**Psychology 210**

Lecture 10
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**Today**

- Sexual Development
  - Body
  - Brain
  - Disorders
  - Variations

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**Sexual Development of the Body**

- Genetic development
  - XY = male
  - XX = female

- Prenatal stages of development
  - Development of gonads
  - Development of internal organs
  - Development of external genitalia
  - Pubertal development

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**Prenatal stages of development**

- Up until 6 weeks of development, no sexual differentiation has occurred
  - Ovaries and testes are both able to develop

- At 6 weeks, Sex-determining region of the Y-chromosome (SRY) becomes active
  - Produces testis-determining factor
  - Causes the development of male genitalia

- Without expression of the SRY gene, ovaries develop

- If the SRY gene is inserted into female mice, testes develop

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**Stage 2: internal organ development**

- Prior to 3 months of development
  - All fetuses have a male Wolffian system and a female Mullerian system
  - In males, the Wolffian system will develop into male sexual organs
  - In females, the Mullerian system will develop into female sexual organs

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**What happens to the non-developed system?**

- In males, the testes secretes hormones
  - Testosterone
  - Anti-Mullerian hormone
  - Degenerates the Mullerian system

- In females, the ovaries do nothing prenatally
  - Nonfunctional remnants of the Wolffian system remain for the entire life of the female
Main trend of sexual development

- The development of a female is considered the “default”
- Without extra hormones changing development, a female reproductive system will develop
- Androgens: steroid hormones that change development toward a more masculine system

Development of external genitalia

- Male: penis and scrotum
- Female: labia, clitoris, outer part of the vagina
- In females, this occurs automatically, with no activity from the ovaries
- Males require 5-alpha-dihydrotestosterone
  - Product of testosterone and 5-alpha-reductase
  - Without it, female genitalia develop

Development overview

Pubertal Development

- Secondary sexual characteristics develop
  - Male: Facial hair and deep voice
  - Female: Wider hips and breast development

Puberty

- Gonadotropin-releasing hormone (GnRH)
  - Released by hypothalamus at onset of puberty
  - Causes the release of two more hormones
    - Follicle stimulating hormone (FSH)
    - Luteinizing hormone (LH)

Pubertal Development

- FSH and LH cause more production of testosterone (in males) and estradiol (in females)
Disorders of Sexual Development

- Genetic Stage
  - Turner’s Syndrome
    - XO chromosomes
  - Klinefelter’s Syndrome
    - XXY chromosomes
    - Male: require hormone therapy to stop female characteristics from showing

- Internal Development Stage
  - Androgen Insensitivity Syndrome
    - Chromosomes: XY
    - Insensitive to androgens: develops externally as a female
    - Anti-Mullerian Hormone prevents internal female system from forming

Disorders of Sexual Development

- External Development Stage
  - Congenital Adrenal Hyperplasia
    - Female exposed to excess androgens prenatally
    - Born with ambiguous external genitalia

- 5 alpha reductase deficiency
  - Males born with ambiguous female genitalia
  - At puberty, the high levels of testosterone cause development of male genitalia

So… gender differences in sexual development exist

- Are there differences between the genders in the development of the brain?
  - Yes!!!
- Are there differences between the way male and female brains develop sexually?
  - Yes!!!

So that’s all for prenatal development

- What about problems that occur during childhood sexual development?
Pfeiffer (1936)

- Observed that testicular implants in neonatal female rats blocked ovulation
  - Attributed this differences to hormones
  - Concluded that there are hormonal differences between males and females
  - Since the pituitary gland releases the hormones, males and females must have different pituitary glands

So, is the pituitary gland where sexual differences exist?

- A later study transplanted adult male rat pituitary glands into adult females
- Found that ovulation continued normally
- Both male and female pituitary glands are capable of producing the same hormones
- The difference between genders must be in the signals from the brain to the pituitary gland

More animal studies

- Castrated adult male rats
  - Cannot ovulate: even if a female system is implanted surgically
- Castrated baby male rats
  - Can ovulate if a female system is implanted surgically
- Testosterone treatment in adult females
  - Stops ovulation
    - Able to be overcome with direct stimulation of the brain
- Testosterone treatment in baby females
  - Stops ovulation
    - No treatment can reverse the effects

Differentiation effects behavior

- Lordosis behavior
  - Female animals arch spine when touched on the back to aid in copulation
- Mounting behavior
  - Male animals mount other animals to aid in copulation
- Castration in baby male rats
  - Leads to a suppression of mounting behaviors and an increase in lordosis behaviors
- Exposure of female baby rats to testosterone
  - Leads to a suppression of lordosis behaviors and an increase in mounting behaviors

Structural Sexual Differences

- Sexually dimorphic nucleus of the preoptic area of the hypothalamus
  - Five times larger in males
- Male cortex is thicker in the left hemisphere
  - Greater asymmetry in the male than in the female

Okay, so that’s how our bodies develop as a response to various hormones at different stages

What about our brain?
Sexual Differentiation of the brain

- Testosterone seems to be the key
  - It’s role seems to be related to estrogen
- What role does estrogen play in the developing brains?

Estrogen

- Estrogen levels are high in both male and female newborns
- Why does the male brain become masculinized and the female brain not?
  - Females and males have a protein that binds to estrogen and stops it from crossing the placenta and entering the brain

So how does estrogen effect the brain?

- Estrogen cannot cross into the brain
- Testosterone CAN
  - Males have a lot more testosterone than females
  - Testosterone crosses into the brain and gets changed into estrogen
  - Masculinizes the brain

What is the effect of estrogen?

- Estrogen levels may play a role in the difference in size between male and female sexually dimorphic nuclei of the preoptic areas
  - It may prevent apoptosis (cell death)

In Hyenas

- Mother’s estrogens are allowed to pass the placenta
- Results in a masculinization of the clitoris

- What are the resulting behaviors and processes that occur because of our hormonal development?
Gender Differences
- Have been found in many areas
  - Regulation of food intake
  - Regulation of body weight
  - Social behaviors
  - Learning behaviors
  - Aggression
  - Performance

Differences in performance
- Mathematical reasoning ability
  - Males seem to have higher abilities
- Linguistic ability
  - Females seem to have high linguistic abilities
- Lateralization of function
  - Males seem to have stronger lateralization of function than females
  - Females use both hemispheres more often

Sexual Hormones and Sexual Behavior
- Main hormone centers
  - Hypothalamus
  - Pituitary gland

Hypothalamus
- Controls hormone release through the release of Gonadotropin Releasing Hormone (GnRH)
- Melatonin inhibits GnRH
  - Light inhibits Melatonin
  - Thus light increases GnRH production
  - Responsible for the production of offspring at the “right time” of the year

What does GnRH do?
- Tells the pituitary gland to release Lutenizing Hormone (LH) and Follicle Stimulating Hormone (FSH)
  - In males: LH tells the testes to release testosterone
    - FSH aids in the maturing of sperm
  - In females: FSH and LH regulate and control the menstrual cycle

(a) Figure Rotation
"Is this the same object?"
The female reproductive cycle

- FSH is secreted at the beginning of the menstrual cycle
  - Causes the ovaries to develop follicles (contain an ovum)
  - One follicle begins to develop more rapidly than others and estrogens are released
    - Estrogens prevent the other follicles from developing

Next

- Increasing estrogen levels stimulate the release of more LH
- Increases in LH causes ovulation
- The remaining empty follicle is now called the corpus luteum
  - Releases progesterone
    - Prevents the formation of more follicles and causes a thickening of the uterine lining
    - If fertilization hasn’t occurred, progesterone levels fall and the cycle repeats

Oral Contraceptives

- Some act to reduce the size of the opening of the fallopian tubes, so the sperm are unable to get to the egg
- Many act to not allow a fertilized egg to attach to the uterine wall

Sexual Hormones and Female Behavior

- Testosterone levels appear to moderate sexual interest
- Testosterone levels appear to aid in some cognitive tasks as well
  - Women received their higher scores on mental rotation tasks when testosterone levels were high, and lower scores when levels were low

Sexual Hormones and Male Behavior

- Androgens appear to effect many different aspects of behavior
  - Testosterone levels are higher during competitive periods
    - Sporting events
    - Single men “on the chase”
  - What about sex life?
    - Low testosterone levels leads to a low sex drive
    - Normal and high testosterone levels don’t really show a difference in sex drives
Male arousal

- Triggered by a release of Nitrous Oxide
  - Allows the penis to fill with blood and become erect
- Viagra works by causing an increase in the amount of Nitrous Oxide available

A male oral contraceptive?

- Administer a synthetic testosterone
  - Maintains the secondary sex characteristics
  - Unable to cross to the testes
    - Sperm production is inhibited

Anabolic steroids

- Frequently taken by athletes to become stronger
- Lead to androgen levels up to 1000 times greater than normal
- Many side effects
  - Enlargement of sexual organs
  - Hair loss/growth in unusual places
  - Enlarged breasts in males
- Some work by increasing testosterone levels
- Some increase estrogen levels
  - Science is unsure why this seemed to work at all

Variations of sexual identity

- Transgenders
  - When one’s gender identity does not match their biological sex
- Transsexuals
  - Wishes to change their gender
  - Believe they are “a man in a woman’s body”
- Transvestitic Fetishes
  - Achieves arousal by dressing in clothes of the other gender

Other Variations of Sexual Identity

- Drag Queens
  - Cross dressing for the purpose of performing

Homosexuality

- There is a spectrum of sexuality
- Many heterosexual people engage in some homosexual acts and fantasies at some point in their lives
Stoller and Herdt (1985)
- Described a tribal culture where adolescent males were expected to engage in same-sex behavior until marriage to a woman
- Sexual orientation of these men was predominantly heterosexual

Homosexuality: The Facts
- 3-4% of the male population is homosexual
- 1-2% of the female population
- Approximately 1% categorize themselves as bisexual

Animal studies of homosexuality
- Low exposure to testosterone during a critical period leads to a smaller sexually dimorphic nucleus of the preoptic area
  - Leads to an increase in homosexual activity in male rats
- High exposure to testosterone during a critical period leads to a larger sexually dimorphic nucleus of the preoptic area
  - Leads to an increase in homosexual activity in female rats

Homosexuality: Development
- Hormone levels
  - High testosterone in homosexual women
  - Low testosterone in homosexual men
- Birth order
  - Cantor (2002)
    - Found a significance in birth order for homosexuality in men
    - May be due to an increase in the immune response of the mother towards her baby
    - May lead to a masculinization of the gonads, but not the brain

What about brain structure?
- Hypothalamus area INAH-3
  - 2-3 times larger in heterosexual men than in homosexual men
  - No difference between homosexual men and heterosexual women

Genetic issues
- 20-25% correlation of homosexuality among fraternal twins
- 50% correlation of homosexuality for identical twins
- Possibly due to X-chromosome genes
Environmental basis
- Must be involved
- The genetic similarities of identical twins is 100%, but homosexuality only occurs 50% of the time
  - It isn’t all biological
- Unsere of the environmental factors involved

Viewing of Attraction
- Cultures have their own definitions of attraction
- Biological mechanisms must play some role
- Infants spend more time staring at “attractive” faces than “unattractive” faces
- Symmetry seems to be important

Attractive Features: faces
- In women
  - Delicate jaw
  - Childlike face
  - Full lips
  - Wide-set eyes
- May indicate a preference for youthful females

Attractive features: faces
- In men
  - Prominent chins
  - Prominent brows
- Usually indicates higher testosterone levels
- These men tend to be more quickly promoted in the military, possibly due to the perception of their greater masculinity

What about bodies?
- Men seem to focus on figures more
  - Preference is for waist measurements to be approx. 70% of their hip measurements
  - Highly controversial
  - Some researchers suggest that a BMI of 20 is most important
  - Possibly because a women’s figure is more important for her reproductive fitness

Pheromones
- Found in ants
- Chemical messengers that can transmit different signals
  - Alarms
  - Food trail
  - Sex
- Possibly in humans
- Highly controversial
Love Centers in the Brain

- FMRI studies of love
  - Showed patients pictures of lovers and of friends
  - Different areas were active
  - Viewing of lovers caused increases in
    - Medial insula (inner temporal lobe)
    - Basal ganglia
    - Anterior cingulate gyrus (limbic lobe)

Video

- Discusses monogamy
  - 12 percent of primate species practice monogamy
- Discusses hormones that effect mating and parental behaviors
  - Vasopressin
  - Oxytocin
- Discusses homosexuality