Menstrual Synchrony and Suppression

by

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Synchrony and suppression among a group of women living together in a college dormitory suggest that social interaction can have a strong effect on the menstrual cycle.

STUDIES of the influence of pheromones on the oestrous cycles of mice[1-4], and of crowding on variables such as adrenalin production in mice and other species[5], have suggested that social grouping can influence the balance of the endocrine system. Although there has been little direct investigation with humans, anecdotal and indirect observations have indicated that social groupings influence some aspects of the menstrual cycle. Menstrual synchrony is often reported by all-female living groups and by mothers, daughters and sisters who are living together. For example, the distribution of onsets of seven female lifeguards was scattered at the beginning of the summer, but after 3 months spent together the onset of all seven cycles fell within a 4 day period.

Indirect support is given by the investigation of Collet *et al.*[6] on the effect of age on menstrual cycle patterning. A higher percentage of anovulatory cycles were reported for college age women than for older women. Although Collet *et al.* attributed this to a maturational factor, it is interesting that most of the college aged women attended all female schools. Considering the parallel with the Lee–Boot effect in mice[1] (groups consisting only of females become pseudopregnant or anoestrous), it seems possible that an interpersonal factor is operating together with the maturational factor.

Subjects were 135 females aged 17–22 yr—all residents of a dormitory in a suburban women's college. The dormitory in which they resided has four main corridors each with approximately twenty-five girls living in single and double rooms. Six smaller living areas, separated from the main corridors by at least one door, each house approximately eight girls in single rooms.

Three times during the academic year, each subject was asked when her last and second to last menstrual periods had begun; thus the date of onset was determined for all cycles between late September and early April. The average duration of menstruation and presence of dysmenorrhoea were noted. In addition, subjects estimated how many times each week they were in the company of males and listed by room number the girls ($N \leq 10$) with whom they spent the most time, indicating which two of these they saw most often.

The date of menstrual onset was compared for room mates and closest friends, for close friend groups and for living groups. Two people qualified as "closest friends" only if both had indicated that they saw each other most often. While menstrual cycle timing in women using birth control pills is individually invariant, these women were still included in the analysis, because their influence on the menstrual cycles of the others was unknown. For room mates and closest friends, the difference between the date of onset in October for one arbitrarily chosen member of the pair and the closest date of onset for the other was calculated. This difference was compared with a difference for March calculated in a similar way, but with one change: instead of choosing the closest onset dates for the pair, both onsets for March were chosen to follow the initial October onset by an equal number of cycles. For example, if onset 6 occurred on March 10 for the first member of the pair, and onsets 5 and 6 for the other member occurred on March 1 and March 29 respectively, then the March 10 and March 29 dates were used to calculate the difference in onset. This procedure was used to minimize chance coincidences that did not result from a trend towards synchrony.

The Wilcoxon matched-pairs signed-ranks test[7] was used to test for a significant decrease in the difference between onset dates of room mates and closest friends. This test utilizes both the direction and magnitude of change in differences and is therefore a relatively powerful test.

There was a significant increase in synchronization (that is, a decrease in the difference between onset dates) among room mates ($P \leq 0{\cdot}0007$), among closest friends ($P \leq 0{\cdot}003$) and among room mates and closest friends combined ($P \leq 0.000$[illegible]). The increase in synchrony for room mates did not differ significantly from the increase for closest friends. The increase in synchrony was further substantiated by non-overlapping confidence intervals, calculated for the median difference of onset dates[8] (Table 1).

This synchrony might be due to some factor other than time spent with an individual; Koford[9] has attributed synchrony of the breeding season in *Macaca mulata* on Cayo Santiago to common seasonal changes in available food. The fact that the subjects generally eat as a dormitory group in a common dining room might be a significant factor in creating synchrony. A similar life pattern and common, repeated stress periods might also effect synchrony. Subjects were therefore randomly paired and tested for synchrony within the dormitory as a whole, but no significant trend (N.S., $P \leq 0.8$) was found, and the confidence intervals for the median difference in onset date overlapped completely.

Group synchrony was also investigated and the data were analysed to verify that the decrease in difference between onset dates was a true measure of synchrony. All subjects were divided into fifteen groups of close friends ($5 \leq N \leq 10$), using the lists of close friends made by each subject. During the interview, it was stressed to each subject that her list of "close friends" should include the people she saw most often and with whom she spent the most time, not necessarily those with whom she felt the closest. But because there is usually some overlap, the term "close friends" was adopted. Only subjects who mutually listed each other were included in a group.

A mean onset date (μ_t) was determined for each group in October, late November, January, late February and April. As before, the onset dates (X_t) being compared, each followed the October onset (X_1) by an equal number of cycles. The mean individual difference from the group onset mean

$$\frac{\sum^{n}(X_t - \mu_t)}{n}$$

was determined for each group and compared across time in two ways. First, a linear rank method, designed by Page[10] to

Table 1 Confidence Intervals (> 0.99, in days) for the Median Difference in Onset Date between Members of the Pair

	October	March
Close friends and room mates N = 66	7 < M < 10	3 < M < [illegible]
Random pairs N = 33	6 < M < 14	5 < M < [illegible]

test ordered hypotheses for multiple treatments, showed a significant decrease in individual differences from the group onset mean for close friend groups ($P \leq 0.001$). Second, a graph of this decrease as a function of time (Fig. 1) indicated that the greatest decrease occurred in the first 4 months with little subsequent change. This asymptotic relation indicated that the decrease in difference between onset dates was indeed an increase in synchrony for close friend groups.

Usually those who considered themselves close friends lived together. Because this was not always the case, however, subjects were divided into thirteen living groups ($5 \leq N \leq 12$), solely on the basis of arrangement of rooms, to test the importance of geographic location. When grouped in this way, there was no significant increase in synchrony within groups.

Dewan[11] has suggested that the menstrual cycles of monkeys around the equator are synchronized because each cycle is locked in phase with the Moon. As the production by the pineal gland of a substance which inhibits the action of luteinizing hormone is suppressed by light, the continuous light of nights with a full Moon would facilitate ovulation across a group of monkeys and induce synchrony. This suggests that the synchrony in close friend groups and among room mates comes from a common light–dark pattern, perhaps with common stress periods in which the subjects may stay up for a large part of the night. It would be expected that if synchrony arose from common light–dark cycles, room mates would exhibit a more significant amount of synchrony than do closest friends. The opposite trend was found, however, although it was not significant (room mates, $P \leq 0.007$; closest friends, $P \leq 0.003$). It does not seem likely therefore that a photoperiodic effect is a significant cause of synchrony. This is further supported by the lack of significant synchrony in random pairings in the dormitory.

Paralleling the Whitten effect in mice[3] (in which suppression of oestrus in groups of females can be released by the introduction of a male pheromone) synchrony may result from a pheromonal interaction of suppression among close friend groups, followed by a periodic release due to the presence of males on the weekend. However, this would be insufficient to explain the synchrony which occurred among room mates and close friends, but did not occur throughout the dormitory.

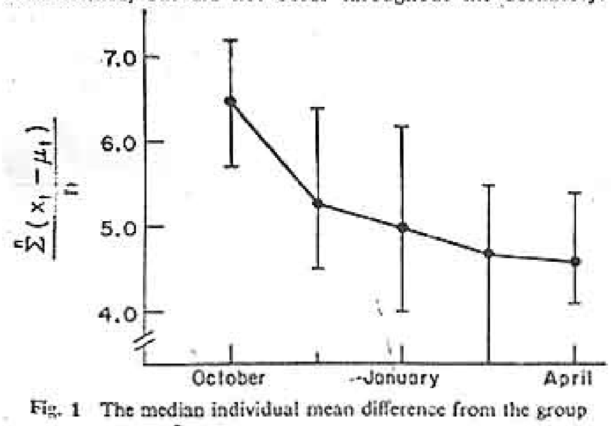

Fig. 1 The median individual mean difference from the group onset mean $\left(\frac{(\sum^{n} X_i - \mu_i)}{n} \text{ days}\right)$ as a function of time. The asymptotic relation and non-overlapping confidence intervals[8] for the medians in October and late February, and October and April (>0.99), indicate an increase in synchrony for close friend groups.

Some additional pheromonal effect among individuals of the group of females would be necessary. Perhaps at least one female pheromone affects the timing of other female menstrual cycles.

Another possible source of synchrony might be the awareness of menstrual cycles among friends. A sample taken from the dormitory, however, indicated that 47% were not conscious of their friends' menstrual cycles, and, of the 53% who were, 48% (25% of the total) were only vaguely aware.

The significant factor in synchrony, then, is that the individuals of the group spend time together. Whether the mechanism underlying this phenomenon is pheromonal, mediated by awareness or some other process is a question which still remains open for speculation and investigation.

Subjects were divided into two groups: those who estimated that they spent time with males, once, twice or no times per week ($N = 42$), and those who estimated that they spent time with males three or more times per week ($N = 33$). Borderline cases and those taking birth control pills were discarded. After testing for homogeneity of variance, the mean cycle length and duration of menstruation was compared using Student's t test. Those who estimated seeing males less than three times per week experienced significantly ($P \geq 0.03$) longer cycles than those of the other group whose mean cycle length corresponded with national norms (approximately 28 days)[12]. There was no significant difference in duration of menstruation itself ($P \geq 0.2$, Table 2).

Table 2 Mean Cycle Lengths and Duration of Menstruation

Estimated exposure to male (days/week)	Length of cycle (days)	Duration (days)
0–2 $N = 56$	30.0 ± 3.9	5.0 ± 1.1
3–7 $N = 31$	28.5 ± 2.9	4.8 ± 1.2
P	≤ 0.03	N.S. ≤ 0.2

The possibility that the results were confounded by a maturational factor was tested, as subjects included members of the freshman, sophomore, junior and senior classes. The subjects were regrouped and compared according to class: underclassmen were compared with upperclassmen. There was no significant difference in cycle length (underclassmen 29.6 ± 5.6 days; upperclassmen 29.9 ± 5.7 days).

Exposure to males may not be the significant factor. It may be, for example, that those with longer cycles are less likely to spend time with males. However, many subjects spontaneously indicated that they became more regular and had shorter cycles when they dated more often. For example, one subject reported that she had a cycle length of 6 months until she began to see males more frequently. Her cycle length then shortened to 4.5 weeks. Then, when she stopped seeing males as often, her cycle lengthened again. Whether this is due to a pheromone mechanism similar to the Lee–Boot effect in mice[1] has yet to be determined.

Although this is a preliminary study, the evidence for synchrony and suppression of the menstrual cycle is quite strong, indicating that in humans there is some interpersonal physiological process which affects the menstrual cycle.

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