Hormone-Behavior Interactions
Hormone – Behavior Interactions

- Deals with both the way physiology affects behavior and with how behavior affects physiology
- Former more familiar than the latter
- For women, lots of stereotypes address the ways in which physiology affects behavior.
Stereotypes

- Strong beliefs about negative effects of the premenstrual phase of the monthly cycle on mood and behavior can be found in political and philosophical writings throughout history.

- Such beliefs may have made sense in a time prior to scientific understanding of reproduction and reproductive endocrinology.
Stereotypes

- But they remain as part of the popular culture well into the present day.
- Many studies show that women and men, girls and boys, in the US have strong negative stereotypes about women’s moods and behaviors around the time of menses.
Stereotypes

- Stereotype says that virtually all women experience negative moods and often debilitating behavior changes pre-menstrually.
- Throughout most of the 20th century, physiological and psychological sciences took these beliefs as fact.
Stereotypes & Research

- Prevalence of such beliefs led to relaxed standards on scientific procedures in the study of mood or behavior and the monthly cycle.
- Resulted in publication of many studies that were poorly designed and yielded dubious results.
Mood & Behavior Across the Monthly Cycle

- The first critique of the quality of studies into the relationship between behavior and the monthly cycle was published by Parlee in 1976.
- Pointed out problems with definition of what symptoms or behaviors were measured, how they were measured, what time period was relevant and conclusions totally unrelated to data but accepted as fact.
Mood & Behavior Across the Monthly Cycle

- One major problem was reliance on recall of behavior over time.
  - Recall is always a problematic way to assess symptoms
  - This is particularly true when there are strong stereotypes about typical experiences in a situation or condition or at a given time.
Recall studies of behavior and cycle

- When recall is used to assess changes in mood and behavior across the cycle:
  - All studies find increased negative moods and behaviors premenstrually.
  - A few studies find an increase of positive moods during the follicular phase or midcycle.
    - ignored
    - attributed to a contrast effect
Concurrent Studies

- Women asked to keep daily diaries of moods, behaviors, and cycle phase.
- Thought to provide a more accurate measure of mood and behaviors less tainted by stereotypes – particularly if the women do not know that cycle-mood relationships are being studied.
Concurrent Studies

- Women report more positive moods and behaviors during the follicular phase or at mid-cycle.
- No increase in negative moods and behaviors during the premenstrual phase of the cycle is noted.
1. Daily diaries of normally-cycling women show significantly more positive mood during the follicular phase (here divided into menstrual and follicular).

2. Daily mood pleasantness of women on oral contraceptives does not differ from that of men randomly assigned a cycle phase.

Figure 2. Mood pleasantness ratings for women who were normally cycling (womenNC), women taking oral contraceptives (womenOC), and men, for each phase of the menstrual cycle (*p<.05, **p<.01).
Data from McFarlane et al., Psychology of Women Quarterly, 1988

When asked to recall moods across cycle phases, women report significantly less pleasant moods during the premenstrual and menstrual phases of the cycle compared to the same women doing daily recordings of mood across the cycle. Note that in this study, mood pleasantness is recalled as significantly more positive than indicated in daily reports during the follicular phase.
Conclusion of General Population Work

- Studies using recall methods still report negative mood and behavior changes around the time of menses.
- Studies using concurrent recording of moods and behaviors show no increase in negative moods and behaviors in the premenstruum.
- Concurrent recording studies show increases in positive moods and behaviors during the follicular phase or at mid-cycle – but these are not part of our cultural stereotypes.
Premenstrual Syndrome (PMS)

- Demonstration that not all women experience problematic symptoms around the time of menses does not mean that PMS does not exist.
- Need protocol for assessing moods and behaviors and agreement on timing of the event to really diagnose PMS.
Premenstrual Syndrome (PMS)

- Defined as the recurrent presence of problematic physical and emotional symptoms during the perimenstruum – defined as the 7 days before menses and up to 3 days after the start of menses.
- Can include physical symptoms such as headache, backache, abdominal pain, fatigue, nausea, etc. as well as emotional symptoms.
Premenstrual Syndrome (PMS)

- Experienced by approximately 11% of cycling women
- Symptoms must be confined to the perimenstruum and absent outside of this time period.
- Cannot be an exaggeration of symptoms always present.
Premenstrual Magnification Pattern

- In some cases, symptoms are present throughout the month but become aggravated during the perimenstruum.
- This is referred to as the Premenstrual Magnification Pattern or PMM.
- Can see magnification of symptoms of a lot of physical and psychological conditions.
Premenstrual Dysphoric Disorder (PMDD)

- More rigorous definition than PMS
- To be diagnosed with PMDD, the individual needs to recurrently experience 5 or more symptoms during the perimenstruum during nearly all cycles (and be symptom free outside of that time period).
PMDD Symptoms

- At least one of the following 4 symptoms must occur:
  - Marked **affective lability** – mood swings, sudden tearfulness, increased sensitivity to rejection
  - Marked **irritability or anger** – increased interpersonal conflicts
  - Marked **depressed mood**, feelings of hopelessness or self-deprecating thoughts
  - Marked **anxiety, tension**, feelings of being keyed up or on edge
PMDD Symptoms

- Other symptoms could include:
  - Decreased interest in usual activities
  - Sense of difficulty concentrating
  - Lethargy, marked lack of energy
  - Change of appetite – overeating or specific food cravings
  - Hypersomnia or insomnia
  - Feeling of being overwhelmed or out of control
  - Physical symptoms such as breast tenderness, bloating, aching joints
PMDD Symptoms

- Symptoms must be associated with significant distress or interfere with work, social activities and/or relationships.
- Symptoms must be confirmed by daily diary for at least 2 cycles.
- Cannot be due to licit or illicit drug use or due to a general medical condition.
- Experienced by 3-8% of cycling women.
- Having such rigorous diagnostic criteria has helped identify specific physiological correlates of PMDD.
Causes of PMDD (NOT PMS)

- Women with PMDD respond differently to estrogen and progesterone (E/P) and recent research suggests that a genetic difference may underlie this differential response.

- In women with PMDD
  - Blood levels of E and P are the same as in women without PMDD.
  - But women with PMDD respond to these levels with irritability, sadness, etc. while women without PMDD are not.
Causes of PMDD

- Suppression of E/P using GnRH agonists (like Lupron) decreases or eliminates the symptoms in many women with PMDD.
  - Symptoms return with replacement of E/P
  - Neither suppression nor replacement affect moods of women without PMDD
- Some brain regions of women with PMDD respond differently to E/P including the amygdala and striatum and others related to affective states.
Causes of PMDD

- Recent work shows differences in gene expression in cells of women with PMDD which result in different responses to increases in E and P (Dubey et al., Molecular Psychiatry, 2017)
- Most noticeable difference was in the gene complex (ESC/E(Z)) that responds to environmental factors such as sex hormones and stressors.
- May be a path to identifying and treating PMDD.
Current Treatment of PMS and PMDD

- No 100% effective treatment for all women.
- Many treatments show some success.
- Least invasive treatments should be tried first but the severity of the symptoms should play a role in selecting even initial treatments.
Current Treatment of PMS and PMDD

- Non-pharmacological Interventions (least invasive):
  - Awareness
  - Improved social support
  - Cognitive-behavioral therapy – focus on management of symptoms
  - Changed diet - to high carbohydrate/low protein; decreased caffeine; decreased sodium; increased calcium intake
  - Increased aerobic exercise
  - More are listed in the reading by Rapkin.
Current Treatment of PMS and PMDD

- Pharmacological Treatments:
  - Selective Serotonin Reuptake Inhibitors (SSRIs) like fluoxetine (Prozac) & sertraline (Zoloft)
  - Anxiolytics like alprazolam (Xanax)
  - Hormonal Contraceptives and GnRH agonists (like Lupron) that stop the cycle
Menstrual Synchrony (or effects of social environment on cycle)

- When women live together, their cycles become more synchronous
- First described by McClintock - 1971
Menstrual Synchrony

- Synchrony may be based on pheromonal secretions (McClintock, 1971)
- **Pheromones**: airborne chemical signals which affect the physiology or behavior of other members of the same species often over great distances.
- Exposure to underarm perspiration of donor draws cycles of recipient women into closer synchrony with that of the donor (Russell et al., 1980)
Menstrual Synchrony

- Synchrony may not actually be in the timing of menses directly.
- Evidence suggests that the timing of ovulation, not menses.
Pheromones & Cycle Length

- Stern & McClintock, 1998
  - Donor underarm secretions from late follicular phase (postmenses to day before LH surge)
  - Recipient has earlier LH surge (ovulation) than would be expected
  - Recipient’s total cycle length is shorter than typical
Late Follicular

After menses to day before LH surge (ovulation)

Recipient ovulates sooner

Recipient’s cycle is shorter

Day 1
First Day of Menses

Ovulation
Separates first and second halves of cycle

Day 1
First Day of Menses
Pheromones & Cycle Length

- Stern & McClintock, 1998
  - Donor underarm secretions from ovulation phase of cycle
  - Results in *delayed LH surge* in recipient
  - And *increased total cycle length* for recipient
  - Note: all effects in follicular phase suggesting effect on follicular maturation or estrogen release
Ovulation Phase

At LH surge

Recipient ovulates later

Recipient’s cycle is longer

Menses

Day 1
First Day of Menses

Ovulation
Separates first and second halves of cycle

Day 1
First Day of Menses
Menstrual Synchrony

- Not all studies looking at timing of actual menses find synchrony.
- Effects most apparent in the first months of living together.
- More apparent in younger women than in older women (may be due to greater cycle variability in younger women).
Menstrual Synchrony

- Not due to dominant female dragging others to her cycle
- Cycles of all women in the group change
Men and Cycle Length

- Exposure to men may result in shorter cycles
- McClintock (1971) - women in contact with men at least 3 times per week have shorter cycles
- Burleson (1995) - intercourse at least once a week results in more regular cycle length (most apparent in young women).
Stress and Cycle Length

- Sudden, severe psychological stress can influence cycle length.
- Effect on cycle depends on when the stress occurs:
  - Stress during preovulatory phase = increased cycle length, delayed ovulation.
  - Stress during postovulatory phase = decreased cycle length, earlier menses.