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Measuring the cycles of female sexuality

Level of sexual desire varies with hormonal and social milieus. A daily accounting procedure keeps track of fluctuations in female-initiated sexual activity that peaks at specific times in the menstrual cycle.

We have recently conducted studies that suggest hormonal and general nonhormonal factors, as well as individual differences, influence cycle fluctuations in female sexuality. Women have a hormonal rhythm associated with ovulation, which can be shown by using measures of auto-sexual as well as female-initiated heterosexual behavior. Also, despite the custom of abstinence from intercourse during menstruation, women apparently have sexual interests at this time.

Several years ago, when we became interested in changes in sexual desire over the course of the menstrual cycle, we found that although investigators reported premenstrual and postmenstrual increases in intercourse rates, they were not able to explain the processes underlying these increases. In addition, these studies rarely reported significant mid-cycle increases in sexual activity. Mid-cycle increases would be expected because sexual activity is heightened as a result of ovulatory hormone changes in nonhuman mammals.¹ We reasoned that previous investigators of human sexuality might have missed some effects by relying on intercourse and orgasm rates, measures of sexual behavior that probably reflect male rather than female initiation of sexual activity. Therefore, we designed a series of studies measuring sexual activity of all kinds.

Cyclicality of sexual desire

Studies have shown that many women believe they experience regular fluctuations in sexual desire during their menstrual cycle. Davis² conducted one of the earliest investigations over fifty years ago. When she questioned 1,000 unmarried Americans in their midtwenties, about one third reported regular periodicity of desire. Anthropologic data on the Hopi in North America and the Masai in Africa¹ reveal beliefs in periodicity in other societies as well. According to Davis, about 90% of her sample who believed they experienced regular fluctuations reported a heightening of desire directly before or directly after menstruation, or at both times. The crosscultural reports are similar. Also, about 5% of the women experiencing regular

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periodicity of desire in Davis' study reported a midcycle rise. Other studies support this statistic.³

Hormonal factors affecting cyclicality

Inconsistency of findings. Investigators have linked sexual activity in the human male, as well as in male primates and lower mammals, to the presence of the gonadal hormone testosterone. When castrated males or those with nonfunctioning testes, who often report low levels of sexual desire and behavior, are injected with testosterone, their levels of desire and frequency of sexual behavior may increase substantially.⁴

Data on hormonal control of sexual behavior in the human female are not as clear. Animal studies link female arousal to the presence of estrogen and indicate that androgens may also play a role. Data on human females, however, have been contradictory. Some studies in which oophorectomized women were injected with estrogen or androgen have reported increased sexual activity and interest; others have not.⁴

Three components of female sexuality. A recent paper by Beach⁵ provides a useful approach to these inconsistent findings. He distinguishes three components of female sexuality that are controlled by hormones: attractivity, the female's sexual attractiveness to the male; receptivity, the female's acceptance of and response to the male's invitations; and proceptivity, the female's sexual invitations to the male. The inconsistencies reported in the literature may reflect a failure to distinguish among these components.

Among nonhuman mammals, the first two components are strongly estrogen-dependent. Changes in attractivity, for example, are a function of pheromones, chemical substances that transmit messages through the sense of smell. Pheromone levels affecting attractivity vary directly with estrogen levels. Although researchers have isolated sex-related pheromones in the human female,⁶ they do not know if these substances are functional. Among nonhuman mammals, females are also more receptive when estrogen levels are high. Analogous data on the human female are not available, but levels of estrogen do affect vaginal lubrication, another aspect of sexual receptivity. It should be noted, however, that although these two components may result in female sexual behavior they do not necessarily represent "female" sexual desire. The behavior itself may be initiated by the male.

Beach's proceptivity component most closely approximates the idea of female sexual drive. As such it represents that aspect of sexuality most relevant to our investigations. The author notes that this component also appears to be estrogen-dependent, but that testosterone or other androgens such as androstenedione may also play a part. Although some researchers^{7,8} have shown that implantations and injections of testosterone in female monkeys increase their proceptive behavior, the hormone levels used in these studies are far in excess of those normally found in the female. In fact the injected testosterone may be converted to estrogen before affecting behavior.⁴ Recent research by Harold Persky of the department of psychiatry, University of Pennsylvania, however, does suggest a link between endogenous testosterone levels and female sexuality.⁹

Designing our study. To demonstrate the link between female sexual arousal and hormones, we examined fluctuations in proceptive sexual behavior during the menstrual cycle.¹⁰ Because estrogen levels rise sharply at ovulation, we hypothesized that the proceptive activity of women not using oral contraceptives should also rise at this time. Oral contraceptives, we argued,

should suppress such an effect because they do not allow estrogen levels to fluctuate.

Our subjects were 35 college-educated, married women, aged 21 to 39. All were carefully interviewed before the study to screen out individuals with marital or medical problems that might affect sexual activity or menstrual cyclicity. Twelve participants had been using combination oral contraceptives for at least six months, 9 used an intrauterine device, 2 had vasectomized husbands, and 12 used diaphragm, foam, condom, or a combination of these techniques.

Collecting data. Daily the women recorded all sexual experiences. For each heterosexual encounter, they indicated the initiator (mutual, self, or partner). They also recorded rejected initiations, both their own and those of their partner. The 35 participants completed data for a total of 165 menstrual cycles. The median number of cycles completed per participant was 4.2, with a mode of 3. Cycle lengths ranged from 23 to 36 days.

Calculating results. We measured proceptive sexual behavior by summing female-initiated experiences. We included all female-initiated heterosexual behavior, such as self- and mutually-initiated sessions of intercourse and caressing as well as female advances rejected by the male; and all autosexual behavior, such as masturbation, sexually arousing fantasies and dreams, and reports of arousal from books, magazines, or films. Each participant's data were standardized to a common baseline so that *relative* changes in levels of activity could be more easily identified.

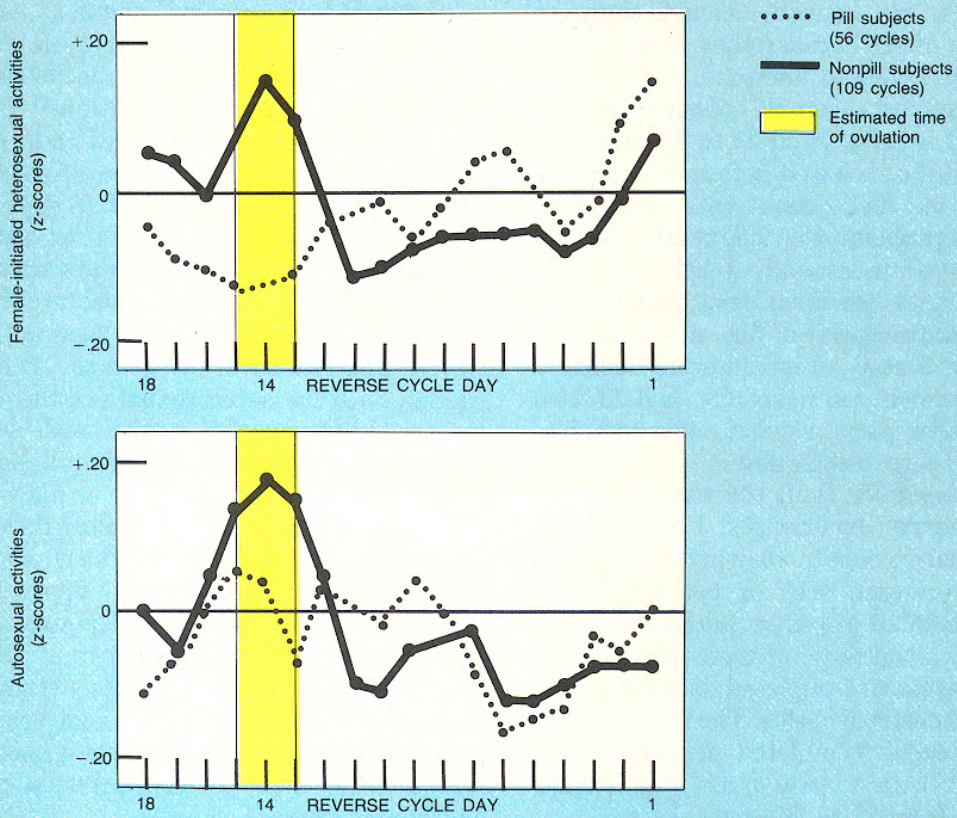
Pill and nonpill subjects. Figure 1 shows the data collected for the two groups (pill and nonpill) plotted backwards from the time of menstruation. Because we did not take daily blood samples, our best estimate of ovulation was reverse cycle day 14—the 14th day counting backwards from the succeeding menstruation.¹¹ The shaded area (reverse cycle days 13 to 15) represents the presumed time of ovulation. We included only the last 18 days of each cycle because earlier days for many cycles are confounded by events occurring around menstruation, which are discussed below as nonhormonal factors.

Differential pattern of two groups. As expected, both the heterosexual and the autosexual measures for women with normal hormone fluctuations (nonpill subjects) show sharp peaks at ovulation; those for women without hormone fluctuations (pill subjects) do not. These peaks are significant when tested by appropriate statistical methods.¹⁰ Analogous analyses of rates of intercourse per se (the typical measure used in previous studies of female sexual behavior) or analyses of male-initiated sessions do not show such a strong differential pattern between pill and nonpill users.

The data, therefore, suggest that increased female initiation is caused by fluctuations in hormone levels. At present, it is not possible to state the precise hormonal mechanism involved. Although the level of estrogens is known to peak sharply at this time, recent evidence suggests that ovarian-secreted androgens such as androstenedione and testosterone may also peak then.^{12,13} Although oral contraceptives suppress estrogen levels, they do not suppress androgen levels.¹⁴

It should also be noted that estrogen levels are known to rise sharply again during the luteal phase of the cycle. Then, however, the simultaneous high

Fig. 1. Female-initiated Sex: Latter Part of Menstrual Cycle



Days of the menstrual cycle are counted backwards from the onset of the succeeding menstruation. Ovulation is estimated as day 14 counting backwards. Data points are calculated from three-day means of standardized z-scores to reduce variability of the curves.

Fig. 2. Female-initiated Sex: During Menstruation and Partner Absence

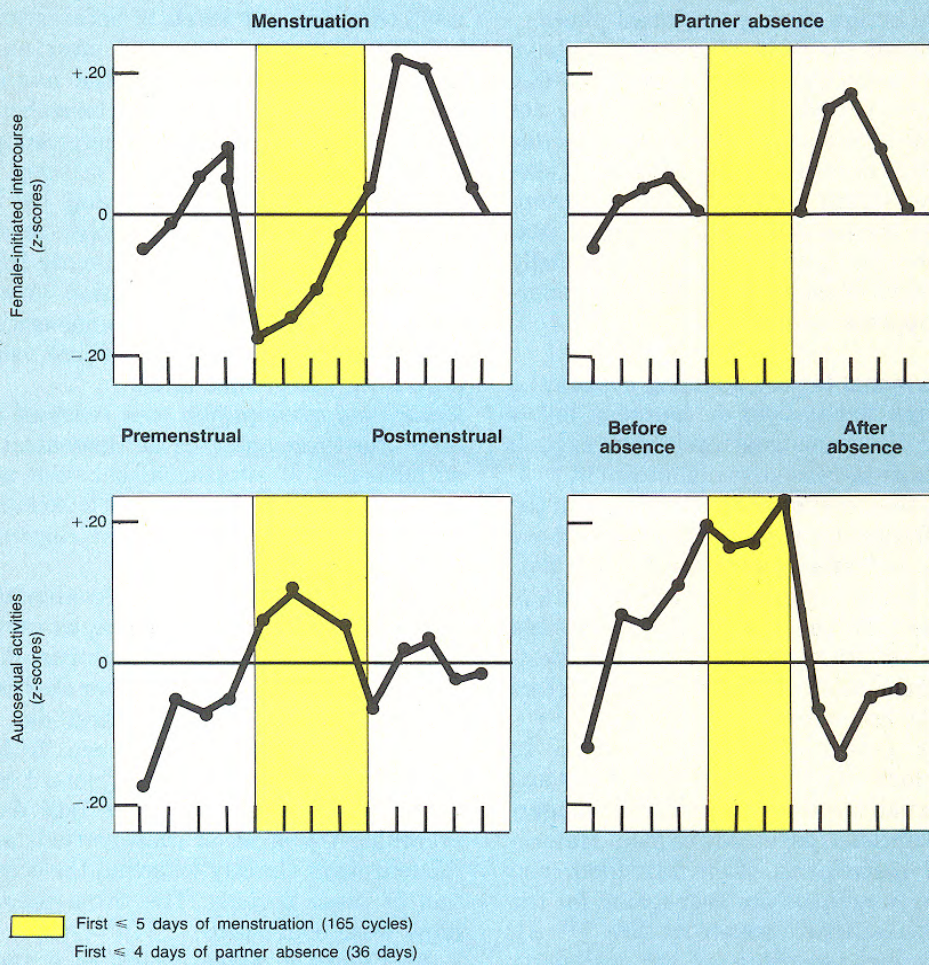


Fig. 3. Female-initiated Sex: For Abstainers and Nonabstainers During Menstruation

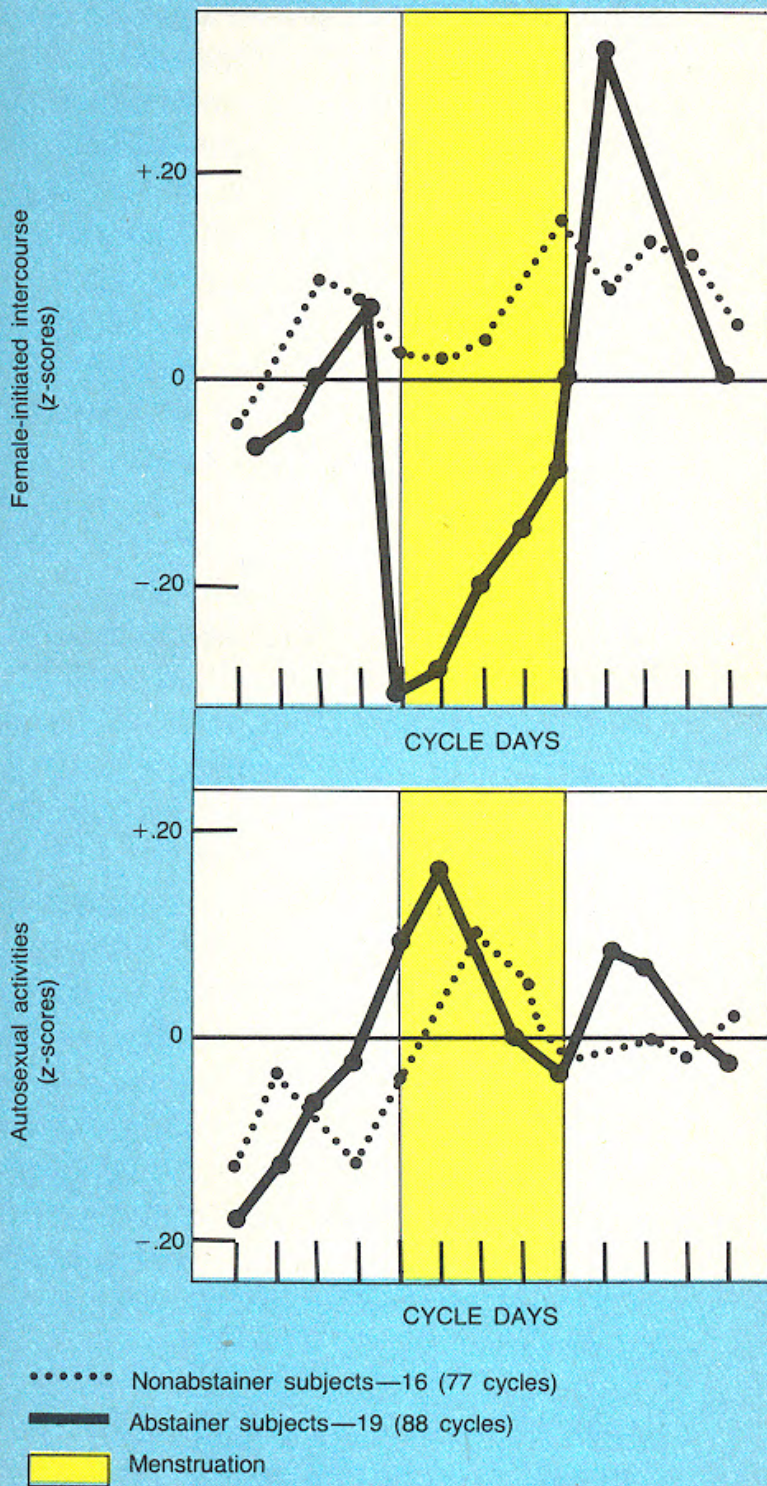
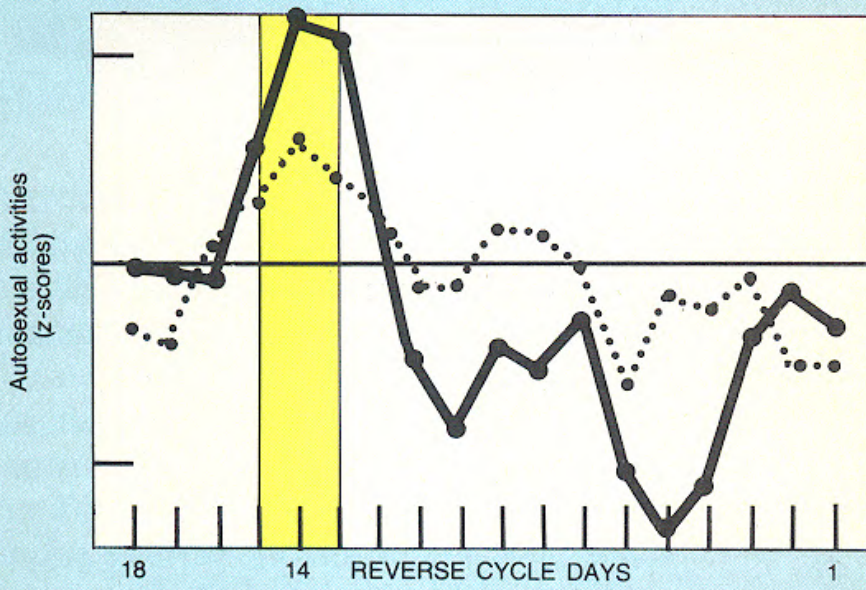
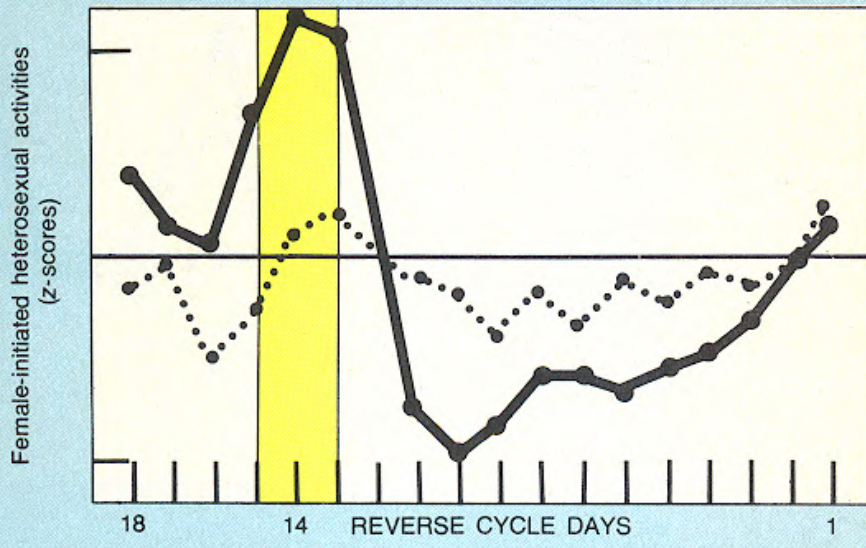
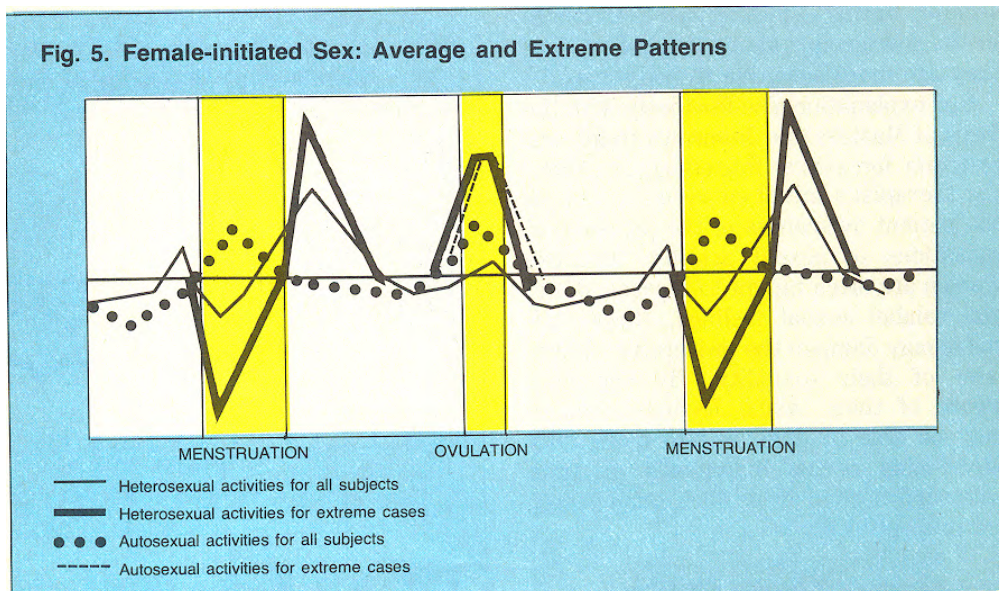


Fig. 4. Female-initiated Sex: For Sensuous and Nonsensuous During Latter Part of Cycle



..... Nonsensuous nonpill subjects—12 (50 cycles)
———— Sensuous nonpill subjects—11 (59 cycles)



levels of progesterone are believed to counteract any possible estrogenic effects.¹⁵ As Figure 1 shows, no heightening of sexual arousal occurs during the luteal phase.

Although the rates of preceptive sexual activity were higher during the three-day ovulatory period for women who did not use oral contraceptives, the increase was negligible in terms of overall rates of proceptive sexual activity. The pill suppresses the natural cyclic rhythm of sexual behavior, but because it involves only a few days of the cycle, it does not generally suppress sexuality.

Nonhormonal factors affecting cyclicity

Although fluctuations in hormone levels during the menstrual cycle can explain reports of increased sexual desire at ovulation, they cannot adequately explain the most frequently reported changes—those before and after menstruation. At such times, hormone levels are low relative to the rest of the cycle. To understand causes of these premenstrual and post-menstrual changes, nonhormonal factors must be examined.

Taboos surrounding menstruation. In many societies, menstruating women and menstrual blood are considered dangerous or unclean, especially to men. Heterosexual behavior is often forbidden, and women sometimes are segregated for the duration of their menstrual flow.^{11,16} Although such practices are not customary in the U.S. or most Western countries, a stigma of uncleanness remains. Abstinence from heterosexual relations is common. In a recent survey of 960 California families, Paige reports that half had never had intercourse during menstruation.¹⁵ Such explicit and implicit taboos suggest that the premenstrual rise in desire may represent an anticipation of abstinence and the postmenstrual rise may represent a rebound effect from the deprivation experienced during menstrual flow.¹

Sexual abstinence and desire. We theorized that if higher levels of heterosexual behavior directly before and after menstruation result from anticipation and rebound, it followed that this pattern should appear during other times of enforced abstinence; women should also attempt to compensate for the deprivation by increasing their use of alternative sexual outlets; and

those who abstain more from intercourse during menstruation should show greater rebound and compensation effects. We tested these predictions using data from our sample of 35.

Measuring anticipation and rebound effects. For these analyses we concentrated on measures of autosexual behavior and female-initiated intercourse. We excluded caressing because it does not decrease during menstruation.

Figures 2 and 3 show the relevant data. The shaded portions in the graphs represent the first five days of menstrual flow and the first four days of partner absence, counting forward from the first day of menstruation or partner absence. In the nonshaded portions, we have plotted levels of sexual behavior for the four days preceding the onset of these periods and the four days directly following the cessation of these periods. The three predictions were confirmed.

As Figure 2 shows, there is a small anticipation effect before menstruation, a larger rebound effect following it, and some autosexual compensation during menstruation. Because both pill and non-pill subjects showed all the effects, we combined the data. Anticipation, compensation, and rebound are also shown in relation to periods of partner absence.

For Figure 3, the 35 women were divided into one group (n=19) who tended to abstain from intercourse during menstruation and another group (n=16) who did not. Although this figure shows no difference in compensation or anticipation effects, it does show a large difference in rebound effect. This supports our prediction that increases in deprivation lead to subsequent increases in the deprived behavior following the period of deprivation. All the effects except the small anticipatory increases have been found to be significant when analyzed by appropriate statistical tests.

Desire during menstruation. One important implication of these data is especially noteworthy. Although the data do point to the significance of nonhormonal factors in accounting for cyclic fluctuation in female sexual behavior, they also indicate that the female sexual drive is not particularly low during menstrual flow. Summing the heterosexual and autosexual measures in Figure 2 shows that the level of female-initiated behavior is close to the participants' baseline levels, the average of all days during the cycle. Also, female advances rejected by the male and female-initiated caressing sessions are at their highest levels at this point, and male advances rejected by the female are at their lowest levels. Apparently it is the males' reluctance that causes the low level of heterosexual activity typically observed during menstrual flow. We believe this point is very important when counseling patients. They should realize that their sexual desires and the prescriptions of social convention may not coincide during this particular time in their cycle.

Belief and behavior discrepancies. It is surprising that women are more likely to recollect fluctuations in sexual arousal associated with menstruation than fluctuations at ovulation. This is despite the fact that the actual magnitude of

the changes in sexual behavior at these two times can be very similar. In Davis' study, only 5% of the women (all nonpill) believed they experienced a rise in sexual desire at midcycle as compared with 90% who cited rises around menstruation. We found similar recollections among the nonpill users in our study. Why this discrepancy between belief and behavior?

First, because menstrual flow is a convenient marker during the cycle, events occurring near this time may be more easily remembered. Time of ovulation, which varies with cycle length, has no external manifestation. Because it is less likely to be noticed, associated events may be less easily remembered.

Second, retrospective accounts of behavior, such as those reported in the Davis study, are often distorted by an individual's belief system. If a woman believes she usually experiences a rise in sexual desire at a certain time of the cycle, when remembering her feelings, she may interpret much of what has happened in a manner congruent with her beliefs.¹⁷

Because the rise in sexuality at menstruation is more easily remembered, retrospective reports may exaggerate it. The opposite effect would be expected at ovulation. Therefore, we would caution against assessing patients' sexual behavior by methods other than a daily accounting procedure.

Which women exhibit a midcycle increase in sexuality?

Although the evidence points to the actual occurrence of midcycle increases in female sexuality, the phenomenon is not universal. Many women exhibit the change, others do not. What accounts for the difference?

Sensuous women. We hypothesized that women who experienced changes in sexual arousal might be more interested and involved in sex and hence more attuned to sexual "messages" from their bodies. These women, therefore, might be more aware of the hormonal messages at mid-cycle and respond to them with an increase in heterosexual initiation and auto-sexual behavior. To test this hypothesis, we divided our participants by level of autosexual activity—the measure of proceptive female sexual behavior least influenced by the partner. We expected that those subjects with relatively high overall rates of autosexual behavior ("sensuous" subjects) would be more likely to exhibit the ovulatory increase. (We should note that the women in the sensuous group are not so categorized as a result of their elevated levels of autosexual activity during ovulation and menstruation. They have higher levels throughout the cycle.) The standardized scores of sexual activity used in previous analyses were used here.

Response to body cues. The resulting data confirmed our hypothesis. As Figure 4 shows, the rise in autosexual and female-initiated heterosexual behavior at mid-cycle was much greater for sensuous subjects than for the other subjects. These findings are preliminary and need replication. Our interpretation that they reflect greater sensitivity to body cues must also be considered as tentative. In support of our interpretation, however, we offer two other pieces of evidence from our research program. First, women with high levels of autosexual behavior were more likely to recollect an ovulatory increase in sexual initiation during an interview after they had completed the study. Although only six women remembered experiencing this type of cyclic fluctuation, five of these were in the high autosexual activity group. Second, the women in this group were much more likely to report *mittelschmerz*

during ovulation than were those in the low group, again suggesting that they are more sensitive to body cues.

Our explanation also fits nicely with the focus of Masters and Johnson's treatment program for sexual inadequacy.¹⁸ There the therapist's initial concern is to teach the patient awareness of the pleasurable sensations of sexual activity. Because women are often taught to repress, deny, and relabel sexual feelings, these attitudes may dampen the preceptive component of their sexuality. By becoming aware of their sexual feelings, women may be able to develop into more fully functioning sexual individuals, in tune with their normal cyclic fluctuation in sexual proceptivity.

Social context of female sexuality

Figure 5, a simplified form of the data presented in Figures 1 to 4, summarizes our findings. If one examines the (solid line) baseline data, which give the relative rate of female-initiated sexual behavior by all married women, one sees only minor fluctuations in sexual behavior—and these fluctuations are difficult to interpret. If one distinguishes between pill and nonpill subjects, however, menstrual abstainers and nonabstainers, and sensuous and nonsensuous women, it is possible to see the fluctuations at their extreme deviations from baseline. One can understand not only how but why these alterations occur.

The ovulatory increase, which is primarily hormonal, is present only in non-pill subjects. Because it is highest in sensuous subjects, cognitive factors also influence it.

The decreases and increases around menstruation are primarily the result of abstinence from sex during menstruation. This social custom causes the decrease in heterosexual activity during menstruation and the rebound in heterosexual activity following menstruation. There is also some evidence for a compensatory increase in autosexual behavior.

Only the small anticipatory rises in sexual activity before menstruation cannot be analyzed by distinguishing different degrees of effect among various subject categories. The presence of an analogous anticipation effect before partner absence, however, suggests that cognitive factors play some role.

Although female-initiated sexual activity has probably received too little attention of researchers, such behavior does not exist in a social vacuum. One must consider it in the broader context of its relation to the partner's sexual behavior and to societal custom. Even within lower animal species, female preceptive behavior is only one of many factors. In humans, the additional effects of social custom are even more powerful. In conclusion, no aspect of female sexuality—hormonal factors, social contexts, individual differences in sensitivity to sexual cues—should be ignored if one wishes to understand and express a full and enriched sexual life.

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