A case of extroversion of the bladder in a female child : with dissection / by Francis Henry Champneys.

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A CASE

OF

EXTROVERSION OF THE BLADDER IN A FEMALE CHILD, WITH DISSECTION.

BY

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At the latter end of February I was called by one of the midwives employed in my out-patient department of Queen Charlotte's Hospital to see a child, born February 14, 1877, which she said was afflicted with a tumour such as she had never seen or read of. She added that the parents were very anxious to have it cut off.

On my arrival, I found what I had expected from her description—an extroverted bladder—and then learnt the following facts:—

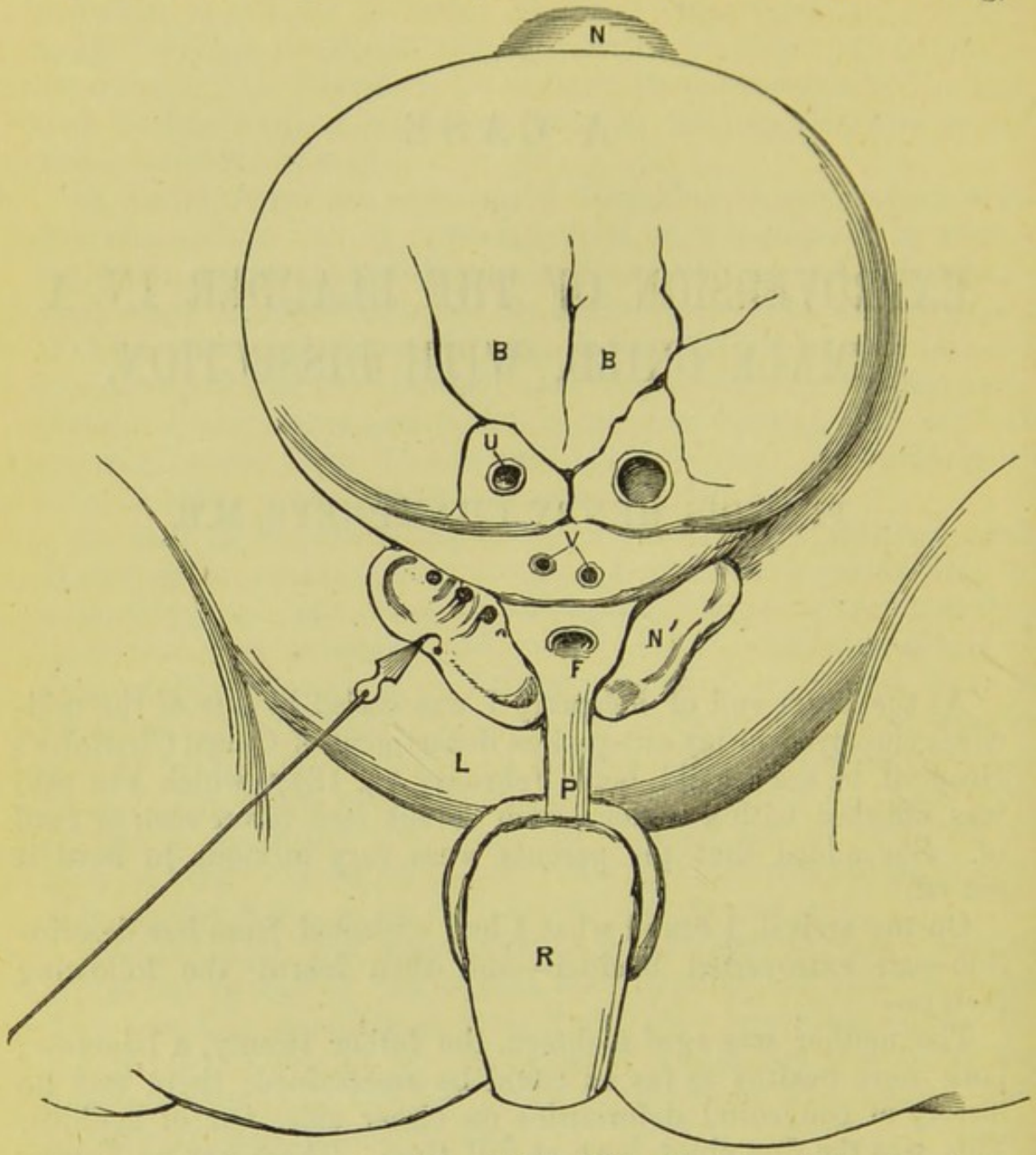
The mother was aged eighteen, the father twenty, a labourer; both were healthy as far as could be ascertained; there was no history of congenital deformities on either side, nor of syphilis. This was the first child, born at full time. There was no history of maternal impressions.

The labour was an easy and natural one, only lasting three and a half hours. Repeated inquiries elicited the fact that the navel-string was split, just before reaching the child's body, into two cords; it separated naturally on the fifth day. There was no adhesion of the membranes to the belly or any part of the body.

The child had always strained since birth, and on the seventeenth day a prolapsus ani occurred.

Three weeks after birth a rash appeared round the chin, somewhat scaly; the palms of the hands were rough, and were said to have been so since birth. No snuffles. Nothing distinctive in the way of a rash round the anus, though all the skin on the buttocks and thighs was dusky red, probably from urine.

There was congenital talipes equino-varus of the left leg,



The parts after soaking in spirit, which had the effect of rendering them more diagrammatic.

N. Navel.

B. Bladder, showing two lateral and one mesial fissures, the latter indicating its occasional separation into two halves.

U. The right ureter, natural size; the left shows the size to which they could be dilated.

V. Two openings into vagina.

F. Blind fossa, entirely posterior to vagina.

N′. Left nympha, the right drawn down by a hook to show the crypts and frænа.

L. Labium majus.

P. Perineum.

R. Rectum prolapsed.

and the whole leg from the trunk downwards was wasted, the left patella even being slightly smaller than the right.

The child had been considered a female, and named accordingly.

The lower part of the trunk presented the following appearances. In the normal situation of the navel none was to be seen; the lower third of the abdomen was occupied by a large, round, convex, purple-red, moist, easily bleeding body, towards the lower end of which were seen two papilliform prominences about one inch apart, into which a probe could be passed for some inches, and out of which clear fluid was seen to flow, at times by drops, but at other times (especially when, after continued suckling in the recumbent position, the child was raised up and began to cry) in fine jets an inch or two long. The mother said as much as a tablespoonful was sometimes passed at once. The surface of the large red body was not smooth, but thrown into numerous wrinkles and prominences, and at its lower end there was one mesial wrinkle, making that part seem bilobed. From the lower end of this wrinkle two others ran upwards and outwards; and from these, again, two others ran downwards, insulating the papilliform prominences. The margin of the large body passed into the normal skin by a boundary-line of smooth bluish tissue, such as lines a hare-lip. This large body was smaller in the recumbent position, and when the child was quiet it could even be inverted and the two edges approximated, but became larger in the erect posture, and when the child strained or cried. At the top of the large body was seen a brown mark of semicircular form, quite flat, and presenting none of the usual button-form of a navel. The summit of this body had a glazed appearance, as if epidermis were beginning to grow on it; the margins of this glazed part were irregular.

The anus seemed situated unusually far forwards; there was a projection of some two inches of bowel, which could be returned, but was immediately protruded again by a combination of straining and hiccough, which was very persistent. Fæces passed freely. From the anus a mesial raphé ran upwards or forwards.

Generative organs of ordinary form there were none, male or female. Below the papillæ above mentioned there was on each side a fold of wrinkled integument like a little lappet turning upwards; it was somewhat semilunar, the convexity upwards; on drawing the lappet down, the furrow which it formed with the surface was seen bridged over by several little frænа, by the side of which were little blind pits or depressions. The little lappets contained no trace of a body harder than themselves. Between them there was felt to be an absence of any pelvic bone, but each of them was situated on a hard body feeling like a tuberosity, continuous with the pelvis.

Beyond and external to these lappets was seen on either side

a fold or redundancy of smooth skin, larger than the above, but, unlike them, not lappet-like, but with a broad base. These folds of skin contained nothing.

There was no appearance of any penis, urethra, vulva, or vagina, perforate or imperforate.

Very close examination, however, detected below the papillæ and above the lappets, nearer the middle line than either, two small round holes with slightly raised edges, their diameter being about that of an ordinary pinhole. They were equally distant from the middle line, but the right was slightly higher than the left. A probe could be inserted into each about three-quarters of an inch.

There was no rupture, inguinal or other.

These appearances made the sex very doubtful, admitting of more than one interpretation. The large red body was of course the extroverted bladder, the pigmented mark at its summit was the umbilicus, the papillæ were the openings of the ureters; but with regard to the folds of integument and the small holes, there was nothing distinctive of either sex, for the larger, broader folds of skin, which I took for the outer integumental folds of the cloaca of the embryo of undetermined sex, might be either[1] labia majora or the two halves of a scrotum with undescended testicles. The smaller lappets, which I took for the inner integumental folds, might be either the ununited nymphæ or the integument of the lower surface of an ununited penis, the corpora cavernosa of penis rclitoris being absent. The two smaller openings might be either the vasa deferentia, no sinus pocularis intervening, or the openings of Müller's ducts, which had not fused to form a single vagina. The direction in which a probe went into these, namely, upwards, was also no help, for this might be the direction either of the vasa deferentia with retained testicles, or of the ducts of Müller (double vagina).

There yet remained one mode of investigation; if the child were male, nothing should intervene between a finger in the rectum and the base of the bladder. The finger in the rectum detected a body about the size of a hazel-nut in this position, and this I believed to be the uterus.

I showed the child at the Abernethian Society on March 8, and gave it as my opinion that it was a female for the above reasons; the external appearances were also less unlike those of a female than a male child, but the more one thought of embryonic equivalents, the less weight this argument seemed to have. I believed this to be a case of extroversion of the bladder in a female child. I believed the larger and smaller integumental folds to represent

[1] Quain's Anatomy, ed. 1867, vol. ii. p. 1001.

the labia majora and minora respectively, divaricated in correspondence with the divarication of the pubic bones, and I believed the two smaller openings to be the openings of Müller's ducts or of a double vagina, leading possibly to a double uterus.

The child continued to take the breast well till March 17, after which it began to grow weaker. On the night of March 12 it had convulsions, and died at noon on March 13. I was thus prevented from showing the child at another Society, as I had intended, but had fortunately been able to get a drawing made by Mr. Godart the day before its death. The drawing is in St. Bartholomew's Museum. (Series 31.)

The day after its death, Dr. Barlow, of the Children's Hospital, very kindly made a careful post-mortem examination with me, of which the following are the notes :—

Talipes equino-varus, left leg wasted from trunk, left patella somewhat smaller than right.

Abdominal swelling pale, moist, scarcely prominent, width $1\frac{7}{8}$ inch, length $1\frac{3}{4}$ inch.

Measurements.—From ensiform cartilage to navel = $4\frac{1}{2}$ inches. From navel to anus = $2\frac{1}{2}$ inches.

Pelvic measurements, interspinous (least) = 3 inches.

Interpubic = $1\frac{1}{2}$ inch.

Conjugata vera (to a line joining pubes) = $1\frac{1}{2}$ inch.

Interacetabular (internal) = 2 inches.

Intertuberous (between tuberosities of ishia) = $1\frac{1}{2}$ inch.

Diameter obliqua (to end of opposite pubic bone) = 2 inches.

The ilia are so far back that the anterior superior spines are almost on the same plane with the anterior surfaces of the bodies of the vertebræ.

Heart.—The foramen ovale widely open.

Umbilical vein patent in nearly its whole length, which was greater than normal.

The arrangement of the abdominal viscera is far from normal.

The duodenum descends vertically to the upper border of the third lumbar vertebra, where it has a long peritoneal attachment to the lower end of the inner border of the right kidney and the brim of the pelvis, at this point making a sudden bend to the left. The small intestine natural.

A common mesentery suspends the whole of the intestines, large and small, except the duodenum and descending colon, the cæcum can be drawn away five inches from the right iliac fossa, the whole attachment exceedingly loose, no diverticulum, the rectum suspended by a long and very loose mesentery, rendering prolapse very easy.

In the pelvis a well-developed uterus, with all appendages complete; two well-developed ovaries; at the apex of the left a small additional acinus, apparently identical in structure. Round ligament plainly seen on each side going to the internal abdominal ring, which is opposite the labium majus. Recto-uterine folds well developed.

The kidneys, ureters, and pelvis, with all its contents, were removed and carefully dissected by me, an injury to my hand, which prevented obstetrics, giving me this opportunity.

The notes of this subsequent dissection are as follows:—

Arteries.—The *common iliacs* bifurcate normally, the external having a normal course and distribution, but the distribution of the internal iliacs, which are much the larger, is altogether abnormal, for there is no division into anterior and posterior trunk, but the arteries are continued as the hypogastrics, which give off along their course all the branches of the internal iliacs separately. The vesical arteries are given off last of all; their trunks are large, the largest of them being about half as large as the external iliac. The uterine and vaginal arteries are given off just before the vesical, and are of a fair size. The vesical are three in number, and run to that part of the abdominal wall which corresponds with the back of the extroverted bladder. The hypogastric arteries terminate in the back of the umbilical scar, about half an inch apart, and are obliterated before their termination. From the upper part of the umbilical scar rises the umbilical vein, patent in nearly all its course.

Renal arteries normal.

The internal iliac veins are distributed in a manner corresponding with their arteries, and likewise possess no primary bifurcation; their distal branches are the vesical veins.

The ovarian vessels normal.

Nerves.—Principal nerve trunks of pelvis normal.

Recti abdominis muscles inserted normally, insertion $1\frac{7}{8}$ inch apart. From the inner borders of the insertions of the recti muscles a tough strong aponeurosis stretches across behind the posterior wall of the bladder.

Generative organs.—The two small openings described above, below the openings of the ureters, are found to open into a single well-developed vagina, and are therefore perhaps in their nature two perforations of a hymen. On the other hand, they look so much like the openings of ducts, that, considering the absence of any external appearance like the opening of a vagina, it is not unlikely that they may be the openings of Müller's ducts, remnants, in fact, of a double vagina, of which the septum has disappeared.

The thickness of the tissue through which they run is considerable, and very unlike a hymen. Length of vagina 1 inch.

The cavity of the uterus is normal. A probe can be inserted three-eighths of an inch into each Fallopian tube, when the calibre narrows so as not to admit even a bristle. It measures from os externum to fundus five-eighths of an inch. Extreme width of cavity at fundus three-eighths of an inch.

Both ureters are much dilated at various points, especially at their lower end. The diameter of their largest parts being more than a quarter of an inch. No obstruction anywhere. Right ureter = 6½ inches long, left = 5 inches long. Both ureters run down into the pelvis, and curve up again to their orifices.

Kidneys.—Both pelves markedly dilated, but tissue healthy; surface lobulated.

Spina bifida.—Last lumbar vertebra well developed; spinous processes of three upper sacral vertebræ feebly developed; the last two do not meet, and the spinal canal is patent. A drawing of the internal parts is in the Hospital Museum. (Series 31.)

Remarks.—It is not my intention to write a complete treatise on extroversion of the bladder, for there are many good accounts of the malformation; nor is it possible to make a complete table of the cases even in one sex, for the literature is far too copious. It will, on the whole, be most convenient to use the principal features of the case just described as the text on which to comment.

Sex.—With regard to the relative frequency of this deformity in the two sexes, there is no real doubt that it is comparatively uncommon in females. Schneider, Meckel, and Velpeau, indeed, doubt this; Meckel because he was able to find many female instances; Schneider believes the relative infrequency of recorded female cases is due to female modesty; and Velpeau, who expresses the same opinion, adds that the deformity is more easily concealed in a female, and that in many cases the sex is not stated. Earle collected sixty-eight cases, of which sixty were in males, eight in females. M'Whinnie had himself seen nine cases, two being females. Mr. Holmes states that he has never seen a female case. Sir H. Thompson (Holmes' System of Surgery, 1870, vol. iv. p. 882) had seen eight cases, of which two were in females. Dr. Braxton Hicks, in his Croonian Lectures for 1877, gives a table furnished from Mr. Bryant's notebook as follows:—

	No. of Cases.	Male.	Female.	Doubtful Sex.
1. Spina bifida	30	13	17	...
2. Extroversion of bladder . . .	20	14	2	4
3. Epi- or hypo-spadias . . .	26	22	2	2
4. Hare lip	64	44	20	...
5. Do. with cleft palate . .	21	17	4	...
6. Malformation of bowel . . .	8	2	6	...
7. Do of extremities (excluding talipes)	46	27	19	...
8. Malformed ears	4	3	1	...

On which he remarks, that in deficiencies of the anterior median line males far exceed ; in those of the posterior median line, females rather exceed. In anomalies of the heart, cyanosis is much commoner in males (comp. St. Hilaire, "Anom. de l'Organisation," Schüler, Nasse, Meckel).

Benjamin Phillips collected twenty-one cases in females. Duncan attributes the comparative frequency in males to greater complexity of their generative organs.

Nomenclature.—The deformity has been known by various names, but principally by two, "Extroversion of the bladder" and "Ectopia vesicæ." With regard to the latter, Vrolik has confined it to a certain class of less severe cases, in which the abdominal walls only are cleft, the bladder projecting between them, but being itself perfect. It would seem advisable to use it for the future in this restricted sense. Mr. Holmes suggests the name "Congenital hiatus of the bladder;" this represents the truth, but since it does not represent the whole truth, there is no sufficient reason for discarding the well-known name "extroversion."

Degrees of deformity.—The lowest or slightest degree of deformity tending to extroversion is that observed by Mr. Mayo, in which the pubic bones were five inches apart, but there was no fissure of the abdominal walls, but only a weak linea alba forming a hernial pouch containing a bladder, which was perfect and held a large calculus.

The next degree is that described by W. Vrolik under the name "Ectopia vesicæ," the bladder being perfect, but protuding through a fissure in the abdominal walls (Taf. 30, fig. 1). In this condition inversion or prolapse of the bladder is possible, either through the urethra or through the urachus if that be patent (Froriep), though Rudolphi states this to be inconceivable in animals possessing an allantois.

The next degree is that commonly observed, in which both bladder and abdominal walls are cleft, as in my case.

The highest or greatest degree of deformity is that in which the

extroverted bladder is separated into two halves by the opening of the intestine (Bartels, Berlin Museum, No. 3077 and 9482; Retzius, p. 532; Friedländer, Taf. 22, figs. 8 and 9; Rose; Fränckel; Meckel, vol. i. p. 734). The reason of this division will be seen when we consider the causes of the deformity.

Double insertion of umbilical cord.—About this fact there is some doubt in my case, but abnormalities of the umbilical vessels have been noticed. Dietrich describes the umbilical vessels running separately to the placenta.

Umbilicus.—This is usually a flat pigmented spot, as in my case; it was formerly described as *absent*, not being recognised under its changed appearance. Schneider mentions a case in which the extroversion did not reach up to the navel, some normal skin intervening. Benjamin Phillips mentions a case in which the tumour reached *above* the navel; this seems hard to represent to one's mind.

In connection with this, the *urachus* is usually said to be *absent*, but this is an incorrect expression; it would be more correct to describe it as not differentiated from the bladder. Ayres describes a case in which the urachus was prolonged into the umbilical cord, and being included in the ligature, fatal peritonitis resulted. This connection of events is not easily intelligible. It may be well to notice here that the word "urachus" is used by Allen Thomson (p. 134) to signify the proximal end of the allantois, that is to say, the part abutting on the Wolffian bodies; this is, however, incorrect, though the allantois is described by some embryologists under the name "urachus."

The low position of the umbilicus is a point universally observed; it is due to arrest of development (Chaussier, Meckel).

Position of anus.—This is generally placed more anteriorly than is usual.

Prolapsus ani.—This is mentioned in a case described by Vrolik. In the cases presently to be alluded to by Bartels and others, in which there was a protrusion of intestine through an opening between the two separated halves of the bladder, it was not the rectum but lower end of the ileum which opened there (the rectum being generally absent); there was therefore no sphincter ani, and the conditions would be different.

Hernia.—In my case there was none; in some cases herniæ have been noticed. Thus in a case mentioned by Schneider (Case 10) there was a congenital umbilical hernia; in Handyside's case a double inguinal hernia occasionally happened on exertion.

Absence of clitoris.—This is often but not always the case. In Sir Astley Cooper's case, the clitoris and its muscles were present, but in two separate halves; the corpora cavernosa passed

towards the glans, not straight, but in a semicircular direction; the two halves of the glans were two inches apart. Both penis and clitoris are often absent (Schneider); the nymphæ may also be absent (Schneider, Case 10); all the external genitals may be absent (Meckel). In the male the testicles are often in the abdomen, and are in that case often undeveloped (Breschet, Ayres); but they may be in the cleft scrotum and well developed (Handyside).

Opening of vagina.—In my case this was double; and for the reasons above given I think it not unlikely that this was a remnant from the period when the ducts of Müller, which form the uterus and vagina as well as the Fallopian tubes, were still separate, not having fused. This fusion takes place from below upwards, the Fallopian tubes marking the point of termination of the process above (Virchow). From various degrees of arrest of this process of fusion arise those varieties of double uterus, or double uterus and vagina, of which many cases are on record, some of them in cases of extroversion of the bladder in females (Saviard, Retzius, Foerster, Rose, Fränckel); in these cases the vagina may be imperforate (Bartels, Meckel, Coates, Schneider). In one very remarkable case (Meckel), the double uterus ended in a double vagina, which opened into the sheath of the umbilical cord. In a case related by Meckel an opening from the bladder led into a uterus-like cavity (gebärmutterähnliche Höhle.)

Prolapse of uterus has been observed in several cases (Ayres). It is attributed to deficient support in connection with divarication of the pubic bones by Isodore St. Hilaire. In some cases it has thrown doubts on the sex by simulating a penis; such cases are related by Breschet, and (though not in connection with extroversion of the bladder) by Sir Everard Home, and by Mahon, in whose case (that of Margaret Malaure, 1693) the possessor of the deformity pretended to be a hermaphrodite. After having deceived many physicians and surgeons, Saviard reduced the prolapsus, and with it the number of sexes.

Round ligament of uterus in Bartels' case, as in mine, was plainly traceable to the internal abdominal ring.

Divarication of pubic bones (*cleft symphysis*) is commonly said to be an invariable point in the deformity, but this is not the case (Coates, Draman, Roose, Walther, Quatrefages).

When present, it necessitates an awkward gait, the thighs being too far apart (M'Whinnie); the *diameters of the pelvis* are, of course, necessarily affected by it, the transverse bearing too large a proportion to the conjugate; and this disproportion increases with age, a fact utilised by Schroeder (pp. 12–14) in illustration of the operation of the different factors which combine to

render the adult's different from the child's pelvis. The posterior edges of the ilia are pulled forwards by the weight of the body, acting through the sacro-iliac ligaments, and therefore the anterior extremities of the ossa innominata (the symphysis) tend to be drawn apart. In the normal pelvis, divarication is prevented by the symphysis, and the result is curving of the bones and increase of the transverse diameter; but when the symphysis is cleft, this force can act unopposed, and separates the pubic bones more and more.

Isodore Geoffroy St. Hilaire remarks on the solidarity existing between the bones and their superjacent soft parts (clitoris or penis), which are generally cleft in correspondence. But as extroversion of the bladder may exist without divarication of the pubic bones, so may divarication of the pubic bones exist without extroversion of the bladder (M'Whinnie, Meckel, Vrolik). In Mayo's case the pubes were five inches apart, yet the bladder was perfect, only projecting through a weak point in the linea alba, forming a hernia; it even contained a large calculus. Yet here the external generative organs were defective. Mr. Mayo remarks well that this state of pelvis bears a resemblance to that of female guinea-pigs near the end of pregnancy, and M'Whinnie adds, after Vrolik, that in birds, who have no urinary bladder, there is no symphysis (the struthionidæ, however, have a symphysis pubis); that in the two-toed sloth the pubic bones are permanently separated, and that in the mole, whose pelvis will scarcely admit a small probe, the ossa pubis unite to enclose the caudal vessels only, forming a simple hæmal arch. Lastly, divarication of the pubic bones does not necessitate abnormality of the generative organs (Vrolik, Walther).

Bladder.—This was formerly described merely as cleft. To Tenon is due the credit of pointing out in 1761 the fact that all the anterior part is *wanting*, that little, in fact, beyond the Trigone remains.

Behind the extroverted bladder an exceedingly strong aponeurosis is continued from the abdominal muscles and fasciæ. This has many times been described, and was very well marked in my case. The whole of the bladder is thus completely extra-abdominal. The protruding bladder becomes larger and more prominent as age advances, which is attributed by Tenon to distension by the intestines and abdominal pressure.

The bilobed appearance which I have described has been noticed by Chaussier and Breschet. It is of extreme value in explaining the origin of the deformity, and forms a step in the direction of that remarkable set of cases related by Bartels, Retzius, Friedländer, Dietrich, Vrolik, Foerster, Rose, and Fränckel, in which

the bladder was actually divided into two separate halves, the intestine opening between them. In a case mentioned by Palfyn the bladder and vagina were fused into a common cavity, the anterior half presenting the appearances of a bladder, the posterior half those of a vagina.

The *ureters* are nearly always dilated, and with them the pelves of the kidneys ; they are also lengthened, and instead of running straight to the bladder, descend into the pelvis and ascend again towards the bladder. In one case they were two inches wide (Petit) ; in Sir Astley Cooper's they were larger than the rectum ; in another case the right measured nine and a half Paris inches in length, the left fourteen (Mörgelin) ; in Schneider's Case 10, one kidney had two ureters. In Bartels' case the right ureter (the left kidney and ureter being absent) was convoluted, its calibre varying from that of a fine bristle to that of a pencil, and opened into the right half of a double vagina. In cases in which the ureters open abnormally, *e.g.*, into the rectum, vagina, or urethra, they are sometimes dilated, sometimes not. For instance, in Saviard's Obs. 94, the comon ureter which opened into the rectum was not dilated ; in Bousquet's case (p. 128), in which both ureters opened at the orifice of a cloaca, they were not dilated ; but in Thilow's case (p. 17), in which both ureters ended in the urethra, they were much dilated ; in this case, however, they were not specially examined as to the existence of an obstruction ; in Blasius' case (p. 52), where they ended in a similar manner, they were much dilated.

The dilatation, therefore, seems to be in some way connected with the general state of disordered development rather than with any proven obstruction ; and on this point Meckel (p. 650) remarks, that the ureters are sometimes found much dilated in other sorts of congenital deformities, as, for instance, in a case quoted by Klein of an acephalous fœtus (p. 30).

From the mouths of the ureters the urine distils by drops, or in occasional spurts (Mörgelin), as in mine ; the quantity discharged at one time will vary. In one case already alluded to, the urine was retained in the dilated ureters till a prolapsed uterus was reduced, when it flowed again, gushing out at least a foot. This was considered a proof of the existence of a bladder (Huxham) ; in one case it could be voided by a voluntary straining effort (Handyside).

The ureters may open in many abnormal situations ; into the vagina (Bartels, Haller, Van Horne) ; into the urethra (Thilow, Lieutaud, Binningen) ; in a case related by Saviard, in which there was a double uterus and vagina, the urethra opened into the left vagina, but a common ureter from both kidneys into a cloaca ; they may also open into the rectum (Oberteuffer, Meckel).

The *urethra* may end blindly behind (Coates, Nebel), though the external genitals are malformed (Vrolik); it may open into the vagina (Saviard, quoted above).

The *kidneys* have often dilated pelves. In Bartels' case the left kidney was absent, though both suprarenal bodies were in their natural position. Specimen No. 3077 in the Berlin Museum, described by Bartels, shows the right kidney so low down as to be almost in the pelvis (the suprarenal bodies not being displaced), or quite in the pelvis (Rose).

Intestines.—Among the anomalies which have been noticed in cases of extroversion may be mentioned the following:—

Diverticulum (Bartels); the small intestine opening through an unnatural orifice between two separate halves of a double extroverted bladder, in some cases prolapsed, the colon in some cases partly or entirely absent, the rectum absent or imperforate (Bartels, Berlin Museum, Nos. 3077 and 9482; Retzius, Friedländer, Dietrich, Vrolik, Foerster, Rose, Fränckel).

"Fistula ani vaginalis congenita" (Papendorp), rectum opening into vagina (Meckel; Burns, related by Duncan; Schneider, Case 12).

In one case, related by Huxham and Oliver, the rectum, which opened by a perforate anus, communicated with the vagina, which was situated so far forwards as to be in the normal position of the symphysis pubis, and through which the subject was impregnated; labour setting in, the two had to be laid into one by an incision.

"Fistula ani vesicalis congenita" (Papendorp), rectum opening into bladder in the male.

"Atresia ani urethralis" (Papendorp), rectum opening into urethra.

The *anus* is often imperforate (Retzius, Friedländer, Dietrich, Foerster, Rose, Vrolik, Fränckel, Bartels, in the cases above alluded to, with small intestine opening between the two separate halves of a double extroverted bladder). In one extraordinary case related by Bartholin, the anus was imperforate; the subject lived forty years, all the ingesta returning through the mouth. It is usual for the anus to be placed abnormally far forwards.

Omental and peritoneal adhesions have been noticed by Bartels. The mesentery was very abnormal in my case.

Arteries.—In my case all the branches of the internal iliac were given off separately from the hypogastric, which was continued as the trunk of the internal iliac, and the veins followed a similar course. In Schneider's Case 14, the branches of the posterior division of the internal iliac were given off from the hypogastric; the spermatic artery on the right side absent (Schneider); the left renal and the left kidney absent, the left spermatic being

given off from the left suprarenal (Bartels); the inferior mesenteric absent, the right renal arising just above the bifurcation of the aorta, the sacra media being larger than the renal, and bifurcating opposite the coccyx (Bartels); two left renal arteries (Schneider); absence of the left hypogastric artery (Fränckel); the umbilical vessels running separate to the placenta (Dietrich); one umbilical artery absent (Marin, Dupuytren);—such are some of the recorded abnormalities of arteries in these cases. It will be observed that, in my case, the fœtal state was maintained, the hypogastric artery continuing the main aortic current, as in the early embryo.

Sexual potentiality in the male is generally entirely abolished, for not only are the testicles (and with them the sexual appetite) often undeveloped (Breschet, Ayres), sometimes intra-abdominal, but, when they are well developed, and the sexual appetite strong, as in Handyside's case, there is generally an extreme degree of epispadias, the penis being absent or in two halves, and the vasa deferentia opening nakedly below the ureters. Besides the sterility which, apart from the question of possibility, such a repulsive deformity might well be expected to entail, nothing but accident or artifice could ever effect a junction between sperm cell and germ cell. Thus males are practically sterile.

It is different with females. In them the essential generative organs need not be malformed, and many cases of pregnancy and parturition are on record. One related by Huxham and Oliver has already been quoted; in another the delivery took place through the perineum (Thiebault), though it may be perfectly normal. It must be remembered that the mechanism of parturition may be altered by the alterations in the pelvis. In Phil. Trans., vol. xxxii., will be found a letter from Oliver to Mead with regard to a female with extroversion, in which this passage occurs: "Hunc in modum conformata, valetudine satis bona fruebatur virgo, et æterna virginitate ex necessitate laboraturam concluserant omnes quibus res innotuerat. Advenit tandem nauta quidam, cui æs triplex circa pectus erat: illam vidit, amavit, duxit, et non multo post impregnavit."

Viability.—Contrary to former preconceived ideas, there is no prejudice to life in extroversion of the bladder. Bartholin records a case aged forty, Quatrefages two aged forty-six and forty-nine respectively, and Flajain one aged seventy.

Other co-existing deformities.—Spina bifida (Berlin Museum, No. 9482, and Fränckel); non-closure of the cranial vault (Is. G. St. Hilaire); patent foramen ovale (in my case); pes varus dexter (Fränckel); pes varus sinister (my case); adhesion of fœtal membranes to edges of bladder (Wood).

Comparative teratology.—The only instance of extroversion of the bladder in animals which I have been able to find is one of a young male cat dissected by Is. Geoff. St. Hilaire; he says the appearances were the same as in man.

Maternal impressions.—It would be indeed strange if there were nothing to record under this head. We are indebted to Schneider for the following instances:—A woman having been largely occupied during her pregnancy in eviscerating geese, brought forth a child with extroversion of the bladder. A woman fell from a pear-tree on her coccyx; she felt as if her bowels were coming out at her navel, and her child at its birth was found to have an extroverted bladder. A pregnant woman during the French Revolution saw many people killed, fainted away, and on recovering her senses imagined she had been ripped up; she bore a child with an extroverted bladder. A woman mentioned by Saviard attributed a smilar result to her longing for a fowl's tail.

Paternal impressions.—Schneider (Case 1) mentions that a man dreamt that his eldest son was standing by his bed with genitals just torn from his body, which was red and bleeding; he was much alarmed. Next afternoon his wife bore a son who had extroversion of the bladder.

Theories.—The numerous theories which have been put forth in explanation of this deformity seem to fall under the following heads:—*A*. Mechanical; *B*. Pathological; *C*. Developmental, or combinations of them.

1. *Breschet* believes it is probably due to (1) the bladder bursting through the abdominal walls by distension or fœtal movements; (2) the posterior wall of the bladder breaks through the anterior wall, which leads (?) to the (3) obliteration of the urethra. This is a mechanical explanation, and will be seen to be the converse of Duncan's.

2. *Duncan* believes the order of events to be (*a*) impervious urethra; (*b*) distension of the bladder from retention of urine, not fatal because he says fœtal urine contains very little excrementitious matter, and children have been even born alive with a bladder having no outlet, some of the contents being reabsorbed; (*c*) divarication of the pubic bones; (*d*) rupture of the bladder. Thus the first term is developmental, the others mechanical, the force acting from within outwards.

3. *Mörgelin* adopts Duncan's view, and says that obstruction of the urethra is a sufficient cause; but adds that the urachus is generally open in the fœtus, and instances cases in which it has again become pervious after birth in consequence of retention of urine. He modifies Duncan's view so far as to say that the

obstruction begins before the abdominal walls have closed over the bladder. Lastly, he gives out that he believes the adhesion of the bladder to the abdominal walls yet ununited has more to do with their failure to close than rupture of the bladder from obstruction of the urethra. This is therefore a mixed view, savouring of mechanical and pathological or developmental explanations.

4. *Foerster* attributes it to accumulation of fluid in the allantois, which prevents the abdominal walls from closing over it. This is a modification of Duncan's view, but is, strictly speaking, dependent on arrested development.

5. *Velpeau* believes it to be due to pathological causes, and not to arrest of development. The sequence of events is, according to him, (*a*) extreme thinness of the lower abdominal walls; (*b*) laceration and ulceration; and he cites cases of intra-uterine laceration observed by Desalle and himself. He believes that the ulceration may begin at the hypogastric region or the root of the penis, and that the bladder being destroyed, in the second place unites with the abdominal walls; the navel may or may not be included in the destructive process, and the pubes are not separated, as usually described, but partly destroyed.

6. *Benjamin Phillips* believes it to be due to ulceration, and states that fœtuses have been seen in which the abdominal parietes only were destroyed. "In one of three months the bladder was already comprised in such a perforation, and the borders of the whole were so ragged, thin, and unequal, that it could be referred to nothing else than a laceration. The pubes are commonly destroyed, and not simply separated."

7. *Chaussier* attributes it to (*a*) failure of the anterior abdominal walls to meet; (*b*) destruction of the anterior wall of the bladder "par une cause quelconque" (!) This is an explanation based partly on arrested development, partly on a "cause quelconque."

8. *Creve* believes the deformity to be due to separation of the pubic bones.

9. *Roose*, giving the same explanation, says he believes it to be due to mechanical injury to the mother or to the fœtus in utero. Both these explanations depend on arrested development, one of them attributing this to injury.

10. *Meckel* believes it to be due to failure of the bladder to unite in front, and says that the bladder is originally a flat surface open in front, the edges subsequently uniting.

11. *Schneider* gives a similar explanation, attributing it to imperfection of the urethra. Both these depend on arrested development.

12. *Ayres* believes the order of events is as follows: (*a*) deficient development of the "urachus" (? = allantois); (*b*) failure

of the anterior abdominal walls to unite; (*c*) extroversion of the bladder by abdominal pressure. This depends, as will be seen, on arrested development.

13. *Rose* (in whose case the right kidney was in the pelvis) attributes the extroversion to the abnormal position of the kidney. This is presumably a theory of arrested development.

14. *Bartels* (in whose case an abnormal opening of the intestine separated the two halves of a double extroverted bladder) believes this form of defect to be due to abnormal development of the intestine, beginning before the two halves of the allantois have joined, and as Scanzoni describes a human embryo of three weeks with a perfect allantois, the deformity must have been established before these.

15. *Isodore Geoffrey St. Hilaire* believes it to be due to arrest of development because of the co-existence of complications of (1) generative organs, (2) fissure of the head, (3) umbilical hernia, (4) abnormalities of the intestine, and imperforate anus, (5) spina bifida in various regions, all showing arrest of development, and also the bilobed appearance of the bladder in many cases.

16. *W. Vrolik* agrees with the above opinion because of the co-existence of (1) occasional absence of an umbilical artery (G. Vrolik), (2) abnormalities of kidneys and ureters (Pinel, Astley Cooper, Isenflamm), (3) fissured dorsal vertebræ (Littré, Revolat, Delfin, G. Vrolik), (4) hare-lip (Dupuytren, Meckel), (5) confluent toes (Saxtorph); and he adds that the urinary bladder is probably developed in two halves, which may be separated by the rectum (probably alluding to Bartels' case and others, in which, however, the unnatural anus was *not* the opening of the rectum but of the small intestine in most cases).

17. *Wood* explains that the allantois is composed of two layers, (*a*) the outer or "vascular" layer of Von Baer, containing the umbilical vessels, (*b*) the inner or "mucous" layer of Von Baer, which connects the allantois with the intestine. "If about this period (the period of the differentiation of the sinus urogenitalis), by inflammatory change or adhesion, or some degenerative process arising from one of those specific diseases, such as syphilis, to which we know the fœtus in utero to be liable, the normal progress is arrested in the outer abdominal or amniotic layer of the allantois, without affecting the inner or mucous layer, the result at the time of birth would be the formation of the deformity termed by Vrolik 'ectopia vesicæ,' *i.e.*, a fissure of the hypogastric wall only, with a completed condition of the walls of the bladder itself. But if the morbid process extends also to the subjacent portions of the internal cylinder or mucous layer of the allantois, then, according to the position or extent of the abnormal change,

the result would be a more or less extreme degree of epispadias, an open or imperfect urachus, or a completely fissured and extroverted bladder, with separation of the pubic bones, and the other changes associated with that deformity. An important observation has been made in these cases, that, at the time of birth, the hypogastric surface of the fœtus, from the umbilicus to the genital organs, is usually found to be adherent to the placenta or its membranes, the adhesions becoming separated by the process of parturition at the parts in which the cicatricial appearance is afterwards found" (Müller's Physiology, translated by Baly, vol. ii. figs. 220 and 222). This, he thinks, explains the deficiency of the anterior or superficial portions only, and also by cicatricial contraction, the low position of the navel. The above changes occur at the second month. This explanation belongs to the heading of arrested development.

Objections.—The following objections have been raised to the above explanations:—

1. Against *Duncan's* theory.

(*a*) In animals having an allantois, stoppage of the urethra cannot cause extroversion of the bladder (Schneider).

(*b*) Duncan himself saw extroversion in a boy in whom the urethra, situated at the root of the penis, curved towards the anus and admitted of an easy flow (Benjamin Phillips).

(*c*) Duncan's theory does not account for rupture of the abdominal walls (Meckel).

(*d*) It does not account for the malformation of the sexual organs (Mörgelin).

(*e*) (1) If the bladder bursts, it need not burst the abdominal walls. (2) It does not account for the epispadias, which is an essential part of extroversion, but often exists without extroversion. (3) The penis may be cleft, though the posterior part of the urethra is closed. (4) Vrolik has found atresia urethræ in the fœtus with great distension of the bladder, but without any symptom of extroversion. (5) "Ectopia vesicæ" (Vrolik) shows that the abdominal walls only may be affected (W. Vrolik).

(*f*) (1) The fœtus makes no urine during intra-uterine life; and Duncan quotes a case of extroversion where there was a free passage through the urethra. (2) Duncan states that divarication of the pubes is the second step, and, according to his theory, this must be the case; whereas in some cases of extroversion the symphysis is complete (Velpeau).

(*g*) Co-existing deformities are certainly due to arrested development, *e.g.* (1) malformations of genital organs, (2) cleft skull, (3) umbilical hernia, (4) imperforate anus and abnormalities of intestine, (5) spina bifida in various regions, (6) bilobed appear-

ance of bladder (Is. Geoff. St. Hilaire). This is also an objection to Bonn, Roose, and Chaussier, whose theories St. Hilaire calls "destructive."

2. Against *Roose and Creve's* theory.

It implies early ossification of the pubes, which is really a late process, and occurs after the deformity is already a *fait accompli;* nor does it account for fissure of the bladder or abdominal walls (B. Phillips).

3. Against *Meckel's* theory.

The bladder is never a flat open surface (B. Phillips).

The above objections to Duncan's theory may be arranged as follows:—

1. In atresia urethræ, the allantois (urachus) should prevent extroversion, as Rudolphi says it prevents inversion of the bladder (Schneider).

2. The urethra is not always impervious (Duncan, Phillips, Velpeau).

3. The theory does not account for rupture of the abdominal walls (Meckel, Vrolik).

4. It does not account for co-existing abnormalities, which are signs of arrested development, and some of which, *e.g.*, epispadias, though essential parts of extroversion, are often found apart from extroversion (Mörgelin, Vrolik, Is. Geoff. St. Hilaire).

5. The divarication may extend *beyond* the obstruction, *e.g.*, epispadias with impervious urethra (Vrolik).

6. When atresia urethræ exists in the fœtus, there may be great distension of the bladder, but there need be no extroversion (Vrolik).

7. "Ectopia vesicæ" (Vrolik) is quite unexplained, for the rupture of the bladder should *precede* rupture of the abdominal walls (Vrolik).

8. Extroversion of the bladder without divarication of the pubes is quite unexplained, for divarication of the pubes should *precede* extroversion of the bladder (Velpeau).

9. The fœtus secretes no urine (Velpeau).

Before proceeding further, it will be well to review shortly these objections, for some of them appear to be not well founded, while those which are valid will not need to be repeated.

1. Schneider's objection that the allantois should prevent extroversion cannot be maintained. Extroversion is a totally different thing from inversion; and were this not so, cases of inversion are on record either through the open urachus or meatus (Froriep).

2. The objection that the urethra is not always impervious is certainly true, but the statement that the urethra is or is not impervious is most misleading. The cases in which an urethra

exists—a such at all are exceptional, the usual state being one of complete patency, in the form of at most a demi-canal in the male; and in the female even this does not usually exist, for the whole bladder is cleft, and the urethra likewise. Therefore it is correct to describe the urethra as "absent," but not as "impervious," the usual condition being one of only too great patency.

9. Velpeau's statement that the fœtus secretes no urine is untrue. Cases of congenital distension of the bladder, such as that mentioned by Vrolik, would be quite enough to disprove it. Moreover, urea is found (though not constantly) in the liquor amnii; and when it is absent, it has probably been reabsorbed, and excreted by the mother. At any rate, its presence in the liquor amnii, even if not constant, is enough for our purpose. Again, Claude Bernard has found sugar in the liquor amnii during the first six months of fœtal life, during which period it is also present in the fœtal urine, the quantity diminishing as birth approaches. Many other urinary salts have also been found in the liquor amnii. An interesting paper on congenital hydronephrosis, by Mr. Morris, will be found in the "Lancet" for May 13, 1876, p. 708.

We will now proceed to discuss the various theories for ourselves; and, first, it will be well to state—with reference to our analysis of the theories, and our division of them according as they appeal to *A*. Mechanics, *B*. Pathology, *C*. Development—that theories appealing to more than one of these influences must be *a priori* regarded with distrust. It is surely very unlikely, even on the arithmetical doctrine of chances, that a combination of such factors should result in producing a deformity which, though not uniform, is capable of such satisfactory classification. If, therefore, we should find that of two theories which equally well explained a phenomena, one depended on two causes, and the other on one, it would so far be wise to prefer the latter.

1. *Breschet* believes the course of events to be that the rupture of the abdominal walls by means of the distended bladder precedes rupture of the bladder itself. This is to attribute to the bladder not only far more strength, but more capacity for distension, than the abdominal walls. But what other instance is there in which the abdominal walls have ever been ruptured by distension of the bladder? Again, if the bladder ruptures, why should it always (on this hypothesis) rupture along its anterior wall and in a lineal direction; and why should it rupture from top to bottom? This objection applies to all mechanical explanations which include rupture of the bladder. When rupture of the bladder occurs after birth, an excessively rare accident except as the result of direct violence, the rupture in the majority of in-

stances extends "from the attachment of the urachus through the *posterior* wall of the organ" (Birkett, in Holmes' System of Surgery, vol. ii. p. 715, 1876). Cases of rupture from over-distension are quoted there in the fœtus (Wilkinson King, Guy's Hosp. Rep., vol. ii. 1837, p. 508; also Dr. R. Lee, Med. Chir. Trans., vol. xix. p. 238); and in the adult (Mus. of Roy. Coll. of Surg., No. 1967), it is needless to say, without rupture of the abdominal walls. The rent need not be large, for a very small hole gives immediate relief to the pressure. It would be very difficult, if not impossible, to rupture a bladder from top to bottom by liquid pressure outside of the body.

Lastly, the obliteration of the urethra as a consequence of this is inconceivable, besides our former objection that in most cases the urethra is not obliterated, but only too patent.

2. *Duncan's* theory is sufficiently combated by the authors cited above, and other objections have just been mentioned. It is, however, undeniable that this is the only hypothesis which explains satisfactorily the very constant distension of the ureters.

3. *Mörgelin's* plea that the urachus is generally patent in the fœtus would imply that obstruction to the urethra more commonly resulted in patent urachus than in extroversion of the bladder. But if obstruction of the urethra is the cause of extroversion of the bladder as well as of patent urachus, patent urachus should be a commoner malformation than extroversion of the bladder. But the reverse is the fact. His idea that the obstruction to the urethra begins before closure of the abdominal walls amounts to a theory of arrested developement, but is open to the objection already named, that the urethra is not, as a rule, "impervious."

4. *Foerster's* view is much the same. It is presumed that the "allantois" means that part of the structure included in the abdomen, *i.e.*, the bladder, and that the "fluid" is the urine.

5 and 6. *Velpeau and Benjamin Phillips.*—Without denying the possibility of ulceration during intra-uterine life, no stress can be laid on the cicatricial appearance of the edges of the extroverted bladder, unless it is intended to apply the explanation very widely; for many other failures of union in the fœtus, hare-lip for instance, present a similar aspect.

Of the statement that the ossa pubis are not usually separated, but partly destroyed, I can find no confirmation.

It is hard to imagine why, if the process be one of ulceration, the bladder should so accurately apply itself to the hole in the abdominal walls in all cases. We should expect a proportion of cases in which other organs, such as the intestines, filled the gap.

7. *Chaussier's* explanation is a mixed one, and therefore objectionable; and to refer the destruction of the bladder to a "cause

quelconque," is to "darken counsel by words without knowledge." The "cause quelconque" is the whole object of search.

8 and 9. *Roose and Creve's* theory does not attempt to explain *how* extroversion of the bladder depends on divarication of the pubes. Besides, as we have seen, divarication of the pubes is not a necessary feature of such cases.

10. *Meckel's* explanation that the bladder is originally a flat surface open in front is the first attempt in our list to attribute the state of the bladder to arrested development of the bladder. The explanation, however, is not in accordance with the facts of embryology. Still it shows an appreciation of the real point to be ascertained.

11. *Schneider's* explanation again recurs to the "impervious" state of the urethra.

12. *Ayres* is so laconic, that it is hard to understand how much he means by "deficient development of the urachus" (? = allantois). This, however, includes the whole question.

13. *Rose* attributes the phenomena to a casual and most unusual feature in a single case.

14. *Bartels* goes to the root of the matter, and his explanation sufficiently accounts for the phenomena of his extreme case, and for those of the cases which he cites.

15 and 16. *Is. G. St. Hilaire and W. Vrolik* lay stress on the co-existence of other abnormalities which are certainly due to arrested development.

17. *Wood* gives an exhaustive account of the embryology concerned in the production of the deformity, and there are few points to criticise. He attributes the arrest of development to pathological causes, "inflammatory change or adhesion, or some degenerative process arising from one of those specific diseases, such as syphilis, to which we know the fœtus in utero to be liable;" and says, that "at the time of birth the hypogastric surface of the fœtus, from the umbilicus to the genital organs, is *usually* found to be adherent to the placenta or its membranes, becoming separated by the process of parturition at the parts in which the cicatricial appearance is afterwards found."

I have no doubt Mr. Wood is speaking from facts when he writes of adhesion of the membranes, but I have been unable to find a single recorded instance. The literature, however, is too large for me to claim to have read all recorded cases. Still I think that he must be speaking beyond the mark when he says this usually exists.

Again, as I remarked above, the cicatricial appearance of which he speaks cannot be quoted as a proof of pathological change, being shared by so many other kinds of deformities, unless it is

intended that it should apply to all. There is, as a rule, nothing which marks pathological change to be found in the subjects of arrested development, nor are syphilitic children specially liable to deformities. Still I believe my case to have been the subject of congenital syphilis. It is, however, a very interesting fact that, till lately, nearly all the lions, tigers, and other large felidæ born in the Zoological Gardens had cleft palates. For some years back, probably in connection with improved hygiene, this defect has been much less prevalent (Mr. W. Sedgwick, Brit. Med. Jour., July 21, 1877, p. 96).

It would, I think, have made Mr. Wood's explanation more complete to have added instances of the process of arrested union in the middle line, going beyond and above ordinary complete extroversion, or, in other words, affecting the posterior as well as the anterior wall of the bladder. These, I think, we have in those remarkable cases mentioned by Bartels and others, in which the extroverted bladder was divided into two separate halves.

There can be little doubt that the theory which attributes the deformity to arrest of development is the correct one, because the other theories do not bear inspection, some of them being even unimaginable; because of the frequency of accompanying proofs of arrested development; and lastly, because of the known development of the allantois.

The first point has been already disposed of. As regards the second, the following instances of results of arrested development coinciding with extroversion of the bladder have been mentioned above:—1. Malformations of the generative organs, too numerous to recapitulate, most of them only to be explained by reference to the development of the cloaca. 2. Cleft spine. 3. Cleft skull. 4. Hare-lip. 5. Open foramen ovale of heart. 6. Abnormalities of kidneys and ureters. 7. Abnormalities of intestines. 8. Abnormalities of peritoneum. 9. Hernia. 10. Abnormalities of blood vessels. 11. Talipes. 12. Confluent toes. 13. Low position of navel. 14. Forward position of anus.

Now, with regard to the development of the malformation, it is well known that the abdominal walls are developed from two lateral halves which approach one another, and this part is plain; the pelvis is developed in a similar way, the bones growing from behind forwards, and their anterior extremities meeting in front to form the symphysis pubis (Meckel).

With regard to the bladder, this is developed from the allantois, and the question remains as to the development of the allantois. It is often described as originating in the form of a hollow vesicle, but that would not explain our point; it is obvious that what we want is a history of bilateral development.

In Baly's supplement to his translation of Müller's Physiology, p. 86, we read: "According to Bischoff, the allantois of the mammalian embryo is developed neither from the intestinal tube, as stated by Von Baer, Rathke, Valentin, and others, nor from the Wolffian bodies, as was said by Reichert to be the case in the chick; for at the time of its first appearance, no trace either of the intestinal canal or of the Wolffian bodies can be perceived. At its earliest appearance, the allantois in the rabbit consists of a solid mass of cells projecting from the visceral plate of the tail. But in the dog this mass is at first double (fig. 13 and 14), though the two halves soon fuse together, and are converted into a single vesicle. The allantois is abundantly vascular, for it contains the ramifying extremities of the two arteries which run along the sides of the vertebral arches, and of the two veins which are situated within the walls of the visceral laminæ. These vessels subsequently become the umbilical arteries and veins. When the allantois has assumed the form of a vesicle, it then communicates both with the intestinal tube and the corpora Wolffiana, though the mode in which this communication is effected is not quite clear. The allantois now rapidly increases in size, and the two umbilical arteries in connection with it are recognised as branches of the iliac, while the umbilical veins unite into either one or two trunks, which empty themselves in the liver and the inferior vena cava. As the visceral laminæ close in the abdominal cavity, the allantois is thereby divided at the umbilicus into two portions, the smaller of which is retained in the abdomen, and is converted into the urinary bladder, while the external and larger portion, accompanied by the umbilical vessels, proceeds to the chorion, where its vessels are brought into connection with those developed within the villi of this structure. The middle portion of the allantois, namely, that which traverses the umbilicus, at first contracts into a canal, and subsequently is converted into a fibrous cord, the urachus."

Here we have a distinct account of the bilateral development of the allantois, and of its close connection with that of the hypogastric vessels. Its intimate association with the formation and differentiation of the cloaca, and its near proximity to the lower end of the intestine, are also facts well ascertained.

Reichert (Müller's Handb. der Phys., Buch viii. p. 688) also describes the allantois as beginning by two solid heaps of cells at the posterior end of the Wolffian bodies, which approach one another by degrees, and which afterwards unite and form a hollow body.

Scanzoni (Lehrbuch der Geburtshülfe, i. 86) describes a human embryo of three weeks with a perfect allantois, so that the malformation must occur before then.

Professor Wood refers to drawings of two human embryos in Baly's translation of Müller's Physiology (pp. 1585–1587, figs. 220, 222), fig. 220, after Coste, of about 16 to 20 days, the other, fig. 222, after Wagner, of about the 21st day, and to them may be added fig. 221, after Allen Thomson (Edinb. Med. and Surg. Jour., vol. cxl. 1839, p. 135, fig. 3) of about six weeks. He thus describes them: "The allantois sac is found just as it begins to be attached to the chorion to form the umbilical cord. Its outer or amniotic layer (the vascular layer of Von Baer, in which are afterwards developed the umbilical arteries, and which forms the sheath of the funis) is seen in both these specimens to be continuous with the edges of the fissure in the yet imperfectly closed abdominal wall. In the middle of this is an inner cylindrical portion (constituting the mucous layer of Von Baer), which is prolonged down to the pelvic cavity, where it is continuous with the end of the intestine, and is connected with the lower part of the Wolffian body, from which it seems to be originally developed. This union with the intestine afterwards forms the common cloacal cavity, persistent in some of the lower animals, which, according to Tiedemann, opens externally about the fifth or sixth week. By arrest of development at this stage originate those extreme cases of the deformity in which the bowel opens upon the exposed bladder or urethra, or the ureters open into the rectum. In the normal course of development the rectum and anus become separated from the ducts of the urinary and genital organs, and a common sinus urogenitalis is then found, in which open the Wolffian ducts, the ureters, and the efferent ducts of the generative apparatus. From this is afterwards differentiated the bladder, urachus, and urethra, on the one hand, and the prostate and its appendages, or the uterus and vagina, on the other." The remainder has been quoted above. Professor Wood explains "ectopia vesicæ" as arrest of union in the superficial or "vascular" layer, and complete extroversion as arrest of union in both layers of the allantois.

The points just mentioned will appear plain after reference to Coste's Pl. ii. figs. 3 and 5 (Human Ovum, 15 to 18 days), which shows the early allantois (*a*), with its two arteries and its abutment on the rudiment of the future large intestine (*i*); Pl. iii. fig. 3 (Human Ovum, 25 to 28 days), which shows the continuation of part of the allantois from the unclosed abdominal walls; Pl. iii. *a*, figs. *A* and *B*, which show a similar continuation, and also the two umbilical arteries and two umbilical veins (*n*, *n*, *u*, *u*) in the external or "vascular" layer of Von Baer, the inner or "mucous" layer being visible (*q*, *q'*) as a sac ending blindly at its distal end.

We may add, that when the process affects the posterior as well as the anterior part of the allantois, or when the two halves of the allantois fail to join behind as well as in front, we get a condition such as that described by Bartels and others, in which the extroverted bladder is divided into two entirely separate halves.

As we never get congenital fissure of the bladder without fissure of the abdominal walls, we may conclude that the process of arrest operates from the surface towards the deep aspect.

Here, then, we have an explanation accounting not only for all the various degrees of extroversion of the bladder, but for some of the best-marked co-existing malformations, namely, those of the pubic bones, genitals, intestines, and umbilical vessels.

The other frequently co-existing defects are similarly explained, namely, by arrest of development, though the cause of this arrest is at present quite unknown.

The period at which the malformation begins is fixed by the date of development of the allantois, that is, according to Scanzoni, before three weeks of embryonic life.

The degrees are seen to be principally four in number, as we stated at first, namely :—

1. Weakness of the anterior abdominal walls, constituting a hernia of the bladder (Mayo).
2. Fissure of the abdomen, but not of the bladder, constituting "ectopia vesicæ" (Vrolik).
3. Extroversion of the bladder, generally with more or less bilobed appearance.
4. Complete separation of the extroverted bladder into two distinct halves (Bartels and others).

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