Heilbron, who argued that the chemical changes in the muscles were not different from those occurring in dead matter. On theoretical grounds also, he concluded that muscular action was not attended with great destruction of nitrogenous matter. Subsequent experiments have proved this to be the case, showing that muscular activity is not followed by an increase of nitrogenous matters in the excretions, but by an increase of non-nitrogenous matters, particularly carbonic acid.

Since 1840, our knowledge of muscular action has been gained chiefly by experiment. Schwann was the first to measure the force of muscular contraction. Weber, in 1846, showed that muscles possess elasticity, and that the elasticity is diminished as the muscle contracts. He also made the important discovery that tetanus is due to a rapid series of short contractions, fused together by the elasticity of the muscle. In 1846, Wertheim investigated the elasticity of muscle. In 1850, Von Helmholtz devised the myograph, an instrument which in its various forms has been of immense service in physiological research.

The lecturer then showed a number of experiments, illustrating the single contraction curve, the tetanic curve, and the method of studying muscular work. He also demonstrated the period of latent stimulation. Next, he referred to the researches on the mechanical work of muscle by Weber, Von Helmholtz, Fick, Heidenhain, and others. Von Helmholtz, in 1848, was the first to make accurate measurements of the heat produced by contracting muscle.

The lecturer referred very briefly to the chemical researches of Kühne (1859) and others as to the chemistry of muscle. Finally, he showed how Hermann had devised a theory to account for the phenomena of muscular contraction.

ABSTRACT OF LECTURES

ON THE

METAMORPHOSIS OF SUCTORIAL FISHES AND BATRACHIA.

Delivered at the Royal College of Surgeons of England.

By W. K. PARKER, F.R.S.,

Hunterian Professor of Anatomy in the College.

LECTURE III.—ON THE EARLY DEVELOPMENT OF THE LAMPREY.

THE ripe ovum of the lamprey is a slightly oval body, about one millimetre in diameter, formed of an opaque, nearly white yolk, invested by a membrane of an inner perforated and an outer structureless layer. There seems to be a pore perforating the inner layer at the formative pole, which may be called a micropyle. Enclosing the egg-membrane, there is a mucous covering, which causes the egg, when laid, to attach itself to stones or other objects. Impregnation is accomplished by the male attaching itself by its suctorial mouth to the female. The couple then shake together, and at the same time emit from their abdominal pores ova and spermatozoa. The segmentation of the ova is total and unequal, resembling that in the ova of the frog. The upper pole is slightly whiter than the lower. A segmentation-cavity is found very early, and is placed between the small cases of the upper pole and the large ones of the lower. The roof is formed of a single row of small cells. At the sides of the segmentation-cavity there are several rows of small cells, which gradually emerge into the larger cells of the lower pole. Segmentation is followed by an asymmetrical invagination, which leads to the formation of a hypoblast like that of the frog. A small circular depression forms near the border below the segmentation-cavity. The top of this is formed by the infolding of the small cells, while the floor is composed of the large cells. This pit is the commencement of the mesenteron. It soon becomes deeper, and forms a well-defined tube running in the direction of the segmentation-cavity; this latter gradually becoming smaller, and finally obliterated. The external opening, which eventually closes, is arched over by a prominent lip. Simultaneous with these changes, the small outer or epiblastic cells gradually spread over the yolk-cells. The growth of the yolk-cells is as in normal types of epibolic invagination. By the time the segmentation-cavity is obliterated, the whole yolk is enclosed by the epiblast, which is composed of a single row of columnar cells. During these changes, the mesoblast is formed as two plates from the primitive hypoblast. These plates are triangular in form, and are situated one on each side of the middle line. When the mesoblast is fully formed, the

lateral parts of the hypoblast grow inwards underneath the axial part, so that it becomes isolated as an axial cord, and is next enclosed between the medullary cord and a continuous sheet of hypoblast below. Here its cells divide, and it becomes the notochord. The notochord is thus formed out of the axial portion of the primitive hypoblast. The medullary plate forms as a streak extending forwards from the blastopore over fully one-half of the circumference of the embryo, about the time when the enclosure of the hypoblast by the epiblast is complete. The medullary plate first contains a shallow median groove; along its line, the epiblast becomes thickened, and forms a kind of keel projecting inwards towards the hypoblast. This becomes more prominent, and the groove in it disappears, and it becomes separated from the epiblast as a solid medullary cord. The embryo is now of an elongated form, and the medullary cord forms a ridge on its closed surface. At the lip of the blastopore, the medullary cord is continuous with the hypoblast, thus forming the rudiment of the mesenteric canal.

After the formation of the neural cord, the cephalic portion first becomes distinct, forming an anterior protuberance free from yolk; and at the same time the mesoblastic plates begin to divide into somites. Shortly afterwards, an axial lumen appears in the centre of the neural cord. With the growth of the embryo, the yolk becomes entirely confined to the posterior part of the embryo; the embryo itself becomes spirally coiled.

After hatching, the body is somewhat curved, the posterior extremity being thick with the yolk, while the anterior is thin. The larva exhibits only slow movements, and is not capable of swimming. On the ventral side of the head is placed the oral opening, leading into a large stomodæum, which is still without connection with the mesenteron, but prolonged a considerable distance under its anterior part. Behind the stomodæum is the branchial region of the mesenteron, which is laterally attenuated on each side into seven or perhaps eight branchial pouches; these extend outwards nearly to the skin. Between the pouches are placed mesoblastic segments, which enclose a central cavity. One segment is placed behind the last, and two in front of the first persistent pouch. This pouch is situated in the same vertical line as the auditory sac, and seems to be the hyobranchial cleft. At the front end of the branchial region of the mesenteron is a thickened ridge of tissue, which, on the opening of the passage between the stomodæum and the mesenteron, forms a partial septum between the two, and is called the vulum. On the ventral aspect of the branchial region is a sac extending from the anterior end to the third cleft. At first, it constitutes a groove opening into the throat above; but soon the groove becomes narrowed into a groove placed between the second and third permanent branchial pouches. The sac in the adult forms a glandular mass below the branchial region, and is equivalent to the thyroid gland in higher vertebrates.

ON SOME POINTS IN THE REPARATIVE SURGERY OF THE GENITAL TRACTS.

By MONTROSE A. Pallen, A.M., M.D., LL.D.,

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Post-Graduate School of Medicine, etc.

It is proposed, in the first part of this paper, to consider a condition of the cervico-vaginal spaces which is most constantly associated with displacement, dysmenorrhœa, dyspareunia, and sterility. Arrest of development (certain normal transitory embryological states becoming fixed conditions in infantile life), or a failure of the second formative development of puberty, is the usual cause of this condition, although excessive developmental impulse quite frequently determines an increase of one or more of the factors of copulation, generation, or parturition.

Wherever there is a defect in symmetrical anatomical and physiological correlation of the generative organs, some abnormality is present to indicate either arrest or excess of embryogenic impetus. The symmetrical relationships and interconnections of the vagina, bladder, rectum, uterus, oviducts, and ovaries cannot be disturbed without protest upon the part of one of these organs, or possibly the whole of them. For the re-establishment of the symmetrical correlation of the congenital disorders of place and function, I have made certain surgical procedures successful, based upon the belief that there were possible plastic operations which might overcome teratological (fixed transitory embryonic) states. An understanding of the development and functions of the vagina will explain how its faulty implantation produces either an apparent, not true,

intravaginal elongation of the cervix uteri, a false hypertrophy and procidentia; or how the converse may ensue (the so-called infantile neck) when there is a false supravaginal hypertrophic elongation.

The usual treatment for intravaginal cervical elongation has hitherto been amputation. Clinical observation has demonstrated the correctness of this treatment in true hypertrophic elongation, but in the *apparent* (B Fig. 1) form of the lesion such proceeding is actual mutilation, even if we exclude the immediate and remote dangers of hæmorrhage, peritonitis, septicæmia, permanent

Fig. 1.—A Histological fusion, or normal vaginal implantation. B Faulty implantation of the vagina, or the anomaly of excessive dimension.

dislodgment of the uterus, and sterility. Should the woman not be made sterile by the amputation, the parturient after-complications are serious.

The vagina—an organ of mixed functions, intermediate in position—is formed by the hollowing out of a membranous spur, the cloacal septum between the bladder and rectum, at about the eighth week of conception, at which period the uterine and vaginal cavities are continuous. Sometime about the fifth month, these two organs are materially distinct; and, if no arrest of development take place, or no increased formative action be manifested, the implantation of the vagina upon the cervix (A Fig. 1) (histological fusion) is such as to cause the proper pubertic conglutination to be about one hundred and sixty degrees, and the correlations of place symmetrical.

The normal fusion of the vagina being higher on the posterior than on the anterior cervical segment, it is folded upon itself posteriorly, the pelvic extremity being agglutinated with the peritoneal dip in Douglas's pouch. The dip from the bladder anteriorly is much less than posteriorly, although there are marked falciform processes horizontally thrown around the cervix. The general implantation of the vagina around the cervix is that of an inverted cone folded upon itself, with greater space posteriorly. The supporting and sustentative functions of the vagina depend upon the surrounding connective tissue, as well as its attachments to the pelvic fasciæ from and around the bladder (the pubo-vesico-uterine ligaments of Hyrtl), and the processes and dissepiments of musculo-serous tissue blended with the sacro-lumbar ligaments.

When no increase, either of vascular, muscular, or connective tissue takes place, the vagino-cervical fusions are mutually supporting and sustentative; and it is only when the correlations of place and order are destroyed by pathogenetic causes, that we are called upon to treat postpubertic lesions, whilst congenital abnormalities constantly require surgical interference.

The intravaginal dip of the cervix uteri in the average-sized nulliparous woman is about six lines, and in the mother somewhat less, but with a corresponding increase in length of the supra-

vaginal portion, the isthmus, and the fundus. In the nullipara, the length of the cervical and uterine cavities during the intermenstrual period is a fraction over two inches and a half, and something less than three in the child-bearing woman. Any marked increase beyond these lengths is indicative of *hypertrophic elongation of the cervix, subinvolution, the presence of a neoplasm, or hyperplastic formations.*

The persistence of the normal measurements in totality, notwithstanding an excessive elongation of the intravaginal cervix (B Fig. 1) indicates a faulty implantation of the vagina above its normal site of histological fusion.* The deduction, then, is, that amputation of an elongated intravaginal cervix, however great it may be, when the measurements of the cavities do not exceed three inches, is a mutilation, and should not be made until other procedures have failed.

When the converse implantation of the vagina ensues (the measurements being as in the other condition), the "infantile neck" exists, which is a misnomer, because, during infancy, the neck is in excessive development as compared with the body of the uterus. This formation is abnormal (teratological), as the actual condition is an implantation of the vagina too low down upon the cervix, giving it an intravaginal dip of rarely more than one or two lines. This condition is the anomaly of *defective vaginal dimensions*, in contradistinction to the other as the anomaly of *excessive vaginal dimensions*. For the anomaly of defective vaginal dimension, no surgical procedure has as yet been successful for its rectification, although an operation, the converse of one to be described for excessive vaginal dimension, might be done by sliding the pelvic extremity of the vagina higher up, and fusing it on the cervix.

Amputation of the cervix uteri, made fashionable by Huguier, and further popularised by Chassaignac's system of écrasement, like many other surgical procedures, has been more enthusiastically recommended than rationally performed. Since the use of the galvano-cautery loop has become so general, we have been even more prone than ever to take off the cervix. Whatever the method, and however skilfully performed, except for malignant disease and true supra-vaginal hypertrophy, cervical amputation is to be avoided.

There are a number of cases recorded, where the peritoneal cavity was opened by the écraseur: one by Marion Sims, who saved his patient by stitching the wounded surfaces together with silver wire; one by Breslau, where the section was followed by extrusion of the intestine; one by Biefel, where death from peritonitis ensued after an opening into the bladder; one by a Parisian surgeon (reported by Blanquique), where death ensued on the same day from hæmorrhage and peritonitis; one by Langenbeck, where the peritoneum was wounded; one by Meadows, who described another; by Peter (the French translator of Bennet), who mentions another. Why such an accident takes place during écrasement is readily understood when we recollect that, in all cases of true hypertrophic elongation, the peritoneum is commonly dragged down with the cervix, sometimes as low as the sacculated bladder, nearly always in the retro-uterine space, and may even be drawn out of the vulva. In faulty vaginal implantation (excessive dimension), Douglas's pouch may be drawn down below the plane of the recto-vaginal septum. Therefore, lest the general recommendations of Huguier and the more modern surgeons be carried out, to amputate the cervix, I wish to eliminate those cases wherein such an operation should never be performed. The immediate dangers of hæmorrhage, peritonitis, and traumatic enterocele, as well as the remote trouble of sterility, and roaming uterus with permanent deformity, are contra-indications that should make us pause. Any substitute is welcome, particularly if its theory be based on true rational grounds, and its performance prove a success.

The substitute for amputation consists in a circumsection of the mucous membrane covering the elongated intravaginal cervix, together with a severance of the same above the vaginal implantation, in order to "telescope" and attach the lower to the upper margin of the denuded cervix. The rule in the performance of this operation is, for those cases where the longitudinal diameter of the cervico-uterine cavity does not exceed three inches (Fig. 1), but where the intravaginal portion of the cervix is so long as to interfere with either locomotion, sitting, coition, menstruation, or conception. In other words, this operation is peculiarly adapted to all cases where the anomaly of vaginal dimension exists, where the implantation of the vagina is fused too high upon the cervix.

A very remarkable instance of excessive vaginal implantation is

* A possible condition of incudiform uterus, with hypertrophic elongation of the cervix, might present such symptoms, although I know of no such case.—M. A. P.

described by Martini (Ludv. Martini de Biberach, *Die Unfruchtbarkeit der Weiber*. Erlangen, 1864, p. 66), where the posterior fornix was attached to the very top of the uterus.

When this *vagino-cervicoplasty* is determined upon, the patient should be etherised or anæsthetised from nitrous oxide gas, placed in the left lateral semiprone position, a Sims's speculum introduced, and the cervix steadied by a tenaculum, which is handed to an assistant. Two lines of division of the mucous membrane are swept around the cervix by means of a bistoury with its cutting edge at right angles to the shank, and then stripping off the mucous membrane with scissors curved on the flat, and the lower margin of this surface denudation should be about two lines from the os externum posteriorly, and about three anteriorly. The upper margin should have a parallel sweep extending higher anteriorly than posteriorly. The breadth of the denudation varies from ten to thirteen lines (according to indications) (Fig. 2), which deprives at least seven-tenths of

Fig. 2.—A Circumcervical denudation. B Showing the separation of the covering of the supravaginal cervix.

the intravaginal cervix of its mucous membrane. The hæmorrhage is usually but slight, although one is liable to meet with an abnormal implantation of the circular artery, which, if divided, must for obvious reasons be ligated or twisted at either orifice. When all bleeding has ceased, the next step of the operation must be made with great caution, as exact adaptation is of great importance, and, therefore, we should see each division of the submucous connective tissue. A tenaculum is inserted into the upper edge of the raw surface, and the mucous membrane detached upwards from the cervical structure (B Fig. 3) (by means of scissors curved on the flat, cutting with the concavity towards the cervix), and a separation made all around, varying from three to eight lines in depth according to the greater or less length of the cervix. The bleeding is usually checked by the application of sponges wrung out in iced alum water, although occasionally it is necessary to twist or ligate a branch of the circular artery. After the parts are cleansed, and all oozing has ceased, the silver wires are passed from above downwards, from without inwards on the upper flap, and from within outwards on the lower flap. These sutures are very easily passed by means of fish-hook shaped needles, trocar-pointed, having an eye sufficiently large to admit of the passage of a No. 29 wire. When the wires are adjusted, eight or nine in all, the parts are drawn together, and the apparently elongated cervix is shortened and covered (telescopically) by the vagina, being actually lifted and attached to the upper denuded and detached sheath. (Fig. 3.)

This proceeding has been made seven times for various conditions, resulting from elongated intravaginal cervix. Five of these operations have been published in the *American Journal of Obstetrics*,

(1874), and the *New York Medical Record* (1879). The other two operations were as follows.

CASE VI.—Mrs. X., aged 29, married for five years, sterile and

Fig. 3.—Showing the margins brought together, and the elongated cervix telescoped above the abnormal vaginal implantation.

dysmenorrhœic, presented herself to the New York University Medical College Clinique for treatment in November 1879. An examination revealed a long acuminate intravaginal cervix, quite fifteen lines in length, the uterine probe marking two inches and eleven lines from the external os to the fundus. The uterus was low down in retroversion, and the recto-colic flexure much distended with accumulated fæces. After a couple of weeks' preparation, to re-establish the bowel functions, the operation of *vagino-cervicoplasty* was made in the College amphitheatre. The wounds healed nicely, and the sutures were removed on the eleventh day by Dr. Von Ramdohr, the *chef-de-clinique*. This patient, who had been sterile for five years, conceived early in 1880, and was delivered of a healthy female child (in Sacramento, California, whither she went from New York) in January 1881. In this instance the cervix uteri was telescoped into the vagina above; and, when insemination was made, the germinating fluid entered the cervical canal instead of being discharged, as formerly, into the posterior vaginal *cul-de-sac* behind the cervix, which was evidently the cause of sterility. This is the second case wherein sterility has been overcome by this operative procedure. The other case was shown (prior to conception but subsequent to the operation) to the New York Obstetrical Society in 1879, six months after the *vagino-cervicoplasty*, but Dr. Potter, of New York, has since reported her delivery of a child.

CASE VII.—Mrs. Z., aged 37, widow for nine years, excessively dysmenorrhœic and highly nervous, presented herself in October 1880. Examination revealed a very much distended vagina in consequence of the presence of a very large Hodge's pessary "to keep the uterus up." The intravaginal cervix was thick, hard, and purple-reddish in colour; from the external os a thick tenacious mucopurulent discharge oozed. She had chronic intracervical catarrh in consequence of the obstruction of the circumcervical blood-vessels, caused by the pressure of the pessary, which likewise developed vaginal catarrh. The pessary was removed; the patient kept quiet for a couple of weeks, pending which the vagina was frequently blanched by an almost excessive use of hot water, and the utero-cervico vaginal circulation freed of distension, by removing from the hæmorrhoidal vessels all intestinal obstruction by means of salines. Two weeks more were allowed to supervene without any special treatment, save moderate rest in the horizontal position, and one hot vaginal douche at bedtime. The result of this method of proceeding reduced the circumferential size of the cervix, materially softened it, and rendered its colour almost normally pink.

The endocatarrh diminished, and the endometrium was barely sensitive to the probe, which revealed a longitudinal diameter of three inches and one line, with the intravaginal cervix of fourteen lines dip. In December 1880, the operation of *vagino-cervicoplasty* was made, which resulted in bringing about a shortening of the intravaginal cervix to less than five lines, with an amelioration of the retroversion, sufficient to do away with the use of a pessary. The dysmenorrhoea is better, as is the hyperæsthesia; and now, twenty-five months after, the patient may be said to be decidedly progressing to a recovery that will be lasting. Certainly her condition is vastly better than before.

Seven successful operations for the relief of a condition hitherto treated by amputation (which is mutilation), is testimony well worth considering, more particularly as a failure could only result in the formation of cicatricial tissue, whence the mucous membrane had been denuded. In presenting these seven cases, let me hope that the procedure will be considered worthy of trial, and that plastic reparative surgery will do away with another operation that has for its object, not reconstruction, but ablation of tissue.

The second part of this paper is another sequence of the study of the functions and construction of the vagina, more particularly with regard to its sustentative and sustained properties. All fallings of the uterus from the slightest prolapse to the completest procidentia, necessarily involve more or less folding of the vagina upon itself; and, should the substructure, the perineal conjunction, be absent, the process of vaginal folding ultimately becomes complete inversion. Without the necessary amount of time to properly discuss the relations of vaginal dislocations to the perfect integrity of the perineum, I propose to formulate certain propositions which will be discussed in a future paper.

1. Should there be perineal laceration, even if the uterine structure and circumuterine spaces be perfectly normal, the organ, sooner or later, necessarily sinks in the pelvis, most frequently in retroversion.

2. All perineal lacerations, from a simple submucous muscular sundering (of the *transversus perinæi*, *sphincter*, and *levatoris ani* conjunctions), to a rent that extends into the bowel, necessarily beget vaginal dislocation, primarily as a slight, later as a complete rectocele, to be followed by a prolapse of the anterior wall, causing urethrocele and cystocele.

3. Urethrocele and cystocele seldom occur spontaneously; they ensue from pressure above (very rarely), or they follow from perineal sundering or laceration. I have never seen a case of cystocele, or even much urethrocele, that was not associated with some prolapse of the posterior vaginal wall.

4. All operative procedures for the *suspension of a prolapsed uterus* must be directed mainly to the posterior vaginal wall, because it arches upon the perineum below and the uterus above, serving chiefly as a column of support. The anterior vaginal wall, being straight and shorter, serves rather for the support of the urethra and bladder, and being adherent to the pubo-vesical spaces, it prevents the full bladder from rolling the uterus in retroversion.

5. Operations restoring the integrity of the perineum and posterior vaginal wall, usually develop symmetrical correlations of the canal. In cases of complete procidentia, a perineum restored by plastic procedures which strengthen the recto-vaginal septum will eventuate in a permanent cure, a condition I have never seen in making operations confined strictly to the anterior vaginal wall.

These propositions assumed, I feel satisfied that very many successful issues of *perineo-vagino-plasty* prove that the theory upon which the operation was based is correct, viz., that the conjunction of the transversus perinæi, sphincter ani, pubo-ischio-coccygeus, and levatores ani muscles, (described, but never actually demonstrated as the perineum) is the true and correct foundation upon which the posterior vaginal wall rests, and that the support rendered by the connective tissue in front of the rectum is but secondary, in consequence of the variable calibre of the bowel. The anterior column of the vagina is straighter and shorter, and, as before said, mainly supports the bladder and urethra; but the posterior vaginal column, added to the masses of blood-vessels furrowing the perivaginal connective tissue, tends to support the uterus; therefore, when the basement support of the vagina (perineum) gives way, it folds down upon itself, and drags the uterus in retroversion. I would state *en passant*, that I exceedingly doubt the efficacy of the so-called ligamentous support of the uterus, farther than that the misnamed structures (broad ligaments) serve as vehicles for carrying masses of erectile tissue and blood-vessels; and that in the healthy female the uterine body maintains its normal plane, or it is lifted, or it is depressed therefrom, in consequence of plenitude or empti-

ness of these same blood-vessels. Furthermore, I am disposed to think that all misplacements, except from direct or mechanical causes, depend upon fracture or destruction of the connective tissue in the circumuterine spaces, because of pathological changes in the blood-vessels.

In retroversion, rectocele, and cystocele, from perineal laceration, and in all forms of procidentia, where we cannot re-establish normal vascularity and erectility, the plastic operation about to be de-

Fig. 4.

scribed presents an efficient and satisfactory remedy that *literally increases the strength and usefulness of the pelvic floor.* (C, Fig. 9.)

Perineo-vagino-plasty consists in the forward projection of an everted flap taken from either side of the vulva and the ischio-rectal spaces, which throws the new posterior vaginal wall, as well

Fig. 5.

as the perineum, well up on the vulva (Fig. 5). For complete laceration of the perineum into the bowel the base line (C, D, Fig. 4) may cross the anal aperture. For simple pre-anal rupture, as represented in Fig. 4, in partial or complete procidentia uteri, the dissection of the flap from the base line (C, D,) may be carried up on a line above the recto-vaginal conjunction (Fig. 9).

In performing the operation, the patient (anæsthetised) must be placed in the lithotomy position for the male, and, after shaving off the hairs, two lines of incision, involving only the skin, are made from either side of the vulva (A, B), commencing at a point about three-fourths of the distance from the anus to the urethra; and,

extending to a point just within either ischial prominence (C, D), the base of the flap is then formed by a transverse incision from C to D. The flap is dissected from C to A and D to B, by means of scissors curved on the flat; the edges are then inverted and stitched together with numerous closely adjusted fine silk threads, tied on the vaginal mucous membrane, like intestinal sutures in the bowel (Fig. 5), and

Fig. 6.

which cut out in the course of three or four days. The vulvar margins of the wound are then snugly approximated (Aa, Bx, Fig. 6)

Fig. 7.

with three, four, or five silver wires, which preserve the genito-crural perineal folds. From five to seven silver wires are then passed through the skin fully an inch from the margins (Fig. 7) of and behind the denuded spaces. No one of these sutures should be in front of the raw surface, but between it and the rectal wall. This rule is most important, because of the absolute necessity of an even and regular adaptation of the dissection. When all oozing has ceased, and the parts are thoroughly cleansed, the wires are drawn tightly and twisted, as in any other perineal operation, with the addition of folding in or pocketing the projection (Fig. 8). The wires are cut long, with their ends brought together and clamped with a shot. This operation, or rather a part of it, was originally suggested to me by the late Professor John T. Hodgen, of St. Louis, Missouri, as a procedure for the relief of perineal laceration. He, however, did not pocket the projection, but left it out of the surface adaptation to mummify and shrivel. I made the first three operations under the advice of Dr. Hodgen in 1872 (before he ever operated himself); but, in 1874, I devised the procedure just de-

Fig. 8.

Fig. 9.

Fig. 10.

scribed, and since then have made more than seventy successful operations for perineal sundering, including the pre-anal, perineal, and perineo-anal lacerations, as well as six for partial and (Fig. 10) complete procidentia. The two last cases for complete procidentia were made in the amphitheatre of the New York University Medical College, and the patients then removed to their homes in an ambulance. Both cases were most satisfactory; one in a woman aged 63, who had suffered from complete uterine extrusion for nearly twenty years, the other in a woman aged 71, who had carried her womb in a sling between her thighs for thirty-four years. It is now quite four years since the last was operated upon, and more than forty months since the former. Both women are well.

EXPERIMENTS ON THE INFLUENCE OF DRUGS ON THE EXCRETION OF UREA AND URIC ACID.

By EDMUND ALLEYNE COOK, L.R.C.P. Ed., L.R.C.S. Ed., ETC.

Influence of a Close Atmosphere on the Excretion of Uric Acid.—Some variations in the amount of uric acid excreted having been noticed, while particular attention was directed to evenness of habit and diet, etc., and without the administration of any drug, it was thought probable that a close confined atmosphere had an effect on this excretion. The following estimations bear on this subject.

Date.	Urine.	Sp. Gr.	Urea.	Uric Acid.
November 7 ...	45 oz. acid clear pale	1020 ...	432 grains	10 grains
" 8 ...	45 " " " "	1020 ...	430 "	7 "
" 9 ...	41 " " " "	1023 ...	439 "	22.5 "
" 10 ...	51 " " " amber	1020 ...	480 "	24.3 "
" 11 ...	36 " " " "	1022 ...	423 "	11.9 "

During this period, no drugs were administered, and every effort was made to keep the diet and exercise exact. The low estimation of November 8th in uric acid was obtained from two exactly corresponding experiments, and is the lowest amount obtained in any twenty-four hours during which observations have been made. On the evening of the 8th, two hours were spent in a close room lighted by gas, in company with twelve grown people. The meeting was a committee meeting; there was no excitement; and, although there was much speaking, very little was done by the observer. A restless night followed, and a headache which continued next day. The urine collected on the 9th showed an enormous increase in uric acid, and but little in urea. The headache continued until the evening of the 9th, a most sleepless night following; and, during the 9th, 4 ounces extra water and 6 ounces extra tea were taken. The urine collection of the 10th showed an increase of urea, and an even larger excess of uric acid; the weather was clear and bright throughout, and the usual exercise was persisted in. The above results are given as an extreme instance of the effect of a close atmosphere; and this length of exposure under the conditions mentioned was never tried again.

When the conclusion was once rendered probable that the close atmosphere must have been the cause of the variation of uric acid, and that the headache and discomfort, if not a result of the presence of excess of uric acid in the system, were coincident with it, the fact was always noticed that a close atmosphere for even a comparatively short period was sufficient to increase the amount of uric acid in the next day's urine collection, although no headache might result, and that such an exposure to close atmosphere was sufficient to disturb any experiment which was in progress.

Although such an atmosphere as that breathed during the two hours indicated must have contained a large deficiency of oxygen, it would be far too much to conclude that that deficiency of oxygen was the cause of the excess of uric acid in the urine. The fresh air would contain oxygen, nitrogen, aqueous vapour, and a trace of carbonic acid; while the breathed and vitiated atmosphere would contain less oxygen, nitrogen, more aqueous vapour, large quantities of carbonic acid, and organic material from the various lungs in action; and the last item may act as an absolute poison. Moreover, an animal can breathe in an atmosphere containing many times the amount of carbonic acid normally present in fresh air; but, in such an atmosphere, the blood is freed in a less and less degree of the carbonic acid produced as respiration continues; and it may be not so much the deficiency of oxygen, as the presence of this excess of carbonic acid in the blood, which causes an increased excretion of uric acid, perhaps in consequence of the carbonic acid combining with the alkali with which such uric acid would otherwise combine, *i.e.*, by diminishing the solvent power of the blood for uric acid. The excess of urea in the urine collection of the 10th can hardly be accounted for on the plea of increased disintegration of tissue.

The Influence of Extract of Meat on the Excretion of Uric Acid and Urea.—The following is a summary of the experiments.

Date.	Urine.	Sp. Gr.	Urea.	Uric Acid.
December 4 ...	54 oz. clear acid pale	1022 ...	400 grs.	14.5 grs.
" 5 ...	41 " " " amber	1023 ...	472 "	12.7 "
" 6 ...	40 " " " dark	1022 ...	534 "	28.0 "
" 7 ...	34 " " " "	1024 ...	455 "	18.4 "
" 8 ...	45 " " " pale	1020 ...	432 "	14.0 "
" 9 ...	31 " " " amber	1026 ...	...	14.6 "

The diet on December 4th was normal in every way, the urine collection of that morning having been 54 ounces, and having contained 14.5 grains of uric acid. On the 5th, the urine collection was 41 ounces, and contained 472 grains of urea, and 12.7 of uric acid. On this date, with a normal diet, exercise, etc., a solution of Liebig's extract of meat was taken after the meal at 2 P.M. It was made by dissolving half an ounce of the extract in 12 ounces of water, and flavouring with salt. This solution was taken in place of, and not in addition to, the usual water, so that the total fluids consumed remained at 45 ounces; in the evening, a more than ordinary feeling of thirst was experienced. The urine collection of the 6th amounted to 40 ounces, and was dark but clear; gave 543 grains of urea and 28 grains of uric acid. On the morning of the 6th, there was an awaking very severe headache, similar in every way to that occasioned by the two hours of close atmosphere, and chronicled in preceding experiments; this headache persisted all day. Only 6 ounces of urine were passed between 8 A.M. and 5 P.M. on the 6th; but, after taking tea at the latter hour, a free flow of urine took place, and the headache diminished. The urine passed after the tea was taken had a specific gravity of 1030 when cold; the usual gravity of the urine passed at that time being 1008. The specific gravity of the 6 ounces passed during the day was 1028; that of the night was not taken, but the total collection of the 7th was 1024 sp. gr. The headache continued until the morning of the 7th, and was too intense to lightly provoke again; and therefore this experiment was not repeated. The urine collection of the following day was 45 ounces, yielding 432 grains of urea and 14 grains of uric acid.

It has been noted by Dr. F. Womack that creatin may be oxidised by purely chemical processes to uric acid. I do not know the details of the experiments, nor have I seen them in print, but I believe them to be correct in result; and as extract of meat contains creatin as well as other nitrogenous compounds, it may well be that an oxydation process takes place in the animal economy when this article of diet is administered, and thus the increase of uric acid obtained in the above experiment is accounted for. The dose taken was a fairly large one, but cannot be said to have been too concentrated. Had an increased amount of liquid been taken, the resulting headache and discomfort might possibly have been less, but in that case the result would not have been so fixed, and it certainly points strongly to the avoidance of continual administration of beef-tea or solution of extract of meat as an invalid diet. Dr. R. Neale, in a short article in the *Practitioner*, November 1881, draws attention to the fact that Masterman showed how analogous to urine is the composition of beef-tea, etc., and insists with emphasis upon the amount of harm which may be done with these fluids under the supposition that they can strengthen the weakened frame. The above experiments strengthen this record; for, if half an ounce of Liebig's extract of meat administered in twenty-four hours can so increase the uric acid, what effect must it have upon the state of gouty or rheumatic individuals?

Spirit of Nitrous Ether on the Excretion of Urea and Uric Acid.—The influence of spirit of nitrous ether on the excretion of urine is generally supposed to be so well known that no experiments with it might be deemed necessary. Its action is said to be diuretic or diaphoretic, and the one action is supposed to be the complement of the other. Dr. F. B. Nunneley, however, in some experiments published in the *Practitioner* for 1870, vol. v, page 372, found that it only slightly increases the flow of water and decreases the solids. The circumstance which more immediately prompted personal experiments with this substance was the consideration of some experiments on its action on ordinary urea and sulphur ureas published in the *Deutsch. Chem. Ges. Berz.*, 1871, by A. Claus, and the known fact that a solution of nitrous acid will decompose urea into nitrogen and water. And it was thought that, if the diuretic action of nitrous ether were well established as a constant effect, and if its administration were followed by a decrease of urea and uric acid, then it might receive application as a remedy for gout.

Further, nitrite of amyl and other nitrites are known deoxydisers of the blood, or, more exactly, tend to combine with the hemoglobin and prevent its normal action as a carrier of oxygen; and, reasoning from analogy, nitrite of ethyl ought to have a similar action, and