

DISEASES
OF THE
URETHRA
AND
PENIS

E. D'ARCY
McCREA



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DISEASES OF THE URETHRA AND PENIS

BY

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PREFACE

THIS volume represents an attempt to give in some detail an account of present-day knowledge of diseases of the urethra and penis, and to provide as well a means of reference to the literature of this subject. The author is of the opinion that periodical reviews of surgical subjects have become necessities because of the constantly accumulating mass of published material. It is his hope that in its limited field this book may serve such a purpose.

The clinical material utilized comes almost entirely from the Genito-Urinary Department of the Salford Royal Hospital in the charge of Mr. J. B. Macalpine, with whom the author has worked for many years. The work owes its inception to the stimulus of Mr. Macalpine, and it is difficult for the author to express all his indebtedness to him. He is grateful also to his other colleagues at the Salford Royal Hospital for placing valuable material at his disposal, to Dr. Louis Savatard for a fund of information on intra-epidermal carcinoma, and to Professor S. L. Baker for his readiness to examine and advise on pathological material.

The author is fortunate in being indebted to his artist, Miss Dorothy Davison, for work the excellence of which speaks for itself. His thanks are due to the Oxford Press for permission to copy *Figs. 1, 5, and 6*, to Messrs. Longmans, Green & Co. for kindly lending the blocks of *Fig. 2* taken from *Quain's Anatomy*, and to MM. Masson et Cie. for their courtesy in permitting him to reproduce *Fig. 158* from the *Journal de Chirurgie*. The illustrations of instruments have been provided through the kindness of Messrs. The Genito-Urinary Manufacturing Co.

Numerous authorities have been consulted and many references are made to them throughout the text. The opportunity is taken

here of mentioning in particular the names of Cabot, Hinman, Legueu, Marion, Swift Joly, Thomson-Walker, and Young.

In conclusion the author would express his deep appreciation of the considerateness of his publishers, and not only in the manner of production but also in particular for their readiness to publish such a work at a somewhat inauspicious moment.

E. D'ARCY McCREA.

8, *St. John Street*,
Manchester, May, 1940.

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DISEASES OF THE URETHRA AND PENIS

CHAPTER I

THE ANATOMY AND DEVELOPMENT OF THE PENIS AND URETHRA

APPLIED ANATOMY

Penis.—The penis is made up largely of erectile tissue arranged in three longitudinal portions; these are the two corpora cavernosa penis and the corpus cavernosum urethræ, the last of which contains the bulbous and penile stages of the urethra. The proximal portion of the penis, or root of the penis, lies in the perineum and is fixed, the distal part or body of the penis is free; in the root the three corpora are separate, but in the body they lie side by side.

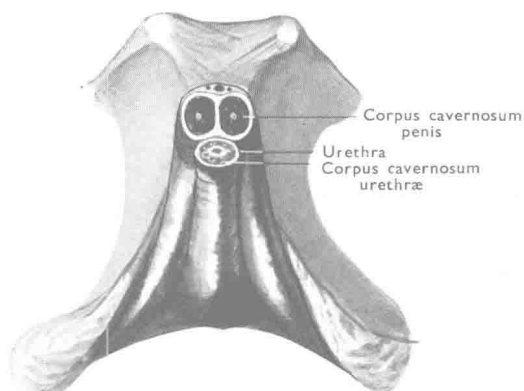


Fig. 1.—Structures composing the root of the penis. The body of the penis is seen in section. (By kind permission from Cunningham's 'Text-book of Anatomy', Oxford University Press.)

Root of the Penis (Figs. 1, 2).—The root of the penis is made up of the bulb of the corpus cavernosum urethræ and the crura of the corpora cavernosa penis. The bulb lies in the median plane and

DISSECTION OF THE MUSCLES OF THE PERINEUM

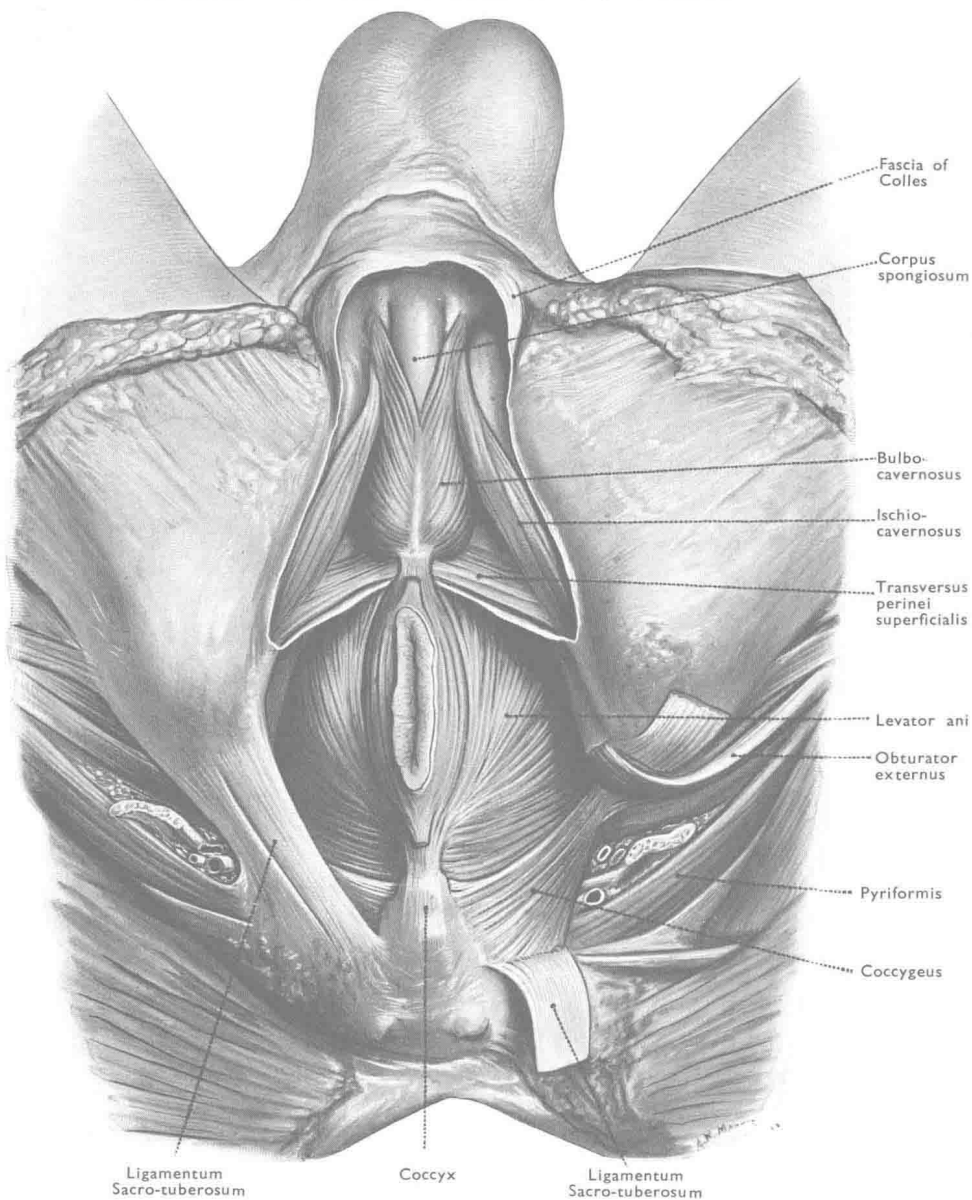


Fig. 2.—The muscles of the perineum. (By kind permission from 'Quain's Anatomy', Longmans, Green & Co.)

is attached to the under surface of the inferior fascia of the urogenital diaphragm. Its posterior extremity is expanded and often shows a notch behind and an incomplete septum within its substance, which indicate the fusion of two separately developed parts. It is covered by the bulbocavernosus muscle, which springs from the inferior fascia and is inserted into a median tendon which runs along the under surface of the bulb. Piercing the inferior fascia of the urogenital diaphragm and entering the bulb are the urethra, the arteries to the bulb, and the ducts of Cowper's glands. Laterally on either side lie the crura of the corpora cavernosa penis, and each crus is firmly attached to the corresponding pubic and ischial rami by its tapering posterior extremity. Each is covered by a dense fibrous-tissue sheath or tunica albuginea, and, externally to this, by the ischiocavernosus muscle, whilst entering each is a deep artery of the penis.

Body of the Penis.—Beneath the subpubic angle the three corpora unite to form the body of the penis, and at this point they are firmly united to the pubic arch by fibrous ligaments, which, diverging somewhat as they approach the dorsal aspect of the penis, leave a passage for the dorsal vessels and nerves. More distally is situated another ligament, the suspensory ligament of the penis; this is a fibro-elastic band which is attached above to the anterior aspect of the symphysis pubis and its aponeuroses, and below to the tunica albuginea of the penis, with expansions to the scrotum. From this point onwards the body of the penis is free and surrounded by skin. The skin is thin, delicate, hairless, and freely mobile; the subcutaneous tissue is loose, free from fat, and contains the superficial dorsal vein and some smooth muscle-fibres which are continuous with those of the dartos of the scrotum. Beneath this lies a thin layer of fascia, the fascia penis, which extends into the prepuce and is continuous posteriorly with the fascia of Colles; deep to this on the dorsal aspect of, and between, the corpora cavernosa penis lie the dorsal vessels and nerves. The corpora cavernosa penis lie side by side enclosed by their tunica albuginea, which forms an incomplete septum between them, the septum pectiniforme. The corpus cavernosum urethræ, surrounding the urethra, lies in a groove on the under aspect of the corpora cavernosa; anteriorly the corpus cavernosum urethræ abruptly expands and forms a cap, the glans penis, covering the blunt terminations of the corpora cavernosa; at the extremity of this the urethra opens through a vertical cleft.

The prepuce is a hood-like fold of skin prolonged to cover the glans either partially or completely; this reduplication of the skin is attached proximally behind the corona of the glans and from here its deep layer is reflected forwards to cover the glans as a layer of skin, modified to resemble mucosa and intimately connected to the erectile tissue. The groove behind the corona receives the name of the retroglandular sulcus. On the under surface of the glans penis a fold of skin, the frænulum of the prepuce, unites the glans to the prepuce, and two small recesses on either side of this are known as the fossæ frænuli.

Blood-supply.—The vascular supply is obtained from the internal pudendal artery through its branches, the deep arteries of the penis to the crura, the arteries to the bulb, and the dorsal arteries of the penis. The veins drain to the pudendal plexus; the dorsal vein, which has on each side of it a dorsal artery, lies in the groove between the corpora cavernosa and passes beneath the arcuate ligament of the pubis to the pudendal plexus.

Lymphatic Drainage.—The following description of the lymphatic drainage of the penis and urethra is based on that given by Rouvière (*Fig. 3*). The cutaneous vessels drain towards the dorsum of the penis and reach the internal, chiefly the supero-internal, group of the superficial inguinal glands of the same side, but occasionally vessels from one side may enter glands of the opposite side.

The lymphatics of the glans, together with those of the glandular and penile parts of the urethra, run with the dorsal vein at first and then form an intercommunicating plexus of lymph-vessels situated in front of the symphysis pubis and suspensory ligament of the penis; from thence the main vessels pass, lying superficially to the spermatic cord, to the superficial inguinal glands (Bruhns), and also to glands, one of which is situated in the femoral canal and another in the external iliac group immediately proximal to this canal. Some vessels pass deep to the spermatic cord to reach another gland of the external iliac group, placed lateral to the vessels (Cunéo and Marcille). Uncommon communications which have been encountered are, first, by means of a lymphatic trunk which, entering the abdomen between the recti abdominis, reaches the hypogastric and external iliac glands, and secondly by a vessel which passes up the femoral canal and enters a gland above the bifurcation of the common iliac artery.

The vessels of the cavernous tissue pass to the presymphysial plexus, which may contain a lymph-node, and from thence, deep to the cord, to the supero-internal group of the superficial inguinal glands; a rare variant is to find a vessel passing to a deep inguinal gland or even to a gland of the external iliac group.



Fig. 3.—The lymphatic drainage of the penis (after Rouvière). A, Superficial inguinal lymph-glands; B, External iliac lymph-glands; C, Common iliac lymph-glands; D, Aortic glands.

The chief lymph-vessels from the bulbous and membranous urethra run with the internal pudendal artery to reach the hypogastric glands (*Fig. 4*); others pass behind the symphysis to the external iliac glands; and some vessels from the membranous urethra pass anterior to the prostate and bladder to reach other glands of the external iliac group (Marcille).

The lymphatics of the prostatic urethra drain with the prostatic vessels to the external iliac and hypogastric groups, and also to glands situated in front of the promontory of the sacrum. Numerous small glands are interposed along their course (Parker).

Nerve-supply.—The nerve-supply originates from the hypogastric ganglion and is derived from the hypogastric nerves of the sympathetic system and the nervi erigentes of the parasympathetic system.

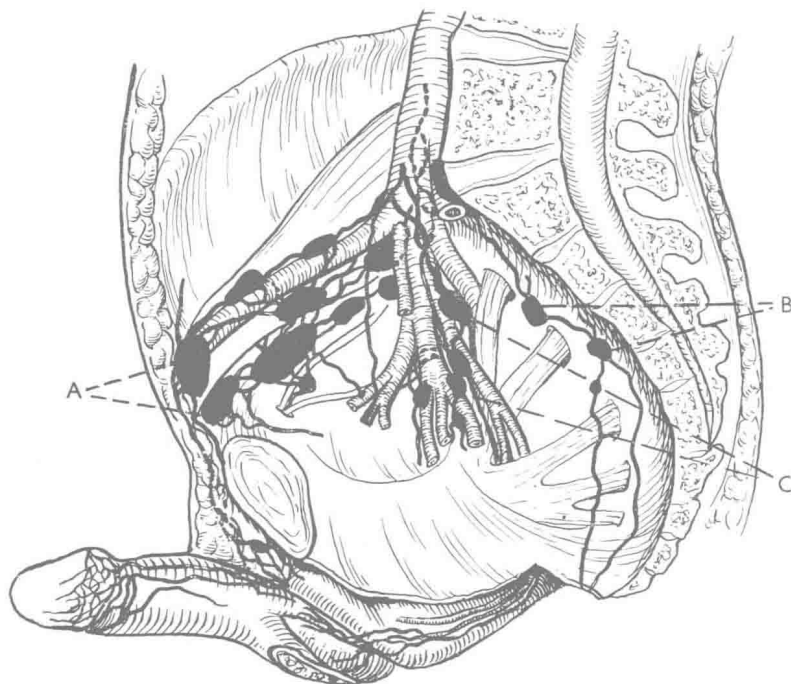


Fig. 4.—The lymphatic drainage of the penis and urethra (after Cunéo and Marcille). A, External iliac lymph-glands; B, Lateral sacral glands; C, Hypogastric lymph-glands.

Urethra.—The male urethra is a canal of about 8 in. in length, which extends from the internal urinary meatus of the bladder to the external urinary meatus of the glans penis (Fig. 5). It is the channel for the urine and the secretions of the testis, prostate, glands of Cowper, and urethral glands. In its course the urethra describes a double curve resembling the letter S; the first curvature, the subpubic curve, is that of the fixed urethra and is concave forwards and upwards and extends as far as the attachment of the suspensory ligament of the penis; the second curvature is that of the pendulous urethra and is open downwards—it disappears if the penis is in erection, when the curve of the whole canal becomes U-shaped.

Anatomically the urethra is considered in three parts—the prostatic, membranous, and cavernous stages.

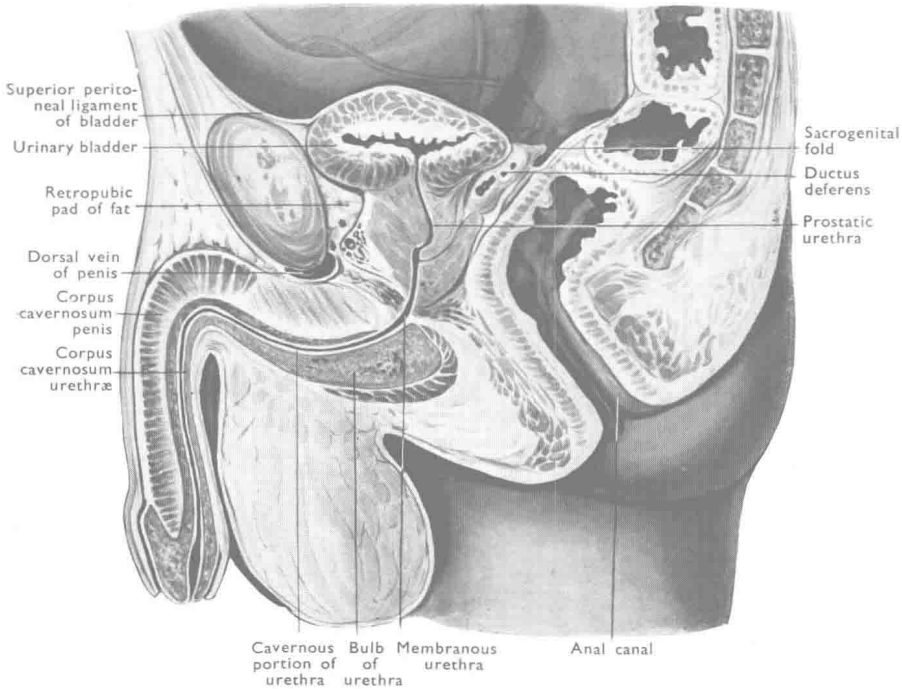


Fig. 5.—Adult male pelvis in median section. (By kind permission from Cunningham's 'Text-book of Anatomy', Oxford University Press.)

The *prostatic urethra* extends from the bladder to a point immediately in front of the apex of the prostate; it is about $1\frac{1}{4}$ in. in length, is the widest part of the canal (33–45–30 Charrière), and is easily dilatable. It is spindle-shaped, and its crescentic transverse section, with the concavity directed posteriorly, is the result of the projection into the posterior wall of the urethra of a longitudinal ridge, the *crista urethralis* (Fig. 6). Into the grooves, the prostatic sinuses, on either side of the crista, open the ducts of the prostate; at the summit of the ridge which forms the *verumontanum* is found a small blind pit, $\frac{1}{4}$ to $\frac{1}{2}$ in. in depth, the *utriculus prostaticus*, and on either side of this lies the small opening of an ejaculatory duct. Variations in the arrangement of these have been studied by Fanz and McCrea, who describe three main types: in the first the

ejaculatory ducts open upon the verumontanum lateral to the orifice of the utricle; in the second the ducts open in common with the utricle, their orifices being either on its floor, wall, or lip; whilst

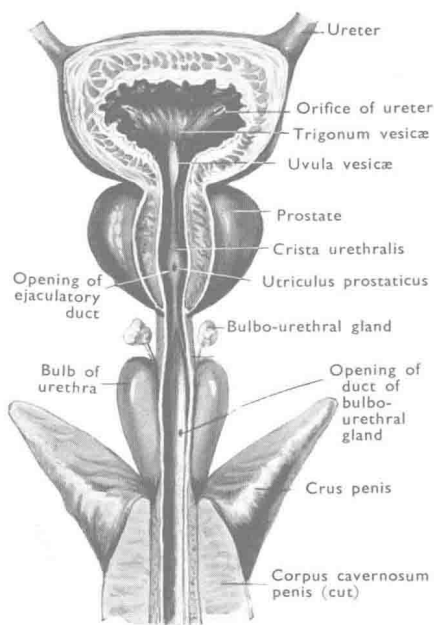


Fig. 6.—Dissection showing the trigone of the bladder and the posterior wall or floor of the urethra in its prostatic, membranous, and the upper part of its cavernous subdivisions. (By kind permission from Cunningham's *Text-book of Anatomy*, Oxford University Press.)

in the third the ejaculatory ducts open on the summit of the verumontanum without any visible opening of the utricle. The utriculus prostaticus is a remnant of the Müllerian ducts, and is the homologue of the vagina in the female; it has been stated that the verumontanum and ejaculatory ducts contain erectile tissue and become swollen during ejaculation, but McCarthy, Ritter, and Klemperer find that although rich in blood-vessels they do not possess cavernous tissue; Begg has reviewed the anatomy and physiology of the verumontanum.

The *membranous urethra* is the shortest stage of the urethra, about $\frac{1}{2}$ in. in length, and unites the prostatic portion to the penile; it passes for the most part between the layers of the urogenital diaphragm, where it is firmly fixed, but the terminal portion before entering the corpus cavernosum urethræ, half an inch in front of the latter's posterior extremity, lies superficial to the inferior fascia of the urogenital diaphragm. This is, with the exception of the meatus, the narrowest and least dilatable portion of the canal (27 Charrière) and is stellar in cross section. In its course through the pelvic diaphragm the urethra is surrounded by the sphincter urethræ membranaceæ, while behind and to either side lie the bulbo-urethral glands or glands of Cowper. It pierces the inferior fascia of the urogenital diaphragm at a point about 1 in. from the arcuate ligament of the pubis.

The *cavernous urethra* is the longest stage and extends from the point at which the membranous urethra reaches the bulb to the external urinary meatus. The various aspects assumed by this opening have been described by Pasteau. The bulbous portion is the widest part of the urethra and often presents a shallow cul-de-sac posteriorly; on the inferior wall of this region the ducts of Cowper's glands open. The intermediate part of the canal is narrower than that of the bulb and of fairly uniform calibre (27-30 Charrière) until the glans penis is reached, where another dilatation occurs, the fossa navicularis; this opens on to the surface by a vertical cleft, the external urinary meatus, which is frequently the narrowest and least dilatable portion of the whole canal. Sometimes another narrowing is found between the fossa navicularis and the penile urethra. On cross section the cavernous urethra appears as a horizontal slit except in the glans penis, where it assumes a vertical aspect; when empty the walls of the canal are in contact throughout.

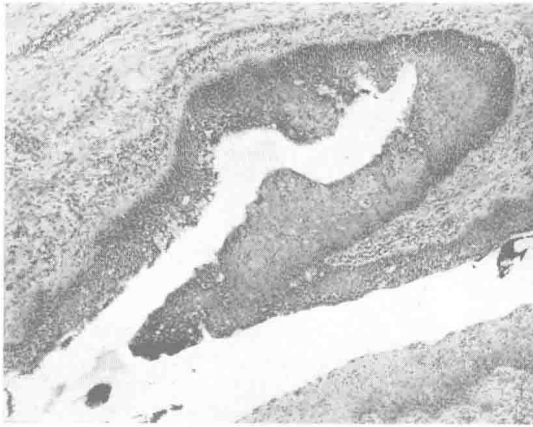


Fig. 7.—Photomicrograph of a urethral lacuna opening into the urethra.

Urethral Mucosa and Glands.—The prostatic urethra is lined by transitional epithelium which merges into the columnar epithelium of the membranous and cavernous urethræ, whilst in the fossa navicularis squamous epithelium is present. The lacunæ of Morgagni (Fig. 7) are simple recesses of the mucosa, and are variable in number and size; the larger ones lie in the midline of the superior wall, with their orifices looking towards the meatus; their depth

varies from 5 mm. to a recorded maximum of 27 mm., and their appearance has been compared to that of a swallow's nest; the largest and most constant is the lacuna magna, or sinus and valve of Guérin, which is situated on the superior wall between 1 and 2 cm. from the meatus. The smaller lacunæ, which are variable in number and size, lie on the lateral walls. The urethral glands proper are of three types, and are described by Lichtenberg as: (1) Tubo-alveolar, which are sub-epithelial glands in relation to the epithelium, and communicate with the urethra by narrow ducts;

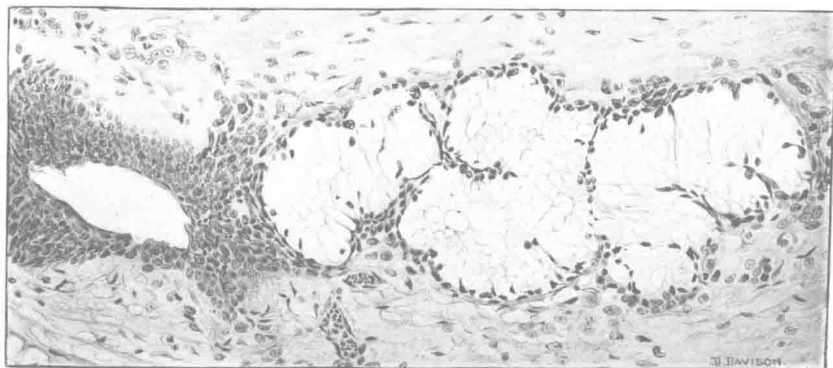


Fig. 8.—Drawing from a section showing a urethral gland in the vicinity of a lacuna.

(2) Depressions of glandular shape, probably not true glands in man; and (3) Submucous glands, the glands of Littré, which are few and rudimentary in the prostatic urethra, scattered in the membranous, and plentiful in the cavernous urethra, where they open mainly on the superior and lateral walls. Their ducts, which vary in length, open either upon the surface of the mucosa or into the lacunæ, and their orifices are directed towards the meatus (*Fig. 8*).

The urethra possesses a muscular coat of two layers, an inner longitudinal, which is a continuation of longitudinal fibres of the bladder, and an outer circular coat. The circular coat of the internal urinary meatus is largely composed of unstriated muscle, the internal vesical sphincter, but there exists also a striated sphincter, the external vesical sphincter (*Fig. 9*). The prostatic urethra possesses a circular coat, mainly made up of striated muscle, but much broken up by the prostatic tubules, whilst the membranous urethra is surrounded by the striated sphincter urethræ membranaceæ

(Guthrie's muscle). The longitudinal coat is best marked proximally, and gradually fades away in the region of the cavernous urethra.

For clinical purposes the urethra is described as being composed of two portions, a posterior and an anterior, which are separated from one another by the sphincter urethræ membranacæ; the anterior urethra is again subdivided for descriptive purposes into perineo-scrotal, penile, and glandular stages. The narrowest parts of the canal are at the external meatus, the junction of the fossa navicularis and penile urethra, the membranous urethra, and the internal urinary meatus. The wall is thinnest and least protected in the membranous portion and immediately distal to the inferior fascia of the urogenital diaphragm, at which point the superior wall in particular is unprotected.

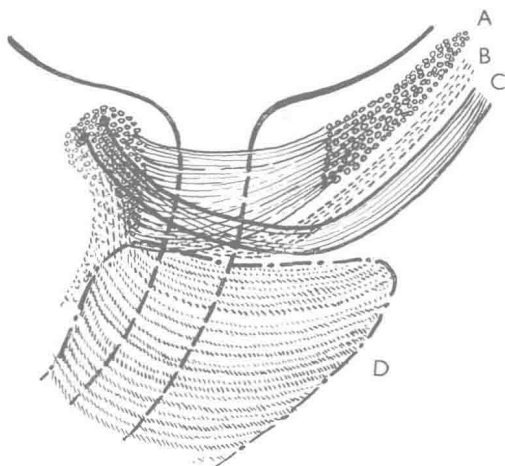


Fig. 9.—The musculature of the internal urinary meatus. *A*, The unstriated sphincter; *B*, Striated sphincter; *C*, Posterior longitudinal fibres of the bladder joining the sphincter; *D*, Striated urethral fibres overlying the prostate.

DEVELOPMENT OF THE URETHRA AND PENIS

The development of the urogenital organs is described by Tourneux, Born, Keibel, and Felix. The cloaca, which is a derivative of the hind-gut, is in embryos of 1.4 mm. in contact with the ectoderm ventrally, and the two layers of ectoderm and endoderm together constitute the cloacal membrane (*Fig. 10*). Later the cloaca and cloacal membrane are separated into two by the development and downgrowth of the septum between the allantois and gut, the urorectal septum. In this manner the urogenital sinus and membrane are formed anteriorly, and the rectum and anal membrane posteriorly (*Fig. 11*). In embryos of 11 mm. Felix finds that the urogenital sinus shows differentiation into two parts, a dorsal vesico-urethral anlage and a ventral phallic portion; the former, the *pars pelvina* of

Felix, receives the allantois and mesonephric ducts and is joined by an isthmus to the pars phallica. The pars pelvina is destined to form the bladder and intrapelvic portion of the urethra, and the pars phallica the extrapelvic portion of the urethra (see Fig. 13).

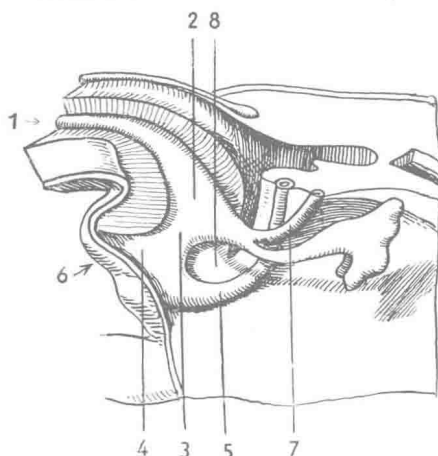


Fig. 10.—The cloacal region of an 11.5-mm. embryo (after Keibel). 1, Urachus; 2, Vesico-urethral anlage; 3, Isthmus; 4, Pars phallica of the cloaca; 5, Rectum; 6, Cloacal membrane; 7, Wolffian duct; 8, Urorectal septum.

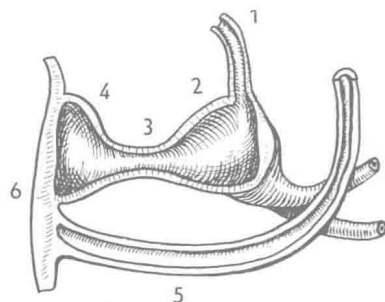


Fig. 11.—The cloacal region of an 11-mm. embryo (after Keibel and Malb.). 1, Urachus; 2, Vesico-urethral anlage; 3, Isthmus; 4, Pars phallica of the cloaca; 5, Rectum; 6, Cloacal membrane.

The external genitalia are developed in the ectodermal cloacal fossa, sexual differentiation commencing during the third month of intra-uterine life (Fig. 12). At an early stage a swelling is formed in the midline at the anterior extremity of the cloacal fossa, the cloacal tubercle; then upon this a second swelling develops, the phallus, and together they form the genital eminence. Cranially to the phallus the cloacal tubercle forms a crescentic swelling, the genital tubercle, which later gives rise to the right and left genital swellings or folds. The phallus is the anlage of the penis which, as it grows, carries with it the phallic portion of the urogenital sinus; the glans becomes marked off by a groove in embryos of 21–26 mm. The primitive slit-like urogenital opening is formed by the breaking down of the phallic portion of the urogenital membrane in embryos of 12 mm.

Differentiation in the male occurs as follows: The phallus grows rapidly at its base so that the glans and urogenital opening are separated from the anus. The urogenital sinus (pars phallica) is carried with, and extends into, the phallus (Fig. 13). In the