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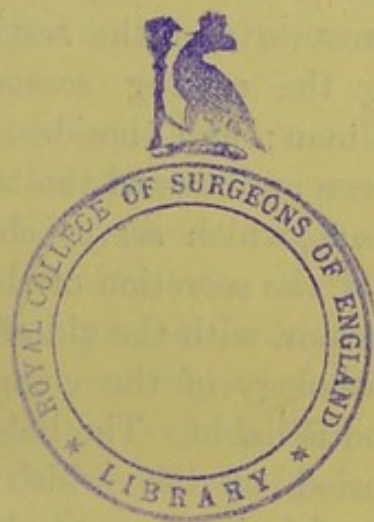


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THE UNIVERSITY OF CHICAGO



THE PROSTATE GLAND: ITS ENLARGEMENT OR
HYPERTROPHY. By JOSEPH GRIFFITHS, M.B., C.M.
Edin., *Assistant to the Professor of Surgery in the
University of Cambridge.* PART III. (PLATE XIV.)

HAVING already in Part I. (*Jour. of Anat. and Phys.*, vol. xxiii. p. 374) drawn attention to the development of the prostate gland, and pointed out that the gland-tubules form the essential structure of the organ, and having in Part II. (*Ibid.*, vol. xxiv. p. 27) shown the close relation that exists between the prostate and the testicles, not only in the lower animals during the rutting season but also in the higher animals and in man; and, besides, having accounted for the existence between and around the tubules of a large amount of non-striated muscle, which serves chiefly as the mechanism for the expulsion of the secretion of the gland into the urethra, I shall now endeavour, with the aid of the above facts as a basis, to give the pathology of the commonest morbid affection to which this gland is liable. The liability to this affection occurs during the period of life which is characterised by the commencement of decline in, and almost total disappearance of, the sexual power. Although the prostate, like the testicle, diminishes in size during that period, and undergoes the physiological atrophy of old age, yet in as many as 30 per cent. of persons above the age of 50 years, according to Sir Henry Thompson,¹ this gland becomes enlarged, and gives rise in many instances to urinary troubles which may or may not prove directly fatal. The enlargement is most frequently met with between the ages of 60 and 70 years. Regarding the prevalence of enlarged prostate in the aged, it will be observed that Professor Humphry, in his work on *Old Age and the Changes Incidental to it* (1889), says that 17 only out of 72 persons between the ages of 80 and 90 years, and 1 only out of 30 above 90 years, suffered from the urinary troubles that are referable to this affection of the prostate.

¹ *Diseases of the Prostate.*

It is clear, therefore, that in a certain proportion of men above the age of 50 years, the prostate gland—an accessory sexual gland as it seems to be—abnormally increases in size after the commencement and during the period of cessation in sexual activity; and this increase, as will be shown further on, is due to a growth of the gland-tubules. Thus more gland substance is formed, but it is obviously of inferior quality, forasmuch as it is not endowed with the same property of resisting degenerative changes, and the same powers of producing secretion as the normal gland. Such secretion as is formed by the enlarged gland is scanty, thin, and watery, whereas that from the normal gland is abundant, and contains more mucus, so that the increase in the amount of glandular substance is associated with diminution in quantity and deterioration in quality of the secretion.

I propose at present to confine myself to a discussion on the nature of the changes that take place during the enlargement of the prostate, and the effect directly resulting upon the prostatic portion of the urethra and the bladder. I may first refer to the fact that in a large proportion of men the prostate is represented only by two lateral lobes; while in others, as I have shown in this *Journal*, vol. xxiii. p. 375, there exists in addition, between and above the lateral lobes, a certain and variable amount of prostatic substance, the glandular tubules of which are originally derived from that part of the hinder wall of the urethra extending from the *verumontanum* to the neck of the bladder. This portion occupies the situation assigned by Home and others to the “*third*” or median lobe.

Inasmuch as enlargement takes place from the abnormal growth of the pre-existing gland-tubules (see further on), it is evident that, unless there normally exists in a particular instance prostatic gland-tubules in the situation of the “*third*” or median lobe, there can exist no enlargement in that position.

When the gland enlarges as a whole, and equally in all its parts, then the prostate is increased in all its dimensions, that is to say, the lateral lobes are wider, longer, and deeper, and this is associated with a corresponding increase in the size of the “*third*” or median lobe when it is present. The gland, however, retains its original shape and form. Coincidentally

there occurs a corresponding increase in the width, length, and depth of the urethral channel; and the channel may become further dilated so as to contain a drachm or more of urine, which is liable to trickle away (fig. 3). This not infrequently gives

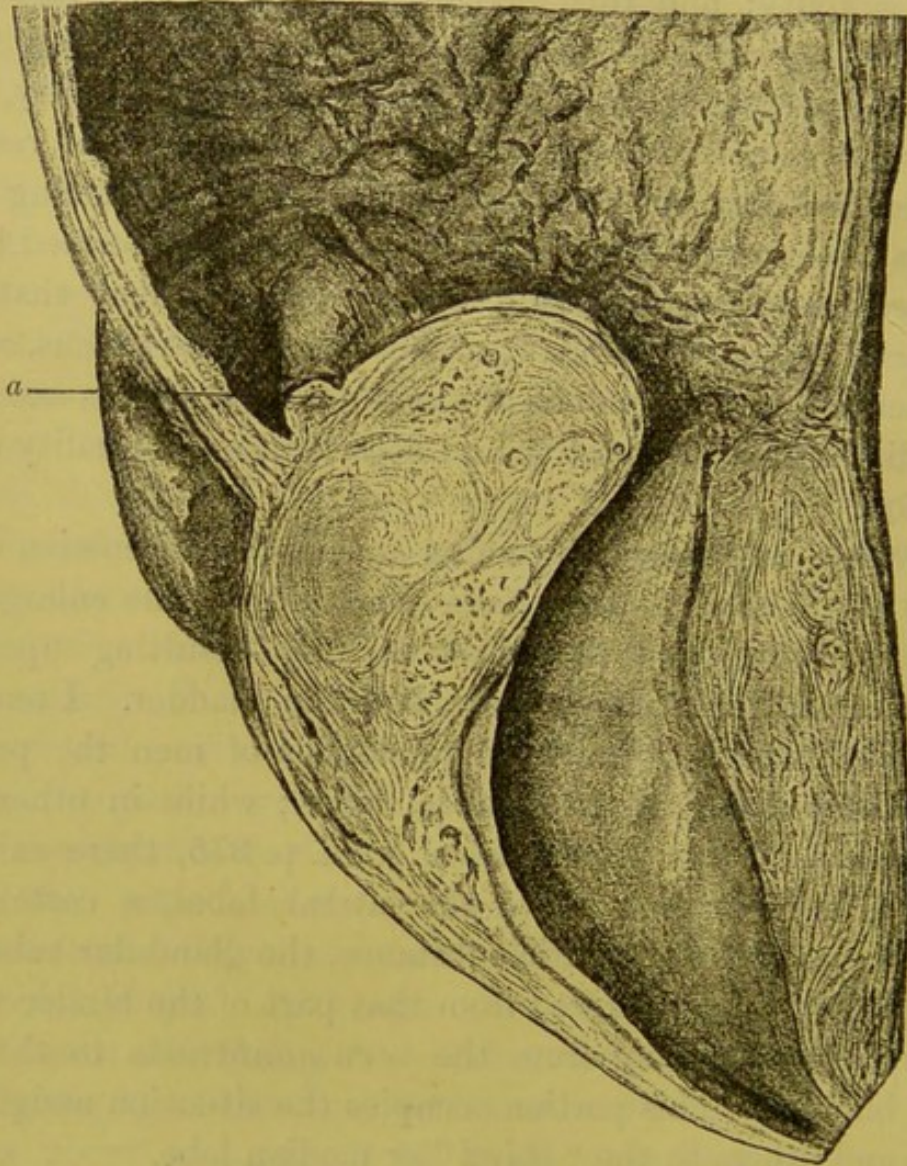


FIG. 3.—A Median Longitudinal Section of an enlarged Prostate, with Bladder, hardened with spirits. The prostate gland is enlarged as a whole, and the urethra is elongated and much increased in capacity. There is no enlargement behind the urethra except in the position of the "third" or median lobe, which has grown upwards into the bladder, pushing before and thinning out the greater part of the trigone, the hinder edge of which is indicated by the letter *a*. The vesico-urethral orifice is greatly enlarged, especially from side to side. The bladder is hypertrophied and fasciculated, and the usual pouch behind the inter-urethral bar is seen in its earliest stage of formation. The urethra is remarkably dilated at the base of the "third" lobe.

rise to the impression that the catheter has entered the bladder while it is still only in the prostate. In the two examples from which these drawings were made, there was uniform enlargement of the whole gland, the one being an instance

of the presence of the "third" or median lobe, and the other the total absence of that lobe (fig. 4). As is well known, the different parts of the gland may enlarge unequally, or only one

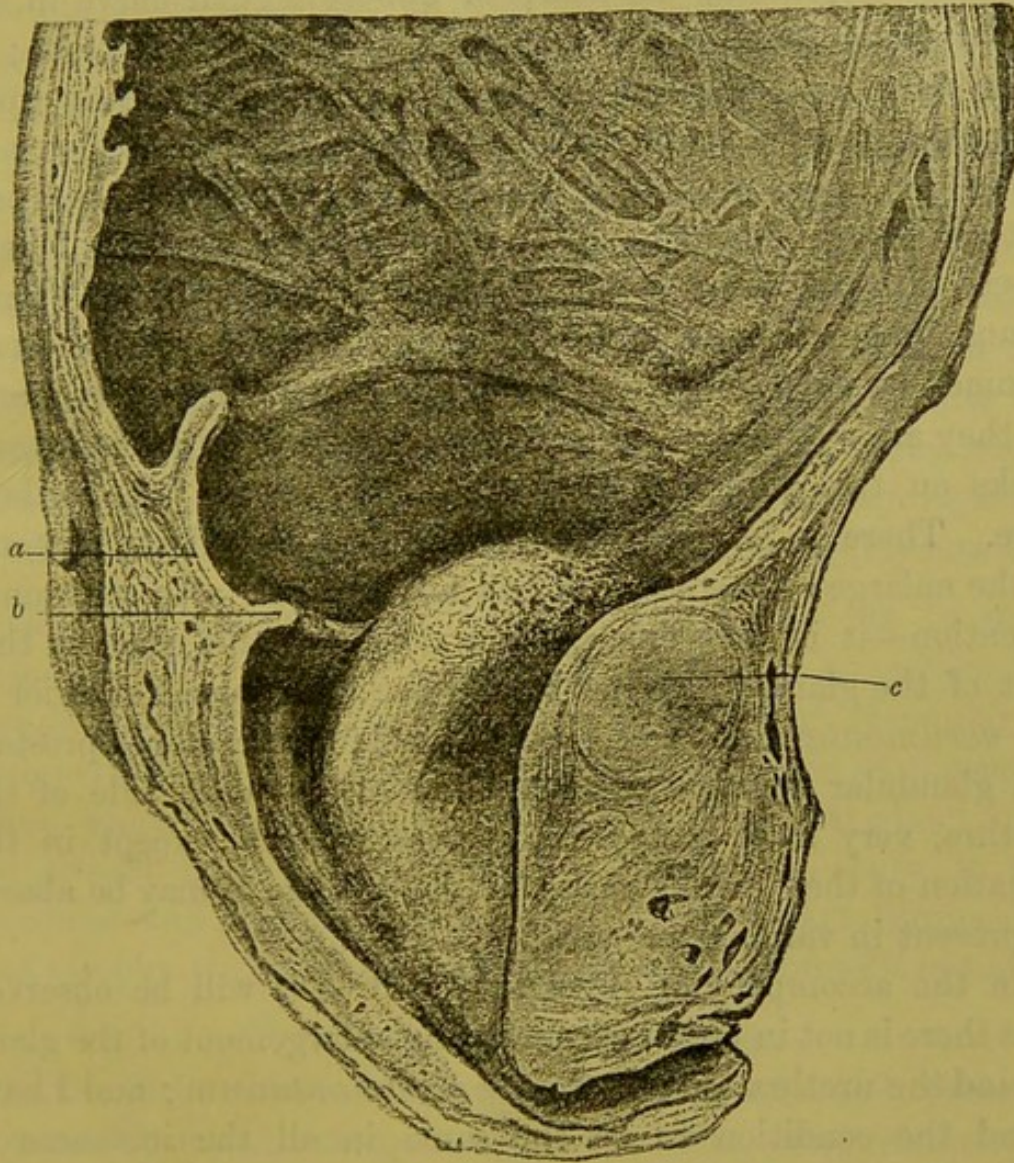


FIG. 4.—A similar Section, prepared in the same way, of an enlarged Prostate, with the Bladder. The prostate is enlarged in both lateral lobes, but no enlargement whatever in any part behind the urethra; there is therefore no trace of gland-substance in the situation of the "third" lobe. The urethra is much increased in all directions, and also the urethro-vesical orifice, which is partially filled by a finger-like process from the enlarged left lobe. There is in the enlarged anterior wall of the prostate, near the bladder, a small, round, circumscribed mass, which is a pure myoma (*c*). The bladder is much hypertrophied and fasciculated; the pouch behind the inter-urethral bar is more pronounced than in fig. 3; and as there is absence of the "third" lobe, the trigone, *a*, is normal, and the bar, *b*, at the neck of the bladder is rendered very prominent.

part enlarge, as is not unfrequently the case with regard to the "third" or median lobe. Besides, there occurs unequal enlargements of the different parts of the same lobe in some instances.

Unequal enlargements, whether of the lobes or of parts of the lobe, will necessarily give rise to various kinds of distortion in the urethral canal, amongst which may be mentioned, as perhaps the most important, the sharp or almost angular curve in the mesial plane produced by enlargement of the "third" lobe; or there may be a deviation to one or other side depending upon unequal enlargements of the lateral lobes. There may also be a collar-like ring surrounding the vesico-urethral orifice and projecting into the bladder. This latter, however, so far as I have observed in various collections of enlarged prostates, is not by any means frequently met with. Numerous, indeed, are the forms assumed by enlarged prostates and the contained urethra; and, as they are so well known and fully described in general text-books on this subject, I need not do more than refer to them here. There is, however, one point in the naked-eye anatomy of the enlarged prostate that has not hitherto attracted much attention—it is, that enlargement does not take place in that part of the gland which lies behind the urethra and anterior to the *verumontanum*. In the normal and fully developed prostate the glandular substance is found mainly on each side of the urethra, very little if any behind the urethra, except in the situation of the "third" or median lobe, where it may be absent or present in variable amount.

In the accompanying figures (3 and 4) it will be observed that there is not in either specimen any enlargement of the gland behind the urethra anterior to the *verumontanum*; and I have found the condition to be the same in all the instances of enlarged prostates that I have had an opportunity of dissecting, and of those which I have seen in the Cambridge and other pathological museums. This fact has long been made use of clinically in cases where there occurred any difficulty in the introduction of the catheter for the relief of prostatic retention, because the instrument can be here felt *per rectum*, and it may be tilted upwards by means of the finger so as to facilitate its passage over an enlarged "third" lobe into the interior of the bladder. Besides, it may prove of considerable value in differential diagnosis between simple enlargement or hypertrophy and the enlargements which result from malignant disease. I make this remark because malignant disease, both in the child and

adult, affects especially the region of the gland behind the urethra.

As the prostatic urethra dilates, so do the ducts of the prostate which open into it; these latter dilate in some instances even to such a degree as to admit, with comparative ease, the point of a medium-sized catheter. This becomes of practical importance when enlargement of the "third" or medium lobe occurs, for in such cases the urethra is most dilated, and the enlarged ducts of this lobe open in the situation where the end of the catheter is likely to impinge. The catheter may be in such cases pushed into these dilated ducts, and through the enlarged and altered gland, either into the bladder or into the surrounding pelvic tissues, so as to form false passages, which were not of unfrequent occurrence in the days when rigid instruments were in more frequent use than they happily now are.

The enlargement of the prostate really presents in most instances two stages, of which the first may be called the *glandular*, forasmuch as it consists mainly of glandular or modified glandular tissue, with its due proportion of muscular tissue, which closely resembles that of the normal gland; and the second may be called *fibrous*, forasmuch as in it the glandular and muscular tissue have in great part disappeared from atrophy, and are replaced by old and fibrous connective-tissue.

The First or Glandular Stage.

In the earlier stages of enlargement the gland merely presents a coarser structure than normal. Often when more advanced it presents a number of small masses of gland-substance, separated from one another by trabeculæ of fibrous or fibro-muscular tissue, which traverse it in all directions. The spaces thus enclosed vary up to one-third of an inch in diameter, the commonest size being about one-sixth of an inch. The gland-tubules in many of these small glandular areas have become dilated so as to form minute cysts, which as a rule do not exceed a line in diameter, and which contain an albuminous fluid readily coagulated by treatment with alcohol. Some of the larger masses projects on the surface of a recent section. They are more or less distinctly circumscribed, and a few of these may be easily enucleated when they have undergone the fibrous degenerative changes which charac-

terise the *second* or *fibrous* stage. It is these larger masses that have attracted so much attention from various writers on the enlarged prostate, and which are usually described as "tumours." More will be said in regard to the real nature of these tumours further on. On microscopic examination at this early stage the lobules of the enlarged gland are seen to be composed of a structure which is in parts almost identical with that of the normal gland; the gland-tubules are of normal size and shape, with the usual papillary projections into the interior, and are lined by a single layer of tall columnar epithelial cells, resting on a basement membrane of flattened epithelial cells, and are separated from one another by connective-tissue bands which contain a considerable amount of non-stripped muscle-fibres. In other parts the gland-tubules are dilated, and have lost the convoluted character of their lining, so as to form minute cysts. Such of the cysts as are in the earliest stages of formation are still lined by the same kind of epithelium as the normal tubules, namely, a single layer of tall columnar epithelial cells; but the larger are lined only by a single layer of flattened epithelial cells, which in all probability corresponds to the basement membrane found in the normal gland-tubule already described in Part I. (this *Journal*, vol. xxiii. p. 378). These cysts usually contain a more or less homogeneous colloid-like substance, which is evidently derived from degenerative changes taking place in the cast-off epithelial cells. That this is so, may, in some instances, be directly traced (Pl. XIV. fig. 1). The stroma or intertubular tissue of the enlarged gland closely resembles that of the normal gland, and, like it, contains a large amount of non-stripped muscle. There are, however, in the stroma small collections of round cells, which resemble leucocytes, scattered here and there like so many foci of inflammation; but, so far as I can observe, there are no farther evidences of inflammation in the rest of the stroma.

The Second or Fibrous Stage.

This stage may be found limited to small areas of the enlarged gland, or it may involve the entire gland, and thus convert the whole into a firm, hard, and fibrous mass. The areas of limited fibrous transformation are best seen in the larger

glandular masses just referred to in the naked-eye description of the first or glandular stage. It is brought about by gradual atrophy of the gland-tubules and of the muscle-fibres in the stroma by the substitution for them of fibrous connective tissue. Thus the once glandular mass is transformed into a mass of fibrous connective tissue, containing only the atrophied remains of the gland-tubules and of the non-striped muscle. We have here, then, a good example of the disappearance of the more highly specialised elements of a tissue and their replacement by a less specialised form which is capable of existing on the minimum amount of nourishment. Where such a change involves the enlarged gland in its entirety, as it occasionally does, the same appearances may be seen scattered more or less uniformly throughout its substance, as seen in Plate XIV. fig. 2. This, which I regard as the *latter* or *second* stage in hypertrophy of the gland, corresponds to the fibrous variety of former writers. Although it occurs only occasionally throughout the enlarged gland, yet it may be found in most examples of enlarged prostates in some of the small glandular masses. Further, I find this change to be associated with very marked alterations in the walls of the larger blood-vessels of the gland, which produce a great diminution in their lumen. This diminution in their lumen results from fibrous thickening of the internal and also of the middle tunics of the vessels. Such a form of arterial change is well known to be accompanied in other organs, as well as the prostate, by fibrous changes in the tissues supplied—in the kidney, for example; and it is considered by Zeigler and others to be the primary cause of the fibrous changes often observed in that organ.

From the foregoing description of enlargement of the prostate gland, it will be observed that enlargement or hypertrophy originates from a growth of the gland-tubules, and that after a variable time atrophy of the gland-tubules and of the muscle in the stroma is liable to supervene, and the place of the hypertrophied glandular tissue to be taken by fibrous connective tissue.

These successional changes constituting my first and second stages scarcely accord with the views of Sir Henry Thompson as given in his work; still less with those of Mr Reginald

Harrison,¹ who, following out his ideas of the muscularity and sphincter action of the prostate, regards the enlargement as due to hypertrophy of the muscle taking place, to compensate for an increased call for a sphincter action in men as they advance in years.

Respecting these ideas, I have already given my reasons for dissent (see Part I., vol. xxiii. p. 383).

The exact nature of the so-called TUMOURS found so frequently in the enlarged prostate has been discussed by most writers on this subject.

Cruveilhier,² Sir Henry Thompson,³ and others regard these little masses as identical with the *fibroids* or *myomata* of the uterus. This view is based upon their occurrence in numbers upon the presence of muscle in them, and upon the supposed homology between the muscle of the prostate, from which they are said to originate, and that of the uterus; whereas Rokitanski,⁴ Socin,⁵ and others look upon these as similar in all respects to the localised glandular tumours frequently found in the mammary gland. The former observers place the muscle elements in the foreground, maintaining that the presence of gland-tissue is accidental, whereas the latter hold the gland-tissue to be the essential and important constituent.

Socin,⁶ rightly I think, observes that these little masses are never without any glandular tissue, and that the amount of the glandular tissue varies with the age of the mass—that is to say, that when it is recent it contains relatively a greater proportion of glandular tissue than when it is old. He would even go further, and give this little mass the appellation *adeno-myoma*, thus placing it among the tumours proper. They are, however, not in reality tumours in the accepted sense of the term, but merely, as I have already intimated, pronounced local enlargements of the gland, passing through the same stages as the gland when enlarged as a whole; and, so far as I am able to

¹ *Surgical Disorders of the Urinary Organs*, Lect. xxiii.

² *Anat. Pathologique*.

³ *Loc. cit.*

⁴ *Zur Anat. des Kropfes*, s. 10.

⁵ *Hand. der Chirurg. Von Pitha. und Billroth*, Bd. iii. Ab. ii. s. 39.

⁶ *Ibid.*

make out from macroscopic and microscopic investigations, they have no claim to be classed with the *myomata*, commonly found in the uterus. It is true, indeed, that pure *myomata* do originate from the non-stripped muscle of the prostate, as indeed from any other non-stripped muscle in the body, but these are of rare occurrence; and where they do occur they do not in their structure correspond with the localised masses or to the general enlargement of the gland above described.

It may perhaps be of interest to mention here an example of such a growth in a specimen in the Cambridge Museum, with the following description:—

“ Tumours at the Neck of the Bladder and Prostate.

There are two conical projections of the fore part of the prostate in the urethra near the bladder. One of these, cut into, is seen to be caused by the presence of a small round tumour invested with a distinct capsule of dense cellular tissue, which separates it from the surrounding substance of the gland. The tumour is solid throughout, and presents an appearance not unlike that of a mammary tumour.”

On microscopic examination of one of the tumours, I find that it consists almost entirely of muscular tissue, and is devoid of glandular substance—that is to say, a pure myoma.

A similar myoma may be seen, fig. 4, p. 239, in the same situation, this being, however, of larger size. It is the only example that I have met with in the specimens examined by myself.

Conclusions.

The chief conclusions arrived at in this paper are the following:—

1. That enlargement or hypertrophy of the prostate gland results from a growth of the gland-tubules with their associated muscle, so as to form new gland-substance, closely resembling in its structure the normal gland. This constitutes the *first* or glandular stage.

2. That after a variable time degenerative changes set in, which ultimately convert the new tissue into a mass of more or less dense, fibrous, connective tissue, containing only the atrophied remains of the glandular and muscular elements. This constitutes the *second* or fibrous stage.

3. That no enlargement takes place behind the urethra except when glandular substance exists behind and above the level of the *verumontanum* in the situation of the "third" or median lobe.

4. That the so-called "tumours" are not in reality *tumours*, but merely pronounced localised enlargements of the gland, which pass through the same stages as the gland when enlarged as a whole.

5. That true muscular tumours (*myomata*) do sometimes, though rarely, arise in the substance of the prostate gland, but that they are pathologically different from the ordinary local or general enlargement of the gland.

DESCRIPTION OF PLATE XIV.

Fig. 1.—A section taken from an enlarged prostate in the first or glandular stage, showing the altered and distended tubules and the presence in the stroma of non-stripped muscle such as is seen in the normal gland. *a*, tubules closely resembling the normal, with convolutions or papillary projections into the lumen; *b*, dilated tubules in which the papillæ are obliterated, lined by cells in several layers, and partially filled with degenerated epithelial cells; *c*, other dilated tubules, lined by a single layer of flattened epithelial cells, and filled with a colloid mass; *d*, the stroma, containing much non-stripped muscle-fibres.

Fig. 2.—A section taken from an enlarged prostate in the second or fibrous stage, showing the fibrous nature of the stroma and the degenerated masses of epithelial cells which represent the altered gland-tubules. *a*, spaces filled with small and degenerated epithelial cells; *b*, fibrous stroma, containing no muscle fibres.

Fig. 1.

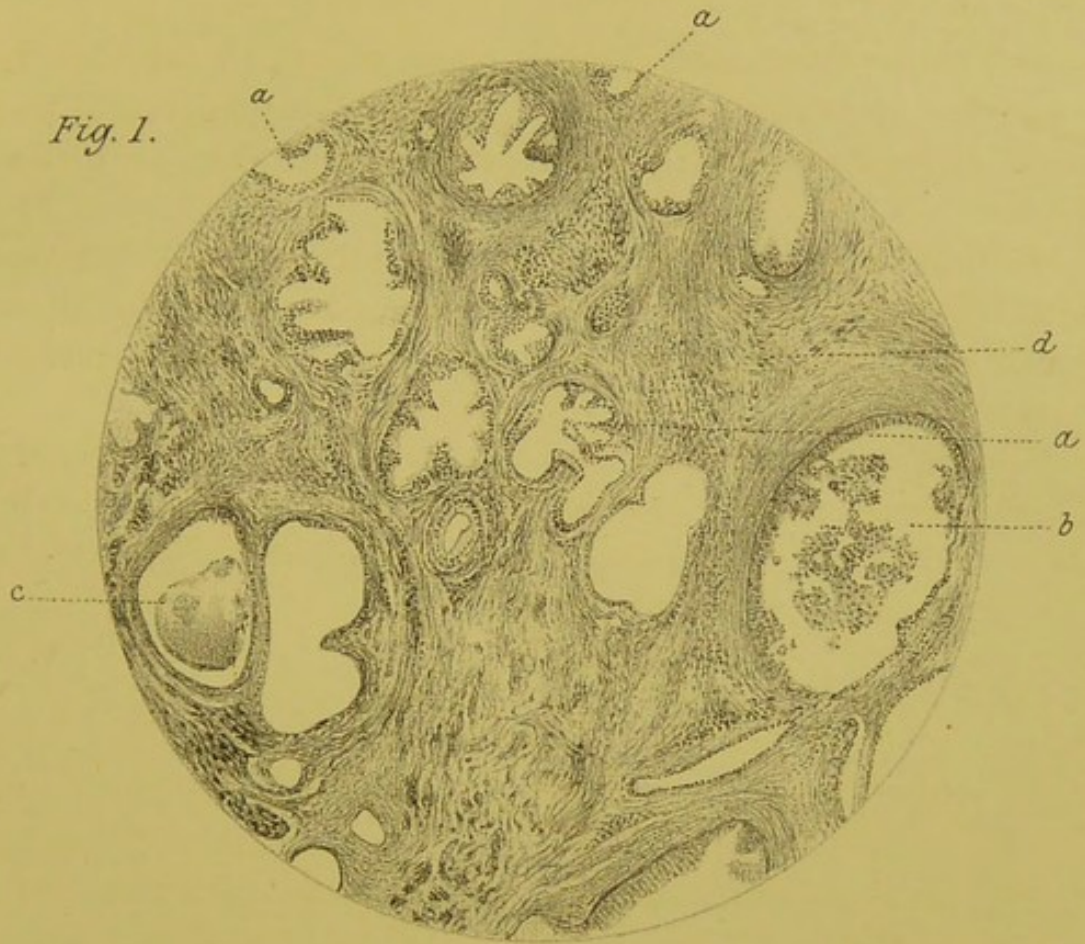
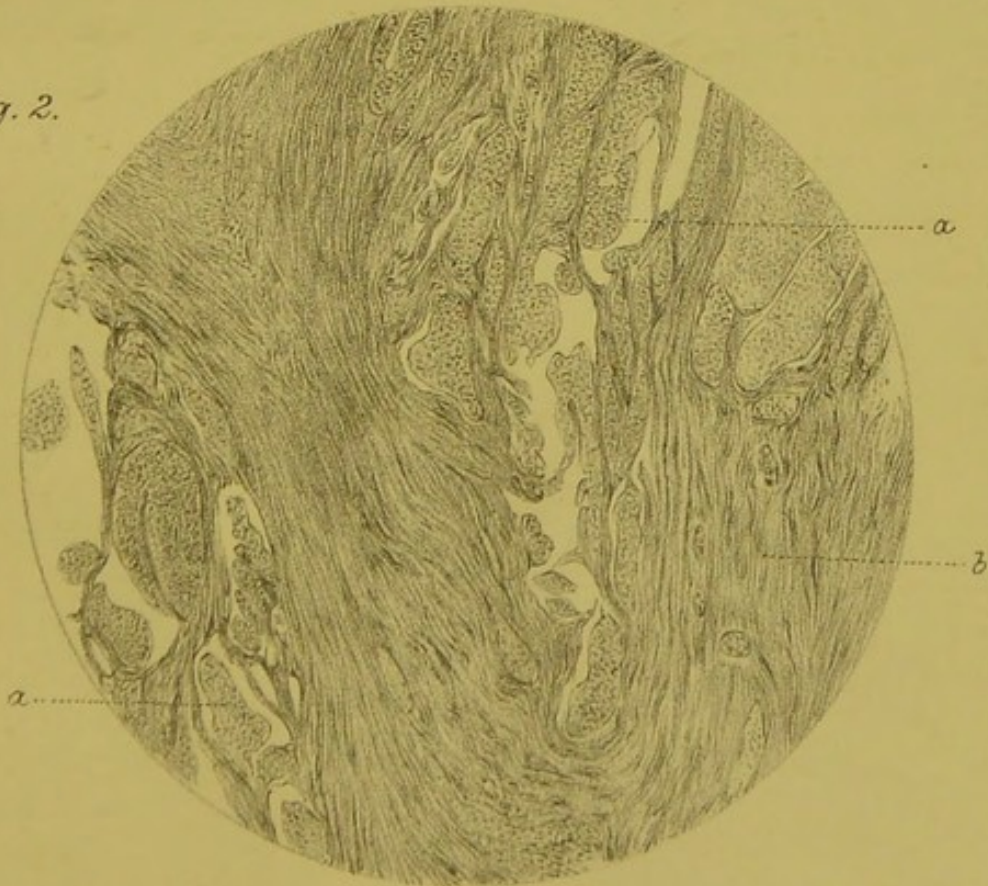


Fig. 2.



F. Huth, Lithr. Edinr.

HYPERTROPHY OF PROSTATE GLAND.

