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A STUDY
OF
TWO MESIAL VERTICAL SECTIONS OF
THE FEMALE PELVIS
IN
RELATION TO THE NORMAL SUPPORT OF THE
UTERUS AND PROLAPSUS UTERI.

BY

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STUDY OF TWO MESIAL VERTICAL SECTIONS OF THE FEMALE PELVIS.

WITHIN the past few years great light has been thrown on topographical anatomy and the mechanism of labour, by the publication of accurate drawings of vertical and transverse sections of the various parts of the male and female body. Reference to Braune's sections¹ will convince any one how much accuracy is given to our anatomical and obstetrical knowledge by this splendid work.

The value of such sections is that we see all the structures in their undisturbed relations; while the ordinary method of "surface dissections," by altering these, misleads as well as instructs.

Now, in studying the topographical anatomy of the female pelvis, we may, in the first place, proceed by the ordinary means of digital examination. Such a method, however, gives us the idea that its fleshy floor is permeated by canals, and is accordingly a somewhat unsubstantial honey-combed structure, through which the uterus can find little difficulty in passing. One indeed begins to wonder not that so many women have prolapsus uteri, but that more are not annoyed by it.

A study of sagittal sections leads, on the other hand, to quite different opinions; and it is what we can learn from such in regard to certain disputed points, that will form the subject of this communication. It is really very curious that, almost without an exception, British gynecological and anatomical text-books have depicted vertical sections of the female pelvis in the most erroneous manner. They are wrong in every point—bones hardly excepted—and have done much to retard the progress of Gynecology. A comparison of the specimens placed before you with our ordinary diagrams will, I feel, convince you that such strictures are not uncalled for.

The female bony pelvis is closed in below by the fleshy layer of the pelvic diaphragm. Its exact anatomical structure does not fall to be described here. It will be sufficient to consider it as made up of muscles, fascia, and the various vessels and nerves

¹ *Topographisch Anatomischer Atlas nach Durchschnitten an gefrorenen Cadavern.* Leipzig, 1867.

requisite for its nourishment, etc. As is well known, the urethra, vagina, and rectum pass through it. Now, as usually drawn, the dilated vagina and rectum appear markedly to impair the compact nature of this diaphragm. The reverse, however, is the case, and we will now attempt to show that this pelvic diaphragm in the virgin is a compact and homogeneous layer, as compact and unimpaired as in the male.

In the first place, the anus is always, during life, closed; and therefore the muscular sphincter, reducing it to a pucker, really adds to the strength of the floor.

Then, above all, the vagina is no cavity under ordinary circumstances and postures.¹ In vertical section its walls are in perfectly accurate apposition. (Fig. I. V. VI.) It has no side walls at all, only an anterior and posterior, each of a triangular shape with multiplied transverse rugosities. From this description, then, it is evident that the "vaginal slit" in no way impairs the strength of the pelvic floor. Were it the tube usually figured, prolapsus uteri would be the normal state in almost all women. We need not delay to prove that the urethra, practically a capillary tube, interferes as little with the efficiency of the pelvic floor as the vagina and rectum.

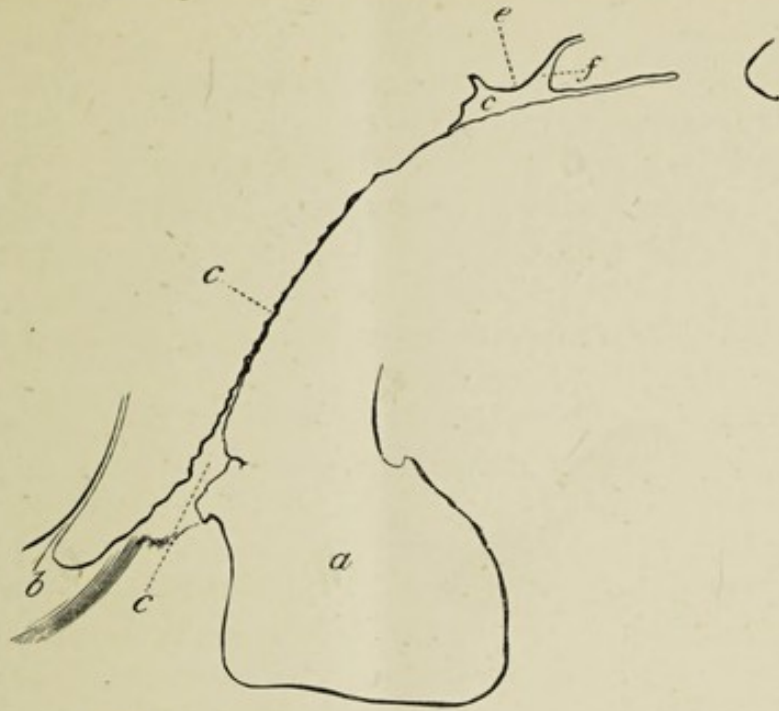
The pelvic diaphragm is therefore a thick, compact layer, tunnelled by no cavities. Its thickness varies, being greatest at its centre, least at its sacral attachment, and intermediate near the pubis. In one of the sections (Fig. V.) the thicknesses at the above points are $2\frac{1}{2}$ inches, $1\frac{1}{2}$ inches, and 2 inches. The slits traversing it are all parallel, or nearly so, to the pelvic brim—a fact of importance to be again alluded to. By this "vaginal slit" we get the pelvic floor divided anatomically into two portions—a pubic anterior, and a sacral posterior, half.

The pubic anterior half is triangular in shape, has a pubic, vaginal, and pelvic side, and is made up of bladder and anterior vaginal wall. The pubic side does not accurately hug the smooth surface of the pubis, but is V shaped, with the apex of the V turned to the sacrum. (Fig. V.) This angular interspace between the pubis and bladder is filled up with loose fat. The vaginal and pubic sides are each 2 inches long, while the pelvic is 3 inches. (Fig. V.) This triangle has, therefore, no firm bony attachments, is only feebly muscular, and is so arranged that its pubic side can freely extend round the symphysis as a centre, and in any movement downwards will necessarily drag on the uterus, since the anterior lip of the cervix is attached to its posterior angle.

The sacral half of the pelvic floor is roughly oblong in its shape. As contrasted with the pubic half, it has a strong dove-tailed

¹ The knee-elbow and lithotomy postures, by admitting air, render the vagina a pyramidal cavity, the apex being at the ostium vaginæ. The probable cause of this will form the subject of a separate communication.

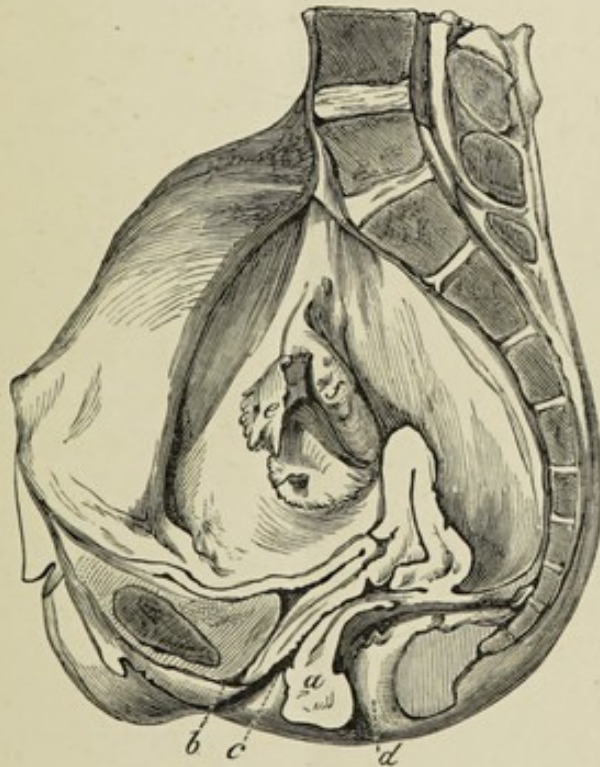
FIG. I.



Life size drawing of Vaginal Slit in vertical section.

- | | |
|----------------------|------------------------------------|
| <i>a</i> , Perineum. | <i>e</i> , Anterior lip of cervix. |
| <i>b</i> , Urethra. | <i>f</i> , Os uteri. |
| <i>c</i> , Vagina. | |

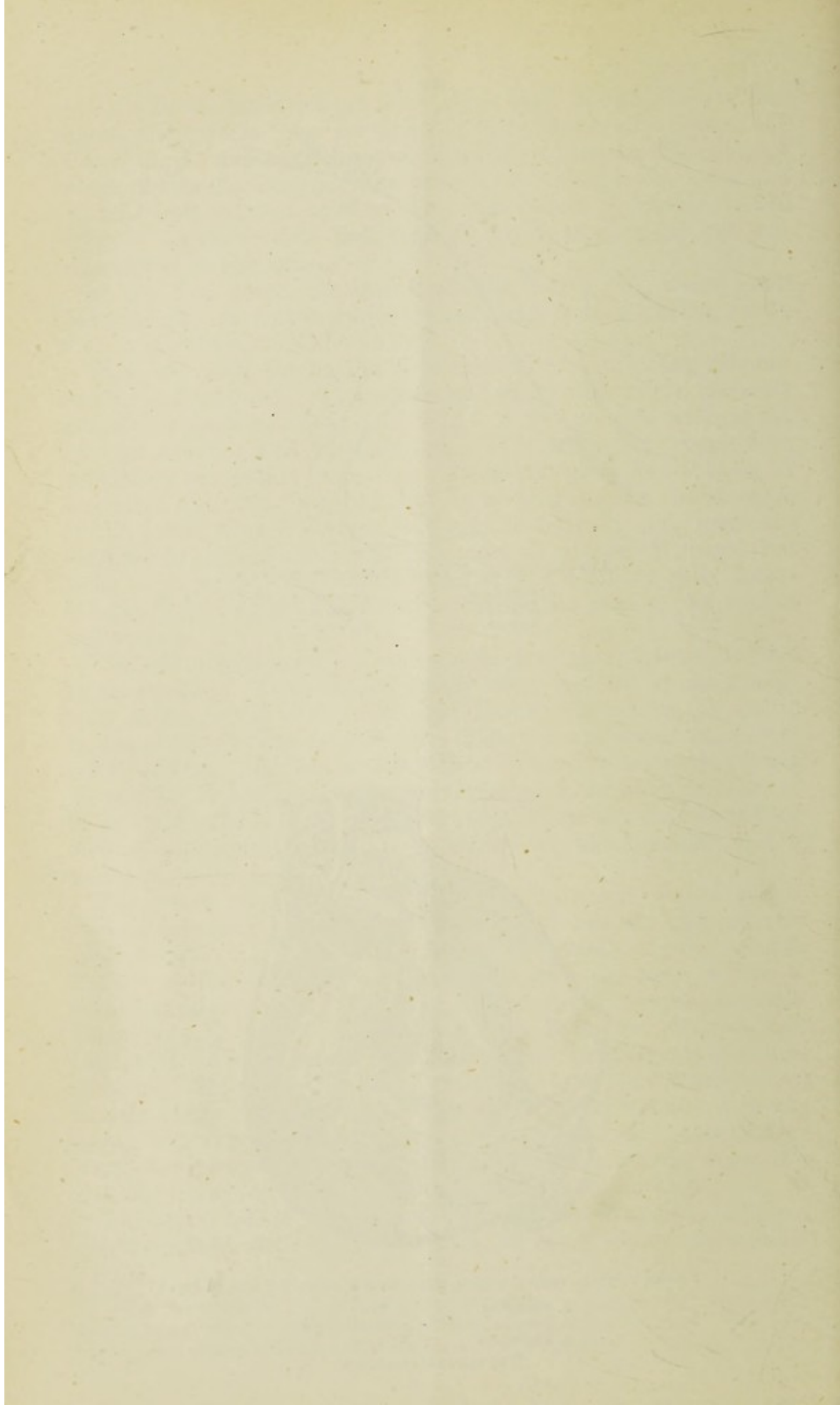
FIG. II.



Female Pelvis in vertical section, whose floor is given, life size, in Fig. V.

- | | |
|--------------------------|--------------------------|
| <i>a</i> , Perineum. | <i>d</i> , Anus |
| <i>b</i> , Urethra. | <i>e</i> Morsus diaboli. |
| <i>c</i> , Vaginal slit. | <i>f</i> , Ovary. |

The uterus is anteflexed.



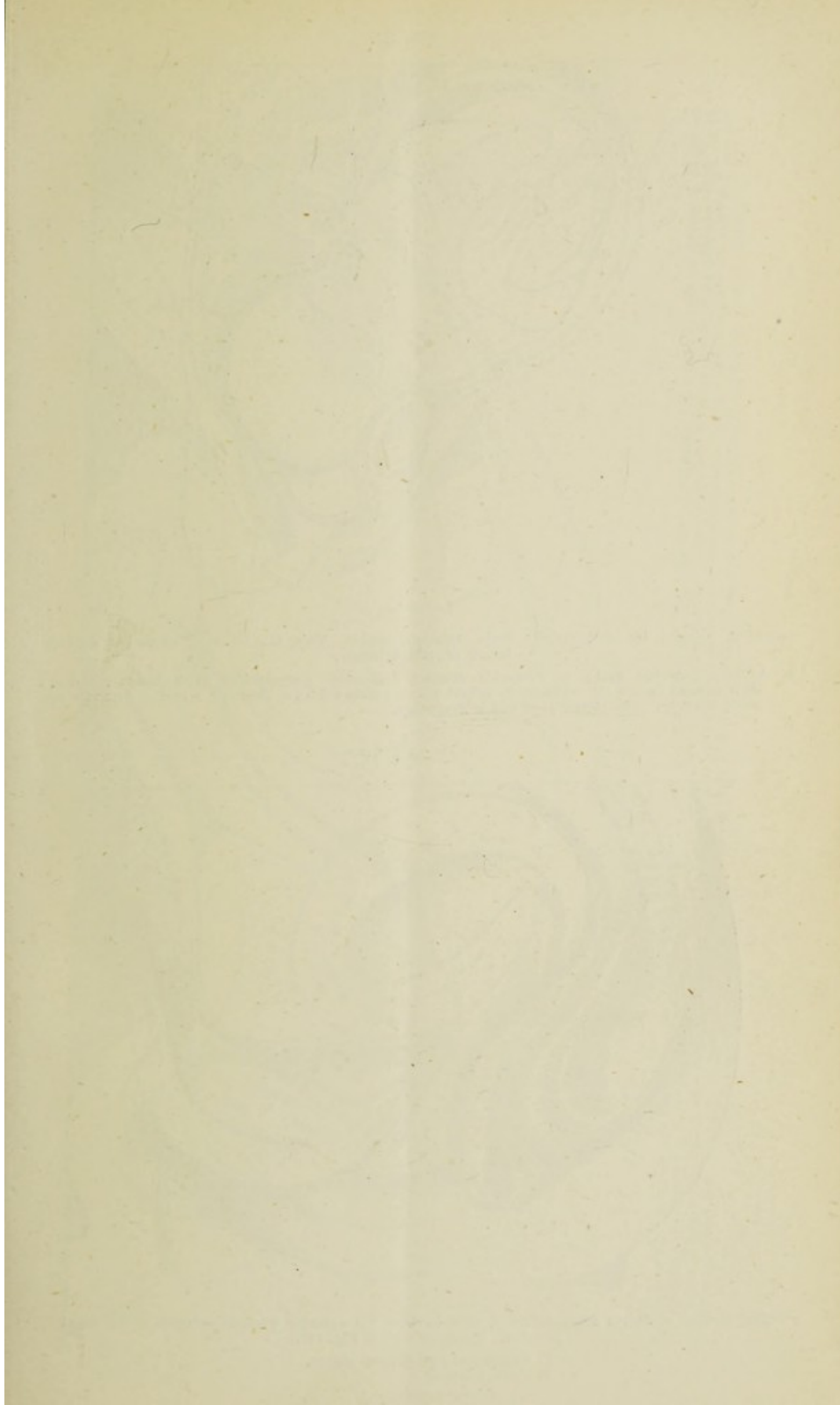
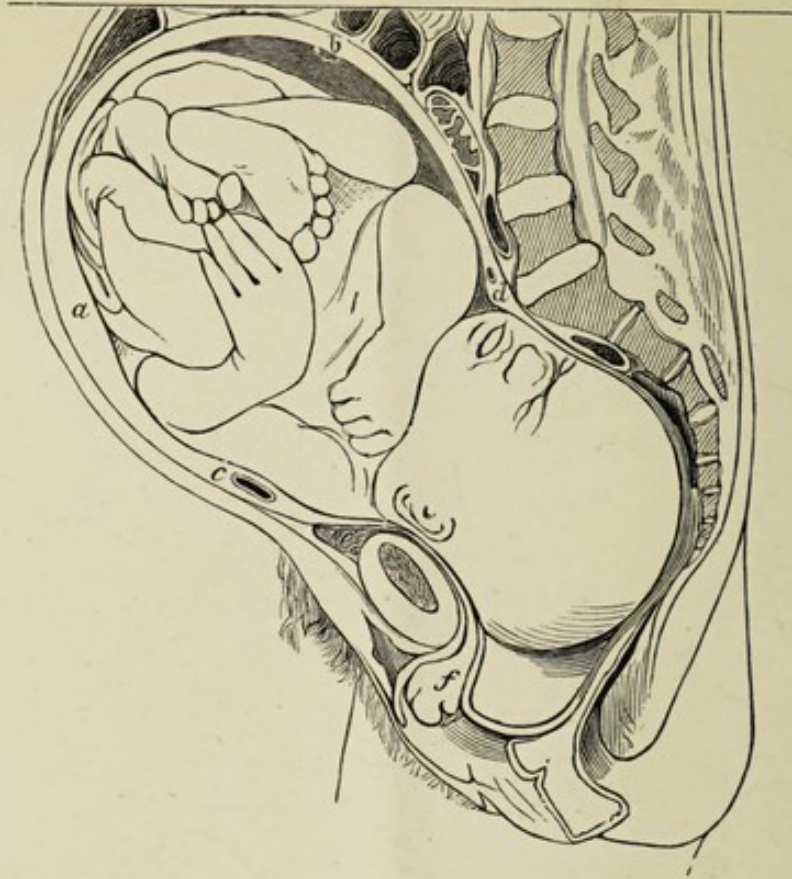


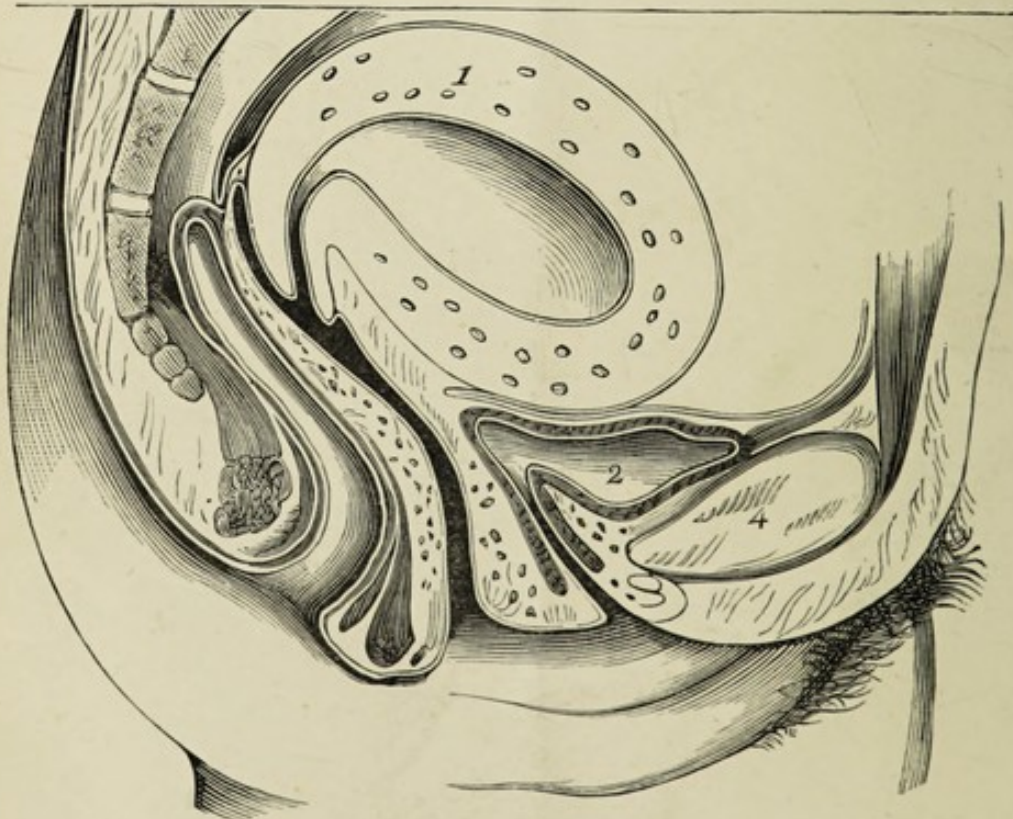
FIG. III.



Drawing reduced by photography from Braune's section, Tab. C., to show elevation during labour of pubic triangle.

a, Anterior uterine wall; *b*, Posterior uterine wall—note comparative thicknesses; *c* and *d*, Os internum shown by veins—note height above pelvic brim; *e*, Bladder; *e* and *f*, Anterior or pubic triangle. The labour is at end of first stage.

FIG. IV.

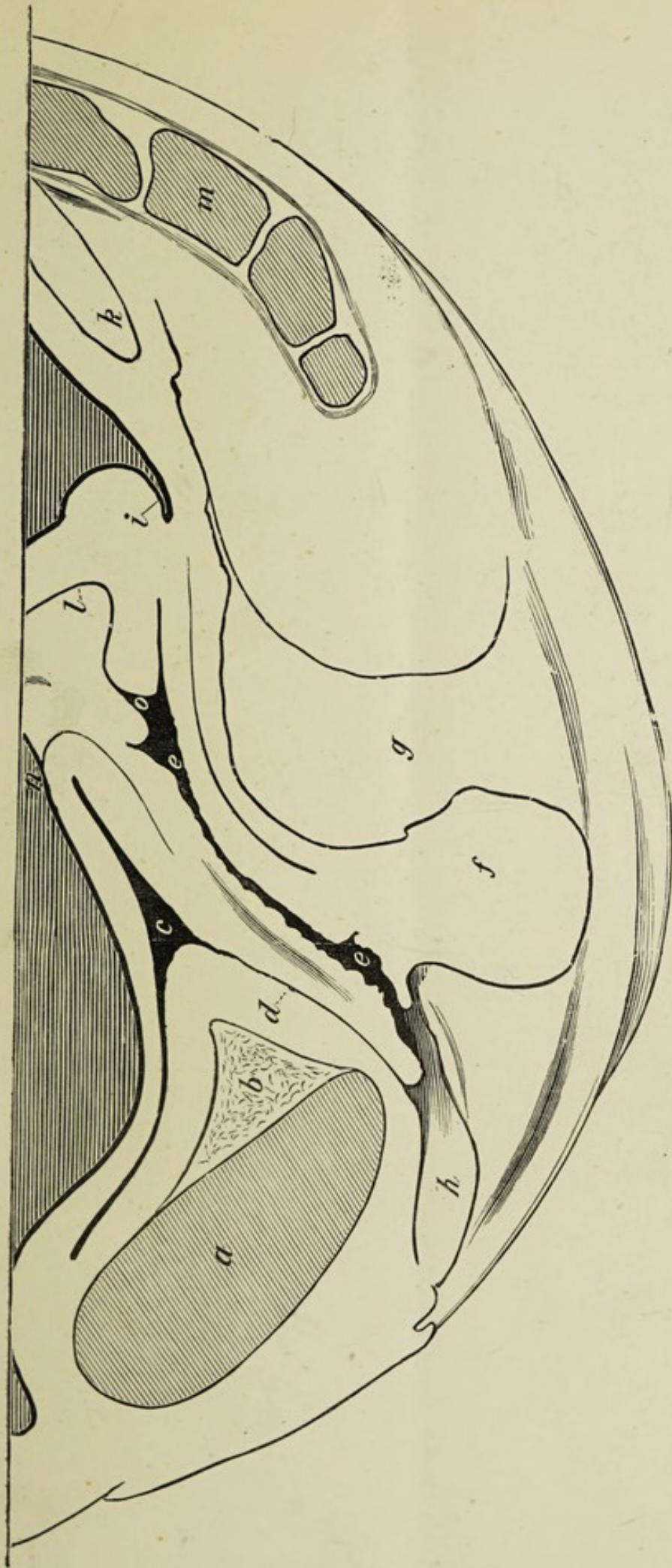


Vertical section of Pelvis after delivery, to show how the anterior triangle returns to its usual position. Compare with it Fig. III.


1. Anteflexed post-partum uterus.
2. Pubic triangle.

(From Legendre.)

FIG. V.



Pelvic floor of Virgin, life size: *a*, Symphysis pubis; *b*, Fat triangle; *c*, Bladder; *d*, Urethra; *e e*, Vaginal slit; *f*, Perineum; *g*, Anus; *h*, Labium minus; *i*, Pouch of Douglas; *m*, Coccyx; *n*, Vesico-uterine pouch; *k*, Rectum cut; *o*, Os externum; *l*, Cervical canal. From symphysis pubis to *e e* is pubic triangle; from *e e* to coccyx is posterior quadrilateral division. The black line between vagina and rectum indicates the loose connexion between the posterior vaginal wall and the anterior rectal one. The anus is open, but of course is closed during life. If it be imagined closed, then the compactness of the floor is seen at a glance.



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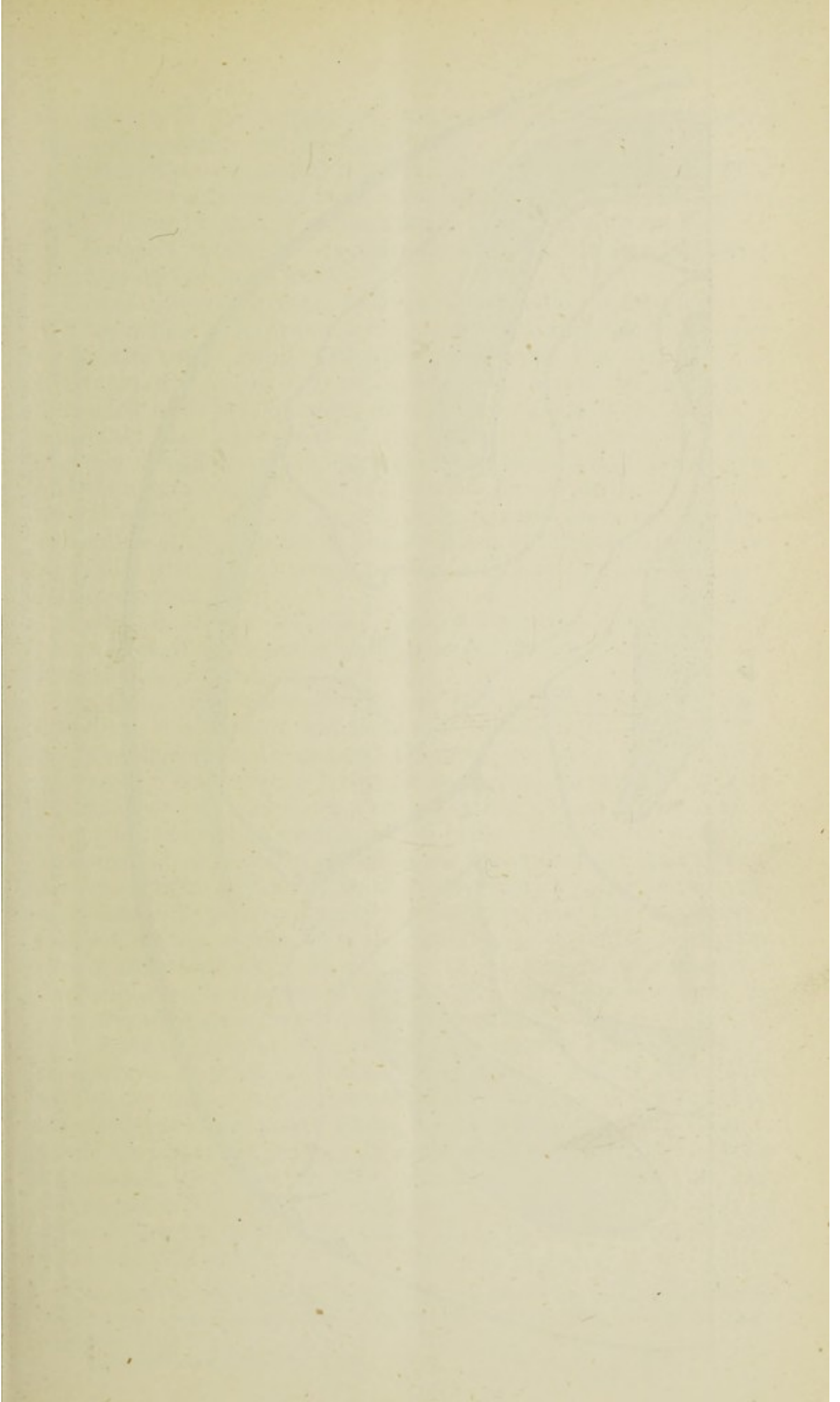
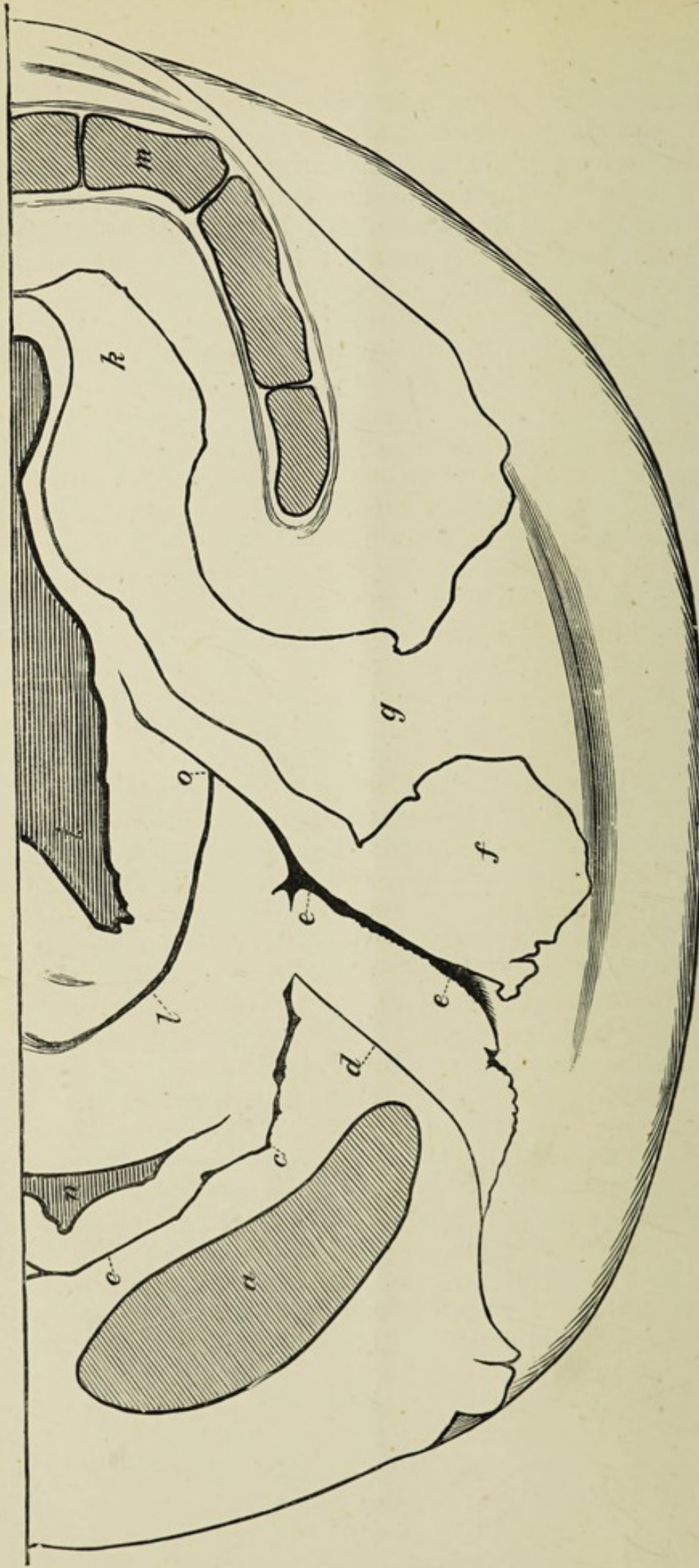


FIG. VI.



Pelvic floor of female Pelvis, life size. In this case the uterus is retroflexed, and pregnant two months.

a, Symphysis pubis; *c c*, Urethra; *d*, Vaginal slit; *e e*, Perineum; *g*, Anus; *i*, Pouch of Douglas; *k*, Rectum; *l*, Cervical canal; *m*, Coccyx; *n*, Vesico-uterine pouch; *o*, Os uteri.
 Note here how, owing to the retroflexion, the pouch of Douglas is enlarged, the pubic triangle diminished, and the bladder elevated by compression.

attachment to the sacrum and coccyx, and is made up of strong resistant muscular and tendinous tissue.

A fact of some practical bearing is that the posterior wall of the vagina is loosely connected to the anterior wall of the rectum until within $1\frac{1}{2}$ inch from the anus. This is shown in Plate II. of Braune's work, and is seen in Fig. V. It has important bearings on prolapsus uteri.

One of the most striking features in the section is the perineum. We see it here in its true relations and usefulness. It is a wedge of elastic tissue lying, with apex up, between the lower half of the vagina and rectum. It strengthens that part of the pelvic floor distended most by expiratory efforts; like an elastic pad banks up efficiently the lower part of the vagina: distends into a thin segment to allow of the passage of the head during parturition, and then resiles again to its old buttress form; prevents pouching of the rectum into the vagina; and in most cases hinders that crumpling of the anterior or pubic portion of the pelvic diaphragm past the posterior or sacral portion, which is the initial step of prolapsus uteri.

Lastly, it should be noted, that of these two portions of the pelvic floor, the anterior or pubic receives the greater share of the intra-abdominal pressure.

If, then, the pelvic diaphragm is as compact as we have described, it is evident that the uterus, resting on its upper surface, needs no ligaments to suspend it, any more than a chair or table resting on a floor, does. If ligaments, indeed, do suspend it, why is it that we can haul down a uterus in any woman to the level of or outside the ostium vaginae? We believe it is not suspended by ligaments at all, but simply rests on the substantial pelvic floor almost at right angles to the slit down which, under certain circumstances, it may be dragged.¹ Before passing from the natural support of the uterus, it will be advisable to notice briefly the theory advocated by Dr M. Duncan in his *Researches in Obstetrics*. A special retentive power of the abdomen² has been advocated by him as contributing greatly to the support of the uterus. It is difficult either to grasp or criticise this theory, as Dr Duncan does not precisely state what he himself thinks it is. Thus he frankly says at the end of his communication—"Having shown that this so-called retentive power exists, and has important functions, it would be proper for me now to enter upon the description of its mechanism, its degree or force, the causes of its variations, and the means which might be employed to increase or diminish as medical practitioners might desire. . . . This knowledge is very scant and deficient."³

¹ See Studley on "The Mechanical Treatment of Versions and Flexions of the Womb," *American Journal of Obstetrics*, January 1879, p. 39, for more elaborate views.

² *Researches in Obstetrics*, 1868.

³ *Loc. cit.*, p. 478.

From his paper we learn, however, that it is a mechanical quality which may be present in an extraordinary degree, diminished, or entirely absent. As to its power, Dr Duncan thinks it is considerable, for he speaks of it sucking back a 9 lb. child, and lifting a 2 lb. uterus out of the pelvis up to, or even above, the umbilicus, "against gravitation, against the resistance of superincumbent bowels and anterior abdominal flap."

While admitting the value of Dr Duncan's contributions to the physics of the abdomen, I do not think he has as yet proved the existence of a special retentive power.

Many of the cases in which Dr Duncan supposes it to act may be explained in other ways. Thus, the recession of the head after a pain is more easily explained as due to the recoil of the elastic lining of the female pelvis than to any sucking-back power of the abdomen. Then is not the alleged ascent of the uterus a growth of it upwards in the direction of least resistance, just as it grows down towards the perineum when retroflexed? It is difficult to conceive why the retentive power should act so strongly during labour or at the end of it. There is no reason for supposing that, if it does exist, it may not be as strong when the uterus is unimpregnated. If so, it could easily suck up a $2\frac{1}{2}$ oz. uterus to the level, or nearly so, of the thoracic diaphragm itself. The difficulties in accepting this theory are so great, and the proofs as yet advanced in support are so scanty, that I do not see how we can give it a share in the natural support of the uterus. We now pass to the clinical applications of the views of the pelvic floor already given.¹ If the pelvic diaphragm of a virginal patient be watched during strong expiration or bearing down, it will be seen to become more convex, especially at or near the base of the perineum. No part of the vaginal or anal mucous membrane is everted, *i.e.*, the compactness of the pelvic diaphragm is not interfered with during violent efforts; or, to put it in other words, the pubic half of the floor is accurately pressed against the sacral half, and does not slip past it.

The reason of this is as follows:—The intra-abdominal pressure strikes the pelvic floor in lines whose resultant coincides more or less with the axis of the brim, and thus distends it. It is therefore almost at right angles to the vaginal slit. From the accurate apposition of the vaginal walls, the anterior triangular part of the pelvic floor is, in the virgin, accurately and firmly pressed against the posterior, and thus the pelvic floor, viewed from without, only becomes more distended, but the continuity of its skin boundary is unbroken by any eversion of vaginal mucous membrane. In the case of a woman who has only had an abortion, say, violent straining even

¹ The clinical cases now given are all from patients attending Professor Simpson's clinique.

with the posterior wall of the vagina well hooked back by the finger, gives little or no eversion of the anterior wall, although the usual posterior vaginal support is withdrawn. The anterior triangle has indeed not lost its elasticity and rigidity, and does not crumple up sufficiently to pass out at the artificially dilated vaginal orifice. Now, in a multiparous woman with a perineal tear only slightly involving the pyramidal body, inspection of the vaginal orifice will show that generally about $\frac{1}{3}$ inch of the anterior vaginal wall is exposed. Under strong expiration another half inch will slip past and appear. At the same time, however, from cohesion between the vaginal walls, the posterior wall is also partially dragged down, and, by blocking the vaginal orifice, tends to keep up the further eversion of the anterior wall. If the posterior wall be now hooked back, then more of the anterior wall will slip past.

The stages in the descent of a complete prolapsus are now as follows:—We have first, of course, the appearance of the anterior vaginal wall, from below up, at the orifice. *Pari passu* with its descent, the uterus and posterior vaginal wall have come down, the lowest uterine point, tracing out the pelvic curve, and the uterus becoming more and more inclined backwards, until at the vaginal orifice it lies in the vaginal axis, with the posterior vaginal wall forming a pouch, the depth of half its own length, behind it. Further efforts on the part of the woman now drive the uterus outside. The os uteri sweeps upwards and forwards, and the posterior vaginal wall is now completely everted, its lowest part appearing last.¹

A vertical section would now show—

1. Almost complete extrusion of the anterior or pubic part of the floor. The upper and anterior part of the bladder is, however, still behind the symphysis.

2. Complete extrusion of the uterus, which generally lies with fundus below the level of the os.

3. Rectum in position, and only posterior vaginal wall down. The latter peels from the rectum from above downwards until it reaches the lowest inch and a half of close connexion, which then elongates.

Thus we have complete descent of the anterior triangle and uterus, but only of the anterior layer of the sacral half of the pelvic floor. Occasionally we meet with deviations from this mechanism. Sometimes both vaginal walls descend equally from below up, and the uterus appears last. In such cases a large rectocele is present, bulging out at the orifice, and accordingly, from the resistance it offers to the outer vaginal wall, the posterior vaginal

¹ The above description of the mechanism in a complete prolapsus is drawn from personal clinical observation of a large number of cases, and a comparison of that given by Drs Matthews Duncan, Marion Sims, and A. R. Simpson.

wall is forced out equally with the former. When this rectocele is hooked back, the prolapse follows its usual course.

Before finally summing up the factors in the production of a prolapsus uteri, we must consider two important cases which throw some light on the whole subject.

E. M., æt. 19, was admitted to ward XII. M. The points in her case bearing on our present subject were, first, that the perineum was completely torn just down to the anterior margin of the anus. The sphincter was only involved to a very small extent, but still a little flatus and fæces passed if she strained violently. More than an inch of the anterior vaginal wall was, of course, exposed unsupported. The perineum had been thus torn about eighteen months previously, but as yet no prolapse of vaginal wall had occurred. Under straining efforts and hooking back of the posterior wall the vaginal wall prolapsed considerably.

Now, at first, I felt inclined to think that here was strong proof for the belief that the perineum has nothing to do with prolapsus uteri. Careful observation of the case, however, revealed the following facts:—Filling up the angular gap left by the perineal tear was an excrescence of mucous membrane, really a small rectocele. It almost touched the anterior vaginal wall, and pressing firmly against it when enlarged during straining, helped efficiently to bank it up. It was indeed an accidental and by no means inefficient substitute for the perineum. But, further, the patient had a retroflexed and enlarged uterus, which of course made tension on the anterior triangle, and helped to prevent its eversion. These two co-existent lesions explain why this girl had no prolapsus as yet, and show that in other cases careful search should be made for causes preventing it.

The second case was one with marked lacerations of the perineum and no prolapse. A tedious first labour ending in vesico-vaginal fistula, and consequent urinary irritation, had, however, so thickened and indurated the vaginal wall as to render its crumpling out at the dilated vaginal orifice impossible.

In the last place, we have in almost all cases of prolapsus uteri, a definite mechanism as viewed at the vaginal orifice, viz., descent of anterior vaginal wall, cervix uteri, and posterior wall. Now, if the uterus be pulled down by a vulsellum, it will be found that the os uteri is at the vaginal orifice before any part of the walls is everted, and that when the os uteri is so placed, we have the vaginal walls forming a deep pouch all around. Hauling down the uterus to imitate a prolapsus would really do so if the uterus ever primarily descended—a thing I have never seen. The true way to imitate prolapsus is to haul or push down the anterior pubic triangle. It is evident that this will be easy in a cadaver where the support of the posterior wall is lost at its lowest part by perineal laceration, and where the anterior triangle has more or less lost its tone. There will be great difficulty

in doing so in a virgin pelvis where the parts are rigid, and the pubic and sacral halves of the pelvis floor in close contact. Still it can be done; so that I can quite fairly imagine what I have not yet seen, viz., a descent of the pubic triangle past the sacral in a virgin, the conditions of great intra-abdominal pressure and a vaginal axis not parallel to, but making an angle more or less acute with the pelvic brim, being present.

Of late years the changes in the cervix uteri during labour have attracted the attention of obstetricians. From the researches of Braune¹ and Bandl² we know now with some accuracy the alterations, physiological and pathological, in its length and calibre. From time immemorial the alterations in the perineum during the passage of the head have been known, although as yet we have no accurate anatomical information on the changes taking place during labour in the posterior part of the pelvic floor. I shall therefore only describe it as being driven down and thinned out by the advancing head. At present I wish more particularly to describe the hitherto ignored changes during labour, and their significance, of the anterior triangular part of the pelvic floor—an inquiry in which I was assisted by Professor A. R. Simpson—as seen in Braune's beautiful sections.³ This thick substantial part is elevated, thinned out, and flattened against the pubis. From a triangular shape it is altered into a thin, elongated egg shaped arrangement, accurately hugging the pubis, obliterating the fat triangle there, and driven forward above and below it. The bladder, instead of lying with its upper border hardly reaching up to the top of the pubis, becomes dragged up, and flattened out to the form already described. (Fig. III.)

Bandl⁴ describes the *os internum* as lying close above the level of the pelvic brim after labour is completed. If we examine Braune's section (Tab. C), then the anterior margin is $2\frac{1}{8}$ inches above the symphysis pubis, while the posterior margin is only a little above the promontory of the sacrum. The cervical tube has its anterior and posterior walls almost exactly the same length. Then, as Bandl points out, the anterior uterine wall is at least twice the thickness of the posterior one. (Fig. III.) Now, further, if in Tab. B, we measure the vertical distance of the base of the labium minus from the lower edge of the symphysis, we find it to be about $2\frac{1}{4}$ inches, whereas in Tab. C the same measurement is only $1\frac{1}{4}$ inch. Tab. B⁵ shows the anterior triangle at the end of pregnancy, while Tab. C gives it at the end of the first stage.

¹ Braune, *Die Lage des Uterus und Fœtus am Ende der Schwangerschaft*, Leipzig, 1872.

² Bandl, *Über Ruptur der Gebärmutter, und ihre Mechanik*, Wien. 1875.

³ *Die Lage des Fœtus und Uterus am Ende der Schwangerschaft*. Table C.

⁴ *Loc. cit.*, s. 54.

⁵ This section is that of a different woman. The difference given is more than can be accounted for by special peculiarity. Braune, *loc. citat.* Table B and C.

All this is easily explained as follows:—The contraction of the muscular uterus not only propels the child down, but elongates and draws the cervix up over the advancing head.¹ The anterior lip of the cervix is attached most advantageously to the upper and posterior angle of the movable pubic triangle of the pelvic floor, the posterior lip to the fixed sacral part. (Fig. V.) Accordingly, the anterior or pubic triangle is drawn up considerably, and the anterior uterine musculature, therefore, thicker than the posterior, simply because it is more contracted.²

During labour, then, the pubic half of the pelvic floor is elongated and drawn up above the symphysis pubis, the sacral is thinned out and depressed.³

We have already stated that the true way to bring about prolapsus uteri artificially would be to depress the pubic triangle past the posterior sacral part of the pelvic floor. During parturition, however, this does not happen, and accordingly the best means of causing prolapse never occurs. The way in which parturition brings about prolapse is by impairing the apposition of the posterior and anterior walls, and the elasticity of the anterior triangle.

It is evident, then, that there is sufficient ground for considering the pelvic floor as made up of two parts, anatomically, physiologically, and pathologically contrasted.

The pubic part is made up of slack membranous tissue, and has loose attachments, permitting easily its elevation or depression; rests on the posterior sacral part, and by being driven down causes prolapsus uteri. The posterior quadrilateral part has strong bony attachments and resistant tissue; is thinned out and driven down in labour, supports the pubic half, and by laceration of its anterior and lower edge, allows of that slipping past of the atonic anterior pubic triangle which initiates, and may end in, prolapsus uteri.

The following are, briefly, the conclusions arrived at:—

I. The virgin pelvic diaphragm is an unbroken fleshy layer, with no cavities in it.

II. It may be regarded as divided into pubic and sacral parts, differing anatomically and functionally, by the vaginal slit.

III. The uterus lies anteverted on this unbroken layer, independently of ligamentous or other support, and its lips are attached one to the anterior half, the other to the posterior half of the pelvic floor.

IV. Prolapse of the uterus is caused by the slipping of the anterior half past the posterior. The uterus never comes down, but is always dragged down.

¹ Bandl, *loc. cit.*, *passim*.

² The appearance of great distention of the bladder, sometimes found in a mismanaged first stage, is accounted for partly by this drawing up.

³ It should be noted in Fig. VI. that we have a distinct alteration of the pubic triangle, *i.e.*, its diminution and obliteration of the fat triangle there, owing to the retroflexion.

V. Increased weight of the uterus in itself does not initiate prolapse. The three factors concerned are—

A. Loss of apposition of the pubic and sacral parts, in most cases started by perineal laceration.¹

B. Loss of "tone" of anterior triangle.

C. Intra-abdominal pressure.

It should be kept in mind that a prolapse may be prevented by some co-existent lesions, and caused in some rare cases by increased intra-abdominal pressure alone.

¹ For the view that the perineum has nothing to do with prolapsus uteri, see Dr Duncan's *Papers on the Female Perineum*. Churchill, 1879.

