure of the contracted pelvis. Immediately beneath it the section of the symphysis pubis can be seen. A similar deep impression is caused by the internal os uteri upon the left arm and in the longitudinal folds and furrows of the right forearm traces are left of its almost longitudinal retraction.

The abdomen of the child was almost transversely divided, but on account of the axial turning the saw passed through the thorax and still more so through the head in a direction intermediate between the antero-posterior and the transverse diameters. It is consequently difficult to recognise the individual parts of the brain in the section of the child's head: only the cerebrum and cerebellum can well be seen and a portion of the corpus callosum distinguished. More however cannot be made out. Beneath the anterior lobe of the cerebrum (see drawing above) lies a section of the orbital cavity together with a portion of the eyeball. Further towards the trunk is the transverse section of the inferior maxilla together with a dental follicle. In the cervical region which is here only represented by a deep incurvation of the skin forming a narrow fissure the oblique sections of the trachea and oesophagus are seen and then the heart with the adjacent right lung and the thymus gland. The cavity of the pleura did not contain any notable quantity of fluid, whilst in that of the peritoneum a large quantity was found, which is also indicated by the wide interspaces between the different coils of the intestines. The left lobe of the liver covered the spleen. Below was the contracted and empty bladder and beneath it, the rectum distended by meconium. The contents and color of the large intestines were characteristic, whilst the extremely contracted small intestine contained only a small quantity of pale mucus, a thick mass consisting of bile, debris of cells, lanugo etc. distended the various portions of the large intestines. The mass in the upper portion was yellow and gradually assumed the greenish black color of meconium in the lower. I have found exactly the same in examining normal infantile bodies which I extracted after cephalotripsy and I have no hesitation in pronouncing that state normal. The liquor amnii was, on the whole, not abundant. It was chiseled out from between the prominences and folds of the infantile body to obtain a better view of it and could not therefore be exactly measured. Only on the abdomen of the foetus on the left of the observer, a stripe of the frozen liquor amnii is seen. This represents the 'after waters' discharged after the birth of the child and contrasts with the 'fore-waters' which, presenting before the head distend the vagina. The chorion and amnion can well be distinguished in the bag about to burst as well as in the 'after waters'.

Of special interest however is the uterus, the relations of which could only be carefully studied after the removal of the whole child. Therefore a particular drawing of the empty uterine cavity appeared to

be necessary. The uterus closely surrounds the child and nowhere shows any folds which could point to a laxity of its walls; its longitudinal axis is directed almost perpendicularly to the plane of the pelvic inlet: the uterus appears to have retained its contraction even after death. The internal os uteri lies somewhat above the pelvic inlet and is marked by a large vein, the only one found patulous in the uterine wall on account of its engorgement with blood.

In the empty uterine cavity, 3,5 cent. above the symphysis pubis and 2,6 cent. above the promontory, the internal os uteri is seen as a projecting semicircle, distinctly separating the dilated cavity of the cervix from that of the body of the uterus. The fully dilated external os uteri is seen as a slight prominence in the vagina. It extends obliquely from the region of the lower margin of the symphysis pubis to the junction between the coccyx and the sacrum and surrounds the protruding occiput. The uterine orifice of the right Fallopian tube is especially well marked.

The depth of the uterine cavity as measured from the horizontal plane of the cut surface to the deepest point was 6,5 cent. The length from the internal os to the fundus uteri was 16,5 cent. The distance between the external and the internal os uteri along the pelvic axis was 11 cent. The thickness of the uterine walls showed great variation in different places. The placenta was situated high up at the fundus and by far the greater part of it in the left half of the section, therefore the umbilical cord had to be divided.

Whilst the rectum still remained pervious at some places, the bladder was entirely emptied and flattened. Its walls behind the symphysis pubis were so thinned that they could hardly be distinguished. Above and below the symphysis where the pressure had not so forcibly acted upon the bladder, it is thicker and consequently more easily distinguishable. The thinnest part is behind the symphysis pubis and the drawing represents it rather thicker than it actually was. This was necessary to show the continuity of the cavity of the bladder. A distension of the bladder could have taken place only in its upper portion and thus would have separated the anterior abdominal walls for some distance from the uterus.

The prominence of the abdominal walls caused by the projection

of the uterus, was in the present case not so considerable as in that shewn in the preceding plates. There the position also of the uterus was different although this difference is not so great as it may appear at first sight. In both cases the vertebral column projects only beyond the first third of the thickness of the whole trunk.

To sketch the child the left half of the mother had to be chiseled off and thus unfortunately the skeleton was destroyed. It was therefore impossible to prepare and to sketch the skeleton also in the same way as had been done in the other case. But that loss is of no consequence. The pelvis is found to be perfectly normal, the conjugate diameter measuring 11 cent. The vertebral column had no lateral deviation and the section passed exactly through its middle line. The great curvature of the dorsal and cervical portions of the vertebral column is of no importance to our present purpose.

With regard to the intestines, which, together with the rather empty stomach were pushed upward just as in the other body, there was nothing remarkable. The liver and the spleen were normal. The former weighed 1500 grammes. Its anterior margin was turned upwards. The latter weighed 200 grammes and measured in length, breadth and depth 14, 7, and 3 cent. respectively. It was consequently somewhat smaller than the spleen of the other pregnant woman at term. The abdominal cavity measured from the symphysis pubis to the highest part of the diaphragm, had exactly the same height as the one represented in the first drawings. But the two thoracic cavities differed considerably from one another as regarded their height. I am therefore not inclined to attach any importance to the uniformity in both preparations of the depth at the base of the thorax which here also considerably surpasses the depth of the thorax of the woman in the second month of pregnancy delineated on plate II of the Atlas. To arrive at any conclusion on the depth of the cavity of the thorax during pregnancy, measurements must be made on the living subject, since attention must be paid to the capacity of the thorax both before and after delivery.

Nothing of special interest can be added in regard to the relations of the heart, the trachea, the larynx, the buccal cavity and the brain. Those parts are sufficiently explained in the drawings by marks on the points of importance.

Plates A-C missing

