Human Sexual Behavior
What makes sexual behaviors different between adult males and females?

- Hypothesis:
  - There is an activational effect of hormones during development

- Females:
  - Rats: hormones (estradiol and progesterone) control the behavior (e.g. lordosis) and the motivation
  - Primates: hormones don’t control the behavior but perhaps the motivation
  - Female motivation and initiation is highest when estradiol is high. In primates this corresponds to period of high male selectivity. Females select males.

- Males:
  - Key hormone: testosterone
  - Testosterone controls both physiology (sperm production, erection) and motivation (initiation, overall interest)
  - GnRH blocker in men leads to loose sperm/erection and loose sexual interest
  - GnRH loss in monkeys depends on rank (i.e. previous experience, low ranking have the largest loss)
  - Testosterone levels increase with psychological anticipation
  - Testosterone involved in other male behaviors like aggression
  - Testosterone levels decrease with age
    - Explains why there is a decrease in libido

Sexual Orientation
Sexual orientation: gender of preferred sexual partner, homosexuality vs. heterosexuality

- Other dimension of sexual preferences: monogamy, polygamy, age...etc.

Is there a dependence of sexual orientation on developmental vs. genetic factors?

- Developmental factors like education
- Genetic factors like physiological factors
- No single evidence to this...but evidence prenatal exposure to androgens and genetic factors

Genetic Females:
- Disorder called Congenital adrenal hyperplasia (CAH): too much androgens prenatally
  - Mild physical effects (e.g. enlarged clitoris)
  - Increased likelihood for homosexual preference
  - Increased likelihood for male “behaviors” (e.g. liking boy toys)
  - Sexually dimorphic behaviors
  - In video:
    - Women predisposed to more nurturing behaviors than men
    - CAH girls’ adrenal glands are overactive and produce testosterone in the womb (evidence that testosterone before birth affects behavior)
Genetic Males:

- **Androgen Insensitivity Syndrome: failure of androgenization**
  - XY looking female
  - Internal testes that produce testosterone, but there aren’t receptors
  - Produce estrogen in small amounts and that produces feminization
  - Normal female sex lives and behaviors
  - **XY genes not sufficient for heterosexual behaviors. Lack of androgens sufficient for homosexual behaviors (but not necessary)**

Genetic Factors:

- **Twin studies:**
  - Significantly more monozygotic (identical) twins that are both homosexual than dizygotic (fraternal) twins
  - There is a **genetic component** for both female and male homosexual orientation
  - **There are sexual dimorphisms in the brain, but they (as of today) don’t explain sexual orientation**

Brain differences:

- **Men vs. women:**
  - The **corpus callosum** and a few other areas are different (including the hypothalamus which is responsible for hormone production)
  - Women have more fibers in the corpus callosum than men
- **Heterosexual vs. homosexual:**
  - **Inconclusive** (or to the very least, indirect) differences

Are there more genetic differences?

- May be able to look at just finger length
  - **Genes that control the development of the fingers are the same genes that control the development of the ovaries and testes**
  - Males have longer ring fingers relative to their index fingers than women do
    - Long ring finger for women is a sign of protection against breast cancer
  - Men may have better sense of space due to testosterone
  - Testosterone for men is protective against early heart attack (betrers the cardiovascular system but may lead to dyslexia/autism)
  - Estrogen is a promoter of breast cancer

Do animals show homosexual behaviors? (homosexual behaviors vs. “being” homosexual):

- Yes
- About 500-1500 species
- Show homosexual behavior for dominance and for bonding

**Neural control of sexual behavior**

**Males:**

- Medial Preoptic Area: evidence for control from recordings, stimulation and lesion studies
  - Sexually dimorphic nucleus of MPA: androgen-induced enlargement in males
- Circuitry: 2 routes
  - Sensory inputs: come from the spinal cord, vomeronasal organ, and medial amygdala
- Sensory stimuli go to the MPA then goes to inhibit the ParaGigantoCellularis (PGi) or the PeriAqueductal Gray (PAG)
  - If inhibit the PGi will excite the spinal cord which leads to erection/ejaculation
  - If inhibit the PAG will excite PGi and then inhibit spinal cord and inhibit sexual behavior
- **Mostly inhibitory pathway**
  - For normal behavior the PGi needs to be constantly inhibited
  - PAG (in the midbrain): leads to erection
  - Nucleus of the PGi (in the medulla): leads to ejaculation
- SSRIs are antidepressants and decrease male sexual behaviors
- Amygdala sends its outputs to the MPA (“emotional” control of sexual behavior)

**Male sexual behavior**
Amygdala receives sensory inputs, and inputs are indicative of sexual behavior
- Information about stimuli is indicative of the performance of sexual behavior
Amygdala sends its outputs to the MPA (this is the “emotional” control of sexual behavior)

**Neural control of sexual behaviors**
Females:
- VentroMedial nucleus of the hypothalamus: lesion and stimulation studies show neural control of the ventromedial nucleus of the hypothalamus
  - Estradiol and progesterone (in rats) act in VMH
- Circuitry:
  - Sensory inputs: same as males (spinal cord, vomeronasal organ, medial amygdala)
  - Sensory inputs lead to VMH
  - VMH excites PAG or PGi
  - PAG or PGi excites the spinal cord
  - Spinal cord excites lordosis/vaginal secretions
- **Mostly excitatory pathway**
  - For normal behavior, the PGi needs to be excited
  - PAG active in female sexual behavior (orgasms in scanner)

**Female sexual behavior**
As in males, sensory inputs converge in the amygdala

**Neural control of bonding**
About 5-7% of mammalian species are monogamous (possibly “serially monogamous”)
- For example: prairie voles are monogamous and meadow voles are polygamous
  - In voles, monogamous when there are high levels of oxytocin in females and high levels of vasopressin in males
- In humans: oxytocin increases trust and is involved in empathy
- In video:
  - Oxytocin designed to help mothers nourish their offspring (produced through childbirth)
Believed that language developed through women as a way to educate offspring, etc.
  ▪ Don’t need language to hunt so developed through women
  ▪ May explain women’s better verbal ability (have denser corpus callosum)

**Parenting Bonding**
Parturition: set of behavior at and immediately after giving birth (nesting, hiding, cleaning, nursing, etc…)
  ● Example:
    ○ Rat milk production equivalent to 2 gallons of milk a day
    ○ Urine recycling and fluid exchange between mother and pups
    ○ Chemical signals from pups to mothers

Hormones and and maternal behaviors:
  ● Rats: prolactin (involved in maternal behavior) and oxytocin (involved in maternal bonding)
  ● Humans: postpartum depression affects about 13% of women, problems with the bonding part

Neural structures and parenting behaviors:
  ● MPA: lesion studies show it affects maternal but not sexual behaviors
  ● MPA, oxytocin, and prolactin also involved in paternal behaviors

**Quiz**
Estradiol is an androgen.
  ● False, it’s an estrogen

The vomeronasal organ is involved in vomiting.
  ● False, it’s involved in communication through pheromones

In order to develop normal male internal organs, the testes produce an anti-______ hormone which has a ______ (defeminizing/masculinizing) effect, and a pro-______ which has a ______ (defeminizing/masculinizing) effect.
  ● Anti-**Mullerian** hormone, defeminizing, pro-**Wolfian** hormone, masculinizing

MPA is involved in…
  ● Male sexual behavior, maternal and paternal behaviors