cm² flasks containing a confluent monolayer. The final ethanol concentration was 0.04*M*. The monolayer was incubated for 1 hour at 37°C. PGE levels in the media were then determined by radioimmunoassay (*14*) with antiserum to PGE, [^{3}H]PGE_2 (from New England Nuclear), and goat antibody to rabbit γ-globulin (from Clinical Assays, Inc.). In inhibitor experiments, cells were incubated with indomethacin (IM) for 15 minutes.

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Premenstrual Symptoms: A Reinterpretation

Abstract. *Conclusions regarding the physiological basis and disruptive effects of premenstrual symptoms may be biased because of the reliance on self-report questionnaires as a source of data. In order to examine this possible bias, women's perceptions of their cycle phase were separated experimentally from actual cycle phase. Women who were led to believe that they were premenstrual reported experiencing a significantly higher degree of several physical symptoms, such as water retention, than did women who were led to believe they were intermenstrual. Thus, because of these psychosocial influences on symptom reports, it seems necessary to reexamine previous conclusions regarding the magnitude of menstrual-related changes as well as their physiological basis.*

A variety of physical and psychological symptoms, such as cramps, painful breasts, irritability, and depression have been associated with the premenstrual and menstrual phases of women's reproductive cycles (*1–4*). These uncomfortable symptoms have generally been interpreted as reflecting underlying physiological changes which accompany the menstrual cycle (*2, 3*). However, a major source of evidence regarding cyclic changes has been women's self-reports of symptoms experienced at various phases of the menstrual cycle (*1*). The data presented in this report suggest that self-report studies may have led to exaggerated conclusions regarding the kinds of symptoms experienced, the magnitude of cyclic changes, and the physiological basis of premenstrual symptoms.

Although studies based on women's self-reports of symptoms have found cyclic differences, studies based on less subjective measures have frequently found no differences. For example, in spite of strong beliefs that women gain weight and retain water premenstrually (*4*), carefully controlled observations have shown little cyclic variation in these symptoms (*5*). Furthermore, investigators who find a premenstrual increase in these variables usually also report a midcycle peak (*5, 6*). In addition, according to a recent review (*7*), most objective measures of performance (such as athletics or tests of reasoning) fail to show an impairment associated with the menstrual cycle, even though 8 to 16 percent of the women themselves believed that their performances are affected negatively by their cycles.

In view of the inconsistent findings regarding menstrual-related symptoms, it becomes necessary to question the validity of self-report studies. That is, self-report measures are susceptible to various kinds of biases and may reflect cultural beliefs concerning the kinds of symptoms women experience at various phases of the cycle. This report presents a study in which a woman's actual cycle phase was separated experimentally from her belief concerning her cycle phase. Women were told that it was possible, through new scientific techniques, to predict the expected date of menstruation. In this way, it was possible to assign them to "premenstrual" and "intermenstrual" groups on a random basis. It was hypothesized that the different groups of women would report experiencing different levels of menstrual-related symptoms even though they were all tested at about a week before the onset of menstruation.

Subjects were 44 women undergraduates at Princeton University, aged 18 to 24, who were not taking oral contraceptives at the time of the study nor had taken them within the previous 3 months. Variability in the length of their cycles did not exceed 2 weeks. Upon initial telephone contact, subjects were told they were participating in contraception-related research in which a new technique for predicting the expected date of menstruation from an electroencephalogram (EEG) was being surveyed on young women, having been successfully tested with older women. Brief menstrual histories were also obtained. Later, subjects were telephoned to arrange an appointment. Unknown to the subject, the scheduled day of testing was chosen specifically to correspond to the sixth or seventh day (as estimated from her menstrual history) before her next menses.

The research was conducted in the university infirmary in two connecting rooms, one of which contained an examining table and a large oscilloscope with EEG electrodes attached to it. Subjects were greeted by the first experimenter, given a sheet explaining the purpose of the study, and asked to complete a short medical history. The experimenter then took the temperature and blood pressure of the subject and explained the EEG procedure. Electrodes were attached to the subject's forehead with beautician's tape, and the experimenter proceeded to "run" the simulated EEG machine. After 4 minutes, the electrodes were removed, and the experimenter pretended to read the output. She then informed the subject, according to the experimental group to which she had been randomly assigned, that (i) the subject was "premenstrual" and her period was due in 1 or 2 days (premenstrual group) or that (ii) she was "intermenstrual" and her period was not expected for at least a week to 10 days (intermenstrual group), or (iii) she was given no information at all about the expected date of menstruation (control group). The subject was then instructed to go into an adjoining room, where a second experimenter, who did not know to which experimental group the subject belonged, administered the Moos (*2*) Menstrual Distress Questionnaire (MDQ), consisting of 48 items, 46 of which form eight clusters of symptoms (*8*). Subjects were asked to rate the extent to which they had experienced any of the symptoms in the last day or two. Immediately afterward, subjects were given information describing the true intent of the experiment and were questioned concerning any suspicions

Table 1. Mean ratings on MDQ ± the standard error of the means. The ratings ranged from 1 (not at all) to 6 (extremely).

Variable	Experimental condition			P*
	Premenstrual (N = 15)	Intermenstrual (N = 14)	Control (N = 15)	
	Scales			
Water retention	2.62 ± 0.29	1.54 ± 0.12	2.35 ± 0.31	<.01†
Pain	2.32 ± 0.17	1.88 ± 0.17	2.12 ± 0.21	<.05†
Negative affect	3.13 ± 0.32	3.10 ± 0.30	2.44 ± 0.25	
Concentration	2.51 ± 0.27	2.20 ± 0.19	2.39 ± 0.24	
Behavioral change	2.57 ± 0.38	2.23 ± 0.23	2.92 ± 0.27	
Autonomic reactions	1.45 ± 0.18	1.27 ± 0.08	1.18 ± 0.07	
Arousal	3.35 ± 0.31	3.06 ± 0.22	3.09 ± 0.30	
Control	1.56 ± 0.19	1.41 ± 0.14	1.57 ± 0.15	
	Individual items			
Change in eating habits	2.93 ± 0.51	1.57 ± 0.27	2.93 ± 0.44	<.025†
Sexual arousal	3.60 ± 0.42	2.50 ± 0.40	3.20 ± 0.48	<.05 ‡

*Levels of significance for t-tests between premenstrual and intermenstrual groups. †One-tailed test. ‡Two-tailed test.

they might have about the manipulations (*9*). They were also contacted later to find out the actual day of onset of menstruation, which did not differ across groups ($P > .25$).

The MDQ was selected as the dependent variable because it is one of the most frequently used instruments in self-report studies and has yielded reasonably consistent results. Previous research has shown that water retention, pain, and negative affect are the scales that show the greatest premenstrual as compared to intermenstrual differences (*2–4, 10, 11*). In addition, one of the individual items, "change in eating habits," has also shown a very strong association with the premenstrual phase in a sample very similar to that described here (*11*). Thus, it was predicted that women who thought they were premenstrual would report experiencing a higher level of water retention, pain, negative affect, and change in eating habits, as compared to women who thought that they were intermenstrual.

Scale scores were created for each subject by summing the items in each of the eight scales identified by Moos and dividing by the number of completed items in each scale (*12*). An examination of the means for these eight scales plus the two individual items (Table 1) reveals a pattern consistent with the predictions; that is, symptom ratings of "premenstrual" women were higher than those of "intermenstrual" women. Statistical analyses revealed that these differences attained significance for three of the four predicted variables: water retention, pain, and change in eating habits. Furthermore, the magnitude of the mean differences for most scales was very similar to that reported in previous research (*2, 4, 10, 11*). The means for the control group either generally fell in between the two other groups or were closer to the premenstrual group's means. Possibly, the women given no information about their cycle phase perceived themselves as premenstrual at 6 or 7 days before the onset of their next period. One other comparison reached significance—sexual arousal. This result, while not specifically predicted, is consistent with some previous reports of cyclic changes in sexual interest (*13*). Contrary to predictions, ratings for negative affect did not approach significance.

Although one might argue that the results of this study are partly due to implicit demands for the women to report symptoms consistent with their cycle phase, similar "demands" are present in previous self-report studies. That is, subjects are asked to respond to a series of items identified as possible menstrual symptoms. Indeed, demand characteristics represent a major problem affecting the validity of self-report measures.

These results question previous accounts of menstrual cycle–symptom associations in two respects. First, it may be misleading to assume that responses on a self-report scale accurately represent the nature and extent of changes accompanying the menstrual cycle. Second, previous physiological interpretations of premenstrual symptoms must be reevaluated, since cyclic differences in symptoms were found for women who only believed they were premenstrual or intermenstrual. The results reported here do not suggest that women never experience pain or water retention nor that such symptoms never accompany the premenstrual phase. Instead, it appears that learned associations or beliefs might lead a woman either to overstate what she is actually experiencing or to perceive an exaggeration of naturally fluctuating bodily states (for example, pain and weight changes) when she believes she is premenstrual. This interpretation is consistent with suggestions in other research concerning the importance of psychosocial factors in women's experience of menstruation (*4, 11, 14*).

In conclusion, these results show that psychosocial factors can influence reports of menstrual-related symptoms. In conjunction with inconsistent results from other kinds of studies, these data suggest that the extent to which psychologically or physiologically based changes (or both) accompany the premenstrual phase must remain an open question.

DIANE N. RUBLE
Department of Psychology, Princeton University, Princeton, New Jersey 08540

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