Lecture 9: Male Reproductive Biology and Reproductive Ecology

- Male Reproductive Biology
- Testosterone and Behavior
- Male Reproductive Ecology
- Male Puberty Rituals

Male Reproductive Biology

- The Testes
  - Gamete Production & Hormonal Production
    - Leydig cells - manufacture testosterone
    - Sertoli cells - support and nourish sperm cells

The Testes

- Seminiferous Tubules
  - Spermatogenesis

The Testes

- Epididymis
  - Sperm storage
  - Become spermatozoa
  - Develop swimming ability
The Testes

- Vas deferens
  - Brings sperm to urethra

Sperm Maturation:
Inside Germinal Epithelium of Seminiferous Tubules

- Sperm cells develop from Spermatagonia embedded in germinal epithelium (wall) of the seminiferous tubules.
  > Nurtured by Sertoli Cells.

- Repeated mitotic divisions produce more Spermatogonia.

- Spermatogonia mature into primary Spermatocytes

- Primary Spermatocytes undergo meiosis (chromosome # halved) and become secondary Spermatocytes

- Further mature into spermatids before ready to be released into lumen (liquid center) of seminiferous tubules.

- Entire sequences takes 74 days in humans
**Sperm Maturation:**
Inside Germinal Epithelium of Seminiferous Tubules

- Spermatagonia ➔ Germ Cells
- Primary Spermatocytes ➔ Mitosis
- Secondary Spermatocytes ➔ Meiosis
- Spermatids ➔ Further Maturation
- Spermatozoa ➔ Mature Sperm

**The SPERM**

- Head
  - Contains chromosomes
- Acrosome (covering the head)
  - Enzymes dissolve egg membrane

**The SPERM’s Journey**

- Spermatids released into lumen of seminiferous tubules
- Move through tubules and water is replaced by fluid from seminal vesicles and prostate.
- Stored in Epididymis

**Seminal Fluid**

- Seminal Vesicles
  - Base of bladder, duct joins vas deferens
- Prostate Gland
  - Just below bladder
- Cowper’s Gland
  - Either side of urethra
- Contains sugars and prostaglandins that cause uterus to contract

**Penis**

- Base of bladder, duct joins vas deferens
- Prostate Gland
  - Just below bladder
- Cowper’s Gland
  - Either side of urethra
- Contains sugars and prostaglandins that cause uterus to contract
Male Hormonal Functioning

- Hypothalamus stimulates anterior pituitary to produce FSH and LH
- FSH promotes spermatogenesis
- LH promotes production of testosterone in interstitial cells

As testosterone levels fall, the hypothalamus stimulates the anterior pituitary to produce FSH and LH.
Testosterone

• Sperm maturation

• Stimulates growth and development of penis and testes

• Male secondary sexual characteristics
  • Axillary hair, larynx, oil and sweat gland secretion

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Beard Growth and Sexual Behavior

Anonymous, 1970
**Testosterone**

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- Role in positive ‘affect’

**Wrestler Study**

![Graph showing testosterone levels over time.](image)

**Testosterone and Aggression**

- Permissive effect on aggression

**Testosterone and Aggression**

- Differences in testosterone don’t tell us about individual differences in levels of aggression
- Individuals with more T not more aggressive
- Aggressive behavior can lead to increased T, not other way around
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- Individuals with more T not more aggressive
- Aggressive behavior can lead to increased T, not other way around
- T does not increase violence unless quadrupled
- After castration T usually goes down, but if a lot of social experience with aggression likely remains

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Testosterone

- Key promoter of muscle anabolism
  - Particularly in muscles showing most dimorphism - Upper body muscles

Testosterone and Muscle Mass

Testosterone and Male Rank in Chimpanzees
Population variation in adult male salivary testosterone levels

- Boston (n = 10)
- Tamang (n = 27)
- Kami (n = 18)
- Lese (n = 33)
- Ayitama (n = 17)
- Ache (n = 46)
- Kung (n = 114)

Salivary testosterone (pmol/L)

Morning  | 800  | 600  | 400  | 200  | 0
Evening  | 900  | 700  | 500  | 300  | 100

Male Senescence

Wood 1994; Campbell 1994

Age Changes in Testosterone Cross-culturally

Wood 1994; Campbell 1994
Should males show same fine-tuned responsiveness of reproductive functioning to ecological conditions?

NO!

Sperm Count and Overtraining
Decrease not enough to effect fertility

Ache Testosterone Levels Poor/Rich Communities

Testosterone levels not improved by increased nutritional status.

Testosterone and Fasting
Male Reproductive Ecology

- Between Societies: Men growing up under chronic energetic stress have lower testosterone levels than non-energetically stressed males
  - Less investment in maintaining a large body
  - No evidence of effects on sperm quality

- Within an individual:
  - Testosterone levels decrease in response to severe malnutrition
  - Testosterone levels and sperm quality decrease in response to overtraining
  - No clinical effect on sperm quality
  - May effect behavior, reproductive effort

Differences between Males and Females in Reproductive Ecology

**Males**
- No effect on testosterone of small changes in nutrition & energy expenditure

**Females**
- Large effect on ovarian hormones (estrogen and progesterone) from small changes in nutrition and energy expenditure

- Even small energetic changes can cause a decrease in the probability of conception.

**Males**
- Large changes cause decrease in T levels and sperm quality
- Sperm quality shut down only under very severe conditions
- Lower T causes less investment in muscle mass and possibly effects mating effort

**Females**
- Even small energetic changes can cause a decrease in the probability of conception.

**Males**
- Subincision of the penis
- Penile modification
- Circumcision

**Females**
- Between populations: Energetically stressed populations have lower ovarian hormones — may result in longer inter-birth intervals
Common Elements of Puberty Rituals

- Modification of Penis
- Shedding of blood
- Changes in clothing
- Changes in hair style
- Inducement of trance state

Australian Aborigines
Subincision of the Penis

Penile Modification:
Dyaks of Borneo

Indonesia Circumcision Ceremony

Warrior Initiation & Circumcision in the Maasai
Circumcision

- Found especially in strongly patrilineal and patriarchal societies
- Symbolizes belonging to a male kin group.
- Ritual circumcision -- at puberty or after birth
- Why the penis?
- Non-religious circumcision developed in English speaking countries at the end of 19th century as 'cure' for masturbation
- Medical foundation for circumcision debated.
  - US only country in world with routine non-religious circumcision
  - 80% of men in world not circumcised
  - By 1984, 40% of US babies not circumcised.

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Circumcision
Functions of Foreskin

- Protects the glans of the penis
  - Shield glans and urinary opening from irritation due to feces and urine (newborn) and friction

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  - Smegma - produced by Tyson’s glands of Glans
    - Protects the glans
    - Lubricates the glans during intercourse.

Changes with Circumcision

- Cornification of the Glans:
  - Increased thickness (10x) in outer cell layer
  - Free nerve endings disappear
  - Surface cells covered with a layer of dead cells
- Smega no longer produced for lubrication
- Skin on penile shaft is tighter

Cost & Benefits of Non-Religious Circumcision

**Costs**

- Risk of non-essential surgical procedure, mutilation or damage - 1-3%
- Emotional stress on baby
- Ulcerations formed around urinary opening
- Decreased sensitivity of glans
- Lack of smega production for lubrication
- Increased tightening of skin of shaft

**Benefits**

- Possible slight decrease in rates of penile cancer and STD’s, but study results are equivocal
- 1% risk of urinary tract infection during 1st year of life without circumcision
- May decrease AIDS risk

Next Time...

- Primate Sexuality
- The Clitoris
- Orgasm and Sexuality
- Clitoridectomy