The Female Brain

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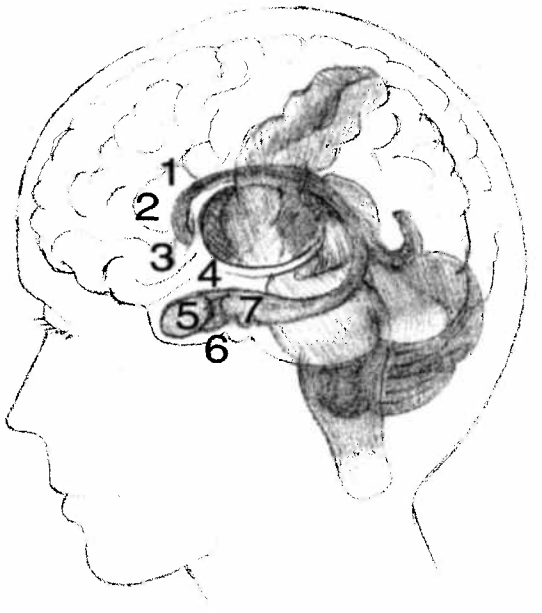

1. Anterior Cingulate Cortex (ACC): Weighs options, makes decisions. It's the worry-wort center, and it's larger in women than in men.
2. Prefrontal Cortex (PFC): The queen that rules the emotions and keeps them from going wild. It puts the brakes on the amygdala. Larger in women, and matures faster in teen girls than in boys by one to two years.
3. Insula: The center that processes gut feelings. Larger and more active in women.
4. Hypothalamus: The conductor of the hormonal symphony; kicks the gonads into gear. Starts pumping earlier at puberty in females.
5. Amygdala: The wild beast within; the instinctual core, tamed only by the PFC. Larger in men.
6. Pituitary Gland: Produces hormones of fertility, milk production, and nurturing behavior. Helps turn on the mommy brain.
7. Hippocampus: The elephant that never forgets a fight, a romantic encounter, or a tender moment—and won't let you forget it, either. Larger and more active in women.

THE CAST OF NEURO-HORMONE CHARACTERS

(in other words, how hormones affect a woman's brain)

THE ONES YOUR doctor knows about

ESTROGEN—the queen: powerful, in control, all-consuming; sometimes all business, sometimes an aggressive seductress; friend of dopamine, serotonin, oxytocin, acetylcholine, and norepinephrine (the feel-good brain chemicals).

PROGESTERONE—in the background but a powerful sister to estrogen; intermittently appears and sometimes is a storm cloud reversing the effects of estrogen; other times is a mellowing agent; mother of allopregnenolone (the brain's Valium, i.e., chill pill).

TESTOSTERONE—fast, assertive, focused, all-consuming, masculine; forceful seducer; aggressive, unfeeling; has no time for cuddling.

THE ONES YOUR doctor may not know about that also affect a woman's brain

OXYTOCIN—fluffy, purring kitty; cuddly, nurturing, earth mother; the good witch Glinda in *The Wizard of Oz;* finds pleasure in helping and serving; sister to vasopressin (the male socializing hormone), sister to estrogen, friend of dopamine (another feel-good brain chemical)

CORTISOL—frizzled, frazzled, stressed out; highly sensitive, physically and emotionally.

VASOPRESSIN—secretive, in the background, subtle aggressive male energies; brother to testosterone, brother to oxytocin (makes you want to connect in an active, male way, as does oxytocin).

DHEA—reservoir of all the hormones; omnipresent, pervasive, sustaining mist of life; energizing; father and mother of testosterone and estrogen, nicknamed "the mother hormone," the Zeus and Hera of hormones; robustly present in youth, wanes to nothing in old age.

ANDROSTENEDIONE—the mother of testosterone in the ovaries; supply of sassiness; high-spirited in youth, wanes at menopause, dies with the ovaries.

ALLOPREGNENOLONE—the luxurious, soothing, mellowing daughter of progesterone; without her, we are crabby; she is sedating, calming, easing; neutralizes any stress, but as soon as she leaves, all is irritable withdrawal; her sudden departure is the central story of PMS, the three or four days before a woman's period starts.

	Major Hormone Changes	What Females Have That Males Don't	Female-Specific Brain Changes	Reality Change
Fetal	Brain growth and development left unperturbed by the high testosterone that makes a male brain	Brain cells are XX, which means more genes for faster brain development and female-specific circuits	Female brain circuits for communication, gut feelings, emotional memory, and anger suppression grow unabated—there is no high testosterone of the male around to kill all those cells	More brain circuits for communication, reading emotions, social nuance, nurturing skills; able to use both sides of the brain
Girlhood	Estrogen is secreted in massive amounts from age 1 to 24 months, then the juvenile pause turns off hormones	High estrogen for up to 2 years after birth	Verbal and emotional circuits are enhanced	Major interest in playing and having fun in connection with other girls, not boys
Puberty	Estrogen, progesterone, and testosterone increase and begin to cycle monthly	More estrogen and less testosterone; girls' brains develop 2 years earlier than boys'	Increased sensitivity and growth of stress, verbal, emotion, and sex circuits	Major interest is sexual attractiveness, desperate love interests, avoidance of parents
Sexual maturity, single woman	Estrogen, progesterone, and testosterone change every day of the month	More focus on relationships, finding a lifelong mate, and choosing a career or job compatible with raising a family	Earlier maturation of decision-making and emotional control circuits	Major interests in finding a mate, love, career development
Pregnancy	Huge increases in progesterone, estrogen	Focus more on nesting, how the family will be provided for; less on career and competition	Stress circuits suppressed; brain calmed by progesterone; brain shrinks; hormones from the fetus and placenta take over brain and body	Major interest in physical well-being, coping with fatigue, nausea, and hunger, and not damaging the fetus; surviving in the workplace; and planning maternity leave
Breast feeding	Oxytocin, prolactin	Focus more exclusively on the baby	Stress circuits still suppressed; sex and emotion circuits hijacked by infant care	Major focus on coping with fatigue, sore nipples, breast milk production, making it through the next 24 hours
Child rearing	Oxytocin; cycling estrogen, progesterone, and testosterone	Less interest in sex, more worry about kids	Increased function of brain circuits for maternal aggression, stress, worry, and emotional bonding	Major interest in well-being, development, education, and safety of kids; coping with increased stress and work
Perimenopause	Erratically cycling estrogen, progesterone, and testosterone	Fluctuating interest in sex, erratic sleep, more fatigue, worry, moods, hot flashes, and irritability	Decreasing sensitivity to estrogen in certain brain circuits	Major interest is surviving day to day and coping with the physical and emotional ups and downs
Menopause	Low estrogen and no progesterone; high FSH/LH	The last precipitous brain change caused by hormones	Circuits fueled by estrogen, oxytocin, and progesterone decline	Major interest in staying healthy, improving well-being and embracing new challenges
Postmenopause	Low, steady estrogen and testosterone; lower oxytocin	More calmness	Circuits less reactive to stress, less emotional	Major interest in doing what *you* want to do; less interest in taking care of others

Phases of a Female's Life