HORMONES:
Effects on your past, present and future
OUTLINE

- What are hormones?
- How do hormones affect sex differences in development?
- How do hormones affect you now?
- What happens with menopause?
**Major Hormone Structures and Functions**

<table>
<thead>
<tr>
<th>Major endocrine structures</th>
<th>Some main functions regulated by secretion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothalamus</td>
<td>Controls hormone secretions</td>
</tr>
<tr>
<td>Pineal gland</td>
<td>Reproductive maturation; bodily rhythms</td>
</tr>
<tr>
<td>Pituitary gland:</td>
<td></td>
</tr>
<tr>
<td>Anterior pituitary</td>
<td>Hormone secretion by thyroid, adrenal cortex, and gonads; growth</td>
</tr>
<tr>
<td>Posterior pituitary</td>
<td>Water balance; salt balance</td>
</tr>
<tr>
<td>Thyroid</td>
<td>Growth and development; metabolic rate</td>
</tr>
<tr>
<td>Adrenal glands:</td>
<td></td>
</tr>
<tr>
<td>Adrenal cortex (outer bark)</td>
<td>Salt and carbohydrate metabolism; inflammatory reactions</td>
</tr>
<tr>
<td>Adrenal medulla (inner core)</td>
<td>Emotional arousal</td>
</tr>
<tr>
<td>Pancreas (islets of Langerhans)</td>
<td>Sugar metabolism</td>
</tr>
<tr>
<td>Gut</td>
<td>Digestion and appetite control</td>
</tr>
<tr>
<td>Gonads (testes/ovaries)</td>
<td>Body development; maintenance of reproductive organs in adults</td>
</tr>
</tbody>
</table>

*Biological Psychology 5e, Figure 5.1*
HOW DO HORMONES WORK?

- Telephone vs. radio
- Speed of transmission
- Graded signal: differing amounts of hormones can lead to different amounts of behavior
- Pulsatile vs. gradual release: this is one of the reasons it is so difficult to measure hormone levels.
(a) Male

Hypothalamus

Anterior pituitary

Gonadotropin-releasing hormone and gonadotropin-inhibiting hormone

Follicle-stimulating hormone

Luteinizing hormone

Testes

Sertoli cells produce sperm

Leydig cells produce testosterone

Target cells

Testosterone and other androgens

Negative feedback

Biological Psychology 5e, Figure 5.19 (Part 1)
HORMONES: YOUR PAST
**WHAT IS MALE OR FEMALE?**

**NATURE VS. NURTURE VS. COGNITION**

**TABLE 2**

<table>
<thead>
<tr>
<th>Genetic sex</th>
<th>Genital sex</th>
<th>Sex of rearing</th>
<th>Gender identity</th>
<th>Clinical description</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>XY</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Common definition</td>
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<tr>
<td>XY</td>
<td>Male*</td>
<td>Male</td>
<td>Female</td>
<td>Transsexual male</td>
<td>Stoller (1968)</td>
</tr>
<tr>
<td>XY</td>
<td>Female</td>
<td>Female</td>
<td>Male</td>
<td>Androgen insensitivity (partial)</td>
<td>Gooren and Cohen-Kettenis (1991)</td>
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<tr>
<td>XY</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
<td>Androgen insensitivity or PGD</td>
<td>Money et al., 1984</td>
</tr>
<tr>
<td>XX</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
<td>Common definition</td>
</tr>
<tr>
<td>XX</td>
<td>Female</td>
<td>Female</td>
<td>Male</td>
<td>Transsexual female</td>
<td>DSM-III-R</td>
</tr>
<tr>
<td>XX</td>
<td>Male*</td>
<td>Female</td>
<td>Female</td>
<td>Congenital–adrenal hyperplasia</td>
<td>Money et al. (1984)</td>
</tr>
</tbody>
</table>

*a* Genitalia were actually ambiguous, which was not discovered more than 20 years after birth.

*b* Genitalia are masculinized, but not to the extent that sex was not assigned as female at birth.
KEY CONCEPTS IN SEX DIFFERENCES

- **Organizational Effects**: A permanent alteration of the brain, and thus permanent change in behavior, resulting from the action of a steroid hormone early in development.

- **Sensitive Period**: The period during development in which an organism can be permanently altered by a particular experience or treatment.

- **Activational Effects**: Short-lived effects of hormones that act on the “organized” structure.
  - Puberty?
(a) GENETIC SEX

Gene expression

XY
- SRY
- AMH and T

XX
- No SRY
- AMH
- Ovaries produce no AMH, no T

GONADAL SEX

Hormone secretion

Anti-müllerian hormone (AMH) and testosterone (T)

AMH

PHENOTYPIC SEX

Internal

- AMH causes müllerian ducts to regress.

- Testosterone: wolffian ducts form epididymis, vas deferens, seminal vesicles; other tissues form prostate and bulbourethral gland.

- 5α-reductase

External

- DHT induces skin to form scrotum; tubercle forms penis.

- No DHT: skin forms labia and outer vagina; tubercle forms clitoris.

No AMH: müllerian ducts form fallopian tubes, uterus, and inner vagina.

No testosterone: wolffian ducts regress, and no prostate or bulbourethral gland forms.
DO YOUR HANDS HOLD THE KEY TO YOUR PRENATAL HORMONE ENVIRONMENT?

- Right hand 2D:4D finger ratio:
- 2\textsuperscript{nd} finger is short in men relative to 4\textsuperscript{th} finger
- 2\textsuperscript{nd} and 4\textsuperscript{th} are equal in females.
- Homosexual men: hyper-males
- Lesbians: male-like

What about behavior????
Males > Females: rough play and spatial navigation

Females > Males: Verbal Fluency and Memory Tasks
SPECIAL CAVEATS

- Prenatal hormones tend to play a large role
  - Congenital Adrenal Hyperplasia
  - Androgen Insensitivity Syndrome
- More testosterone isn’t always better
- “Baby” brain
- Hormonal cycles in women
HORMONES: YOUR PRESENT

“Activational” Effects
Is it really so simple?

- Males = Androgens, like testosterone
- Females = Estrogens, like estradiol

- No! Both sexes have both hormones, and there are other key players as well.
SEX IN MALES

![Graph showing the effect of castration and testosterone therapy on copulatory score over time.](image-url)
HUMAN MALES: ARE MEN DRIVEN BY TESTOSTERONE?

- Daily and seasonal changes of testosterone affect male behavior.
- Nitric Oxide: Viagra
- Hypogonadal men and testosterone
- Testosterone and age
- “Coolidge” effect
- Balding Treatments: block the actions of DHT (dihydrotestosterone), an androgen.
HORMONES AND BEHAVIOR: PARENTING AND MONOGAMY

- Across cultures, testosterone levels in males decrease during parenting (at the time of birth).
- Men with higher testosterone levels are more likely to cheat on their significant others.
Women: Sexual Behavior & the Menstrual Cycle

• Rhesus macaques housed:
  – Pair housed in small cage
  – Pair housed in large enclosure
  – Group
• **Results:**
  
  – Pair housed females in small cages mated throughout the cycle
  – Group-housed females mated only during the ovulatory phase

*Popular press loved this!*
DESIRE VS. ABILITY

“No human female is constantly receptive. Any male who entertains this illusion must be a very old man with a short memory or a very young man due for bitter disappointment” (Beach, 1974)
What regulates desire in females?

- Early view: androgens
- However, estrogens are more likely.
- Birth control pills and sex.
WHAT ALTERS YOUR HORMONES?

- Stress
- Winning or losing
- Birth Control Pills
- Balding Treatments
- Food—soy products
- Pollution
HORMONES: YOUR FUTURE
Menopause and who put the “men” in menopause?
Or, menopause, why have it?
AGE-RELATED DECLINE IN HORMONES AND ASSOCIATED BEHAVIOR

- High variability, particularly among men.
  - Differs across cultures.
  - Differs according to health.
- More consistent among women.
- As we change, hormones seem to affect behavior less. Experience?
HORMONE REPLACEMENT THERAPY—COSTS AND BENEFITS

- **Benefits:**
  - Increase bone density
  - Decrease Alzheimer’s risk
  - Decrease side effects of menopause: hot flashes, night sweats, mood changes

- **Costs:**
  - Increased risk of some cancers and heart disease.
  - Increased risk of blood clots and pulmonary embolisms, particularly in people who smoke and are inactive.

- No study has found an increase in sexual desire with HRT; but testosterone helps.
WHAT HAVE WE LEARNED?

- Development is a tricky process, and is guided by hormones and genes.
- Hormones are difficult to measure, but seem to affect our behavior; sexual behavior has received the most interest.
- Menopause is a largely human phenomenon, and why it occurs is a mystery.