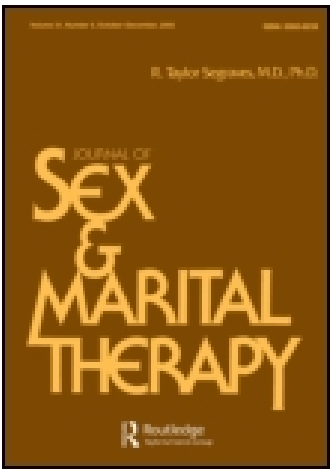

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A Model of Women's Sexual Arousal

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A model of female sexual arousal shows the composite emotion of subjective sexual arousal, which results from conscious appraisal of sexual stimuli and their context in the presence of positive affective and cognitive feedback. Genital feedback augments the subjective arousal to a variable degree. Genital congestion can be triggered by sexual stimuli in the absence of subjective arousal. Then the congestion either is ignored or not interpreted as sexual. An anhedonic or even a dysphoric response to the sensations of genital congestion are further possibilities. This model allows for various subtypes of arousal disorder and thus facilitates a choice of therapeutic intervention.

The concept of sexual arousal implies a mind that is sexually awake and that has registered sexual stimuli, processed them and their context in order to allow the emotion of subjective arousal. This subjective arousal is tolerated, enjoyed, and the mind stays focused on both the stimuli and the experience of arousal. Also inherent in the concept is that there are coincident changes in the body—it is being altered to be physiologically sexually aroused and prepared for sexual experience. The traditional inference has been that the presence of these somatic changes, especially genital ones, indicate that the mind indeed has consciously registered both the sexual nature of the stimuli and their context and has consciously appraised them as sexually arousing. However, psychophysiological studies of woman with arousal disorder show that erotic stimuli can be processed with minimal simultaneous awareness of sexual emotions (Laan, Everaerd, van der Velde, & Geer, 1995). Nevertheless, this limbic processing alters the neurotransmission in the spinal cord, promoting pelvic vasocongestion. The woman may even state that the stimuli not only failed to arouse but were negative for her (Laan, Everaerd, van der

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Velde, & Geer, 1995). Objective genital congestion, as measured by the vaginal plethysmograph, has been repeatedly shown to correlate poorly with both subjective arousal and with awareness of genital sensations in response to visual erotic stimuli (Laan, Everaerd, van der Velde, & Geer, 1995; Everaerd & Laan, 2000; Wouda, Hartman, Bakker, Bakker, van de Wiel, & Schultz, 1998; Morokoff, & Heiman, 1980; Meston, & Gorzalka, 1995; Meston, & Heiman, 1998; Dekker, & Everaerd, 1988; Heiman, 1980). We therefore need a model of a woman's sexual arousal that reflects the complexities of her subjective experience.

MODEL OF WOMEN'S SEXUAL AROUSAL

The following model depicts the results of processing two aspects of sexual stimuli. First, the sexual nature of the subconscious stimulus is registered and processed in the limbic system and within seconds causes objective genital congestion (Everaerd, Laan, Both, & van der velde, 2000). Second, the contextual cues surrounding the sexual stimuli simultaneoulsy are cognitively appraised and contain the potential to trigger subjective arousal. This conscious experience is augmented to a widely varying degree by the woman's awareness of genital arousal. This state of subjective arousal is itself cognitively appraised (Should I be sexual now? Is it appropriate, is it safe?). There also is an affective response to the genital and the subjective arousal: it is viewed as potentially positive and the arousal is enjoyed; or it is viewed as potentially negative and triggers guilt, shame, embarrassment, or fear. It is of interest that when men describe sexual arousal, they focus mainly on their sexual excitement. Women tend to simultaneously dwell on other positive and negative emotions along with their sexual excitement (Dekker & Everaerd, 1988). Moment to moment feedback from the emotions and cognition will modulate the limbic processing and, in turn, the composite experience of subjective arousal, thus influencing the woman's decision to stay focused on the sexual stimuli (see Figure 1).

AUTONOMIC NERVOUS SYSTEM CONTROL OF GENITAL AROUSAL

The genital response involves both the sympathetic (SNS) and parasympathetic components of the autonomic nervous system (see Figure 2). The traditional markers of increased SNS activity, including increased heart rate, blood pressure, and respiratory rate, are present during sexual arousal. Pelvic sympathetic postganglionic neurones release primarily noradrenaline and adenosine triphosphate (ATP), however, some neurones that are involved in vulval congestion presumably release acetylcholine (Ach), nitric oxide (NO), and neuropeptides including vasoactive intestinal polypeptide (VIP). Recent work shows that input from the ganglia of the caudal sympathetic chain

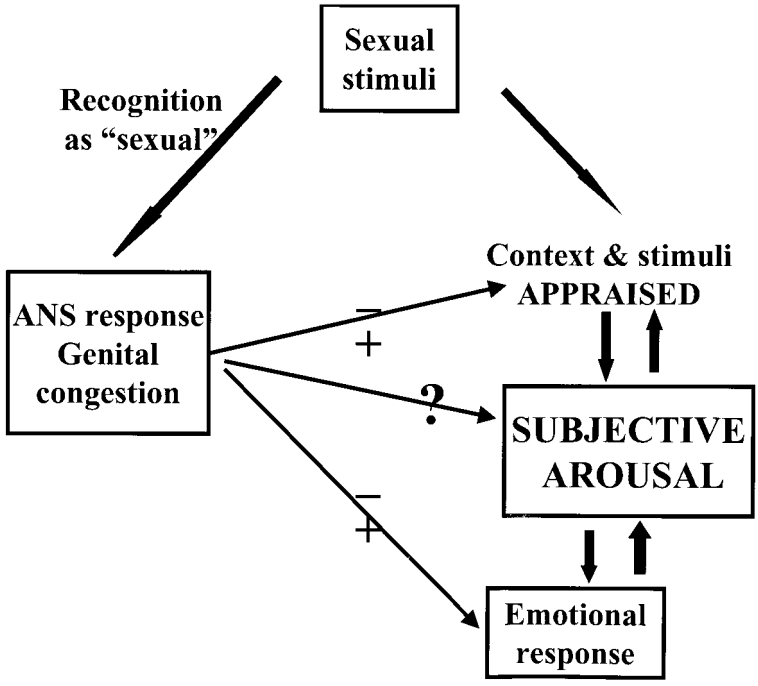

FIGURE 1. Model of women's sexual arousal.

containing noradrenaline and perhaps neuropeptide Y produces, as one would expect, vasoconstriction by way of alpha adrenergic and perhaps peptidergic receptors. On the other hand, input from the hypogastric nerve (sympathetic) passing through ganglionic relay stations in the pelvic plexus can produce vasodilation and vulval congestion, as well as the opposite (De Groat, 1999). Parasympathetic nerves from $S_{2,3,4}$ release NO (Burnett, Calvin, Silver, Pepas, & Docimo, 1997), mediating vasodilation, but also release Ach, which may be acting prejunctionally or postjunctionally by blocking adrenergic vasoconstrictor mechanisms and acting on the endothelium to release NO. Vasointestinal polypeptide also is involved and may be the major neurotransmitter that allows vaginal vascular and nonvascular smooth muscle relaxation, leading to lubrication and upward tenting of the vagina into the pelvis (Levin, 1992).

An increase in sympathetic tone brought on by exercise, hyperventilation, or ephedrine increases the physiological arousal response (Brotto & Gorzalka, 2001; Meston & Gorzalka, 1995; Meston & Heiman, 1998). Similarly, the prior viewing of visual triggers that provoke anxiety increases the physiological arousal response to erotic visual cues (Palace & Gorzalka, 1990). Heightened SNS activity accompanies a range of emotions, including fear and the excitement that accompanies the knowledge that something very pleasant is about to happen. It also is associated with the state of sexual arousal.

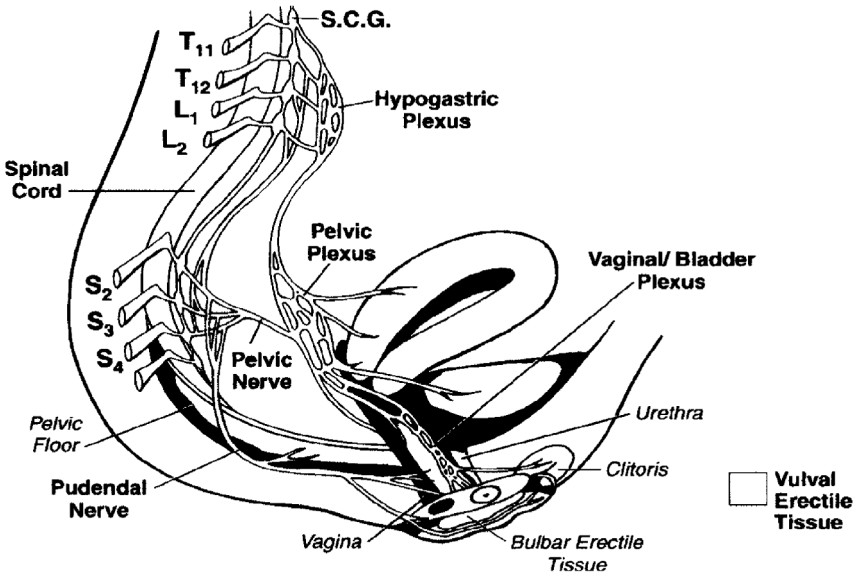

FIGURE 2. Autonomic nervous system control of genital arousal.

GENITAL FEEDBACK

Genital vasocongestion can be considered a potential second-level amplifying (Barlow, 1986), or confirmatory, stimulus (Basson, 2001), as it is in men. However, in women, it may not be registered at all, be registered minimally, not be interpreted as sexual, or, despite sexual interpretation, not enjoyed. A frankly dysphoric emotional response to genital congestion also is possible. Throbbing and tingling and feelings of urgency for genital contact and vaginal entry are far less consistent for sexually healthy women than are the equivalent sensations in men. However, many sexually healthy women, although minimally directly aware of vulval congestion, will access this confirmatory sexual stimulus indirectly; enjoyment of manual, oral, or vibro-genital stimulation is enhanced by the vulval engorgement. Indeed physiological responding of many parts of her body including the breasts may allow a woman to indirectly reinforce sexual stimuli.

The poor correlation that apparently exists between subjective arousal (the total emotion) and objective genital congestion warrants discussion. It should be noted that there are huge variations in the awareness of genital sensations among women and, at different times, within the same woman when studied in the laboratory (Everaerd, Laan, Both, & van der Velde, 2000). Some researchers suggest that whereas at lower levels of arousal the women rate their subjective arousal mostly on the context and the total nature of external stimuli, at more intense levels of genital arousal the genital feedback is more obviously contributing to the total subjective arousal (Laan, Everaerd, Van Berlow, & Rijs, 1995).

Thus, in contrast to men's erections, genital arousal in women produces little conscious afferent feedback. Moreover, because women determine their subjective arousal by appraising the whole situation, the poor correlation between genital arousal and subjective arousal perhaps is explained (Everaerd, Laan, Both, & van der Velde, 2000). When in the laboratory setting, the female response to erotic movies made by women is compared to those typically made by men, there is higher subjective arousal but similar objective genital congestion in response to the female-made films (Laan, Everaerd, van Bellen, & Hanewald, 1994). The evidence that situations do exist where there is correlation between objective and subjective genital arousal resulted from a series of 21 erotic stimuli (film excerpts) that were markedly varied in content and degree of intensity (Laan, Everaerd, van Berlow, & Rijs, 1995), involving frequent changes in the autonomic nervous system. How relevant such laboratory findings are to women in their own sexual settings remains unclear. There, visual cues often are less relevant, whereas sexual stimuli associated with emotional intimacy with their partner are relevant (Tiefer, 1991; Schultz, van de Wiel, & Hahn, 1992; Basson, 2000).

DO WOMEN WITH FSAD REGISTER AND PROCESS THE SEXUAL STIMULUS?

Different researchers have documented that within seconds of receiving an erotic visual stimulus, vaginal blood flow increases in women with FSAD (Laan, Everaerd, van der Velde, & Geer, 1995; Everaerd, Laan, Both, & van der Velde, 2000). There is, however, neither subjective mental sexual arousal nor awareness of this genital process. It would seem that most women so studied in the laboratory simply are unaware, rather than aware of the engorgement but not interpreting it as sexual. A small percentage find the stimulus not only not arousing but very unpleasant (Laan, Everaerd, van der Velde, & Geer, 1995), and such a dysphoric reaction is reported by subgroup of women with FSAD in the real-life situation. In all these women, the stimulus and its context has been registered, the genitalia have responded, but neither has been interpreted as sexual arousal. So, often in clinical practice we hear "I feel nothing." Only a partial explanation comes from women's limited direct awareness of genital engorgement. Manual, oral, or vibro-genital stimulation, as previously discussed, can provide the confirmatory second-level stimulus and thereby indirectly allow women's awareness of genital congestion. Women with FSAD, however, would state that this indirect confirmatory stimulus is absent; the direct stimulation of their engorging genitalia is not subjectively arousing. Again, the issue is that the sensations from stimulating the engorging genitalia are not interpreted as sexually exciting. Do women with FSAD actually "feel nothing"? Can an experience lasting many minutes be devoid of emotions, physical sensations, and cognitions while the person remains fully conscious? Perhaps it is that the woman does

not respond as she used to or as she perceives she should. But any thoughts, emotions, or physical sensations that are experienced require analysis in order to understand the woman's particular form of arousal disorder.

WHY MIGHT WOMEN WITH FSAD NOT CONSCIOUSLY INTERPRET THE STIMULUS AND ITS CONTEXT AS SEXUALLY EXCITING?

Past negative sexual experiences may have "reprogrammed" a woman's appraisal of sexual stimuli such that sexual excitement no longer occurs. For other women, it is more of a global issue: they learned not to feel any emotions as a means of coping with childhood losses and traumas.

The continued tolerance of subjective arousal (and of genital sensations) requires positive cognitive and emotional feedback. For some women with FSAD, there are feelings of inadequacy, embarrassment, guilt, or anxiety. Cognitively, there may be distractions, including those regarding appearance, performance, and the safety of the situation.

COULD THERE BE SEXUAL EXCITEMENT BUT YET LACK OF PLEASURE FOR SOME WOMEN WITH FSAD?

Why might a sexual stimulus that is tolerable (neither negative thoughts nor negative emotions present) and consciously appraised as sexual not be interpreted as sexually pleasurable? Does the finding that bupropion subtly increases the intensity of subjective sexual arousal imply that some FSAD is associated with the dopamine pleasure/reward system? Could FSAD ever be a selective anhedonia? Note that of women who are given off-label Sildenafil for lack of genital response and pleasure only some will find it helpful. Others will agree that there is more wetness, more congestion, but still no pleasure. So for some women with arousal disorders, it is not only the disconnection from an awareness of the genital response but a lack of pleasure even if they do become more aware as a result of pharmacological enhancement.

SUBGROUPS OF FSAD

Because we lack an understanding of the connection (or lack thereof) between sexual arousal/excitement and genital events, we are seeing a number of proposed products, both pharmacological and nonpharmacological to increase genital vasocongestion. Perhaps this is not the most appropriate place to be focusing our energies, except when there is estrogen deficiency or nerve damage accounting for absence of physiological genital engorge-

ment—a subgroup of FSAD previously labeled genital FSAD (Basson, 2000). Clinically, there are at least five different subgroups of FSAD:

1. *Generalized* arousal disorder, i.e., lack of mental excitement, absence of throbbing "pulsing," and lack of pleasure from genital stimulation, plus lack of objective vasocongestion if this were to be measured. How large this group is remains unclear. Of women with FSAD willing to be studied in the laboratory, it would appear to be a small group.
2. *Genital* arousal disorder, which involves mental excitement but no objective *evidence* of genital engorgement.
3. *Missed* arousal involves women who do not attend to genital engorgement that is nevertheless occurring. This is typical of women with FSAD who are studied in the laboratory and who remain unaroused, subjectively.
4. *Dysphoric* arousal comprises the subgroup of women who find the sensation of genital engorgement unpleasant. Typically, they remain subjectively unaroused.
5. *Anhedonic* arousal comprises women who consciously interpret both the external stimulus and the genital congestion as sexual but derive no pleasure. See Table 1.

THE NATURE OF THE DISCONNECTION BETWEEN THE WOMAN'S MIND AND HER GENITAL RESPONSE

In life, as opposed to in the laboratory situation, sexually healthy women usually are not focusing particularly on any visual stimulus (indeed, their eyes may be closed) but more on their enjoyment of both the mental and the physical stimulation. Mental excitement gives full meaning to the genital or other physical sensations. However, women can experience intrinsic genital pleasure in the absence of sexual thinking or fantasizing. They can, for instance, self-stimulate to an intensity of physical feeling that is pleasurable in its own right and they are not necessarily linking this with sexual fantasy or sexual memories. Without the mental sexual excitement, the genital sensa-

TABLE 1. FSAD Subtypes

	Generalized sexual arousal disorder	Genital arousal disorder	Missed arousal	Dysphoric arousal	Anhedonic arousal
Mental excitement	–	+	–	–	–
Genital congestion	–	–	+	+	+
Vasoactive medication indicated	Not initially (Later unnecessary)	Yes	No	No	No

Adapted with permission from the American College of Obstetricians and Gynecologists (*Obstetrics and Gynecology, 98,* 350–353).

tions are just that—genital and pleasurable. "It's not really sexual, it just gets me to sleep" is a typical comment from sexually healthy women. Is this dissociation reinforced by experience?

Women's experience suggests that frequently the sequence of registering/interpreting/ permitting/tolerating/enjoying is interrupted (see Table 2). For instance, while the woman is focusing on something else, her partner (without appropriate context, at least in the woman's mind) may touch her specifically sexually, e.g. on her breast or genital area. Sensations of genital responding are unwanted because in her view, the context is wrong. Another example is the potential discrepancy between two partners' need to reach high arousal and orgasm. The man may need to nurture his own excitement by stimulating the woman genitally while he becomes aroused and orgasmic. She is not averse to this, maybe she even enjoys his excitement, but she is not permitting herself to experience intense arousal; she may have already done so a number of times or may simply not have the mental energy or physical or emotional need to reach orgasm herself. She allows the physiological response driven by her autonomic nervous system to continue; she does not withdraw herself or deliberately focus her mind on nonsexual matters, but she deliberately does not attend to it. A more extreme example of "reprogramming" is the woman who has been sexually abused.

THE SYNDROME OF INTRUSIVE, INAPPROPRIATE GENITAL AROUSAL

Although poorly understood, the clinical syndrome in women of recurrent inappropriate genital engorgement without sexual context (Riley, 1994; Lieblum, 2000), which mimics a seizure generated in the genital sensory cortical area such that genital sensations may be experienced as a partial epileptic seizure (Falconer, Cavanagh, 1959), clearly illustrates that genital engorgement per se can be completely nonsexually arousing. Most would agree that this particular phenomenon, reported by Riley and Lieblum, is a disorder, but it could be seen as the extreme manifestation of genital disconnectedness of which milder versions are normative for many women.

TABLE 2. The Process of Sexual Arousal

Subconscious	
Register	Sexual stimuli (inherent sexual quality)
Conscious	
Appraise	Context of sexual stimuli (subjectively sexually arousing)
Permit	The composite emotion of subjective arousal
Tolerate	The composite emotion of sexual arousal including variable genital and other somatic feedback and remaining focused
Enjoy	Neither negative emotions nor negative cognitions associated with any aspect of arousal

CONCLUSION

Of the subgroups of FSAD, the larger subgroup is typified by the woman who states that although she may enjoy the closeness and affection of sexual interaction with the partner, she has minimal or no subjective arousal. She is unaware of genital sensations even with direct stimulation, even though there is engorgement and lubrication. Pharmacologically enhancing that engorgement is unlikely to change her subjective experience. Instead, her mind needs to interpret what is happening differently—to interpret the external context as sexually exciting and to recognize genital engorgement (directly or indirectly) as sexually exciting. In other words, her physical response needs to be both attended to and interpreted differently. Then the genital response will become a reinforcing stimulus rather than an irrelevant marker that her autonomic nervous system has reacted to stimuli that did indeed have some sexual meaning for her, but they were not interpreted as subjectively sexually arousing.

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