

A CONTRIBUTION TO THE DEVELOPMENT OF THE PROSTATE
GLAND IN THE HUMAN FEMALE, AND A STUDY OF
THE HOMOLOGIES OF THE URETHRA AND VAGINA OF
THE SEXES. By EVELYN JOHN EVATT, *Professor of Anatomy,*
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IN the human male a fusiform fibro-muscular structure, supporting glandular tissue, is found in relation to the whole length of that part of the urethra which extends from the outlet of the bladder to the deep layer of the triangular ligament: this gland is known as the prostate.

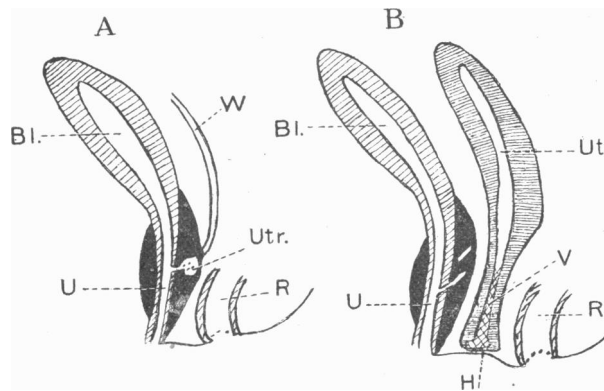


FIG. 1.

Bl., bladder; U., urethra; W., Wolffian duct; Utr., utriculus prostaticus; .
R., rectum; Ut., uterus; V., vagina; H., hymen.

That an organ homologous with this exists in some part of the female urogenital system cannot be doubted; but, owing to the uncertainty of our knowledge regarding the homologies of these organs, it is difficult to know where in the female to look for a structure corresponding to the prostate. In the male we recognise a part of the prostate in relation to the urogenital canal, that is, in relation to that part of the urethra which lies between the attachment of the genital cord and the deep layer of the triangular ligament, and also a part in relation to the urethra between the genital cord and the vesical outlet (fig. 1, A).

The usual method of accounting for the development of the female

urethra, and bringing it into line with the male, is summed up in Cunningham's *Text-book of Anatomy* as follows:—

“The female urethra is developed from that part of the anterior portion of the cloaca which lies below the developing bladder, and above the openings of the Müllerian and Wolffian ducts. The part below these openings, the urogenital canal, during the course of development, becomes

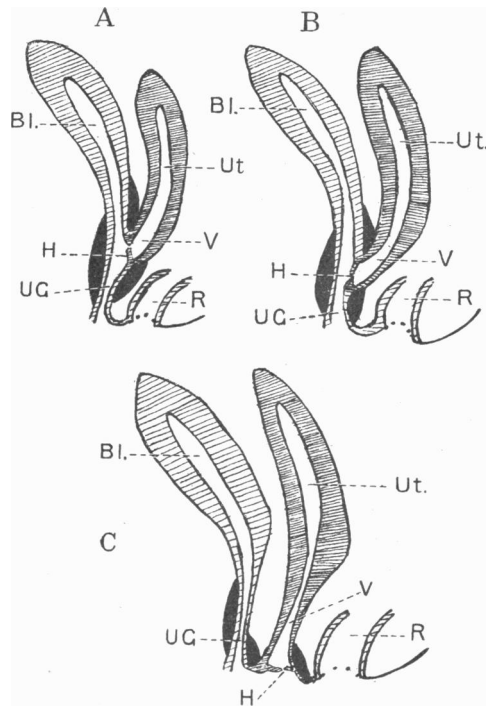


FIG. 2.

Bl., bladder; U., urethra; W., Wolffian duct; Utr., utriculus prostaticus; R., rectum; Ut., uterus; V., vagina; H., hymen; U.C., urogenital canal.

shorter and shorter, and finally forms the epithelium at the bottom of the urogenital cleft, immediately surrounding the urethral and vaginal openings. Thus, in the adult the urethra, which originally led into the urogenital canal, opens into the urogenital fissure; the lower fused portions of the Müllerian ducts, which in the embryo occupy the genital cord, represent the sinus pocularis of the male.

“The vaginal portion of the fused Müllerian ducts is at first relatively very short, and at the point where it opens into the urogenital canal a slight fold appears, which is the future hymen. The vagina increases

rapidly in length, and its opening moves downwards towards the urogenital cleft.

“In the foetus the Wolffian ducts can be traced along each side of the uterus as far as the upper end of the vagina.

“Striped muscular fibres are also found in connection with the female urethra, and are especially plentiful in the lower part of the anterior wall of the passage.”

If this be the correct history of the development of the female urethra and vagina, we should expect to find traces of the prostate in relation to the anterior and posterior walls of the vagina. Fig. 2 represents an attempt to visualise the development of the vagina on the lines suggested above. I have failed to find any prostatic remnants in relation to the posterior vaginal wall, and I have not read of them having been observed in this position.

Quoting from Gray's *Anatomy*:—

“Berry Hart has described the Wolffian ducts as ending at the site of the future hymen in bulbous enlargements, which he has named the Wolffian bulbs, and states that the hymen is formed from these bulbs. He also regards the colliculus seminalis of the male urethra as being formed from the lower part of the Wolffian ducts.

“Ultimately the Müllerian ducts open into the urogenital sinus between the orifices of the Wolffian ducts, and terminate in an elevation named the Müllerian eminence. Berry Hart describes them as ending blindly on this eminence.

“In the female the Müllerian ducts persist and undergo development. The portions which lie in the genital cord fuse to form the uterus and the vagina; the fusion of the Müllerian ducts begins in the third month, and the septum formed by their fused mesial walls disappears from below upwards, and thus the cavities of the uterus and vagina are formed.” Diagrammatically, his view of the relative position of the prostate in the female would also be represented by fig. 2, C.

The development of the vagina in the manner just described would necessitate the growth of a septum between it and the urethra; but Wood-Jones maintains that no such septum exists, and that “the vagina is, for a great part of foetal life, a solid and not an open canal at all.” He says further, “Early in the history of the embryo the Müllerian ducts open into the urogenital sinus at its upper part; late in its history they open at the hind end of the vagina, and for an interval they have no opening at all—the old one being lost, and the new one not yet being formed. No septal division is employed in this change; but as the hind gut, when its cloacal opening is lost, re-establishes communication with the exterior by a

downward growth, so the Müllerian ducts, when this cloacal opening becomes obliterated, tunnel a new passage to the hind end. The active agent in this growth are two epithelial masses that have been described by Berry Hart as the Wolffian bulbs, but to give this name to them is to give a definite idea as to their origin, and this seems to be by no means clear."

Wood-Jones regards the female urethra "as a cloacal remnant in its simplest form," and points out that it does not remain tubular throughout

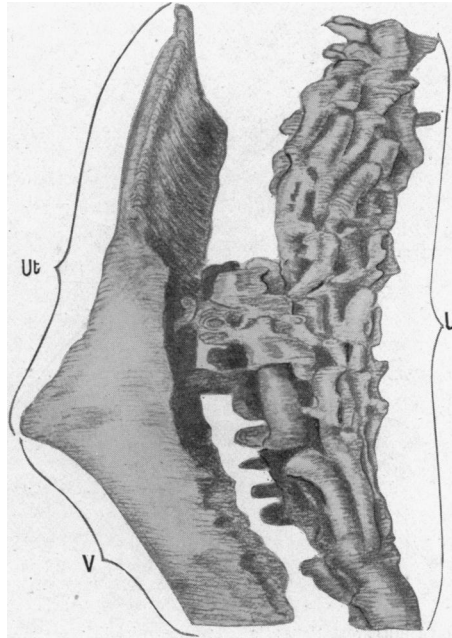


FIG. 3.—Model of female urethra and vagina, reconstructed from sections.

life, but it is for a time "obliterated more or less completely by the proliferation of the vaginal bulbs."

Certain tubules in connection with the female urethra have been described by Skene as the homologues of the prostate ducts in the male. The homology of the urethral glands which are found in the neighbourhood of the vestibule with the prostate was assumed by Virchow as early as 1853. The embryological researches of Tourneaux confirmed this conjecture. He also stated that the glands in the adult female possess a structure which corresponds with that of the prostate in a five or six months old embryo.

J. Griffiths says: "Any structure in the female, homological with the

prostate in the male, must be sought near the fore-part of the urethra, and its immediate neighbourhood in the small mucous glands which are there found." Sir J. G. Simpson, on Hermaphroditism, says: "If we are to find a true prototype in the female of the prostate gland in the male, we shall probably detect it in the follicular glands and structures that exist so abundantly in the course and at the extremity of the female urethra." Gustav Pallin examined a female foetus of three months, criticising, in the light of his observations, the old contention as to whether the ducts

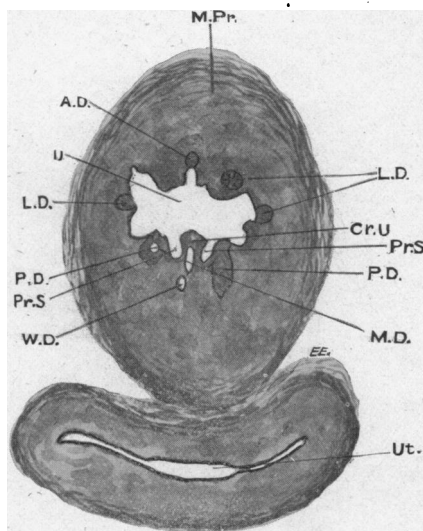


FIG. 4.

M.Pr., musculus prostaticus; Cr.U., crista urethralis; Pr.S., prostatic sinus; A.D., P.D., L.D., prostatic ducts; M.D., Müllerian ducts; W.D., Wolffian duct.

corresponding to the male prostate open into the urethra or vagina. He says: "This embryo affords a decision in favour of neither of these views; that is, they (the ducts) appear to open exactly at the boundary between the two; the ducts have almost the same appearance as those already described on the ventral wall of the urethra of a male embryo of four months . . . hence it is now clear that the lower urethral glands of the female are not homologous with the whole prostate, but only with those glands developed from the cephalic and ventral prostatic positions: and as far as the last are concerned they belong to the urethra proper, and not to the urogenital sinus" (translation).

The foregoing quotations from the works of various observers briefly

summarise our knowledge regarding the homologies of certain structures found in the female with the prostate in the male.

The present writer reconstructed a model of the female urethra and vagina, together with the glandular tissue in relation to these organs (fig. 3). The foetus from which the sections were made was three and a half months old. The urethra of this specimen is enveloped by a fusiform swelling like that of a male prostate, and, like it, it is composed of a stroma of fibromuscular tissue enclosed in a capsule derived from the pelvic fascia; and within this capsule there is a well-developed musculus prostaticus, the

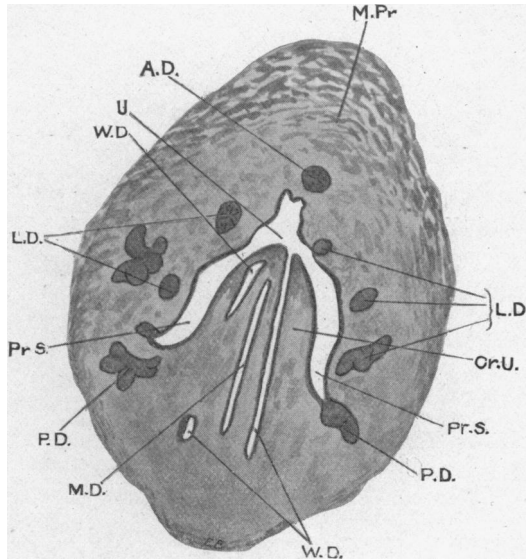


FIG. 5.—Section through prostatic sinuses, lettering as in fig. 4.

sphincter urethrae of later development (fig. 4). The model shows an exuberant growth of glandular tissue, chiefly from the postero-lateral walls of the urethra, as well as also from the anterior wall. Microscopically, the ducts cannot be distinguished from those of the male prostate of the same age.

On comparing the ducts which grow out from the male urethra to form the prostate with those which are derived from the female urethra, we find that they correspond in striking detail as regards their disposition and arrangement, *e.g.* the ducts of the "third lobe" are quite as well developed as in the male of a corresponding age; and the inferior horizontal ducts are also characteristic features; and further, the mode of separation of the ducts, as detailed in a previous paper on the prostate in the male, is the

same in the female; again, the form of the female urethra at three and a half months is closely similar to that of the male of the same age. The crista urethralis is well marked (figs. 4 and 5). The grooves on either side of the crista urethralis forming the prostatic sinus of the male are well defined in the female, and, like the former, receive the prostatic ducts. There can, therefore, be no doubt but that the glandular organ surrounding the

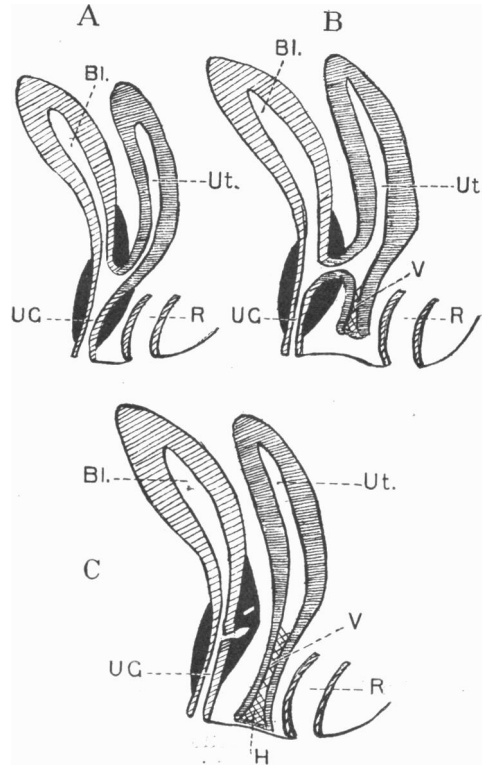


FIG. 6.—Diagrams of growth of female prostate.

whole length of the female urethra is the homologue of the prostate in the male; this indicates that the female urethra is the counterpart of the whole of the prostatic urethra in the male; the corresponding parts in the sexes are represented diagrammatically in fig. 1.

The reconstructed model shows a solid vagina in the female, extending downwards from the level of the attachment of the genital cord. Transverse sections through the middle of the female urethra, as also through the middle of the male prostatic urethra, show the coalesced Müllerian ducts, with the Wolffian ducts entering the urethra (figs. 4 and 5), so that,

as regards the relations of the genital cord to the urethra, the homologies are complete. The vagina cannot be fully accounted for in the male genito-urinary economy. The vagina, whatever its origin may be, is an organ that is probably peculiar to the human female; it does not seem to appear in the male. I find, with Wood-Jones, that no septum exists between the urethra and vagina, and that the vagina is for a great part of foetal life a solid and not an open canal.

I find, further, that early in the history of the female embryo the Müllerian and Wolffian ducts open into the urethra as they do in the adult

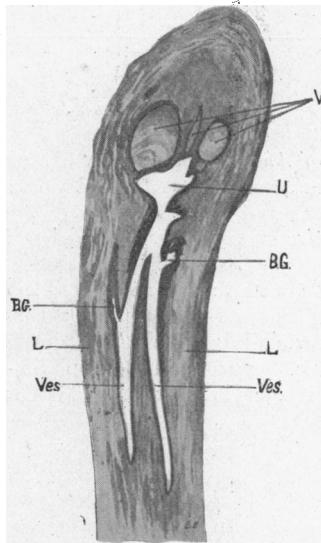


FIG. 7.—Transverse section through urogenital cleft of foetus of 3½ months.
U., uterus; V., vagina; B.G., Bartholin's gland; L., labia; Ves., vestibule.

male. The specimens I have examined show that the vagina is a solid organ; its lining wall is distinct from the contained cellular mass with which it is filled. The cells lining the vagina are columnar; those found within its cavity are large polyhedral structures; further, they are not like the lining cells of the Wolffian ducts; they are probably proliferated from the cells lining the vagina.

The vagina is at first a cæcal diverticulum from the inferior wall of the coalesced Müllerian ducts, and is filled with the cells mentioned above. The blind end of the diverticulum, passing beyond its original attachment to the urethra, reaches towards the surface-epithelium, blends with it, and forms with it a vaginal membrane (the hymen) (fig. 6), in the same manner as the cloacal membrane is formed.

It is probable that the growth of this diverticulum is contingent upon the occlusion of the Müllerian ducts where they open into the urethra. The vagina shows no tendency to be a double organ except at its distal end (fig. 7).

At this stage of development, three and a half months, the urethra is a very patent canal. With the disappearance of the glandular tissue of the prostate, the capsule, with its contained striped muscle, persists; and the former is the source of the fibrous basis of the urethra, the latter constitutes the sphincter urethræ of the adult female urethra.

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