

## REVIEW

# Anatomy and Physiology of the Clitoris, Vestibular Bulbs, and Labia Minora With a Review of the Female Orgasm and the Prevention of Female Sexual Dysfunction

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This review, with 21 figures and 1 video, aims to clarify some important aspects of the anatomy and physiology of the female erectile organs (triggers of orgasm), which are important for the prevention of female sexual dysfunction. The clitoris is the homologue of the male's glans and corpora cavernosa, and erection is reached in three phases: latent, turgid, and rigid. The vestibular bulbs cause "vaginal" orgasmic contractions, through the rhythmic contraction of the bulbocavernosus muscles. Because of the engorgement with blood during sexual arousal, the labia minora become turgid, doubling or tripling in thickness. The corpus spongiosum of the female urethra becomes congested during sexual arousal; therefore, male erection equals erection of the female erectile organs. The correct anatomical term to describe the erectile tissues responsible for female orgasm is the female penis. Vaginal orgasm and the G-spot do not exist. These claims are found in numerous articles that have been written by Addiego F, Whipple B, Jannini E, Buisson O, O'Connell H, Brody S, Ostrzenski A, and others, have no scientific basis. Orgasm is an intense sensation of pleasure achieved by stimulation of erogenous zones. Women do not have a refractory period after each orgasm and can, therefore, experience multiple orgasms. Clitoral sexual response and the female orgasm are not affected by aging. Sexologists should define having sex/love making when orgasm occurs for both partners with or without vaginal intercourse. *Clin. Anat.* 26:134–152, 2013. © 2012 Wiley Periodicals, Inc.

**Key words:** clitoris; vulva; urethra; penis; G-spot; sex education; orgasmic dysfunction

## INTRODUCTION

The anatomy and physiology of the female orgasm is often neglected, and female sexuality is still widely considered as it was 100 years ago when Freud invented the term vaginal orgasm without any scientific basis. For years, it has been assumed that the female orgasm is due to the female erectile organs (Masters and Johnson, 1966; Hite, 1981; Laqueur, 1992; Puppo et al., 2008a; Puppo, 2011a, 2011c).

In the last few decades, in sexology and in sexual medicine (Goldstein, 2000; Goldstein et al., 2006; Komisaruk et al., 2006; San Diego Sexual Medicine, 2012), the lack of concrete knowledge about the female erectile organs (triggers of orgasm) has led

to the development of many concepts about female sexuality, such as: the clitoral system, "the vagina is a singularly female possession ... hence the main body of the vagina would not have a vestigial counterpart in the male" (Sherfey, 1973), the clitoral

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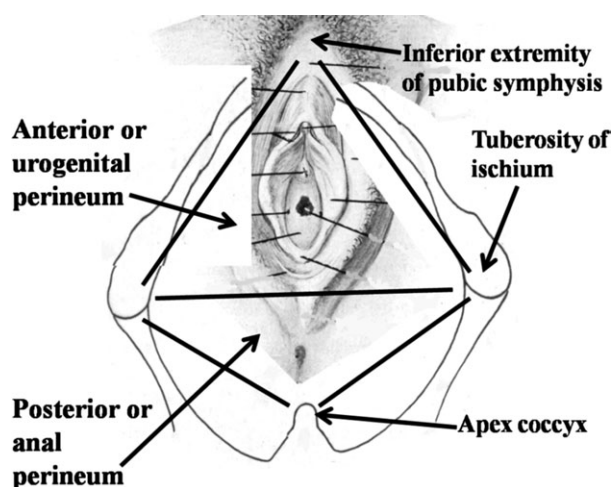
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(i.e., clitoris-urethra-distal vagina) complex, the clitoral bulbs, the internal clitoris, the clitoris composed of two arcs, the clitoris root made of two clitoral bodies and two clitoral bulbs, vaginal penetration causes close contact between the inner clitoris and the distal anterior vaginal wall, the Grafenberg spot (i.e. G-spot), the G-spot represents that part of the urethra that contains the periglandular or paraurethral tissue, the genitosensory component of the vagus nerve, Halban's fascia erogenous zone, the periurethral glans, the vaginal anterior fornix erogenous zone, female ejaculation, the anterior vaginal wall as an organ for the transmission of active forces to the urethra and the clitoris (Addiego et al., 1981; Perry and Whipple, 1981; Hoang et al., 1991; Levin, 1991, 2002, 2011; Ingelman-Sundberg, 1997; O'Connell et al., 1998, 2004, 2005, 2008; Chalker, 2000; Goldstein, 2000; Komisaruk et al., 2004, 2006; Meston et al., 2004; O'Connell and DeLancey, 2005; Goldstein et al., 2006; Yang et al., 2006; Levin and Riley, 2007; Buisson et al., 2008, 2010; Thabet, 2009; Foldes and Buisson, 2009; Buisson, 2010; Jannini et al., 2010, 2012; Salonia et al., 2010; Dwyer, 2012; Ostrzenski, 2012; San Diego Sexual Medicine, 2012), the clitoris formed by crown-corpus-crura and the woman's glans surrounding the urethral opening (Sevely, 1987, 1988; Levin, 1991), the complete clitoris consists of 18 parts (Chalker, 2000), the urethrovaginal space, the presence of pseudocavernous tissue (clitoral bulb) in the anterior vaginal mucosa, the vaginal orgasm, the woman's history of vaginal orgasm is discernible from her walk, the vaginal orgasm is more prevalent among women with a prominent tubercle of the upper lip (Goldstein et al., 2006; Gravina et al., 2008; Nicholas et al., 2008; Brody and Costa, 2011; Jannini et al., 2012), the variation in the distance between a woman's glans clitoris and her urethra predicts the likelihood that she will experience orgasm in intercourse (Wallen and Lloyd, 2011), the premature female orgasm (Carvalho et al., 2011), persistent genital arousal disorder (Korda et al., 2009; Rosenbaum, 2010), orgasm and resolution are not essential in Basson's model of the sexual response cycle (Basson et al., 2005; Rosen and Barsky, 2006), which are without scientific (i.e., embryological, anatomical and physiological) basis (Dickinson, 1949; Grafenberg, 1950; Masters and Johnson, 1966; Hite, 1981; Masters et al., 1988; Laqueur, 1992; Hines, 2001; Puppo, 2006a, 2006b, 2011a, 2011b, 2011c, 2012b; Vicentini, 2008; Puppo et al., 2008a; Shafik et al., 2009; Youtube/newsexology, 2009, 2010; Magnin, 2010; Kilchevsky et al., 2012; Puppo and Gruenwald, in press) and they are not accepted or shared by anatomists (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Standring, 2008; Netter, 2010).

The anatomy of the female erectile organs is described in human anatomy textbooks (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Standring, 2008; Netter, 2010; Puppo, 2011a), but in sexology textbooks (Komisaruk et al., 2006), the anatomy and physiology of the clitoris, other female erectile organs, and of the female orgasm are often neglected (Puppo, 2011c). "In anatomy textbooks there is a separation between the embryological



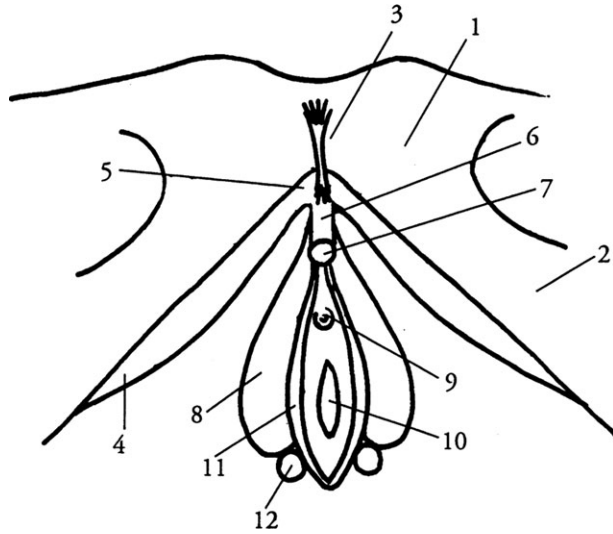
**Fig. 1.** The female perineum (from Puppo, 2011d).

development of the internal and external genital organs in males and females. It is important to know this because it is related to the function of these organs, that is, the internal genitals have a reproductive function while the external ones have the function of giving pleasure" (Puppo, 2011a).

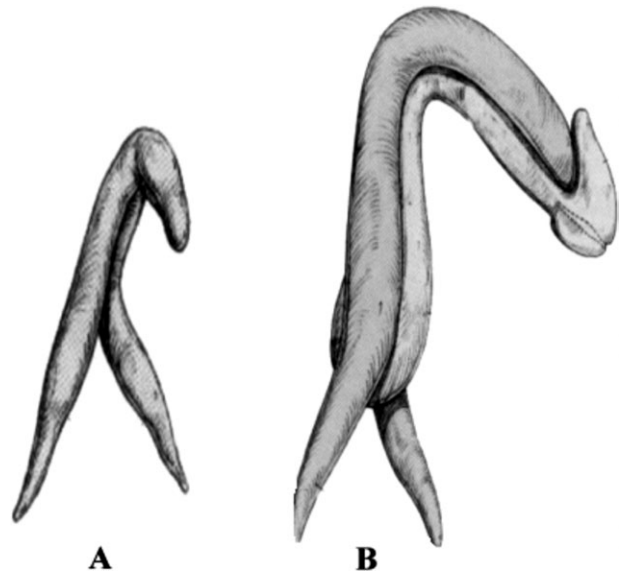
The vulva (i.e., female external genitalia) is formed by the labia majora and vestibule, with its erectile apparatus: clitoris (glans; body; crura or roots), vestibular bulbs with the pars intermedia (i.e., female corpus spongiosum), and labia minora. These structures are external to the perineal membrane (i.e., urogenital diaphragm), in front of the pubic symphysis and in the anterior perineal region (Figs. 1 and 2) (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Standring, 2008; Stein and DeLancey, 2008; Netter, 2010; Puppo, 2011a, 2011d).

The labia majora are two prominent cutaneous folds and from the mons pubis, reach up to the perineum, and correspond to the male scrotum; normally they are in contact and separated only by the vulvar cleft (rima pudendi). When the labia majora are separated, two smaller folds are seen, the labia minora, which anteriorly embrace the clitoris, and in the space between them (i.e., vaginal vestibule) is found the vaginal orifice containing the hymen or its remains and the urethral orifice (Hartmann, 1913; Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Friedman et al., 2004; Standring, 2008). The mucosa of the vaginal vestibule, which originates from the embryonic endoderm, is nonkeratinized (Farage and Maibach, 2006). The term "periurethral glans" (Levin, 1991, 2002) for this area (i.e., vaginal vestibule) is an incorrect anatomical term (Puppo et al., 2008a; Puppo, 2011a, 2011c).

Female sexual physiology was first described in Dickinson's textbooks in 1949 and subsequently by Masters and Johnson in 1966 (Puppo, 2011c). The human sexual response can be physiologically described as a cycle with four phases: excitement, plateau, orgasm, and resolution (i.e., the period of return to the unaroused state). During sexual



**Fig. 2.** The vulva (without labia majora. From Puppo, 2011d). 1, Pubis; 2, ischiopubic ramus; 3, suspensory ligament; 4, root of the clitoris; 5, angle of the clitoris; 6, body of the clitoris; 7, glans; 8, vestibular bulb; 9, urethra; 10, vagina; 11, labia minora; 12, Bartholin's gland.



**Fig. 3.** The clitoris and the penis (from Puppo et al., 2008b). **A:** Clitoris, corpora cavernosa and glans; **B:** penis, corpora cavernosa and corpus spongiosum (glans, pars intermedia, and bulb).

arousal, there is increase in blood flow to the erectile tissues of the female: an engorgement with erection as seen in the penis (Masters and Johnson, 1966; Masters et al., 1988; Argiolas and Melis, 2003; Puppo, 2011a).

This review aims to clarify some important aspects of the anatomy and physiology of the female erectile organs and of the female orgasm, which are necessary for correct (i.e., scientific) sex education and for female sexual dysfunction prevention (Puppo, 2012a, 2012c, 2012d).

## THE CLITORIS

The clitoris is the homologue of the male's glans and corpora cavernosa (Fig. 3) (Puppo et al., 2008b; Standring, 2008; Puppo, 2011a). The clitoris is an external organ and has three erectile tissue parts, most of which lie beneath the skin: the glans, the body, and the crura. The clitoris, in the free part of the organ, is composed of the body and the glans located inside of the prepuce, which is formed by the labia minora (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Standring, 2008; Netter, 2010; Puppo, 2011a). The size of the clitoris varies considerably (Dickinson, 1949). The clitoral body in the flaccid state is 1–3 cm long (Lloyd et al., 2005; Puppo, 2011a). The diameter of the glans ranges from the 3 to 8 mm, and the most common diameter is 4–5 mm (Fig. 4) (Dickinson, 1949).

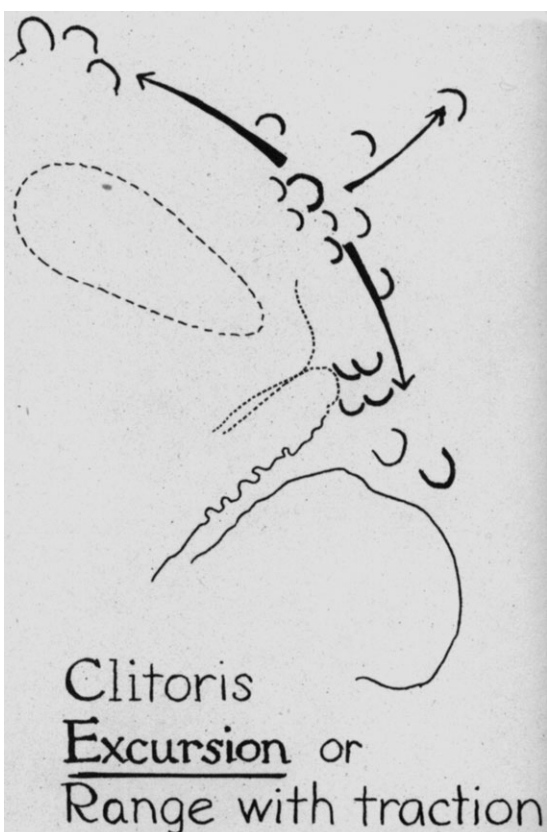
Parity influences clitoral size but age, height, weight, and oral contraceptive use do not (Verkauf et al., 1992). Studies by Dickinson (1949) found that clitoral size "is not necessarily a criterion of responsiveness. A very tiny clitoris, so thin and low it can

hardly be picked up by the fingers, may be associated with powerful orgasm from friction or pressure on the organ alone" "the other relevant finding is the extent of excursion, or the range of mobility of the glans" (Fig. 5). The clitoris is attached by the suspensory ligament to the front of the symphysis pubis (Dickinson, 1949; Testut and Latarjet, 1972); the suspensory ligament is a structure with superficial and deep components (Chiarugi and Bucciante, 1975; Rees et al., 2000).

If the genital tubercles are hypoplastic or fail to fuse, the clitoris may be extremely small or absent (Neill and Lewis, 2009). "Isolated absence of the clitoris is a rare entity with medical and sexual implications for patients" (Martín-Torres et al., 2000; Bellemare and Dibden, 2005). The dimensions of the clitoris vary; "clitoromegaly is defined as a clitoral area greater than 35–45 mm<sup>2</sup>" (Oyama et al., 2004). Acquired clitoral enlargement is relatively rare in adult females and occurs under a variety of circumstances, "the causes of clitoromegaly can be classified into four groups: hormonal conditions, nonhormonal condi-



**Fig. 4.** Sizes of clitoris (from Dickinson, 1949).



**Fig. 5.** Clitoral excursion (from Dickinson, 1949).

tions, pseudoclitoromegaly and idiopathic clitoromegaly" (Copcu et al., 2004). Pseudohypertrophy of the clitoris has been reported in small girls due to masturbation with the chronic manipulation of the skin of the prepuce leading to mechanical trauma, which expands the prepuce and labia minora resulting in clitoral enlargement (Copcu et al., 2004).

Clitoral reduction is a procedure in which the corpora cavernosa are partially removed and the glans clitoris is left intact (Oyama et al., 2004); "the goals of clitoroplasty are to achieve a normal genital appearance and to preserve sensation with a satisfactory sexual response" (Sayer et al., 2007). Clitoral reconstruction is feasible in patients with genital mutilation and can reduce clitoral pain and improve pleasure (Abdulcadir et al., 2012).

The glans of the clitoris, as in the male, contains cavernous tissue and is in direct contact with the skin due to the absence of a tunica albuginea. The prepuce covers all or part of the glans, its size varies considerably, and is comparable to the foreskin of the penis; the prepuce is a specialized erogenous tissue in both males and females. The fetal development of the prepuce and the glans in male and females is similar; they are fused together and the cavity of the prepuce is formed during the first year after birth and if they do not separate, it is possible, as in the male, for adhesions and resultant phimosis of the clitoris to result (Dickinson, 1949; Cold and Taylor, 1999;

Puppo, 2011a); "absence of the prepuce has been noted four times, without history of circumcision" (Dickinson, 1949). Clitoral phimosis may be associated with clitoral pain syndromes (Munarriz et al., 2000). Smegma in infants and preadolescent girls may develop under the prepuce, and the irritation caused by its accumulation may result in adhesions forming between the glans and prepuce, in smegmatic pseudocyst, and in phimosis of the clitoris (Dickinson, 1949; Cold and Taylor, 1999; Goldstein and Burrows, 2007; Puppo, 2011a). Therefore, it is important to maintain proper hygiene of the vulva.

The clitoris is a specialized structure covered with a stratified squamous epithelium that is thinly cornified. There are no sebaceous, apocrine, or sweat glands present (Neill and Lewis, 2009). The body of the clitoris consists of two corpora cavernosa, which become turgid with sexual arousal. The corpora cavernosa begin with the roots or crura (i.e., the hidden part of the clitoris), which are located alongside the ischiopubic ramus. The roots are joined under and in front of the pubic symphysis and constitute the body of the clitoris, which terminates in the glans. The roots are covered by the ischiocavernosus muscles (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Yang et al., 2006; Standring, 2008; Netter, 2010; Puppo, 2011a).

The perineal muscles are innervated by branches of the pudendal nerve derived from Onuf's nucleus; "pudendal nerve integrity may play a role in female sexual dysfunction" (Connell et al., 2005). Onuf's nucleus is located in the sacral levels of the spinal cord and is formed by motoneurons innervating the perineal muscles; the number and the size of these neurons are sexually dimorphic: this dimorphism is mediated by androgens (in the absence of these hormones the motoneurons die by apoptosis) with ciliary neurotrophic factor and other trophic factors (Catala, 2002). Because of this, in females, the ischiocavernosus muscles are much thinner than their male counterparts. Their contraction during female arousal results in a surge of blood in the crura toward the corpora cavernosa of the clitoris and compression of the deep dorsal veins, contributing to erection of the clitoris (Dickinson, 1949; Testut and Latarjet, 1972; Puppo, 2011a).

The ischiocavernosus muscles, like the bulbocavernosus muscle, are mixed muscles (even if histologically they are both striated). During erection, they produce a continuous involuntary reflex hyper-tonic contraction, which is important for maintaining erection (Shafik, 1995; Puppo, 2011a). The erectile tissue of the corpora cavernosa is made up of a system of caverns (i.e., trabeculae and sinusoidal spaces) covered by the tunica albuginea. The two corpora cavernosa are separated by a fibrous septum (Yang et al., 2006; Puppo, 2011a).

The dorsal nerves of the clitoris travel along the dorsal aspect of clitoris in the 11 and 1 o'clock positions, and at the junction of the glans with the clitoral body, they enter the glans beneath the corona and further branch (Ginger et al., 2011a). Large sensory corpuscles have been recognized morphologically in the human external genitalia for more than a century (Martin-Alguacil et al., 2006).

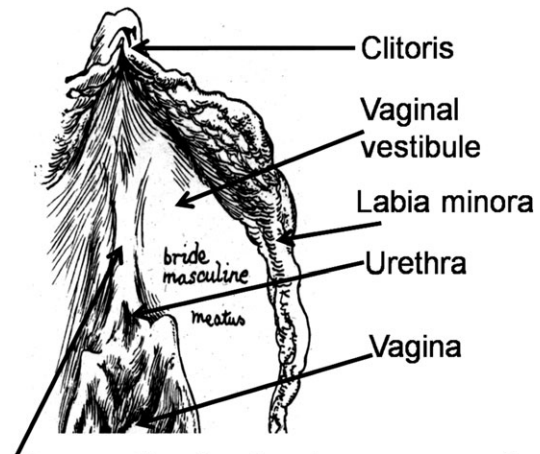
The glans is rich in nerve endings and in genital corpuscles (characteristic receptors of the external genitals), and among these, as in males, Krause-Finger corpuscles predominant. These corpuscles are more concentrated in the female than in the penis (Dickinson, 1949; Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Yang et al., 2006; Puppo, 2011a). Studies by Johnson and Kitchell (1987) revealed that penile mechanoreceptors are more responsive when the penis is erect or near body temperature. Clitoral receptors often have multiple innervations and may receive 8–10 nerve fibers each. This may facilitate transmission of erogenous signals to cranial centers (Chiarugi and Bucciante, 1975; Halata and Munger, 1986; Cold and Taylor, 1999; Puppo, 2011a).

The clitoris has a unique function—sexual pleasure. Studies by Dickinson (1949) and Masters and Johnson (1966) have shown erection and an increase in size (especially the diameter) of the clitoris during sexual arousal. During the plateau phase, they also observed that at the height of arousal and orgasm there is “retraction” of the glans into the prepuce (Masters and Johnson, 1966; Masters et al., 1988). “Clitoral erection causes the shaft to retract into the swollen prepuce or clitoral hood and occurs in every woman, regardless of the type of stimulation, coital position, degree of clitoral tumescence or the initial clitoral size” (Sherfey, 1973). This occurs because in adult women, the size of the glans is much smaller than that in males and does not grow during puberty. In fact, it does not enlarge during sexual arousal. In addition, during sexual arousal, the female prepuce does not retract as it does in males, because it is continuous with the labia minora. So with erection of the body of the clitoris, there is the apparent disappearance of the glans within the prepuce (Masters and Johnson, 1966; Masters et al., 1988; Puppo, 2011a).

It is said that the root of the clitoris is made of two clitoral bodies and two bulbs (Buisson et al., 2008; Foldes and Buisson 2009; Buisson, 2010). Buisson stated that the clitoris is composed of two arcs, the first consisting of two corpora cavernosa along the right and left ischiopubic ramus, with a length of 12–15 cm; they join on the summit of the vulva to bend 90° forward; the raphe ends in the glans clitoris, the visible part of the clitoris. The second arc consists of two bulbs that surround the lateral walls of the vagina. However, Buisson’s statement is not corroborated by any embryological, anatomical, or physiological evidence: the clitoris is not composed of “two arcs.” The clitoral roots are not “made of two clitoral bodies and two bulbs” (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Standring, 2008; Netter, 2010; Puppo, 2011a, 2011b, 2011c).

## THE VESTIBULAR BULBS

The vestibular bulbs correspond to bulb of the penis (Figs. 2 and 3). They are two erectile organs situated in the anterior region of the perineum (i.e., bulbo-clitoral region). Anteriorly, the two bulbs are joined together, under the vestibule of the vagina,



Bride masculine (i.e. female corpus spongiosum or pars intermedia)

**Fig. 6.** The female corpus spongiosum (from Dickinson, 1949).

with the commissure of the bulbs, and through the pars intermedia or female corpus spongiosum, they extend to the base of the glans (Fig. 6) (Dickinson, 1949; Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Van Turnhout et al., 1995; Yang et al., 2006; Standring, 2008; Puppo, 2011a). During sexual arousal, the commissure becomes very distended (Sherfey, 1973).

Under the angle of the clitoris, there is the venous plexus of Kobelt that communicates the venous circulation of the bulbs to that of the corpora cavernosa. This venous plexus corresponds to the inferior veins of the male corpora cavernosa, which open into the inferior median sulcus between these and the male urethra and that receive the veins that begin in the upper part of the male corpus spongiosum. The bulbs are covered by the bulbocavernosus muscles (Dickinson, 1949; Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Standring, 2008; Puppo, 2011a).

On either side of the vagina, there are the bulbs that with stimulation increase in size as they do in males. Studies by Dickinson (1949) found that “the area of most marked erection is on each side of the entrance to the vagina. Here the distension with blood of the erectile tissues of the bulbs of the vestibule produces a bulging inward.” Therefore, the swollen vestibular bulbs also lead to engorgement of the outer third of the vagina and determine the formation of the orgasmic platform of Masters and Johnson (Fig. 7) (Dickinson, 1949; Masters and Johnson, 1966; Masters et al., 1988; Puppo, 2011a).

The vestibular bulbs cause the “vaginal” orgasmic contractions observed every 0.8 sec through the rhythmic contraction of bulbocavernosus muscles (Testut and Latarjet, 1972; Puppo, 2011a). Studies by Hartmann (1913) found that “vaginismus is characterized by a painful reflex contraction of the sphincter of the vulvo-vaginal orifice. It involves the sphincter of the vulva (constrictor of the vulva) and



**Fig. 7.** Bulb swellings during excitement (from Dickinson, 1949).

the sphincter of the vagina (anterior fibers of the levator ani), which leads to a distinction between an inferior and superior vaginismus": the bulbocavernosus muscles are implicated in inferior vaginismus, while the pubovaginalis muscle is responsible for superior vaginismus (Dickinson, 1949; Testut and Latarjet, 1972; Kearney et al., 2004; Larson et al., 2010; Puppo, 2011a; Selbmann and Puppo, 2012).

With Kegel exercises it is possible to train the perineal muscles, the ischiocavernosus muscle (muscle of erection), the bulbocavernosus muscles (muscle of male ejaculation, muscles of female orgasm), the external sphincter muscle of the anus (whose contractions increase the orgasmic sensations), the striated urethral sphincter muscle, the transverse perineal muscles, and the levator ani muscles. Kegel exercises, which strengthen these muscles, may be important for preventing vaginismus (Puppo, 2006b, 2006d; Selbmann and Puppo, 2012).

Studies by Stein and DeLancey (2008) found that the perineal membrane is a complex structure composed of two regions, one dorsal and one ventral. The dorsal portion consists of bilateral transverse fibrous sheets that attach the lateral wall of the vagina and perineal body to the ischiopubic ramus. This portion is devoid of striated muscle. The ventral portion is part of a solid three-dimensional tissue mass in which several structures are embedded. It is intimately associated with the compressor urethrae muscle and the urethrovaginal sphincter muscle of the distal urethra with the urethra and its surrounding connective.

O'Connell et al. (2008), in the *Journal of Sexual Medicine*, stated "The urethral orifice and distal urethra are surrounded by the erectile tissue of the clitoral bulbs." Yavagal et al. (2011) stated "The clitoris ... consists of the paired corpora, vestibular bulbs, and the glans ... The deep suspensory ligament originates from the symphysis pubis and attaches to the body, bulbs, and glans of the clitoris." However, "clitoral bulbs" is an incorrect term from an embryological and anatomical viewpoint, in fact the bulbs do not develop from the phallus, and they do not belong to the clitoris: The correct term for these structures is vestibular bulbs (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Puppo, 2006a, 2006b, 2011a, 2011c; Puppo et al., 2008a; Standring, 2008; Stein and DeLancey, 2008; Larson et al., 2010).

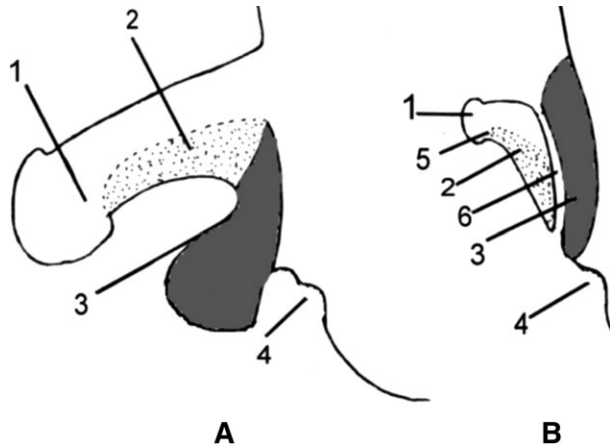
Gravina et al. (2008) stated "The close physical proximity of the urethra and the clitoris to the anterior vaginal wall suggests an association between these anatomical structures and sexual function... The presence of pseudocavernous tissue (clitoral bulb) in the anterior vaginal mucosa is a frequent but not universal finding (86%)..." However, the vagina has not anatomical relation with the clitoris and in the anterior vaginal mucosa there is no "clitoral bulb" (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Standring, 2008; Netter, 2010; Puppo, 2011c).

## THE LABIA MINORA

The labia minora, or nymphs, are at rest, approximated together, in males correspond to the ventral wall of the cavernosa urethra and of the corpus spongiosum of the urethra (Fig. 8) (Puppo et al., 2008b; Puppo, 2011a, 2011d).

The labia minora are two thin folds of skin, again devoid of hair but still possessing sebaceous and eccrine glands. They lack a layer of subcutaneous fat and sit medial to the labia majora and lateral to the vestibule. The labia minora are separated from the labia majora by interlabial furrows in which the normal secretions from the adjacent skin surfaces may accumulate (Neill and Lewis, 2009).

Anteriorly, the labia minora divide into lateral and medial parts. The lateral parts form the prepuce of the clitoris. The medial parts unite on the undersurface of the clitoris to form its frenulum. Posteriorly, they form the frenulum of the labia minora but they



**Fig. 8.** Labia minora and the penis (from Puppo et al., 2008b; Puppo, 2011d). **A:** 1, Penis; 2, corresponding part to the labia minora; 3, scrotum; 4, anus. **B:** 1, Clitoris; 2, labia minora; 3, labia majora; 4, anus; 5, frenulum; 6, sulcus nymphiolabialis.

can be also separated (Neill and Lewis, 2009; Puppo, 2011a).

There is great variation in the size and morphology of the labia minora. They may be almost unrecognizable or may protrude from the labia majora ("hypertrophic" labia minora should not be considered a malformation). In addition, they can be asymmetrical or doubled on one or both sides (Fig. 9) (Dickinson, 1949; Puppo, 2011a). Lloyd et

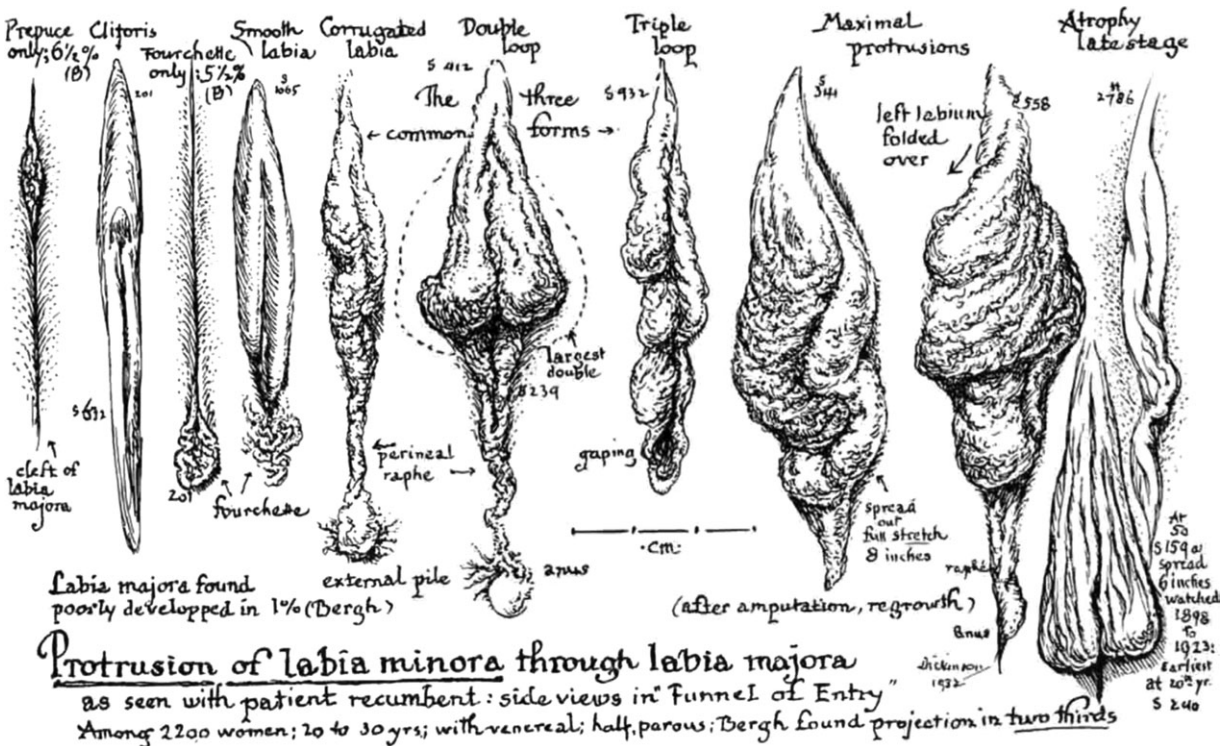
al. (2005) found no statistically significant association between any of the different genital measurements and age, parity, ethnicity, hormonal use, or history of sexual activity.

In some cultures, the labia minora can be very large because of the practice of stretching them. For example, in some African populations they can be as large as 20 cm and are known as a "Hottentot apron" (Dickinson, 1949; Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975). Today, elongation of the labia minora is classified in the type IV female genital mutilation (Koster and Price, 2008; Abdulcadir et al., 2011).

The skin of the labia minora is smooth or mildly rugose and pigmented, particularly at the edges. The dermis of the labia minora is composed of a thick of connective tissue composed mainly of elastic fibers and small blood vessels. "The arrangement of blood vessels within the labia minora forms erectile tissue similar to that in the penile corpus spongiosus, which is their embryological counterpart in the male" (Neill and Lewis, 2009).

The labia minora have a notable sensibility, in fact, like the vaginal vestibule and the glans clitoris, they have a considerable number of free nervous endings and sensory receptors. The genital corpuscles are most important for the perception of erogenous sensibility, but Pacinian and Meissner corpuscles are also present (Martin-Alguacil et al., 2011; Puppo, 2011a).

The labia minora are highly innervated along their entire edge, and this is important for sexual response (Schober et al., 2010). As they engorge,



**Fig. 9.** Labia minora: normal dimensions (from Dickinson, 1949).

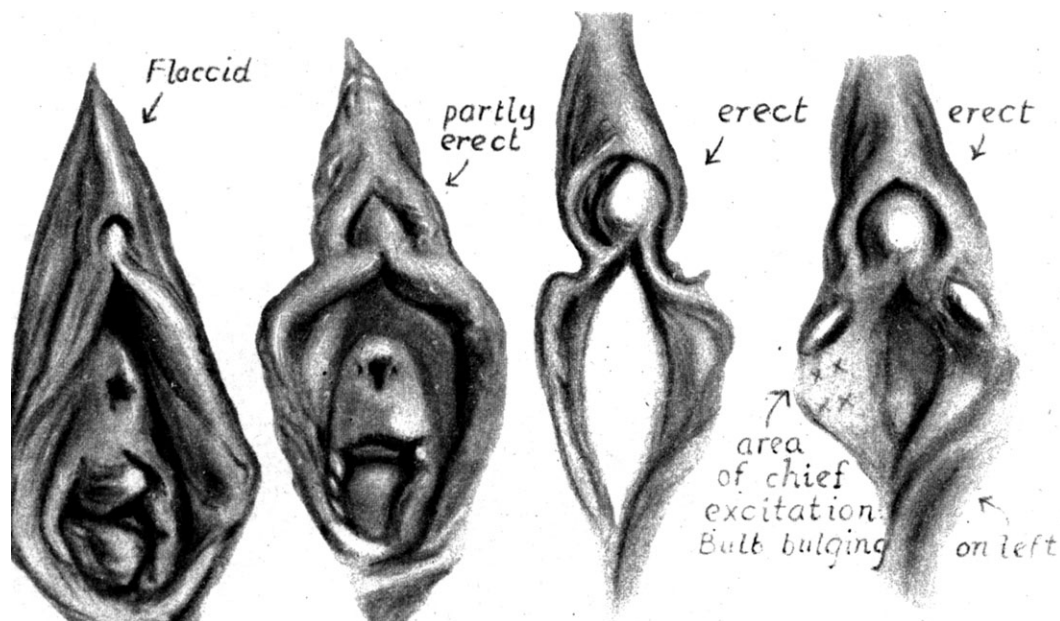


Fig. 10. Clitoris and labia minora erection (from Dickinson, 1949).

the labia minora become turgid, doubling or tripling in thickness (Figs. 10 and 11, Supporting Information Video 1) (Dickinson, 1949; Masters and Johnson, 1966; Puppo, 2011a, 2011d, 2011e).

Another constant phenomenon has been observed in the labia minora during the plateau phase. When these structures have already doubled or tripled their size, they show an intense change in color from pink to intense red signaling impending orgasm (Dickinson, 1949; Masters and Johnson, 1966). Studies by Battaglia et al. (in press) found that estrogen production may influence the anatomic and vascular changes of the labia minora during the menstrual cycle, and these changes can be easily identified with ultrasound.

Fusion of the labia minora may occur in association with defective sexual differentiation. This should not be confused with superficial labial adhesions seen in the neonatal period or in infancy as a result of an inflammatory condition (Neill and Lewis, 2009). O'Connell et al. (2008) stated "The labiae, like the clitoris, are derived embryologically from the undifferentiated phallus." Although Puppo (2011c) believes that only the corpora cavernosa of the clitoris and the glans are formed from the phallus.

### THE CORPUS SPONGIOSUM OF THE FEMALE URETHRA

The external urethral orifice lies in the vestibule, it is positioned in the midline but its exact location is variable. The urethra is fixed at its origin by the pubovesical ligaments and throughout its length by the anterior wall of the vagina. As it enters the perineum, it is fixed by the perineal membrane, also

known as the urogenital diaphragm or triangular ligament (Neill and Lewis, 2009).

The urethral lumen is surrounded by smooth muscle fibers and by spongy tissue (i.e., corpus spongiosum of the female urethra). "The tissue is grossly distinct from the vascular tissue of the clitoris and bulbs, and on macroscopic observation, is paler than the dark tissue of the bulbs" (Yang et al., 2006).

The corpus spongiosum of the female urethra is present in all women. It is a cavernous tissue rich in multiple small vessels, situated in the submucosal and among the muscular bundles of the smooth muscular tunica of the urethral wall. It becomes erect with sexual arousal, as in males (Puppo, 2011a); studies by Gräfenberg (1950) reveal "during sexual stimulation the urethra is enlarged."

Innervation of the female urethra has been scantily investigated although Dickinson (1949) observed that "the meatus is very well endowed with

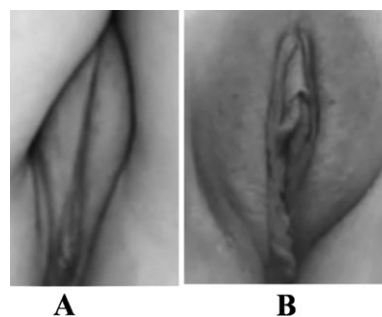
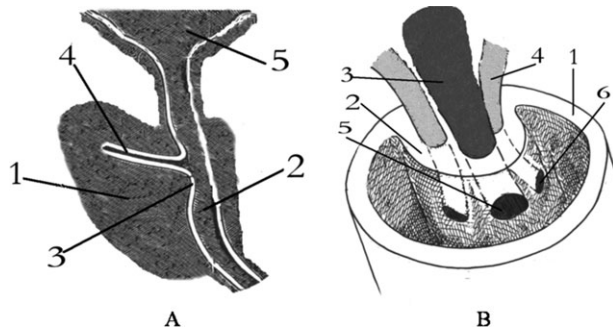


Fig. 11. Thumbnail Video 1 (Supporting Information Video is available online). Woman 28 years old. Clitoris and labia minora: **A**: Flaccid state; **B**: Erect state (from Puppo, 2011d).





**Fig. 12.** The male vagina (from Puppo, 2011d). **A:** 1, Male prostate; 2, prostatic urethra; 3, seminal collicle; 4, male vagina; 5, bladder. **B:** 1, Prostatic urethra; 2, seminal colliculus; 3, male vagina; 4, ejaculatory duct; 5, vaginal orifice; 6, ejaculatory duct orifice.

a special sensitivity... In advanced cases of the urethral masturbation, the meatus will admit the tip of the little finger for a short distance and without discomfort." Gräfenberg (1950) described some cases of male and female urethral masturbation.

### COMPARISON BETWEEN MALES AND FEMALES

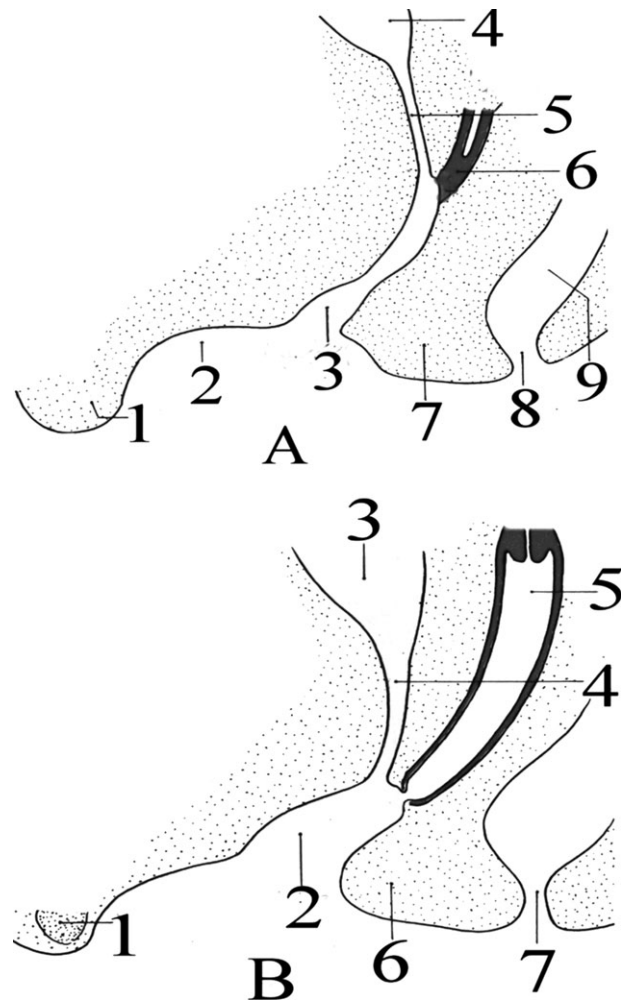
"Erectile genital tissues in both males and females arise from the same embryological structures and thus are homologous" (Yang et al., 2006). The external genitalia of males and females develop from the urogenital sinus (which is divided into pelvic and phallic parts), from the genital tubercle or phallus, from the urogenital folds, and from the labioscrotal swellings. The corpora cavernosa of the clitoris and the glans are formed from the phallus. The vestibule of the vagina, the labia minora, the vestibular bulbs, and the female corpus spongiosum are formed by the pelvic and phallic part of the urogenital sinus and from the urogenital folds (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Standring, 2008; Puppo, 2011a). The phallic portion of the urogenital sinus remains open, and the genital folds do not fuse, and details of clitoral anatomy can be visualized with ultrasound and MRI prenatally (Wünsch and Schober, 2007).

O'Connell et al. (2008) stated "The clitoris is composed of the glans, which is its only external manifestation." "the clitoris itself, in turn, being covered by the vulva... The distal vagina is a structure that is so interrelated with the clitoris that it is a matter of some debate whether the two are truly separate structures... The clitoral complex, composed of the distal vagina, urethra, and clitoris, is the location of female sexual activity, analogous to the penis in men." Puppo (2011c) responded to O'Connell et al.'s statements by stating that "The clitoris is not covered by the vulva": it is a part of the vulva! The whole clitoris (glans, body, roots) is an external genital organ. The roots are hidden: they are not "internal." O'Connell et al.'s clitoral complex definition "has no embryological, anatomical, and physiological support" "the vagina has no anatomical relation with

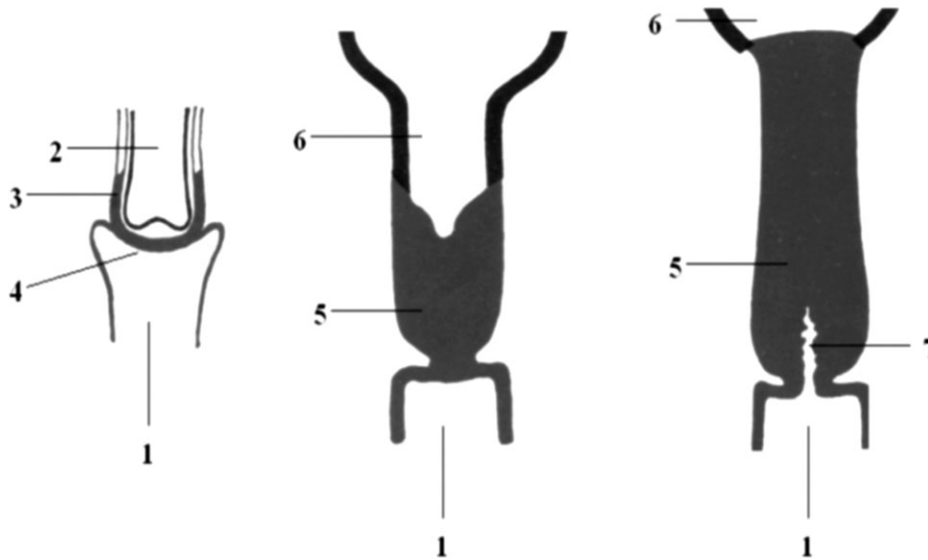
the clitoris" "and in the male penis there is no vagina." The female vagina corresponds in males to the prostatic utricle (i.e., male vagina) situated in the prostate (Fig. 12) (Puppo, 2011c, 2011d).

This has been known for many decades (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975), but according to current opinion in gynecology, urology, and sexology textbooks the female vagina is still a mixed structure, formed by the urogenital sinus and from the Müllerian ducts, even if we know that the vagina always has the same structure for all of its length, furthermore the glycogen is present in the epithelium of the urogenital sinus, in the vagina, and cervix, while it is missing in the Müllerian ducts (Testut and Latarjet, 1972).

In the female, the pelvic part of the urogenital sinus moves down, it is incorporated by the phallic part, and it opens externally with the vaginal and urethral orifi-



**Fig. 13.** Development of the vestibule and vagina (from Puppo et al., 2008b). **A:** 1, Phallus; 2, phallic part of urogenital sinus; 3, pelvic part of urogenital sinus; 4, bladder; 5, urethra; 6, sinovaginal bulb; 7, perineum; 8, anus; 9, rectum. **B:** 1, Clitoris; 2, vaginal vestibule; 3, bladder; 4, urethra; 5, vagina and cervix; 6, perineum; 7, anus.



**Fig. 14.** Development of the vagina (from Chiarugi and Bucciante, 1975; Puppo et al., 2008b). 1, Urogenital sinus. 2, Müllerian duct. 3, Wolffian duct. 4, Müllerian tubercle. 5, Sinovaginal bulb from which the female vagina and cervix will be formed. 6, Müllerian duct in regression. 7, Development vaginal lumen.

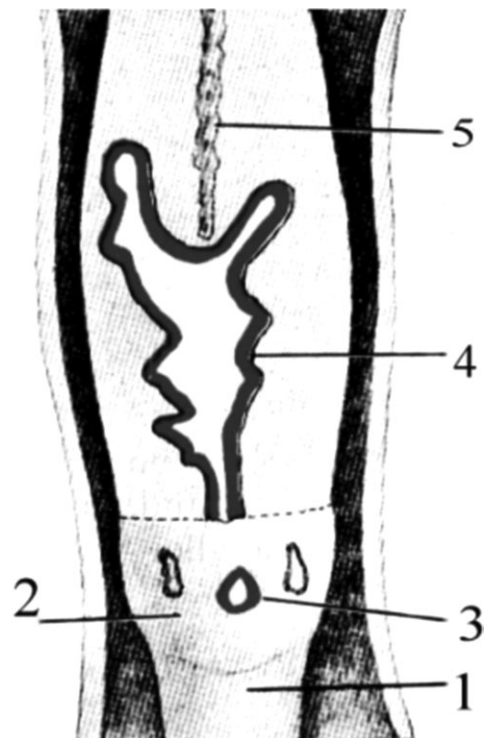
ces (Fig. 13), while in the male the pelvic part of the urogenital sinus corresponds to the internal portion of the urethra situated under the seminal colliculus (*veru montanum*), a prominence of the dorsal surface of the prostatic urethra in which the two ejaculatory ducts open and among them exists the prostatic utricle or male vagina (sometimes the ejaculatory ducts open into the male vagina and not into the prostatic urethra): only the small segment of the prostatic urethra, which reaches the seminal colliculus from the bladder, corresponds to the whole female urethra (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Shapiro et al., 2004; Standring, 2008; Puppo et al., 2008b; Puppo, 2011a, 2011c, 2011d).

The male and female vagina (and cervix) develop from the sinovaginal bulb that grows from the dorsal wall of the urogenital sinus to the level of the Müllerian tubercle (which will become the seminal colliculus in males and the hymen in females), without the contribution of the Müllerian ducts (Figs. 14 and 15). In females, only the body of the uterus and the uterine tubes are formed by the Müllerian ducts (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Acién and Acién, 2011; Puppo, 2011c).

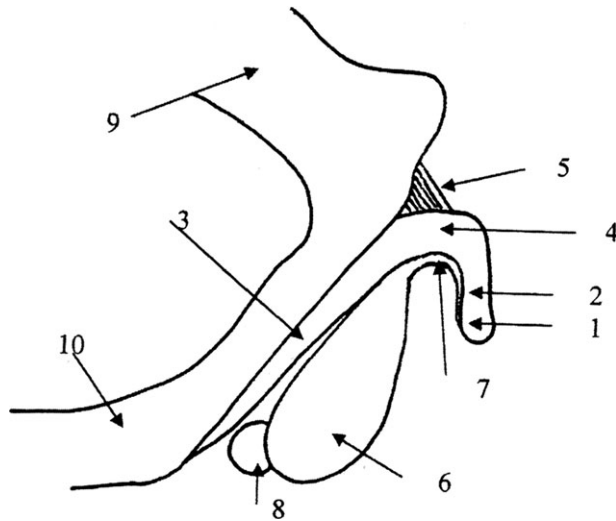
The fused Müllerian ducts form the uterus up to the external cervical os, and the inducing mesonephric ducts regress cranially, although they enlarge caudally from the level of the cervical os, form the sinovaginal bulbs, incorporate the Müllerian tubercle's cells, and give rise to the vaginal plate. The embryological development of the human vagina does not proceed from the urogenital sinus and Müllerian ducts (as classically thought) but from the Wolffian ducts and Müllerian tubercle (Acién and Acién, 2011).

The main difference between the male and the female is the absence of the development of the

external urethra in the female (to be precise, only the urethra in the glans is missing) due to the nonfusion of the urogenital folds; however, the structures



**Fig. 15.** Development of the male vagina (from Chiarugi and Bucciante, 1975). 1, Urogenital sinus. 2, Seminal collicle. 3, Vaginal orifice. 4, Male vagina. 5, Müllerian duct.



**Fig. 16.** The female penis (from Puppo et al., 2008b; Puppo, 2011d) (without labia minora and corpus spongiosum of urethra). 1, Glans; 2, body; 3, root; 4, angle; 5, suspensory ligament; 6, bulb; 7, corpus spongiosum; 8, Bartholin's gland; 9, pubis; 10, ischiopubic ramus.

that form the external urethra in the male are present in the female and correspond to the vestibule of the vagina and the internal surface of the labia minora (Testut and Latarjet, 1972; Standring, 2008; Puppo, 2011a).

The female external genitals, at rest, are joined together even though separated by the presence of the vaginal opening, and represent the penis and the scrotum of the male (Dickinson, 1949; Van Turnhout et al., 1995). The clitoris has corpora cavernosa that are smaller but analogous to those of the penis (Martin-Alguacil et al., 2006; Puppo, 2011a). Yilmaz et al. (2002) demonstrated that evoked and spontaneous clitoral electromyography activity seems to indicate a sympathetic tonus of the corpus clitoris, as seen in the corpus cavernosum of the penis in human males.

Lenck et al., (1992), in their observations on the urethral sphincter, found an increase in the dimensions, after anterior vaginal palpation, of the sphincter, confirming its erectile character, and thus, the urethro-clitorido-vulval complex seems to be the anatomical support for female genital sexuality. "The labia minora engorge with arousal and have a role in the female sexual response" (Ginger et al., 2011b).

As discussed by Puppo (2006c, 2008a, 2008b, 2011a, 2011c, 2011d), the correct and simple anatomical term to describe the cluster of erectile tissues (clitoris, vestibular bulbs and pars intermedia, labia minora, corpus spongiosum of the female urethra) responsible for female orgasm, is female penis (Fig. 16).

The erectile cycle has been extensively studied in the penis and to a lesser extent in the clitoris and in other female erectile organs. However, erection from the flaccid state, is reached in three phases: latent, tumescence, and rigid or muscular (Fig. 17) (Benoit et al., 1987; Shafik, 1995; Wein et al., 2007; Andersson, 2011; Puppo, 2011d).

Erection is due to a neurovascular mechanism: an inflow of arterial blood and an obstruction of venous return. Tumescence is due to a reduction in the alpha-sympathetic tonus of the cavernous tissue permitting influx of arterial blood, and a decreased venous flow from compression of the subalbuginea venous network against the tunica albuginea of the corpus cavernosum. Rigidity is due to an increase in intracavernous arterial pressure together with contraction of the perineal muscles (ischiocavernosus) under the somatic control of the pudendal nerve (Benoit et al., 1987).

Contraction of the ischiocavernosus muscles produces the male rigid-erection phase. As discussed by Toesca et al. (1996) "the absence of the venous plexus in the clitoris suggests that this organ achieves tumescence but not rigidity during sexual arousal."

However, studies by Dickinson (1949) identified a small number of reports showing that pronounced erection can occur. In fact, as in males, in females, it is possible to have priapism of the clitoris, a rare condition associated with prolonged erection of the corpora cavernosa lasting for more than 6 hr and unassociated with sexual arousal. It causes engorgement, swelling, and pain of the clitoris and of its immediate adjacent area. The cause of priapism in males and females is impaired outflow of blood from the corpora cavernosa because of venous obstruction or because of failure of the alpha-adrenergic relaxation system (Medina, 2002; Arntzen and de Boer, 2006; Korda et al., 2009; Rosenbaum, 2010; Puppo, 2011a).

## VAGINAL ORGASM AND THE "G-SPOT" DO NOT EXIST

Even today, female sexuality is still mainly considered in terms of reproduction (the vagina is an internal and reproductive organ), instead of pleasure, and women have to reach orgasm during vaginal intercourse to be considered "true women," however, the female orgasm is caused by female erectile organs (i.e., female penis) and not by the vagina (Masters and Johnson, 1966; Hite, 1981; Masters et al., 1988; Laqueur, 1992; Puppo, 2011a, 2011c).

Vaginal orgasm does not have any scientific basis and is a theory that was invented by Freud in 1905. Laqueur (1992) stated "The story begins in 1905 when Freud rediscovered the clitoris, or in any case clitoral orgasm, by inventing its vaginal counterpart" that is, the vaginal orgasm, "After four hundred, perhaps even two thousand years there was all of a sudden a second place from which women derived sexual pleasure," "In 1905, for the first time, a doctor claimed that there were two kinds of orgasm and that the vaginal sort was the expected norm among adult women," "before 1905, no one thought that there was any other kind of female orgasm than the clitoral sort," "The clitoris, like the penis, was for two millennia both 'a precious jewel' and sexual organ," "Freud, in short, must have known that he was inventing vaginal orgasm and that he was at the same time giving a radical new meaning to the clitoris," "Freud knew that the natural locus of a

### Flaccid phase

- Tonic contraction of the vascular musculature
- Trabeculae contracted and sinusoidal spaces almost empty
- The blood flow prevails in the arteriovenous anastomoses

### Latent phase

- Inhibition of the arteries and arterioles muscular tone
- Tonic inhibition of the trabecular musculature
- Increase of the blood flow in the sinusoidal spaces with a small increase of the pressure
- Small growth of the male/female erectile tissue

### Tumescence phase

- The sinusoidal wall is stretched with more and more difficulty
- Increase of the sinusoidal spaces pressure, with an increase of the sinusoidal wall tension
- Increase of the venular compression, with reduction of the venous outflow
- The male/female erectile tissue increases of dimensions, it has a turgid consistence

### Rigid or muscular phase

- Tonic contraction of the female and male perineal muscles
- The blood is squeezed in the corpora cavernosa from the roots
- Rapid increase of the sinusoidal spaces pressure and of the sinusoidal wall tension
- Blocking of the venous outflow
- The male penis increases in length, it is rigid. Erection of clitoral body and “retraction” of the glans into the prepuce

### Detumescence phase

- Perineal, trabecular and arteries-arterioles musculature return to basal tone
- Reduction of the arterial inflow and increase of the venous outflow

**Fig. 17.** The erectile cycle (from Puppo, 2011d).

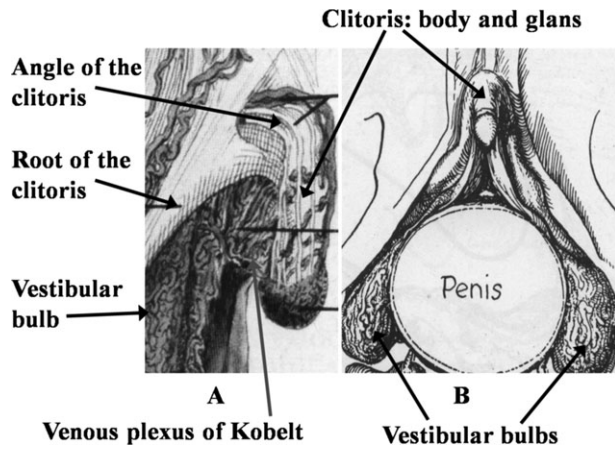
woman's erotic pleasure was the clitoris and that it competed with the culturally necessary locus of her pleasure, the vagina," "And of course Freud himself points out that biology has been obliged to recognize the female clitoris as a true substitute for the penis," "Freud, in short, must have known that what he wrote in the language of biology regarding the shift of erotogenic sensibility from the clitoris to the vagina had no basis in the facts of anatomy or physiology," "For a woman to make the switch from clitoris to vagina is to accept the feminine social role that only she can fill."

The vagina does not have an anatomical structure that can cause an orgasm and up by now in anatomy textbooks the presence of vagus nerve terminations in the vagina and cervix has not been demonstrated (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975; Standring, 2008; Netter, 2010; Puppo et al., 2008a; Puppo, 2011a, 2011c). The genitosensory component of the vagus nerve was only a hypothesis by Komisaruk, Whipple et al. (2004) studied five women with complete spinal cord injury (one woman with significant, but incomplete spinal cord injury; only three women experienced vaginal orgasm) (Puppo et al., 2008a; Puppo, 2011a, 2011c).

Studies by Nicholas and Brody et al. (2008) found that "A woman's history of vaginal orgasm is dis-

cernible from her walk" "Exploratory analyses suggest that greater pelvic and vertebral rotation and stride length might be characteristic of the gait of women who have experienced vaginal orgasm." Studies by Brody and Costa (2011) examined the hypothesis that a prominent tubercle of the upper lip is associated specifically with a greater likelihood of experiencing vaginal orgasm. However, the vaginal orgasm does not exist: Brody et al.'s statements are without embryological, anatomical, and physiological basis. Other studies by Wallen and Lloyd (2011) proposed that the variation in the distance between a woman's glans clitoris and her urethra predicts the likelihood that she will experience orgasm during intercourse and it was proposed that if this distance was less than 2.5 cm, a woman was very likely to have orgasms solely from sexual intercourse. Studies by Masters and Johnson (1966) concluded that clitoral retraction, which always develops during the plateau phase and elevates the clitoral body from its normal pudendal-overhang positioning, further removes the glans from even the theoretical possibility of direct penile contact (Fig. 18).

The variation of the distance between a woman's glans clitoris and her urethra is a hypotheses without anatomical and physiological basis; it cannot predict that women will experience orgasm during inter-



**Fig. 18.** The penis cannot come into contact with the clitoris (from Puppo, 2011c).

course, and it cannot suggest that women exposed to lower levels of prenatal androgens are more likely to experience orgasm during sexual intercourse (Wallen and Lloyd, 2011).

Gravina and Jannini (an andrologist) et al. (2008), in the *Journal of Sexual Medicine*, stated "The urethrovaginal space (where Halban's fascia runs) seems critical, being constituted of fibroconnective tissue and large numbers of blood vessels, glands, muscular fibers, and nerve endings." But "urethrovaginal space" is an incorrect term from a scientific point of view, the anterior vaginal wall is separated from the posterior urethral wall by the urethrovaginal septum (Testut and Latarjet, 1972; Chiarugi and Bucciante, 1975). In addition Halban's fascia, a layer of dense connective situated in the bladder-vaginal septum (Testut and Latarjet, 1972), does not correspond to the male corpus spongiosum, and it is not the site of origin of vaginal orgasm, as some researchers believe (Hoang et al., 1991); this assumption has no embryological and anatomical support. Halban's fascia and the anterior fornix are not female erogenous zones (Puppo et al., 2008a; Puppo, 2011c).

Levin (2011) stated "it is known that penile-vaginal intercourse actually stimulates the clitoris through thrusting traction on its attached ligaments via the anterior vaginal wall"; Gravina and Jannini et al. (2008) stated "In fact, the anterior vaginal wall is an active organ, transmitting, during intercourse, the effect of penile thrusting in the vagina to the clitoris, by stretching the two ligaments that insert around its base." But these statements are only hypotheses derived from Ingelman-Sundberg (1997) and are not corroborated by any anatomical or physiological evidence (Puppo, 2011c) (Figs. 18 and 19).

Studies by Puppo and Gruenwald (in press) stated "In 1950, Gräfenberg described a distinct erotogenic zone on the anterior wall of the vagina, which was referred to as the Gräfenberg Spot (G-spot) by Addiego et al. in 1981. As a result, the G-spot has become a central topic of popular speculation." In 2008, Gravina and Jannini et al. claimed that they had ultrasound images of the G-spot, but no such

images were included in the published article by the *Journal of Sexual Medicine*.

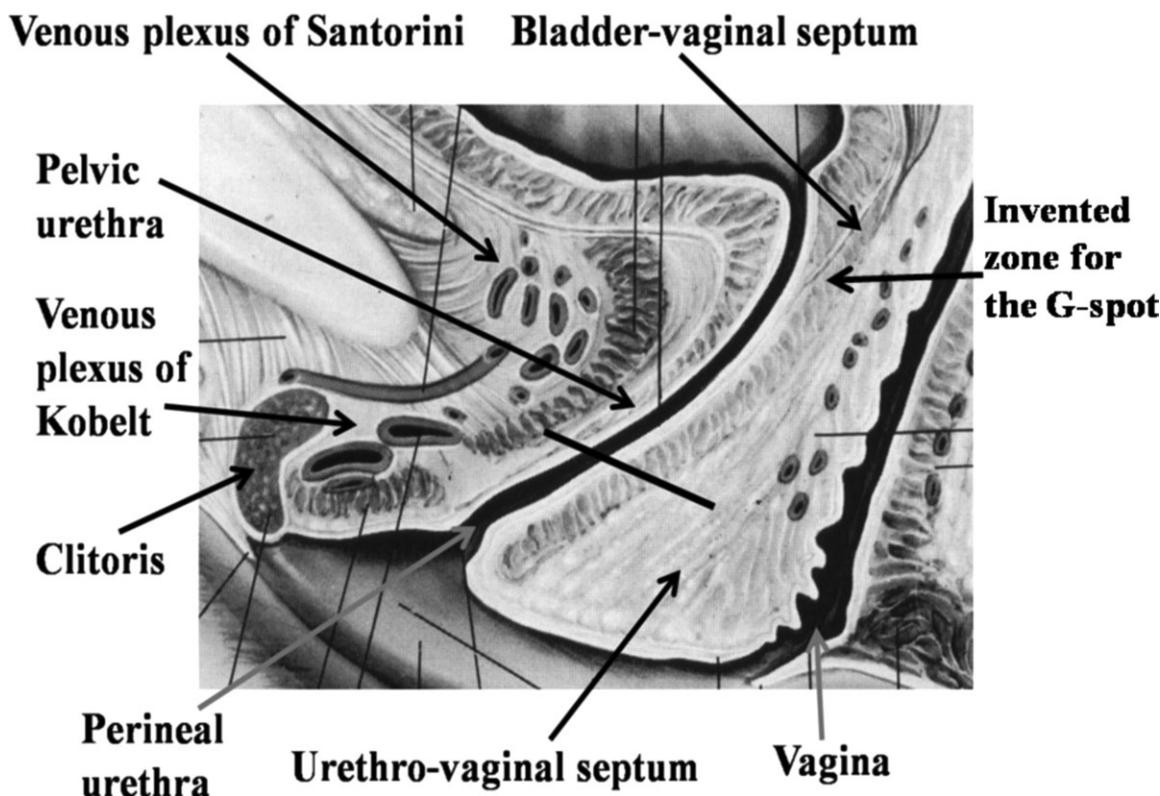
The G-spot represents that part of the urethra that contains the periglandular or paraurethral tissue (San Diego Sexual Medicine, 2012), but studies by Puppo and Gruenwald (in press) stated that the supposed G-spot of the anterior vaginal wall is located in Pawlik's triangle, a region that corresponds to Lieutaud's triangle in the bladder. The mucosa of this region of the anterior vaginal wall is smooth, without rugae (i.e., transverse folds); Pawlik's triangle is an area with minor resistance; hence, it can easily bulge into the vagina of a woman with a cystocele (Figs. 19 and 20).

Ostrzenski (2012) extracted parts of the anterior vaginal wall of the cadaver of an 83-year old woman and called it G-spot and he stated that "The anatomic existence of the G-spot was documented in this study with potential impact on the practice and clinical research in the field of female sexual function" "The G-spot was identified as a sac with walls that grossly resembled the fibroconnective tissues, was easy to observe, and was a well delineated structure." Ostrzenski (2012) also stated that the G-spot gene had been located but this was a misunderstanding of one of the references. Buisson (2010) commented that the G-spot was popularized by sexologist Beverly Whipple in 1980 in honor of the gynecologist Ernst Grafenberg, and that vaginal penetration causes a close contact between the inner clitoris and the distal anterior vaginal wall. However, studies by Puppo (2011c) concluded that the female perineal urethra, which is located in front of the anterior vaginal wall, is about 1 cm in length, and the presumed G-spot is located in the pelvic wall of the urethra, 2–3 cm into the vagina. Therefore, the penis cannot come into contact with the venous plexus of Kobelt or with the roots of the clitoris (which do not have sensory receptors or erogenous sensitivity) during vaginal intercourse (Figs. 18 and 19).

Pastor (2010) concluded that the "Existence of a specific anatomical structure known as the G spot has not been proven by any relevant scientific studies" and Magnin (2010) thought "There is no anatomical, biological and physiological basis for the existence of G-spot." Studies by Hines (2001) concluded with similar thoughts.

## FEMALE GENITAL COSMETIC SURGERY

There is a wide variety in the appearance of normal female external genitalia (Michala et al., 2011). Studies by Braun (2010) stated that "Female genital cosmetic surgery procedures have gained popularity in the West in recent years. Marketing by surgeons promotes the surgeries, but professional organizations have started to question the promotion and practice of these procedures. Despite some surgeon claims of drastic transformations of psychological, emotional, and sexual life associated with the surgery, little reliable evidence of such effects exists." Studies by McPencow and Guess (2012) suggested that female cosmetic genital surgery has gained international popularity over the past two decades, despite the lack of well-designed clinical trials to con-



**Fig. 19.** The clitoris, the pelvic and perineal urethra, and the vagina. G-spot does not exist (from Puppo, 2011c, 2011d).

firm benefit. The American College of Obstetricians and Gynecologists (2007) found that the "So-called vaginal rejuvenation, designer vaginoplasty, revirgination, and G-spot amplification are vaginal surgical procedures being offered by some practitioners. Women should be informed about the lack of data supporting the efficacy of these procedures and their potential complications, including infection, altered sensation, dyspareunia, adhesions, and scarring."

Although G-spot has become a multimillion dollar business (Kilchevsky et al., 2012) Puppo and Gruenwald (in press) concluded that G-spot amplification is not medically indicated and is unnecessary. Giuliano and Clément (2005) concluded that "orgasm is a cerebral process with a series of peripheral physical events comprising contraction of accessory sexual organs."

## FEMALE EMISSION

In the vaginal vestibule, the external orifice of the urethra with the paraurethral (Skene's) ducts opening on both sides is seen. Their length is 0.5–3 cm and they are found, in women, with the intraurethral (Skene's) glands considered by some as the female prostate. This structure can be affected by the same diseases as its male counterpart, including carcinoma and prostatitis (Zaviacic et al., 2000; Puppo, 2011a). The secretion of these glands is expelled through the urethral meatus or through the orifices

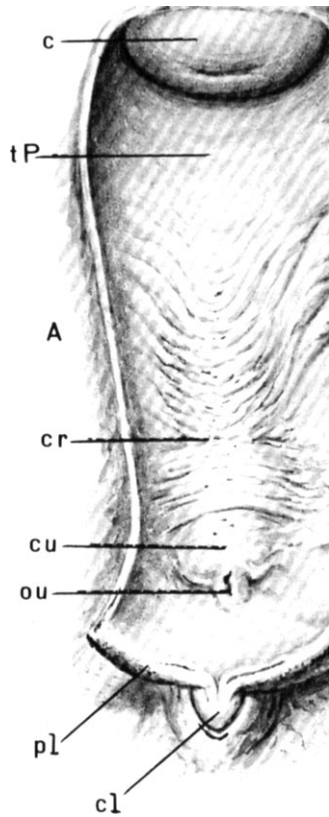
of the paraurethral ducts into the vaginal vestibule, which corresponds to the dorsal wall of the male cavernosa urethra (while the labia minora correspond to the ventral wall); female "prostate" secretion during orgasm corresponds to the emission phase of male ejaculation (Puppo, 2011a).

Studies by Shafik et al. (2009) revealed that opinions vary over whether female ejaculation exists or not. These authors found that female orgasm was not associated with the appearance of fluid coming out of the vagina or urethra. From a physiological point of view, the term "female emission" is a more accurate term than female ejaculation; in the male, this corresponds to emission of seminal fluid into the prostatic urethra (Fig. 21) (Puppo, 2011a, 2011d).

## THE FEMALE ORGASM

Orgasm is an intense sensation of pleasure achieved by stimulation of erogenous zones (glans clitoris is the female primary erogenous zone) that have a heightened sensitivity. The "vaginal" orgasm that some women report is caused by the surrounding erectile organs (Hite, 1981).

Distinguishing between clitoral and vaginal orgasm is not correct from a physiological point of view (Masters and Johnson, 1966). Studies by Sherfey (1973) concluded that "The vaginal orgasm as distinct from the clitoral orgasm does not exist." The high sensitivity of the female external genitals is not



**Fig. 20.** Anterior vaginal wall (from Chiarugi and Buciante, 1975). A, Anterior vaginal wall; c, cervix; cl, clitoris; pl, labia minora; ou, urethral orifice; cu, carina urethralis; cr, anterior column of rugae; tP, Pawlik's triangle.

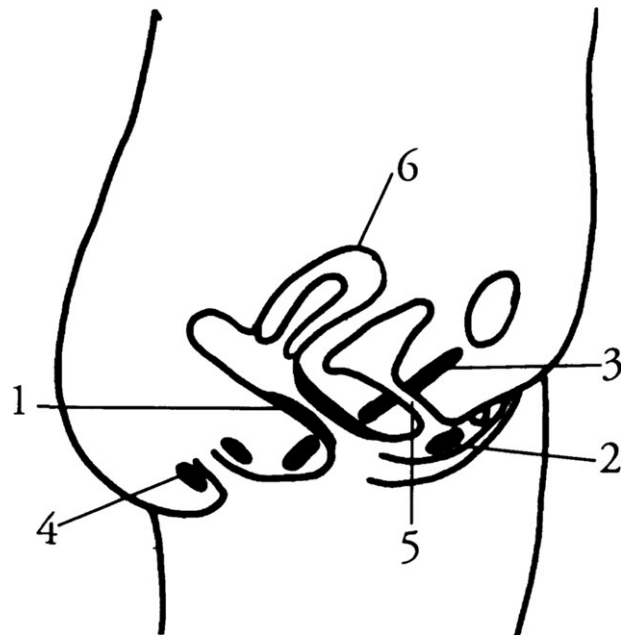
only due to the clitoris but also to the thin epithelial lining covering the labia minora and the vestibule. The stimulation of the labia minora and of the vestibule of the vagina (therefore also the urethral orifice) would facilitate the achievement of orgasm in women, with feelings even higher than clitoral stimulation alone, with a more global stimulation of the external genitalia, which includes the whole female erectile apparatus (Puppo, 2011d).

King et al. (2011) found four types of female orgasm, which varied systematically in terms of pleasure and sensations. Studies by Masters and Johnson (1966) found that the clitoris responds with equal facility to both somatogenic and psychogenic forms of stimulation and Herbenick and Fortenberry (2011) stated that "Orgasm is typically considered to be a sexual experience. However, orgasms occurring during physical exercise have been occasionally documented."

Studies by Masters et al. (1988) revealed that "Females have the physical capability of being *multi-orgasmic* - that is, they can have one or more additional orgasms within a short time without dropping below the plateau level of sexual arousal. Being multi-orgasmic depend on both continued effective sexual stimulation and sexual interest... multiple orgasm in females seems to occur more frequently during mas-

turbation" "From the viewpoint of physical capability, females have an almost unlimited orgasmic potential, while men, because of the refractory period, are unable to have a rapid series of ejaculations. Women do not have a true refractory period; orgasmic potential is undoubtedly restricted by fatigue. Studies by Darling et al. (1991) found that 42.7% of women had experienced multiple orgasms. Shtarkshall et al. (2008) supported this and concluded "a woman's capability to have multiple orgasms is dependent on a combination of developmental, psychological and psychosocial conditions." Some women may experience "status orgasmus," which is a single, long-continued orgasmic episode or a series of rapidly recurrent orgasmic experiences between which no recordable plateau-phase intervals can be demonstrated, which can last up to 1 min (Masters and Johnson, 1966). The lack of the ejaculation phase in women could explain why women do not have a refractory period and why they are able to have multiple orgasms (Puppo, 2011a).

Menopause results in a decline in circulating estrogen levels, which results in atrophy of urogenital tissues, vaginal shortening and thinning, decrease in vaginal elasticity and lubrication reduction. For these reasons, sexual intercourse may become uncomfortable. However, these physiological alterations are only related to the reproductive (i.e., internal) organs of women because estrogen does not affect the clito-



**Fig. 21.** Perineal muscle contractions to the orgasm and the female emission (from Puppo, 2011d). 1, Stereotyped rhythmic contractions of the "orgasmic platform," that is, of the bulbocavernosus and pubovaginalis muscles; 2, rhythmic contractions of the ischiocavernosus and transverses perineal muscles; 3, rhythmic contractions of the levator ani muscle; 4, rhythmic contractions of the external anal sphincter; 5, female emission; 6, rhythmic contractions of the uterus.

ris (Masters and Johnson, 1966; Masters et al., 1988; Martin-Alguacil et al., 2006). Masters and Johnson (1966) believe that there was no reason why menopause should be expected to blunt the human female's sexual capacity, performance, or drive. Female orgasm and clitoral sexual response are not affected by aging and for this reason women have the physical capability of being orgasmic in all ages.

## CONCLUSIONS

For women, clitoral stimulation is important for achieving the orgasm, and the clitoris exists in all women: why not simply stimulate, during intercourse with penetration of the penis, the clitoris with a finger? The claims that were made in the numerous articles that have been written by Addiego, Whipple, Jannini, Buisson, O'Connell, Brody, Ostrzenski, and others, have no scientific basis. Clitoral/vaginal/uterine orgasm, G- /A- /C- /U- /K- /O- /DVZ-spot orgasm, female ejaculation, persistent genital arousal disorder, clitoral bulbs, clitoral or clitoris-urethra-vaginal complex, internal clitoris, periurethral glands, genitosensory component of the vagus nerve, are terms that must not be used by gynecologists, sexologists, sexual medicine experts, women and mass-media. As a matter of fact female sexual dysfunctions are popular because they are based on something that doesn't exist, i.e. the vaginal orgasm (Puppo, 2012a, 2012c). Gynecologists, sexologists, and sexual medicine experts must convey that orgasm may occur in both partners with or without a vaginal intercourse (Puppo, 2012d). "Sexuality is an important part of health, quality of life and general wellbeing" (Elnashar et al., 2007). According to the World Health Organization "Sexual health is a state of physical, emotional, mental and social wellbeing related to sexuality; it is not merely the absence of disease, dysfunction or infirmity ... Sexual health is a global issue that is vital to overall wellbeing" (Abdool et al., 2009). Women's sexual rights are fundamental and universal human rights and the sexual pleasure, including autoeroticism, is a source of physical and psychological wellbeing that contributes to human happiness (World Association for Sexual Health, 2008). The knowledge of the anatomy and physiology of female erectile organs and of female orgasm is essential in the field of women's sexual health.

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