The Influence of Reproductive Hormones on the Female Brain

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Key Objectives and Goals

1. Discuss how reproductive hormones (estrogen, progesterone, and oxytocin) fluctuate across a women’s reproductive cycle.

2. Describe how reproductive hormones influence the major neurotransmitters in the female brain.

3. Introduce how these factors can influence women’s moods, cognitions, and behaviors including childbirth, parenting and sexual behavior.

4. Discuss treatment options for women, based on our knowledge of these factors that are unique in women.
Male/Female Brain Differences

Biologic

Psychologic

Social/Cultural
Brain Neurotransmitters

Dopamine
- Alertness
- Working Memory
- Motivation
- Clarity
- Appetite

Norepinephrine
- Concentration
- Execution
- Perseverance
- Recall Memory

Serotonin
- Satisfaction
- Learning Memory
- Pleasure/Pain
- Relaxation

*Deficit*
A mother’s unique special connection to the child is vital for infants care and survival.

The ability to attach and remain the parent caregiver is the remarkable step that has marked our evolution from reptiles to mammals.”

Women’s Moods – Deborah Sichel MD
Estrogen – Mood Enhancing Effects

- Estrogen supports Serotonin
- Estrogen supports Norepinephrine
- Estrogen decreases the stress response
- Antidopaminergic effects
- Promotes Oxytocin
Progesterone – Anti anxiety effects?

• Elevated in pregnancy with rapid drop postpartum
• Fluctuates monthly –withdrawal premenstrually
• Significant decline in menopause
• Progesterone targets areas of the brain similar to anti-anxiety, pain and sleep medications
• Clinical studies show it has hypnotic and anxiolytic as well as dysphoric effects in postmenopausal women
Oxytocin (OT) and Attachment

• Fosters attachment b/w all mammalian mothers and infants
• Improves ability to interpret social situations and facilitates attending to others
• OT activates limbic structures assoc. with emotion and attention
• Postpartum women: Lactation suppresses physiologic response to stress.
• Promotes amnesia during labor
Oxytocin in men

- Improves social reciprocity in men
- Improves the ability to identify competitive relationships
- Fosters striving to improve social status
- Improves males perception of desirability in their mate
“The female brain has tremendous unique aptitudes: verbal agility, the ability to connect deeply in friendships, a nearly psychic capacity to read faces and tone of voice for emotions and states of mind, and the ability to diffuse conflict.

These are talents that women are born with that men frankly, are not.”

Women’s Moods – Deborah Sichel MD
Brain changes - School Age girls
Brain Changes – Puberty (Menses begins)
“Finding a mate”

- Social status
- Age
- Emotional intimacy
- Physical Appearance
"Entering motherhood is the most significant biological event that happens in your life causing profound and permanent brain changes."

Jodi Pawluski PHD
Hormones across pregnancy
Brain changes in motherhood

- Enable her to multitask to meet her babies needs
- Emphasize with the infants emotion and pain
- Regulate how she responds to stimuli or threats
- Sync her brain with her babies for life
  - Synchronized brain responses
  - Matching responses in gaze, touch and vocalization

Elseline Koekzema Leiden U, Netherlands 2016
hormone levels of lactation

- Progesterone
- Prolactin
- Estrogen
- Oxytocin

pregnancy | birth | postpartum

Breast Feeding
Impact of Reproductive Cycle: Psychiatric Admissions in the 2 Years Preceding & Following Childbirth

Perinatal Mood and Anxiety Disorders (PMADs)
Menopause

• In 1900, average age of menopause=45
  – Life span = 49 years old
• Today, women experience menopause between 45-55
  – Average life span = 75 years
  – 20-30 years or more are post menopause
Sexual Problems/Distress in US Women: Prevalence and Correlates*

Recent data suggest prevalence same in women who identify as lesbian or bisexual.
Women and Sexuality

• Context
• Emotional reciprocity
• Rise and decline of libido
• Sensitivity to stress
Central Effects of Neurotransmitters and Hormones on Sexual Functioning

- Estrogen
- Testosterone
- 5-HT\textsubscript{2+3} (serotonin)
- Opioids
- Progesterone
- Norepinephrine
- Dopamine
- Melanocortins
- Prolactin
- Oxytocin

Desire
Subjective excitement
Orgasm

This image was published in the Journal of Sexual Medicine, Vol 4. Clayton AH, Epidemiology and neurobiology of female sexual dysfunction. Copyright Elsevier 2007.
### Expression of Psychiatric Illness by Gender

<table>
<thead>
<tr>
<th>More common in Males</th>
<th>More common in Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antisocial Personality Disorder/ Behavior</td>
<td>Depressive Disorders</td>
</tr>
<tr>
<td>Autism</td>
<td>Anxiety Disorders</td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>Bipolar II disorder</td>
</tr>
<tr>
<td>Addiction</td>
<td></td>
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</tbody>
</table>
Male/Female Brain Differences: Treatment
# Available Antidepressants

## SSRIs
- **serotonin**
  - **Brintellix** (vortioxetine) **B**
  - **Celexa** (citalopram) **G**
  - **Lexapro** (escitalopram) **G**
  - **Luvox** (fluvoxamine) **G**
  - **Paxil** (paroxetine) **G**
  - **Prozac** (fluoxetine) **G**
  - **Viibryd** (vilazodone) **B**
  - **Zoloft** (sertraline) **G**

Inhibit the reuptake of serotonin (5HT)

G=Generic; B=Brand

## SNRIs/Others
- **serotonin and norepinephrine**
  - **Cymbalta** (duloxetine) **G**
  - **Effexor** (venlafaxine) **G**
  - **Fetzima** (levomilnacipran) **B**
  - **Pristiq** (desvenlafaxine) **B,G**

Inhibit serotonin and norepinephrine reuptake

## Others
dopamine, etc.
- **Wellbutrin** (Bupropion)
- **Remeron** (Mirtazapine)
Medication treatment for Depression and Anxiety in Women across her life span

**Antidepressants**

- Moderate to severe depression or anxiety across the course of her lifespan
- Most effective if in combination with psychotherapy
- Effect in 2-6 weeks

**vs. Hormone therapy**

- Studies underway for PP Depression
- Use in PMDD
- Mild depression or anxiety if other symptoms are present in perimenopause
- In combination with SSRIs for severe depression in menopause
- Surgically induced menopause
- Low Libido (testosterone)

(Oxytocin in boys)

- Effect in 1-4 weeks
Women’s Hormones: Grit and Grace
Further Reading

Books

Women’s Moods: Deborah Sichel MD

The Female Brain: Louann Brizendine MD