spasm that an injection of morphine had to be given, and the experience was one the patient declined to repeat.

Operation (September 20th) was devoid of unusual features, but inspection of the intravesical portion of the prostate showed an enormous venous dilatation, and the oozing of blood during enucleation was freer than usual. On the ninth day there was a good deal of blood oozing from the wound; this continued free for a week, and the temperature, generally averaging about 99.5° at night, rose on the fourteenth day after a rigor to 104° , and again after a rigor on the seventeenth day to 103.5° . In view of the patient's chronic heart trouble I felt anxious about him, but the oozing and the fever both came to an end when on the twentieth day I washed a large slough out of the bladder, probably some of the detached mucous membrane stripped off the prostate. At the end of the third week some urine was passed per urethram, and when the patient went home at the end of the fifth week practically the whole of his urine was passed naturally. By this time the thirst and dryness of the mouth, which had proved so troublesome, had quite disappeared.

At the present time the patient holds his urine for three to four hours in the day time, and is not disturbed at all in the night; the specific gravity of the urine has risen to 1020.

The prostate came away in one mass, and was surrounded by a complete capsule; the weight was 90 grams (nearly 3 oz.) after immersion in preservatives. The whole of the prostatic urethra came away with the organ. The enlargement was almost entirely due to overgrowth and distension of the acini, and there was a considerable amount of prostatitis.

CONCLUSIONS.

Briefly, my conclusions are that:

1. It is possible to enucleate the prostate.
2. The prostatic urethra is then almost invariably, if not always, removed with the organ.
3. If the prostatic urethra were left it would necrose from want of blood supply.
4. Stricture does not follow the damage to the urethra.
5. The operation gives excellent results, often restoring the functions of the bladder to an absolutely normal condition.

I should like to express my great indebtedness to my friend, Dr. Hewetson, for the assistance he has given me in preparing the material I exhibit.

AN ANATOMICAL CRITICISM OF THE PROCEDURE KNOWN AS TOTAL PROSTATECTOMY.*

By CUTHBERT S. WALLACE, B.S., F.R.C.S.,

Assistant Surgeon, St. Thomas's Hospital and the East London Hospital for Children.

THE NORMAL PROSTATE.

A short description of the normal prostate is necessary in order to make one or two points of comparison with the organ in its diseased state.

Fig. 1.

Fig. 1 shows the appearances of a section of an adult prostate taken at right angles to the urethra. There is no indication of any division into lobes. The fibro-muscular tissue is most marked in the following situations: (1) At the circumferential portion of the gland where there is an absence of gland tissue; (2) behind the urethra from which place it radiates in all directions to join the outer non-glandular area; (3) in front of the urethra, where it forms the so-called anterior commissure.

The gland tissue is fairly evenly distributed in the posterior part of the gland, both at the sides of and behind the urethra. The amount of gland tissue behind the urethra varies very much in different specimens, as has been pointed out by Griffiths. This variation has an influence on the type of enlargement, as will be pointed out later in this paper.

Outside the non-glandular area is the fibrous covering of the organ, which is derived from the recto-vesical fascia. This covering is not a dense definite structure, as is the fascia lata of the thigh or the arm, but consists of a series of areolar

planes in which on the lateral and anterior aspects is embedded the prostatic plexus of veins. It is a structure in which extravasation of fluid could take place, and would form the wall of the cavity left if a prostate were completely ablated.

In speaking of prostatectomy and of the presence or absence of a "capsule" it is very necessary to define the terms used.

The term "sheath" as used by Sir H. Thompson is the fibrous covering derived from the recto-vesical fascia, and contains the venous plexus. The term "capsule" as used by the same observer is the thin outer non-glandular portion of the organ, and is really only the outer portion of the stroma of the organ; it contains both muscular and fibrous tissue.

In *Quain's Anatomy* the term "fibrous capsule" is used to express the fibrous sheath derived from the recto-vesical fascia. There is no "capsule" in the sense of a separable membrane such as invests the kidney, nor can the prostate be shelled out from its surroundings like a lymphatic gland or the thyroid body.

Mr. Shattock has suggested that the outer non-glandular portion of the organ be termed the cortex, which title seems to represent the facts adequately.

I propose, then, that the investment from the recto-vesical fascia be called the "sheath," and that the outer part of the gland proper be called the "cortex."

Let us now study the organ in its pathological state:

Fig. 2.

Fig. 2 represents a specimen that I removed by the so-called operation of total prostatectomy. It was taken from a man, J. M., aged 77, who had suffered from complete retention for six years. The intravesical projection was circular, and of a character that I ventured to compare with the projection of the uterus into the vagina, and to which I shall refer hereafter as the "os uteri" type of projection. The

Fig. 3.

weight of the specimen was 152 grams ($4\frac{1}{4}$ oz.). The so-called "capsule" is seen to be composed of transversely-coursing bundles. The upper or vesical part of the specimen is smooth

* A previous paper on the same subject, to which references are made in the present communication, appeared in the *BRITISH MEDICAL JOURNAL* of March 25th, 1902, p. 764.

and rounded. Connected with the inferior part of the gland is a torn portion of the membranous urethra, which projects 13 mm. and partially surrounds the catheter which has been passed through the canal. The prostatic urethra is intact within the tumour.

Fig. 3 is a cross section of the same made through the middle of the organ at right angles to the axis of the urethra. It shows that the adenomatous tissue has practically surrounded the slit-like urethra, the wall of which is very thin and could not be separated from the adenomatous mass without rupture. At the circumference of the specimen and completely surrounding it can be seen the thin so-called "capsule." This may be considered a typical example of the parts removed by the so-called total prostatectomy.

With this specimen compare the following obtained after death:

Fig. 4.

Fig. 4 represents a section at right angles to the urethra of the prostate of a man, H. H., aged 60, who was admitted for the impaction of a stone at the junction of the prostatic and membranous urethra. The stone was removed by supra-pubic lithotomy. The patient died suddenly on the fourth day after operation. After death the prostate and bladder were removed from the body, hardened in alcohol, and examined by means of sections cut at right angles to the urethra.

The projection of the prostate into the bladder was of the "os uteri" type. The "posterior lip" was more prominent than the anterior. The whole organ viewed from the outside forms a globular swelling without any indications of division into lobes. The greatest transverse diameter measures 6 cm.; the urethra along its length also measures 6 cm. The cut surfaces show a distinct envelope and within this a glandular mass. The average thickness of the envelope is 0.3 cm. It is an exceedingly definite structure, and is distinctly laminated to such a marked degree that it admits of artificial cleavage for considerable distances along its lamellae.

In the section taken through the centre of the enlargement the urethra is a vertical slit measuring 1.5 cm., and lies 2 cm. from the posterior and 1.5 cm. from the anterior border of the organ. The glandular substance is arranged in somewhat ill-defined lobules, absent on the anterior aspect of the urethra. In the last-named situation there is a septum of fibrous or fibromuscular tissue surrounding the urethra, and continuous above or in front with the "envelope." Towards the inferior or distal end of the organ this fibrous septum is less distinct, being broken up by processes of gland tissue.

The median projection behind the urethral orifice is shown on a transverse section, carried through this part, to be inseparably continuous with the lateral portions.

Fig. 5 shows the separation between the envelope and the glandular portion. The central mass containing the urethra has been shelled out from the "envelope." This can be repeated in every section of the organ, so that ultimately the organ is divided into two parts, namely, the "envelope" and a contained glandular mass, in which lies the urethra, the only line of continuity between the two being the thick anterior fibrous septum, which is continued in from the "envelope" to join the peri-urethral tissue.

Fig. 5.

Fig. 6.

I think that no one can fail to be struck with the similarity of these two specimens (Figs. 2-3, 4-5), the first obtained as the result of a surgical procedure, the other in the *post-mortem* room. The only difference is the thickness of the surrounding envelope; the central portions are identical; in fact, they appear to represent the same pathological change in different individuals.

In the specimen removed in the *post-mortem* room the nature of the envelope can be studied. Now, this contains gland matter as shown by the lenticular mass seen in Fig. 5, and by the fact that a microscopic section taken at a point which is entirely fibro-muscular to the naked eye, reveals the presence of flattened gland spaces. (A figure illustrating this will be found in the BRITISH MEDICAL JOURNAL, loc. cit., numbered Fig. 7). This envelope therefore represents more than the outer non-glandular part of the organ.

It can be studied further in the specimen on p. 240 (Fig. 6). This represents the bladder and enlarged prostate taken after death from a man, F. H., aged 83, who died of uraemia. The front of the bladder and of the prostate has been removed by a coronal section.

The two lateral adenomatous masses have been removed by digital separation, which was accomplished without any difficulty. The left of these masses has been replaced, but the line of its separation is indicated in the drawing. The lateral wall of the urethra was closely adherent and removed with it. It will be seen that there is a median ridge left after the removal of the lateral masses; this is the posterior wall of the urethra, and is still covered with mucous membrane. At the summit of the ridge and projecting into the bladder in the position of the uvula vesicae is a small rounded eminence formed by a small adenoma. The walls of the bilocular cavity left after the removal of the lateral adenomatous masses have a very considerable thickness. This is especially the case behind the urethra on both sides, as seen in the lowest portion of the drawing.

On the left side behind will be seen a portion of the prostatic plexus of veins. A further examination of the specimen showed that the walls left after the ablation of the lateral masses were capable of a further division. With the finger and a blunt dissector the division was carried out until the part of the envelope immediately surrounding the lateral masses was completely isolated. The result of this isolation is shown in Figs. 7 and 8.

Fig. 7.

Fig. 8.

With this portion of the envelope has come away the posterior wall of the urethra, and with it, of necessity, the terminal portions of the ejaculatory ducts. This shell or envelope shows naked-eye evidences of gland tissue, for it contains the adenoma at the uvula vesicae, and a microscopic section of the envelope taken from the right side, where only fibrous tissue is visible to the naked eye, reveals the presence of flattened gland spaces lined with columnar epithelium (Fig. 9).

Fig. 9.

The outer surface of the envelope shows circularly coursing bundles of fibres. A drawing of these fibres has not been made, but a reverse of the outer surface can be seen in Fig. 8, which represents the parts after the removal of the envelope described. The wall of the now unilocular cavity left by the removal of the adenomata and of the envelope is still a definite structure, and has an appreciable thickness even at its thinnest part, while behind it measures 0.6 cm. in plan of section. The texture at this spot is spongy, and a microscopic section shows the presence of a considerable amount of flattened gland tissue which is not much altered from the normal (Fig. 10).

Still more externally can be seen the prostatic plexus. If the two adenomatous masses were replaced in their envelope, it will be seen that the whole would resemble the parts that are often removed in the so-called total prostatectomy, namely, two lateral adenomatous masses encompassed by an envelope that is most strongly marked at the equator of the mass, and presenting transversely coursing fibres.

Fig. 10.

The two specimens removed after death show that the enlargement of the prostate consisted of adenomatous masses enclosed in an envelope, the urethra being so closely adherent to the adenomata that its separation for any extent was impossible without laceration. The development of the adenomata and envelope will now be traced.

THE GROWTH OF THE ADENOMATA AND THE FORMATION OF THE "CAPSULE."

The first indication of a change in the prostate in the process of enlargement is seen in the altered relations between the fibromuscular and glandular portions. Small white areas become visible, and tend to assume a rounded outline. These areas may be single or arranged in groups. At the same time the arrangement of the fibrous tissue is altered. It no longer runs out in straight lines from behind the urethra, but the strands take a wavy course, and arrange themselves round the growing glandular masses (Fig. 11).

Fig. 11.

There can often be seen in the same specimen normal prostatic tissue areas showing whitish spots, ill-defined lobulated masses.

As the time goes on the normal gland tissues becomes less and less obvious, disappears from the centre of the organ, and is only seen at the periphery of the organ. The whitish areas increase in size, and become recognizable as adenomatous masses (see Figs. 4 and 6, loc. cit.).

The more rapidly-growing areas increase at the expense of the more slowly-growing ones, which are compressed and stretched over the surface of their more-quickly growing neighbours. The tissue between the adenomata, composed partly of the fibromuscular septa of the normal organ and partly of the stretched prostatic tissue, becomes circularly disposed round the gland masses (Fig. 12).

The adenomata may be either single or compound, that is to say they may be composed of several adenomata bound together by one common envelope or one adenoma may contain two or more smaller ones.

By the time that the adenomatous changes have become well marked the external form of the organ has undergone a change. The antero-posterior measurement approaches then equals the lateral, so that the organ not infrequently becomes globular in outline, and its cross section circular instead of being transversely elongated.

There does not appear to be any definite relation between the size of the organ and the progress of the adenomatous change.

This is well shown if Figs. 2 and 3, representing a specimen weighing 150 grams and having an antero-posterior measurement 5.5 cm., are compared with Figs. 13 and 14, representing a specimen weighing 20 grams (5 drachms) with an antero-

posterior measurement of 3.5 cm. In fact, the second specimen is a miniature of the first.

Fig. 12.

Fig. 13.—This specimen was removed by the author from a man, L. C., 65, who was admitted to St. Thomas's Hospital in August, 1903, with a dribbling retention. Its weight was 20.4 grams (5 drachms). It is hardly, if at all, larger than the normal organ. The appearances are those usually presented by the specimens removed by the so-called total prostatectomy. The view is that of the anterior surface, and shows the transversely coursing bundles of fibromuscular tissue. Above and projecting beyond the rough transverse fibres are seen the smooth rounded eminences of the lateral glandular masses. Below are the portions of the torn membranous urethra, the longest of which measures 2 cm. The catheter is placed in the urethra, the wall of which has been removed with the tumour.

Fig. 14.—A transverse section of Fig. 13. The adenomatous growth is situated at the sides of the deepened slit-like urethra. In front and behind there is no abnormal growth of gland tissue. On the circumference of the specimen can be seen the laminated envelope, which differs in thickness in different parts. No part of the prostatic plexus of veins has been removed.

From the disposition of the gland tissue in the normal prostate it follows that the adenomata can develop in any situation round the urethra except immediately in front of the canal where lies the anterior commissure. If the adenomatous change starts in either side of the urethra it will form lateral masses of adenomatous tissue. On the other hand should the change affect all the glandular portion of the organ alike the growth will surround the urethra everywhere except the front and even here by its growth eventually displace the fibromuscular anterior commissure. The projection of the gland into the bladder will in this case be equal round the whole circumference of the urethra, or in other words the projection will be of the "os uteri" type.

Should the adenomata, however, develop more rapidly in the portion of the gland behind the urethra and above the ejaculatory ducts there will be formed what has been called a median lobe, but this is as a matter of fact always continuous with one lateral mass as shown in Fig. 15 or with both as in Fig. 9, loc. cit.

Fig. 15

If situated near a free surface the adenomata grow in the direction of least resistance, and form the nodular masses so often met with on the vesical surface of the prostate or in the interior of the prostatic urethra. This can be seen in specimens Nos. 4,331 and 4,340A in the Museum of the Royal College of Surgeons; a short account of these specimens is inserted here.

Specimen 4,331, Royal College of Surgeons.—"The prostate is generally enlarged, and the parts that project into the bladder and urethra are irregularly knebbed. Part of the right lobe projects as a short, thick nipple-like process into the neck of the bladder in front of the enlarged middle lobe. Part of the left lobe projects as a broad, but rather flattened, process into the urethra directly over the caput gallinaginis, so as to be in contact with the opposite wall. The middle lobe forms a deep and broad transverse and trilobed ridge across the neck of the bladder." The patient was aged 70 years. A vertical, almost transverse, section along the course of the urethra shows the following points: On the urethral aspect it presents three rounded eminences which correspond with the same number of imperfectly circumscribed adenomata. External to these there lies a thin layer of more or less normal spongy prostatic tissue, and beyond this, without any line of separation, lies the prostatic plexus. The section of the right lateral lobe shows the nipple-like process to be separated from the main mass by a fibrous septum. The rest of the mass presents two adenomatous foci, but elsewhere it is spongy, but for the most part less so than the normal gland. The outer surface of the lateral lobe can be separated from the muscular and fibrous tissue enveloping it; the surface of the envelope thus raised is transversely striated from the presence of muscular fibre.

Specimen 4,340 A, Royal College of Surgeons, shows a similar condition in which the adenomatous enlargement occupies a median position behind the urethral orifice. Microscopic sections taken from these adenomatous areas show, besides a fibromuscular stroma, a large proportion of gland tissue.

To recapitulate, it may be said that the increase in the organ is due in the first instance to an increase in the glandular elements. This growth usually affects the greater part of the organ, but often leaves small portions almost unaltered. Within the changed area the alteration of the glandular element may be of very varying degree, consisting in some cases of small discrete points, while in others well-marked adenomatous nodules occur. These adenomata are often, indeed, usually compound, and may occupy the whole space within the "envelope" (Figs. 3 and 4).

The overgrowth of the prostate in these cases is therefore best described as an adenomatous hypertrophy, and is comparable to the adenomatous form of goitre.

In order to ascertain the changes that occurred in enlargement of the prostate many specimens have been examined, and in nearly every instance the changes described above have been seen. There are, however, other forms such as the

fibroid and carcinomatous, with which this paper does not deal.

The formation of the so-called "capsule" goes on *pari passu* with growth of the adenomata. The rapidly growing gland tissue stretches and expands the circumjacent tissue over and around itself. The radiating fibromuscular bands lose their original disposition and run in a wavy course between the adenomata. The normally diffuse spongy nature of the gland is lost. As the adenomata grow the circumferential part of the organ comes to be laminated, the fibres being driven to take a more or less circular course when seen in a cross section of the organ (Fig. 5, loc. cit.). In this specimen, which is in the museum of the Royal College of Surgeons and which was taken from the body after death, the centre of the lateral mass of the prostate is occupied by an adenoma; around it can be seen the remnants of normal gland tissue, the stroma being concentrically arranged. Outside again can be seen the plexus of veins imbedded in the recto-vesical fascia. This is a fairly early stage, but it can be seen that with the growth of the adenoma the circumferential tissue would be more and more thinned and come to resemble the envelope seen in Figs. 3 and 4.

The urethra as seen in cross section is at first crescent shaped. It next becomes triradiate (Fig. 4, loc. cit.), the radii being placed one anteriorly and two laterally. The next change is the disappearance of the lateral radii and the elongation of the anterior until the urethra is a simple slit. If both lobes develop at the same rate the urethra in cross section will be linear, but if one lateral lobe increases disproportionately to the other, the canal will be correspondingly curved.

Not only is the prostatic urethra increased as measured along the catheter, but it is considerably increased in the antero-posterior plane, as can be well seen in Figs. 3 and 4. Even if the adenomata first show themselves towards the middle of the lateral masses, they soon come into close relation with the urethra, and lie immediately alongside the walls of the canal.

The increase in dimensions of the urethra both in length and in the antero-posterior plane caused by the growth of the adenomata leads to a thinning and stretching of the urethral wall, so that in most specimens examined the urethra is represented by a mucous membrane so thin and delicate that it cannot be raised for any distance from the surface of the adenomata without rupture. This necessarily leads to a removal of the urethra on the adenomata. Whether the adenomata are removed singly or as one mass in a surgical "envelope," the mucous membrane is demonstrable on their inner surfaces, though its thinned condition makes this a matter of some difficulty unless a microscopic section is cut.

The tags of urethra that are seen to project from the inferior extremity of the specimens (Figs. 2 and 13) obtained by the so-called total prostatectomy are really derived from the membranous portion of the canal, and their continuity with the prostatic urethra within the tumour can be traced.

ENUCLEATION OF THE ADENOMATA AND THE SO-CALLED TOTAL PROSTATECTOMY.

I think that it can easily be shown that the nature and appearance of the parts removed depends on two factors:

1. The situation and extent of the adenomatous change.
2. The point at which the finger enters and cleaves the envelope.

It has been shown that the glandular portion of the prostate represented in Fig. 4 could be shelled out from the envelope. If the separation were carried out throughout the organ as it had been done in Fig. 5, there would have been removed a glandular mass containing the urethra, the surface of which would have been smooth and somewhat nodular, in other words it would have resembled the surface of the adenoma. Now the envelope is laminated, and can be split in any part of its thickness. If the finger had entered in the middle of the cut surface of the envelope, as shown in the section, the adenomatous mass would have come out surrounded with an envelope, the fibres of which would have formed circularly-disposed bundles, and the surface would have resembled that seen in the specimen represented in Figs. 2 and 3.

The amount of capsule removed with such a tumour will then simply depend on the thickness of the envelope and depth to which the finger happens to have been penetrated in the process of enucleation. Figs. 7 and 8 demonstrate that in such an enlarged prostate as this, each adenoma could have been removed separately, provided that the finger had

reached to the surface of the adenomatous masses. If the finger penetrated less deeply, and entered the envelope, the parts removed would have consisted of two lateral adenomatous masses bound together by the innermost layers of the envelope.

By the help of specimens removed from the dead body, the growth of the adenomata, the formation of a definite laminated envelope, and the alteration in the shape and environment of the urethra have been traced. It has been shown that the glandular masses surrounded by the innermost layers of the envelope enucleated from the parts removed after death correspond accurately to those removed by the so-called total prostatectomy in the living subject. It must be concluded, therefore, that the parts left behind in these two procedures correspond.

Now, in the case of the parts removed after death, after a removal such as that just described, there is left behind a definite envelope. This envelope has been shown to contain glandular tissue, and therefore to have been formed by the periphery of the organ, and to represent more than the outer non-glandular cortex of the prostate. External to this envelope the prostatic plexus has been shown to lie. It therefore follows that after the so-called total prostatectomy an envelope formed of expanded prostatic tissue is doubtless left behind, and bounds the cavity formed by the removal of the tumour. From a study of these facts corroborated by others not referred to for want of space, the following conclusions may, I think, be drawn.

Fig. 16 (slightly reduced).

Fig. 16 represents the mass enucleated; it measures 9.5 cm. in transverse diameter, and 6.5 cm. in a vertical direction. The surface is lobulated, but here and there shows portions of a transversely fasciculated envelope. The prostatic urethra is intact within the mass. A finger introduced into the canal shows the tumour to consist of two lateral masses joined together in front and behind the urethra. The projection from the top of the tumour is a strip of the vesical mucous membrane.

CONCLUSIONS.

1. That the usual form of prostatic enlargement is an adenomatous one.
2. That the adenomatous tissue may surround the urethra or form masses in the lateral parts of the organ, behind the urethra, or in all three parts.
3. That the parts removed may consist of adenomatous masses from the lateral parts, or of an adenomatous formation completely surrounding the urethra.
4. That there is always left behind a definite laminated

envelope containing glandular tissue, derived from the expanded outer portion of the organ.

5. That the amount of envelope left on the surface of the tumour after removal depends on the depth at which the enucleating finger cleaves the envelope.

6. That the recto-vesicular fascia is not opened nor the prostatic plexus of veins injured.

7. That though it is possible to remove a small adenoma from the centre of the lateral part of the prostate without extensively injuring the urethra, yet this canal is removed *in toto* when the adenomatous growths are extirpated in their envelope, and the lateral walls come away adhering to the adenomata when these are of any considerable size.

Fig. 17 (slightly reduced.)

Fig. 17 shows the bladder and the surgical capsule left after the removal of the adenomatous mass. The capsule is a very definite structure; a portion of the front wall of this has been removed, and through this opening can be seen the space left after the ablation of the tumour. Above this the cavity communicates with the bladder by an opening having a diameter of about 4 cm.; below can be seen the opening of the membranous urethra, shown in the drawing as a triangular aperture. At one spot in the capsule, traversed by the section exposing the interior, can be seen a white lenticular mass. This is shown on the right and lower part of the drawing. A microscopic section of this mass shows it to consist of glandular tissue. Flattened recesses of similar tissue occur in the adjoining portion of the capsule. Lying outside the surgical capsule can be seen the layers of areolar tissue forming the recto-vesical fascia, and lying between the planes are the veins of the prostatic plexus.

I would, in conclusion, suggest that the term "surgical capsule" should be applied to the envelope formed from the prostate by the expansion of the adenomata. It is a pathological formation, and represents more than the outer non-

glandular portion, to which Mr. Shattock has given the name "cortex." To its presence is due the small amount of bleeding and the absence of urinary extravasation. Indeed, in the so-called total prostatectomy, the enucleating finger never passes outside the limits of the prostate, and, therefore, cannot enter the recto-vesical fascia or tear the prostatic plexus of veins.

ADDENDUM.

Since the above was written, the specimen (see Figs. 16 and 17, p. 244) has come to hand.

It was obtained from R. O., a male, aged 81, who was admitted to St. Thomas's Hospital in November, 1903, suffering from retention of urine. The bladder had been twice opened for retention. The patient was extremely ill, and beyond giving relief by a third suprapubic opening nothing was done. Death followed in a few hours.

At the necropsy there was found intense haemorrhagic cystitis, double hydronephrosis, and dilatation of the left ureter. The bladder with its enlarged prostate was removed from the body, the membranous urethra being cut across at its commencement. The bladder was then opened on its anterior surface. The intravesical projection of the prostate was of the "os uteri" type. The operation of so-called total prostatectomy was then performed on the parts in an exactly similar way to that adopted in the living subject. The process of enucleation was very easy.

This specimen fully bears out the contention that a definite envelope formed of expanded prostatic tissue is left behind after the so-called total prostatectomy.

NOTES ON MYIASIS.

By CAPTAIN P. S. LELEAN, R.A.M.C., F.R.C.S.ENG.

THERE would seem to have been a somewhat strong prejudice against flies as remotely as the time of the fourth plague of Moses, 1491 B.C., and it is interesting to follow the development of that prejudice into the definite knowledge of the present day, when the researches of the entomologist and the pathologist have shown how important a part is played by winged insects in the etiology of human disease.

Since the geographical distribution of the larvae which cause myiasis is almost co-existent with that of the order *Diptera*, extending as it does from the Shetlands to the equator, the study is obviously not of merely tropical interest; nor can it be said to concern only the biologist when it is observed that a series of 38 cases, recently collected by Maillard, of *Cnipsomyia* larvae showed a mortality of 55 per cent.

Referring to ancient records we find that in 1582, Ambrose Paré described a maggot passed per urethram which he calls "oniscus." This is the first of a series of 30 such recorded cases, the second being in 1641, and the last—published by Dr. Foster Palmer recently—being a larva of *Homalomyia scalaris* (house-fly).

A definite attempt was made by Baier in 1740 to place the subject on a more scientific basis in an article entitled "De generatione insectorum in corpore humano."

In 1787, we read of a case of "Violent pains from worms under the skin," which worms were "near an inch long, all in joints in the back, with hard scales," and the theory of infection by insects is only tentatively advanced as a mere speculative explanation of a pathological novelty.

Clarke in a brilliantly illustrated and able contribution to the transactions of the Linnean Society in 1797 establishes the relation between larvae and oestridae, elucidates the

confusion involving the classification of the latter, and incidentally combats some suggestive fallacies of his day: one *re* the ovulation of *Oestrus haemorrhoidalis* suggested by the quotation "Mire per anum intrans" showing the need for an illuminating contribution to the literature of his day.

In 1824, a really interesting case was reported from the sister isle. A lady, after a prolonged geophagism, became subject to constant vomiting, and produced quite a remarkable biological collection, in which, among many strange beasts, dipterous larvae "literally teemed," larvae, pupae, and imagines being curiously ejected together. One realizes the paucity of accurate knowledge in the last century when one reads that it inspired "a feeling of horror to see them (the larvae) frisking along, occasionally expanding their jaws and extending their talons," and although the doctor himself witnessed the extrusion of these forms, it is impossible not to be a little sceptical of the patient's bona fides, when one reads that she invariably concluded by "chanting the Litany at full length in a clear and beautiful voice."

In 1842, an eminent London physician writes: "I saw hundreds of worms escaping from the skin of her body, the carpet was covered with them where she stood while dressing.....they had a power of ejecting themselves to a distance of from 12 in. to 20 in."—a startling fact, but confirmed in 1899 by Lieutenant-Colonel J. Smith, who saw dipterous larvae spring a distance of 3 ft.

Coquerel, writing in 1858 *Des Larves des Diptères développés dans les Sinus Frontaux*, makes this lament: "Ces faits sont peu précis et laissent beaucoup à désirer sous le rapport scientifique;" and twenty years later Cobbold responds in his "Entozoa," giving a list of species of reputed dipterous parasites under no less than fifteen headings.

1880 brings the record by Blandet of a case of spontaneous cure of *Homalomyia scalaris* by a surfeit of sorrel. The growing

interest in myiasis is shown by the reading of a paper on this subject before the International Congress of 1881 by Dr. Smith of Dublin. In this he gave a brief summary of the progress in the classification of parasitic diptera from the time of Humboldt, who describes the *Oestrus humanus*. Smith contended that there is no *Oestrus hominis* peculiar to man, that human larval parasites are all muscidae, and quoted the extraction from Dr. Livingstone's leg of a muscid larva in Central Africa.

In 1882 two cases of migrating larvae appeared, on specu-

lated segmented specimen, 13 mm. long, being removed from the back of the neck after a three months' journey from the right ankle, leaving an indurated track.

Of more recent years, perhaps the most curious biological contribution is that of Dr. Folker of Guatemala on the gusano worm. The ovulation of this mosquito-like fly was observed to be effected as follows: The proboscis is inserted in the skin; the long body is arched until the "tail" (? ovipositor) is passed along it as along a director; then, erecting itself on its hind legs to a convenient angle, a full charge of ova is passed deeply into the cavity, a boil ensuing in three days.

From a pathological standpoint Colonel David Bruce's recent demonstration of the rôle of *Glossina palpalis* in sleeping sickness stands alone in importance.

While on service recently with the Anglo-French boundary Commission in Northern Nigeria my attention was drawn to this subject by the occurrence of ecto-parasitic larvae on natives near the Sokoto Arc (7.18 N., 13.29 E.). I secured two larvae and hatched the flies. On submitting these to

Auchmeromyia luteola, Falr.