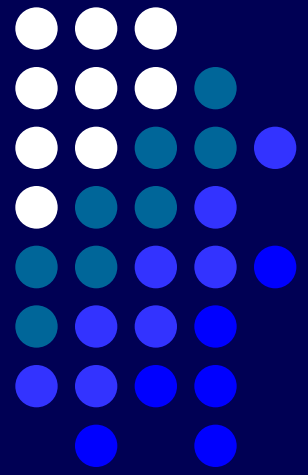
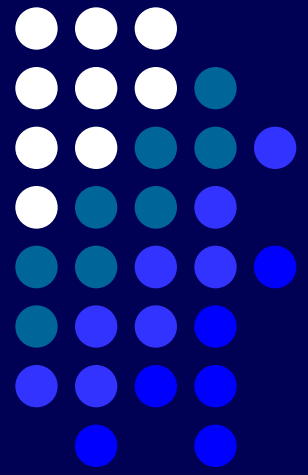
Psychology 312
Biological Psychology

Instructor: Sean Fannon, Ph.D.



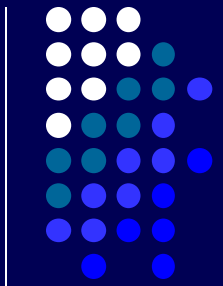
Reproductive Behaviors



Sex and Hormones

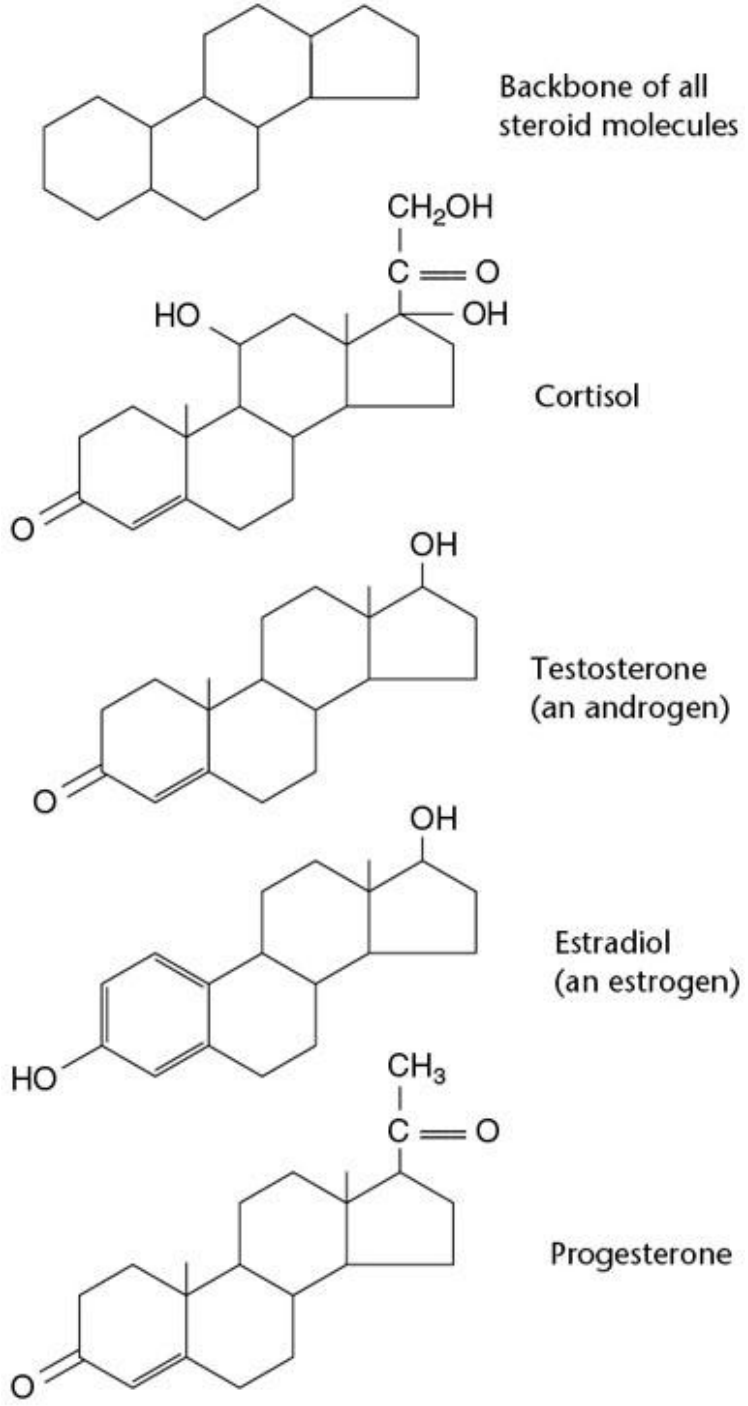
- Sexual reproduction between two individuals increases variation in the gene pool.
  - Reshuffling genes
  - Genetic recombination
- Variation in the gene pool of a species enables quicker evolutionary adaptation to change in the environment.

Sex and Hormones

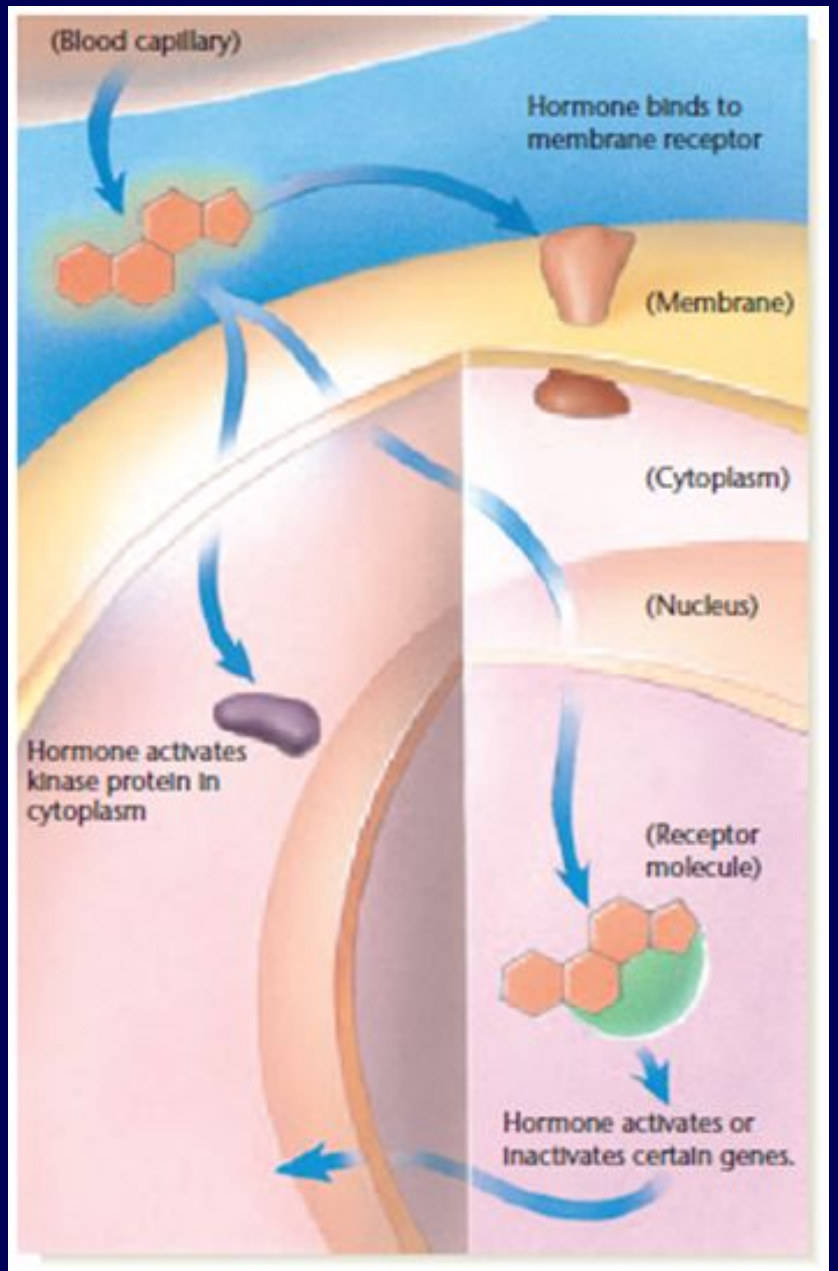


- Widespread communication throughout the body is accomplished via hormones.
- Kinds of hormones
  - Hormones
    - Steroid hormones
      - Sex hormones
        - Estrogens
        - Androgens
        - Progesterone

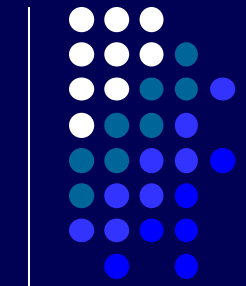
Steroid hormones have
4 carbon rings



How steroid hormones act on cells



Sex and Hormones



- The sex hormones are a special kind of steroid, released mostly by the gonads and to a lesser degree by the adrenal glands
  - affect the brain, genitals and other organs
- Two types of sex hormones include:
  1. Androgens (also called anabolic steroids)
  2. Estrogens
- Both sexes have both hormones.

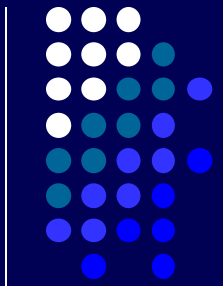
Sex and Hormones

- Androgens - group of sex hormones that include testosterone and others.
- Generally referred to as “male hormones” because men have higher levels than women

Sex and Hormones

- Estrogens include estradiol and others and are referred to as “female hormones” because women have higher levels.
- Progesterone
  - prepares the uterus for the implantation of a fertilized ovum
  - promotes the maintenance of pregnancy.

Sex and Hormones



- Sex limited genes - activated by androgens or estrogens and control most of the differences between male and female.
  - Example: estrogens activate the gene for breast growth; androgens activate the gene for the growth of facial hair in men
- Sex hormones increase or decrease the rate of apoptosis in various regions of the brain
  - Certain areas are slightly larger in males or females

Sex and Hormones

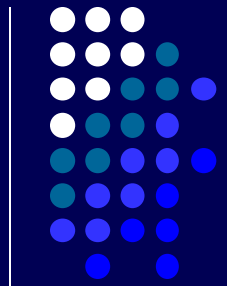
- Sex hormones can have the following effects:

1. Organizing effects- occur mostly at sensitive stages of development.

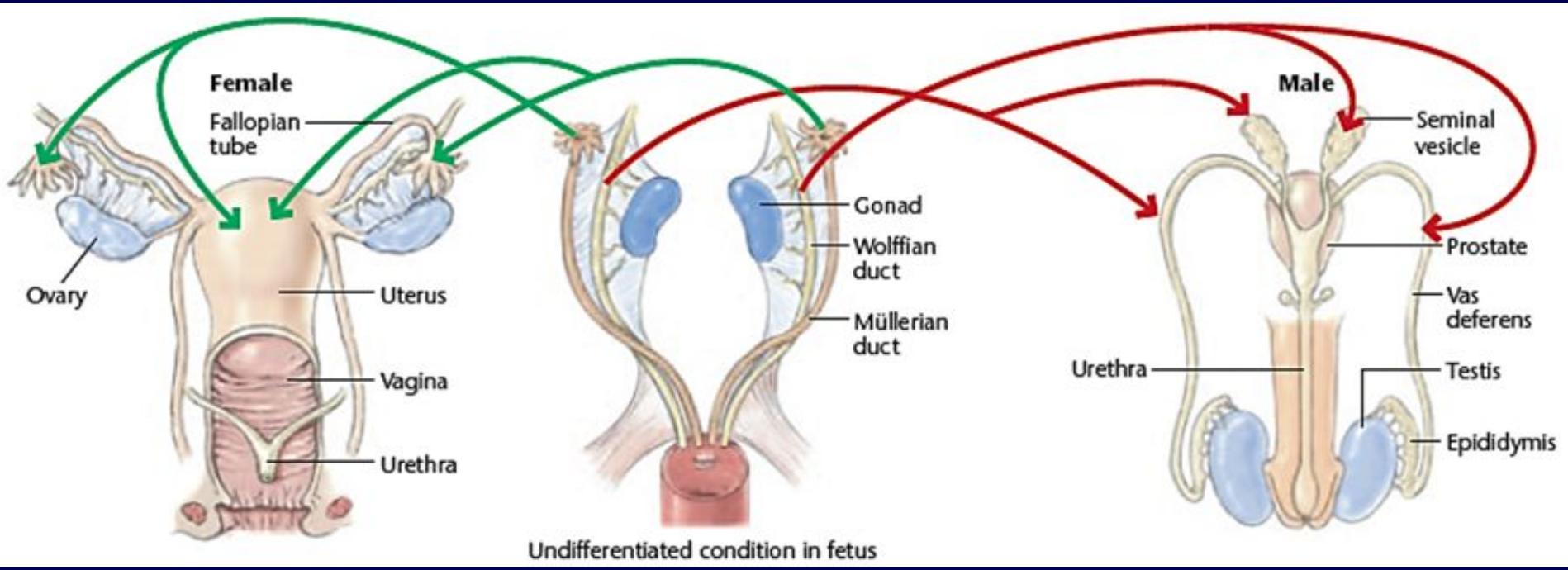
   -Determine whether the brain and body will develop male or female characteristics

2. Activating effects- occur at any time of life and temporarily activate a particular response.

Sex and Hormones

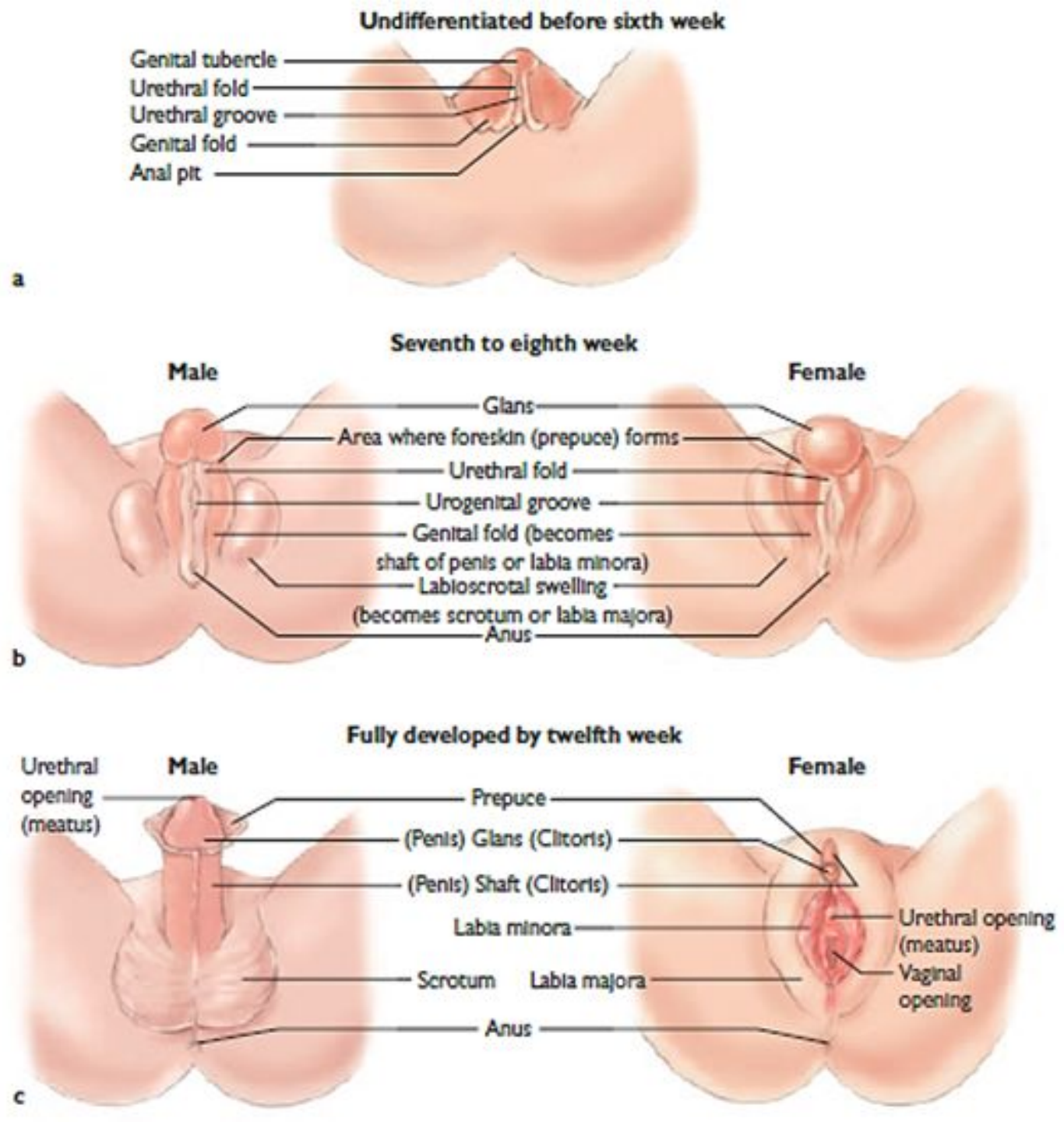


- The male Y chromosome includes the SRY gene (Sex-determining Region Y) - causes the primitive gonads to develop into testes
- The developed testes produce the hormone testosterone
- Testosterone induces the development of the penis and scrotum
- Females are not exposed to high testosterone levels and their gonads develop into ovaries, the egg-producing organs

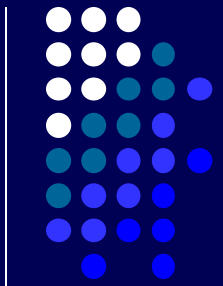

Female
Fallopian tube
Ovary
Uterus
Vagina
Urethra
Gonad
Wolffian duct
Müllerian duct
Undifferentiated condition in fetus
Male
Seminal vesicle
Prostate
Vas deferens
Urethra
Testis
Epididymis

Sex and Hormones

- Sensitive periods - early periods when hormones have long-lasting effects.
- The human sensitive period for genital formation is about the third and fourth month of pregnancy.


Undifferentiated before sixth week
Genital tubercle
Urethral fold
Urethral groove
Genital fold
Anal pit
a
Seventh to eighth week
Male
Female
Glans
Area where foreskin (prepuce) forms
Urethral fold
Urogenital groove
Genital fold (becomes
shaft of penis or labia minora)
Labioscrotal swelling
(becomes scrotum or labia majora)
Anus
b
Fully developed by twelfth week
Urethral
opening
(meatus)
Male
Female
Prepuce
(Penis) Glans (Clitoris)
(Penis) Shaft (Clitoris)
Labia minora
Urethral opening
(meatus)
Vaginal
opening
Scrotum
Labia majora
Anus
c

Sex and Hormones

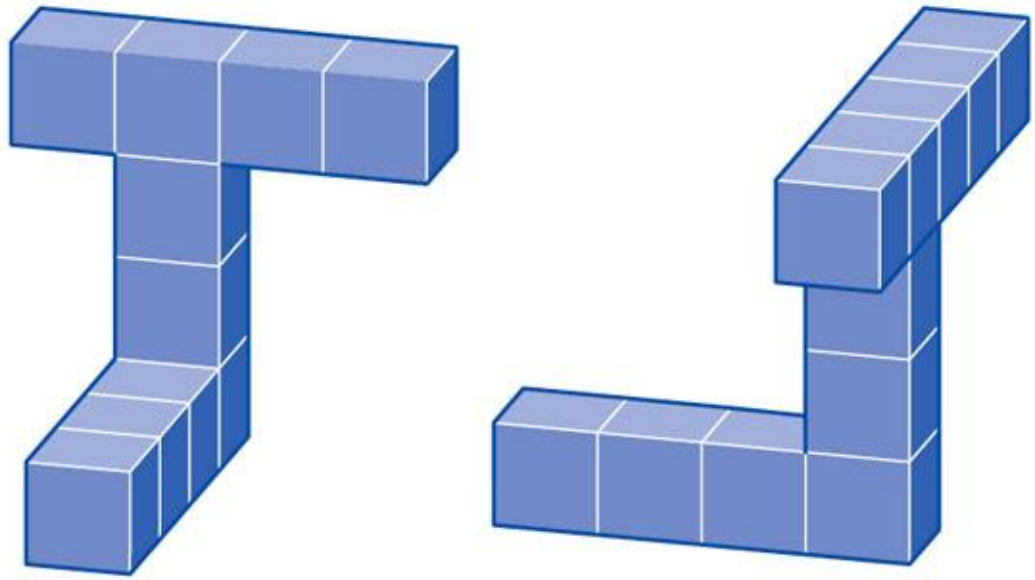


- Female rats exposed to testosterone shortly before or after birth are partly masculinized in anatomy and behavior.
  - Clitoris grows larger than normal
  - At maturity, pituitary and ovaries produce steady levels of hormones instead of cycles
  - Parts of the hypothalamus appear more male
  - Sexual behavior becomes masculinized

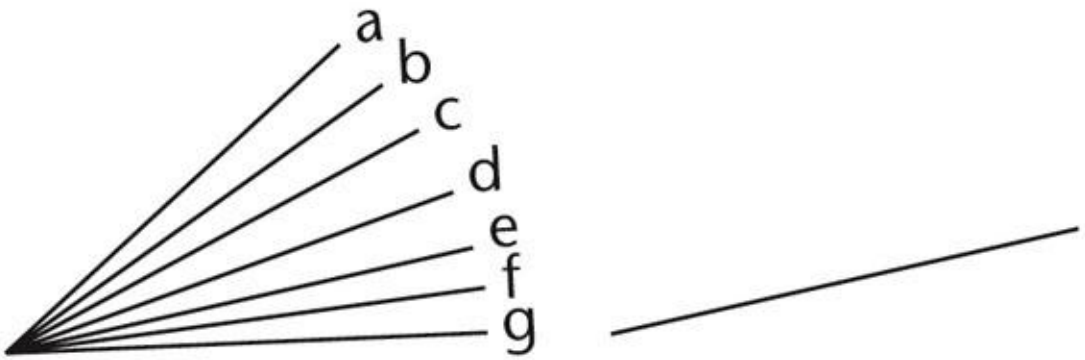
Sex and Hormones

- Sex hormones have also been shown to influence intellectual performance in specific domains:
  - Females typically do better in most school subjects than men, except for math and science.
  - Boys perform better at mental rotation tasks and line orientation tasks.
  - Related to digit lengths (2D:4D)
- Performance on these tasks most likely is attributed to organizational effects.

Can the set of blocks on the left be rotated to match the set at the right?



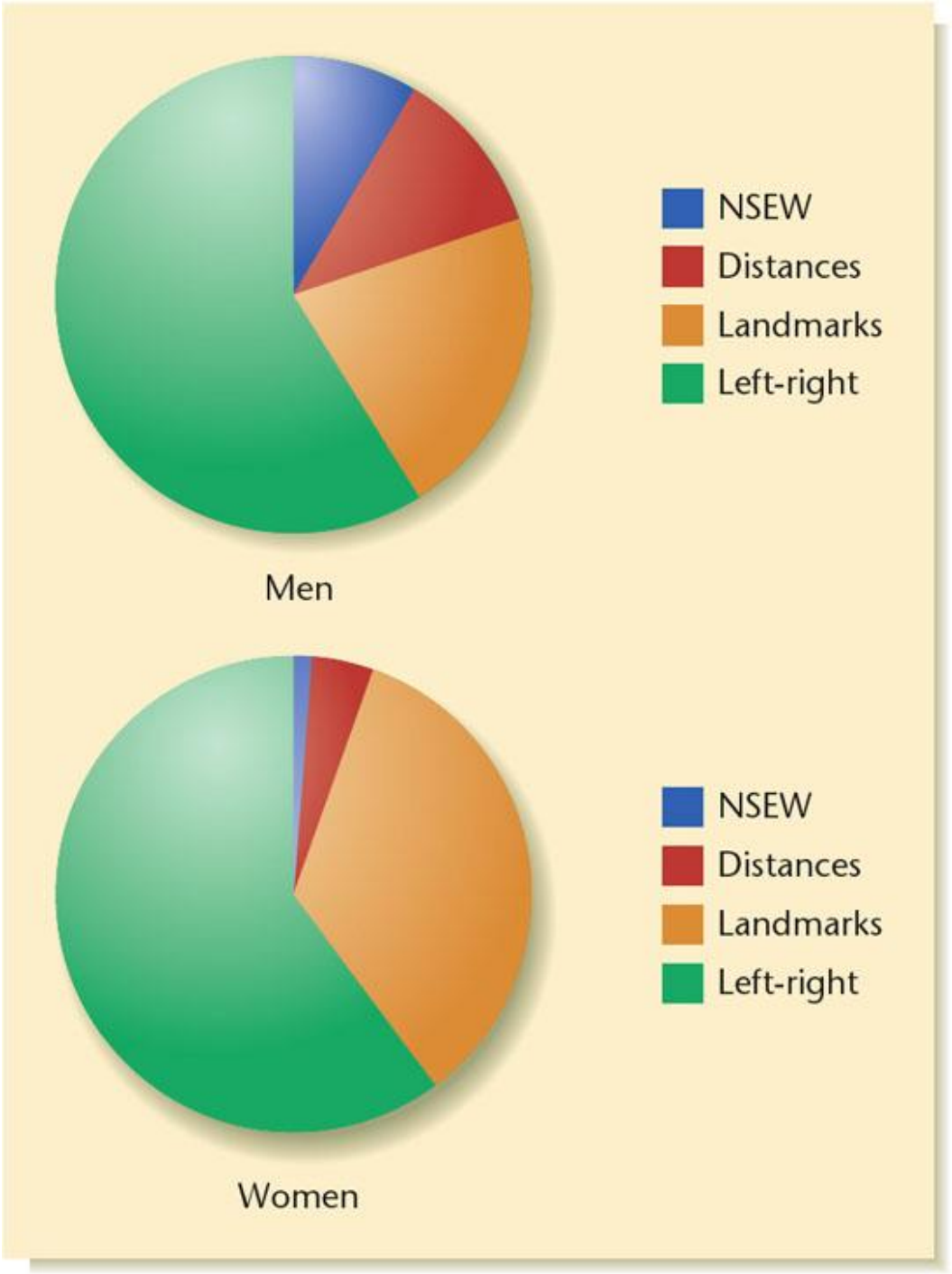
Which of the lines at the left has the same angle as the one at the right?



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Sex and Hormones

- Men perform better in tasks involving spatial reasoning, but performance depends on effectiveness of directional strategy.
  - Men more likely to use directional (north, south, etc.) orientations to navigate.
  - Women are more likely to use landmarks
- Evolutionary explanation - males of many species travel over greater geographical areas than do females.

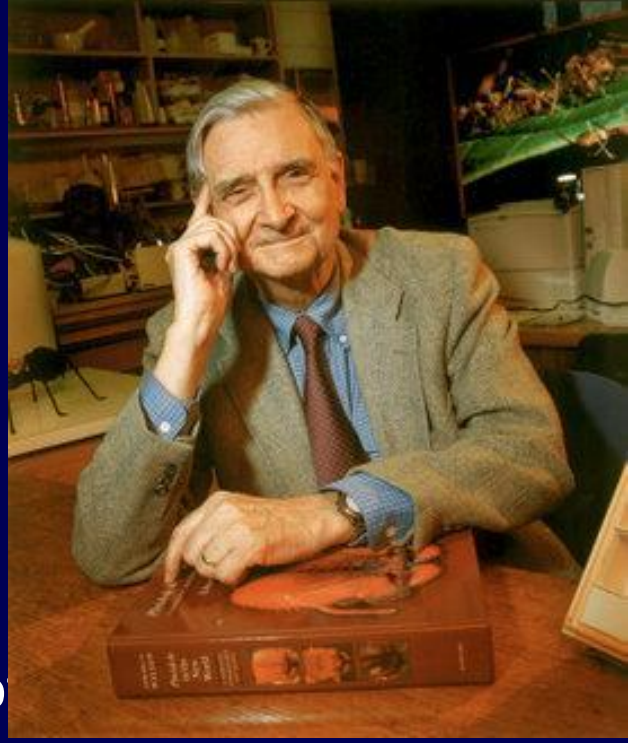

NSEW
Distances
Landmarks
Left-right
Men
NSEW
Distances
Landmarks
Left-right
Women

Reproductive Behavior

- Decreased testosterone →
  - Less sexual activity and interest
- Periovulatory period
  - More sexually responsive

Organizing or activating effects??

Sociobiology



- E. O. Wilson (1975)
  - Darwinian ideas applied to human behavior
  - Mind evolved to maximize gene transmission
  - “In a Darwinian sense the organism does not live for itself. Its primary function is no even to reproduce other organisms; it reproduces genes, and it serves as their temporary carrier... Samuel Butler's famous aphorism, that the chicken is only an egg's way of making another egg, has been modernized: The organism is only DNA's way of making more DNA.”
  - Applied to altruism, sexuality, etc..

David Buss

- Sexual Strategies Theory
  - “Patterns in mating behavior exist because they are evolutionarily adaptive.”
  - Based on sexual selection

Sexual Selection

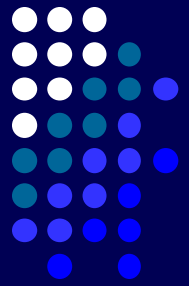


Sexual Strategies Theory

- Experiment: how many partners would you like in your life?

- Men and women face different reproductive challenges b/c of their physiology
  - How many kids can a woman have?
  - How about a man?
  - Given this, what might a woman seek out in a mate
  - How about a man?

Sexual Strategies Theory



- Women want to maximize parental investment:
  - Women report desiring half the # of sex partners as men at every time interval (Buss, 1993)
  - Women rated themselves less likely to have sex at every time interval less than 5 years (Buss, 1993)
  - Across cultures, women more than men value cues to potential mate's ability to acquire material resources
    - Ambition, professional degrees, current wealth
    - Choosing a father who is likely to be a good provider aids the women while she is pregnant or caring for a small child

Sexual Strategies Theory

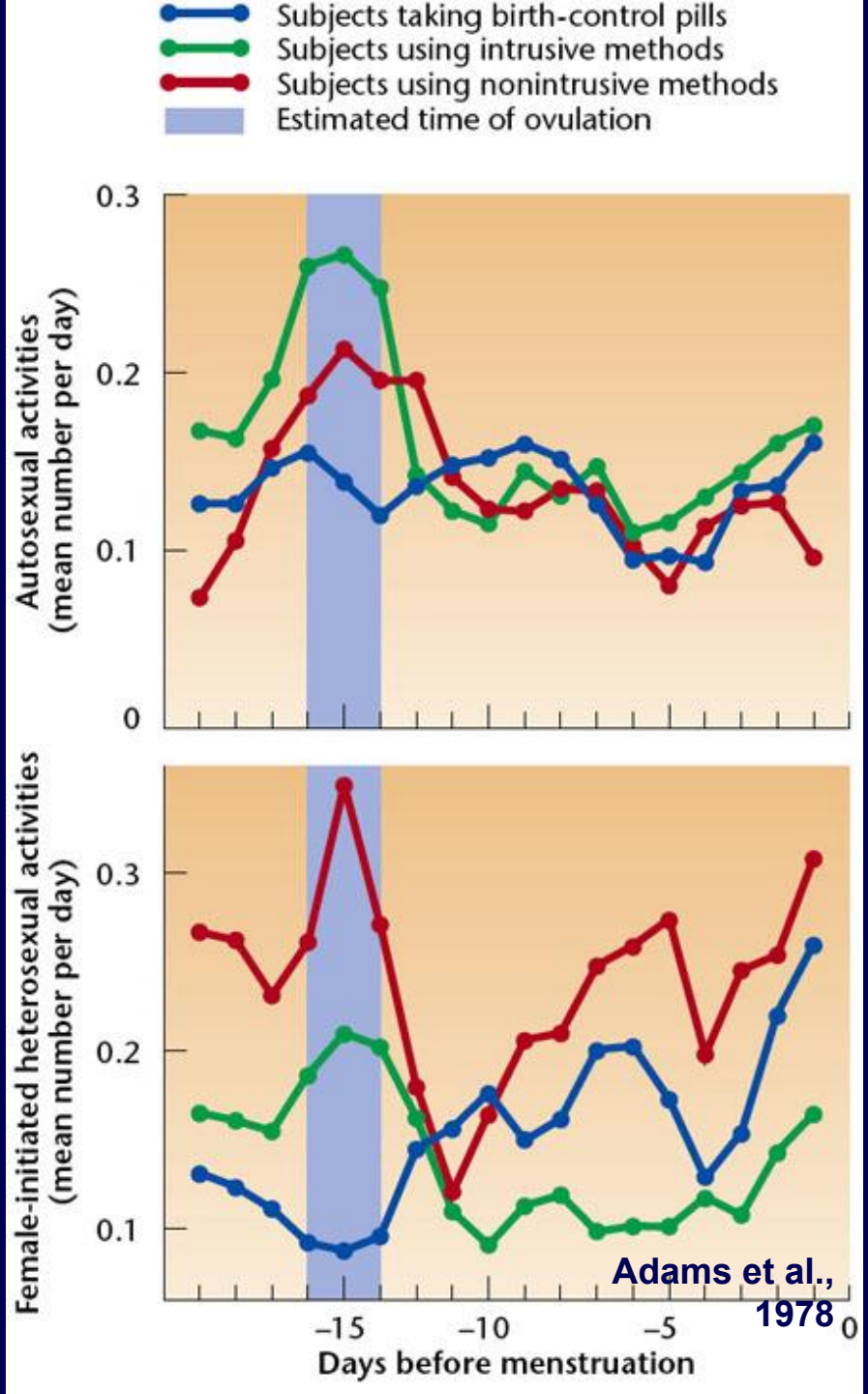
That was for long-term mating relationships, what about short term?

- Research has also suggested that women can gain from having multiple sexual partners as well: “facultative polyandry”
  - Sperm competition hypothesis (Baker & Bellis, 1995)
    - Correlation between testes/body mass ratio and female promiscuity
    - Chimpanzees #1, Humans #2
    - Kamikaze Sperm Hypothesis

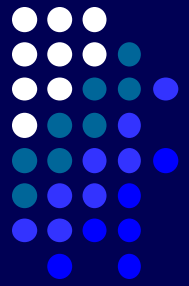
Sexual Strategies Theory

- No pattern to when women have sex with steady partners
- “on the side” sex peaks at periovulatory period

(Baker & Bellis, 1995)



Sexual Strategies Theory

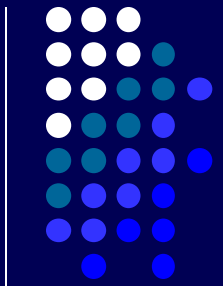


- Why might women bother with short term mating strategies? (Smith, 1995)
  - Good genes
    - Prefer more masculine faces around ovulation
  - Paternity diversity
  - Fertility backup
  - Secure more resources for self and child
    - “gives gifts early on”, “has an extravagant lifestyle” rated more desirable in short-term mates (Buss, 1993)
  - Reduce infanticide by obscuring paternity
    - US child living w/ 1 or more substitute parent is 100x more likely to be fatally abused
      - Eliminate competitor’s dependent offspring
      - Expedite mother’s sexual receptivity

Sexual Strategies Theory

- Men prefer:
  - More partners
  - Younger partners
  - Specific bodily proportions
- Why?
  - Both of these associated with fertility

Sexual Strategies Theory

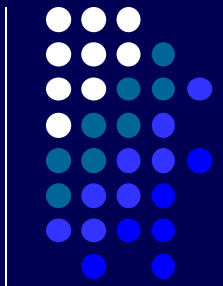


- Differences in jealousy
  - Men more bothered by sexual infidelity
  - Women more bothered by emotional infidelity
  - Men: Paternity uncertainty
    - Women are always sure that the child is their own.
  - Women: Resource security
- Although cultures vary in attitudes towards infidelity, no culture exists where infidelity is more acceptable for women.

Sexual Strategies Theory

- **Are these preferences still at work?**
  - Positive correlation b/w woman's physical attractiveness and occupational status of husband (Udry & Eckland, 1984)
    - Women w/ valuable resources use them
  - 75% of men agreed to have sex w/ attractive female (Clark & Hatfield, 1989)
    - 0% of women agreed
  - Most common reason for divorce worldwide:
    - Female infidelity (Betzig, 1989)
  - Yanomami anecdote:
    - Captured woman subjugated to harem, hammock burned, previous wife "…beat her with a stick. The man looked on quietly, the wife hit the woman hard on the head: blood spurt out. The man took a big stick and gave it to the other woman" (Forsyth, 1986, p. 70)

Sexual Strategies Theory



- Pros and cons
  - Generating and testing hypotheses we already know are true?
  - Although mating habits of people can be explained in terms of increasing the probability of passing on one's genes, we can not assume a genetic basis.
    - Behaviors and preferences may be a product of learning.
  - Need evidence for genes that influence these preferences

Link to survey instruments used by David Buss's lab:

https://labs.la.utexas.edu/buss/research-instruments/

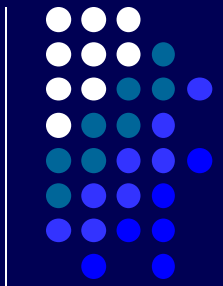
Vole Promiscuity



- Pair bonding in prairie voles enhanced by vasopressin released after sex
  - Block release, no bonding
  - Inject it and get bonding without sex
- Prairie voles – monogamous for life

  lots of vasopressin receptors in reward areas
- Montane voles – promiscuous
  - Fewer receptors in reward areas
- Viral vector transfer of receptor gene for vasopressin (AVP) from Prairie to Montane
  - Voila! Monogamous male montane voles!
- Vasopressin receptor gene variations predict infidelity in human females

Gender Identity



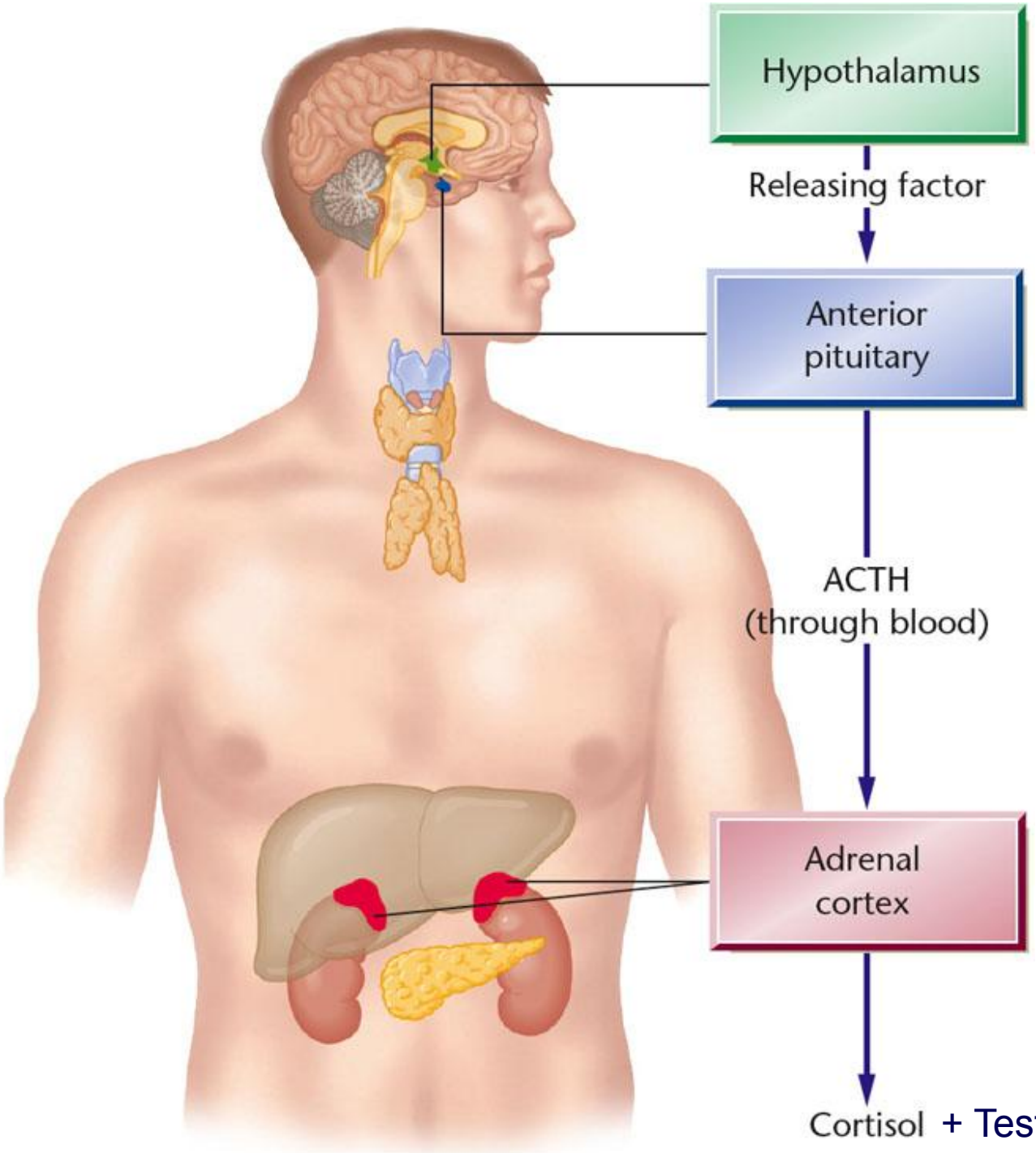
- Gender identity - how we identify sexually and what we call ourselves (doesn't always match the outside)
- Psychologists once believed that gender identity was mostly a product of rearing and experience.
- Current evidence strongly suggests that biological factors, especially prenatal hormones, play a large role

Gender Identity: Intersex

- Intersex people are physically intermediate between being male or female, e.g.:
- Congenital adrenal hyperplasia (CAH), overdevelopment of the adrenal glands before birth, is the most common cause

Genetic defect in cortisol prod. → Overstimulation of adrenal gland → Produces too much testosterone

  - The female fetus becomes partly masculinized
    - External genitals
    - Behavior


Hypothalamus
Releasing factor
Anterior pituitary
ACTH (through blood)
Adrenal cortex
Cortisol + Testosterone, etc.

CAH





Unaffected Girls



Girls with CAH



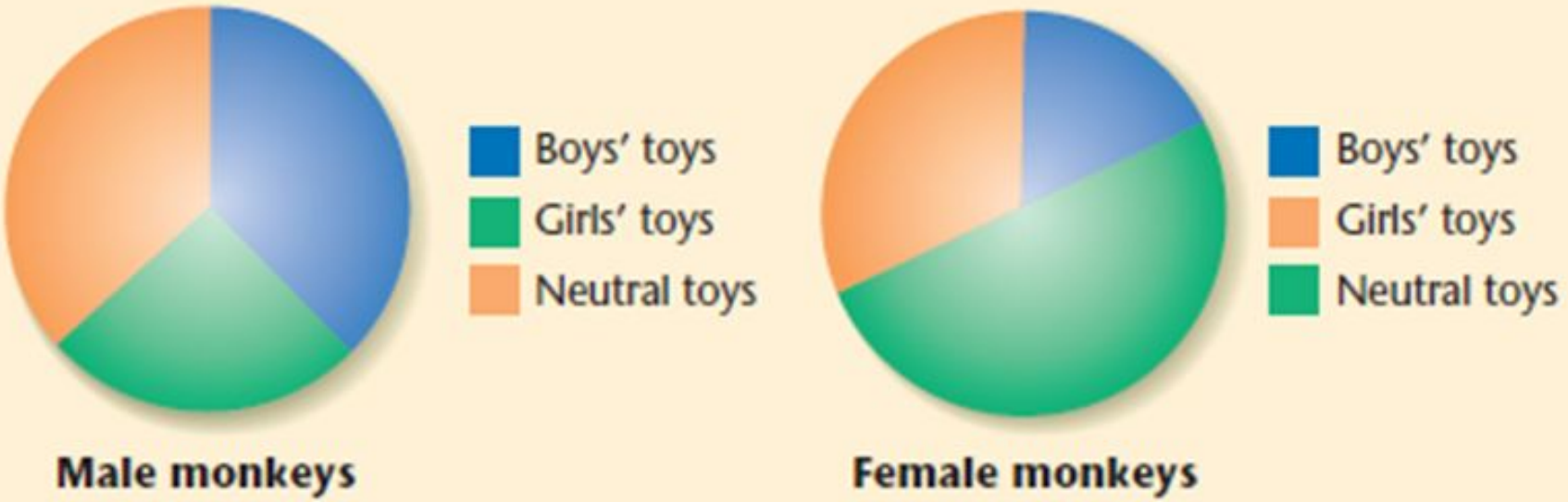
Boys

Girls' toys
Boys' toys
Neutral toys

Pasterski et al., 2005

CAH

- Brains of girls with CAH exposed to high levels of testosterone during prenatal and early postnatal life
- CAH girls show a greater preference for boy-typical toys than do other girls.


Boys' toys
Girls' toys
Neutral toys
Male monkeys
Boys' toys
Girls' toys
Neutral toys
Female monkeys



Unaffected Girls



Girls with CAH



Boys

Girls' toys
Boys' toys
Neutral toys

Pasterski et al., 2005

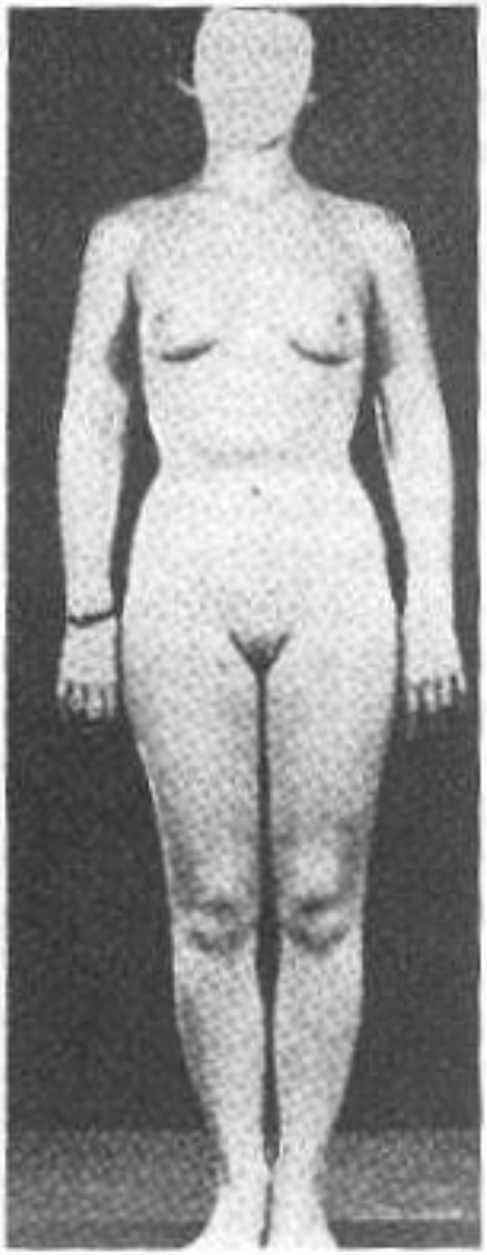
CAH

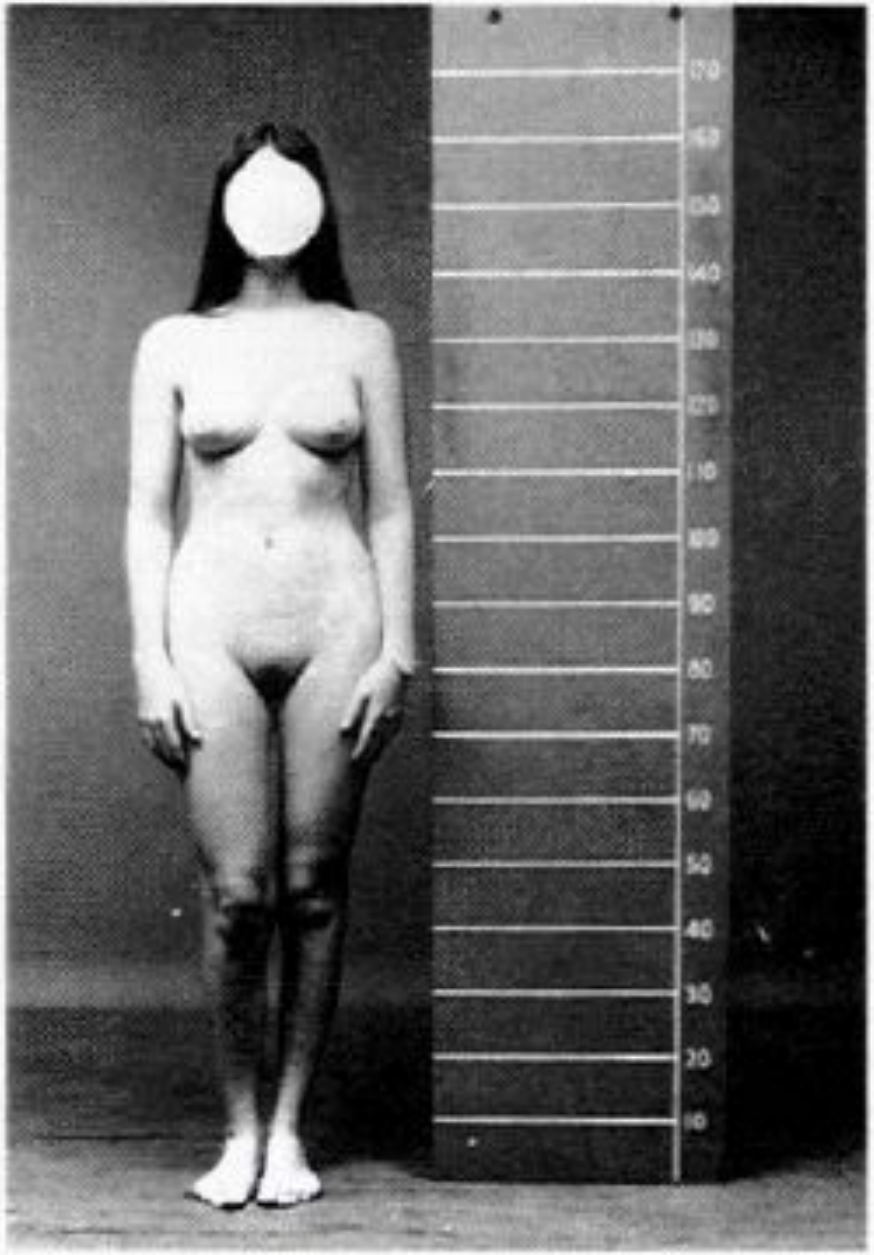
- Brains of girls with CAH exposed to high levels of testosterone during prenatal and early postnatal life
- CAH girls show a greater preference for boy-typical toys than do other girls.
- Fewer than average sexual encounters as adolescents
- Higher rate of homosexuality as adults

Gender Identity: Intersex

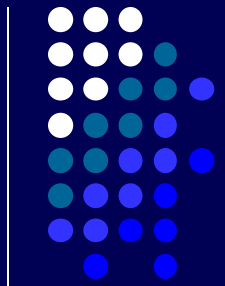
- Androgen insensitivity or testicular feminization: individuals with an XY chromosome pattern have the genital appearance of a female
- Normal androgen production
  - Mutation in gene for the androgen receptor to activate genes in the nucleus.
- Condition occurs in various degrees from a smaller than average penis to genitals that develop a female appearance.





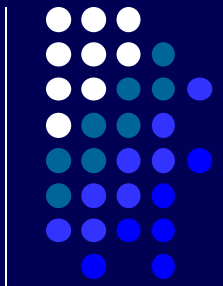


Gender ID
-Androgen Insensitivity



- Normal pubertal changes
  - Testosterone converted to estrogen in body tissues
- Shallow vagina
- Testes?
  - Yes
- Uterus or ovaries?
  - No
- Little to no androgenic hair – Why?
- Usually female gender ID – Why?

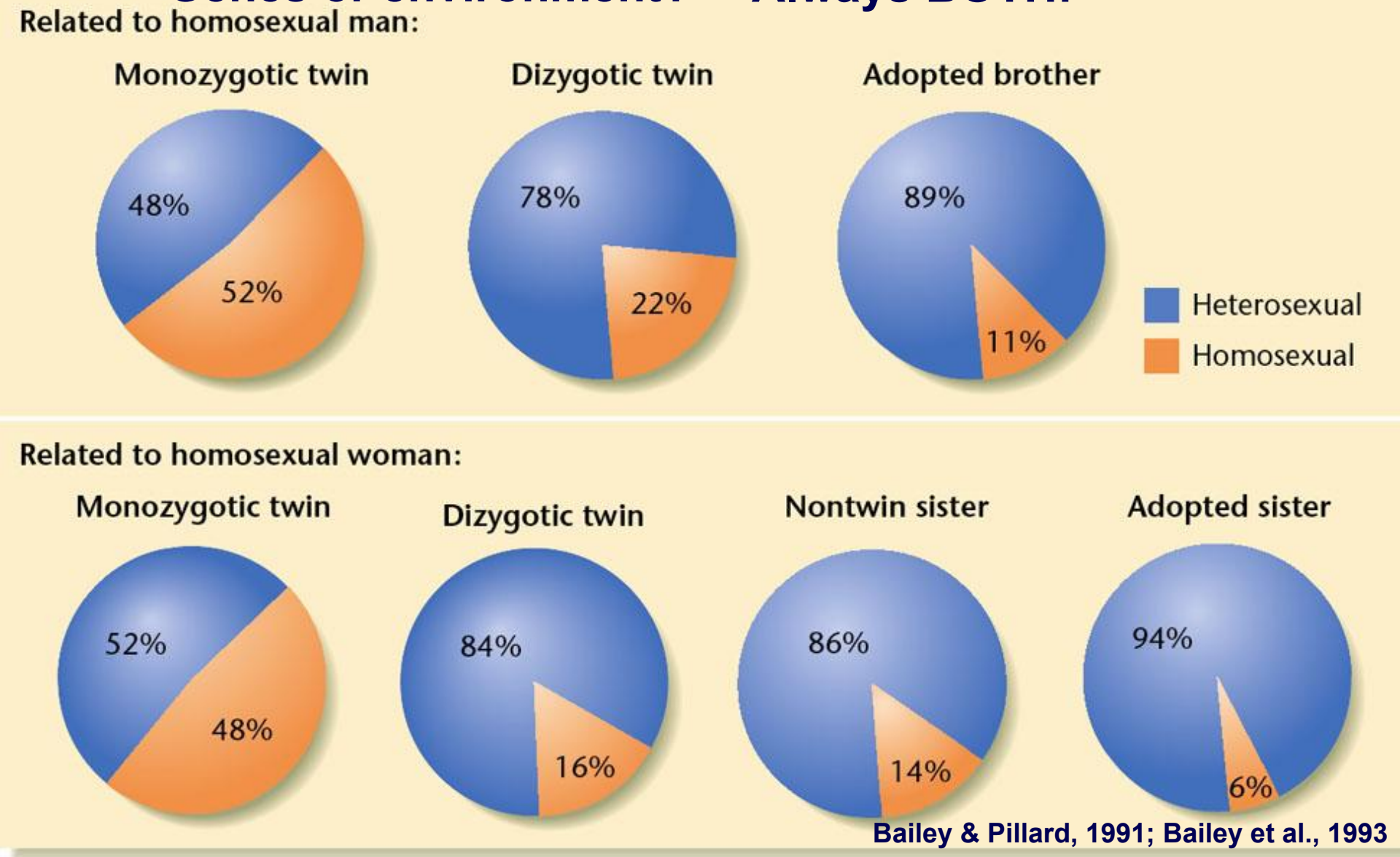
Gender Identity



- Many genetic males born without a penis or who had the penis accidentally removed and who were raised as a girl ask to be reassigned as males
- Many who remain female feel discontent or conflict with being female
- Conclusion: Although hormones do not determine gender identity, they do play a big role

Sexual Orientation: Bio. Basis?

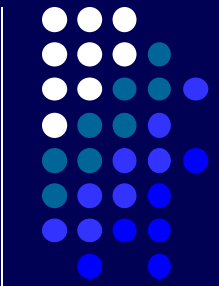
Genes or environment? Always BOTH!



Bailey & Pillard, 1991; Bailey et al., 1993

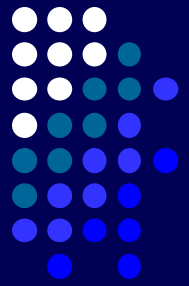
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Sexual Orientation: Bio. Basis?



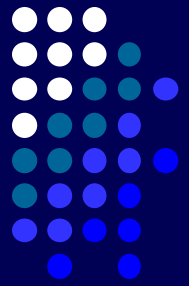
- Are genes the only factor?

Sexual Orientation: Bio. Basis?



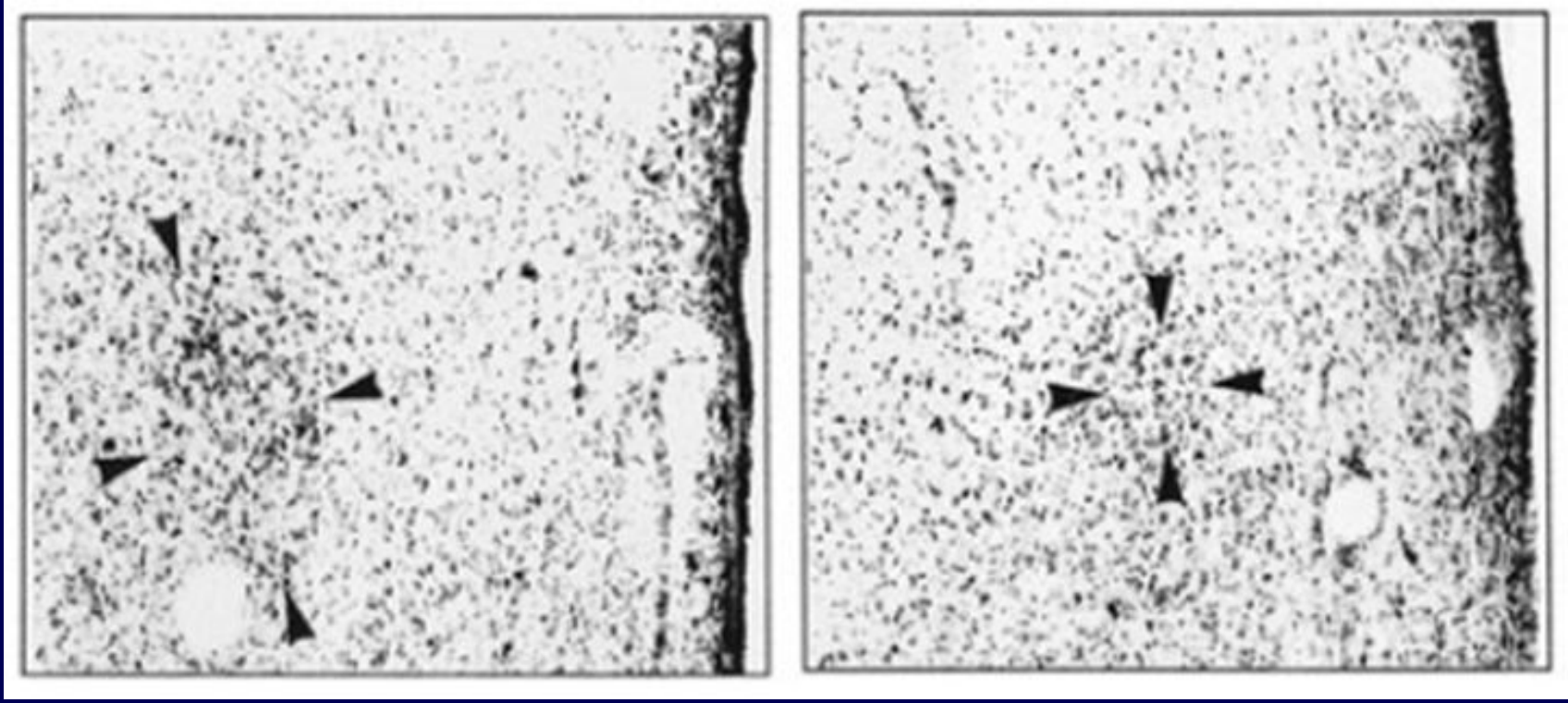
- Hormones
  - Orientation NOT related to adult hormone levels.
  - May be influenced by testosterone levels during sensitive periods of brain development.
- Across species, males deprived of testosterone early in life show increased sexual interest in other males as adults
- Females exposed to testosterone during early development show an increased likelihood of mounting behavior

Sexual Orientation: Bio. Basis?



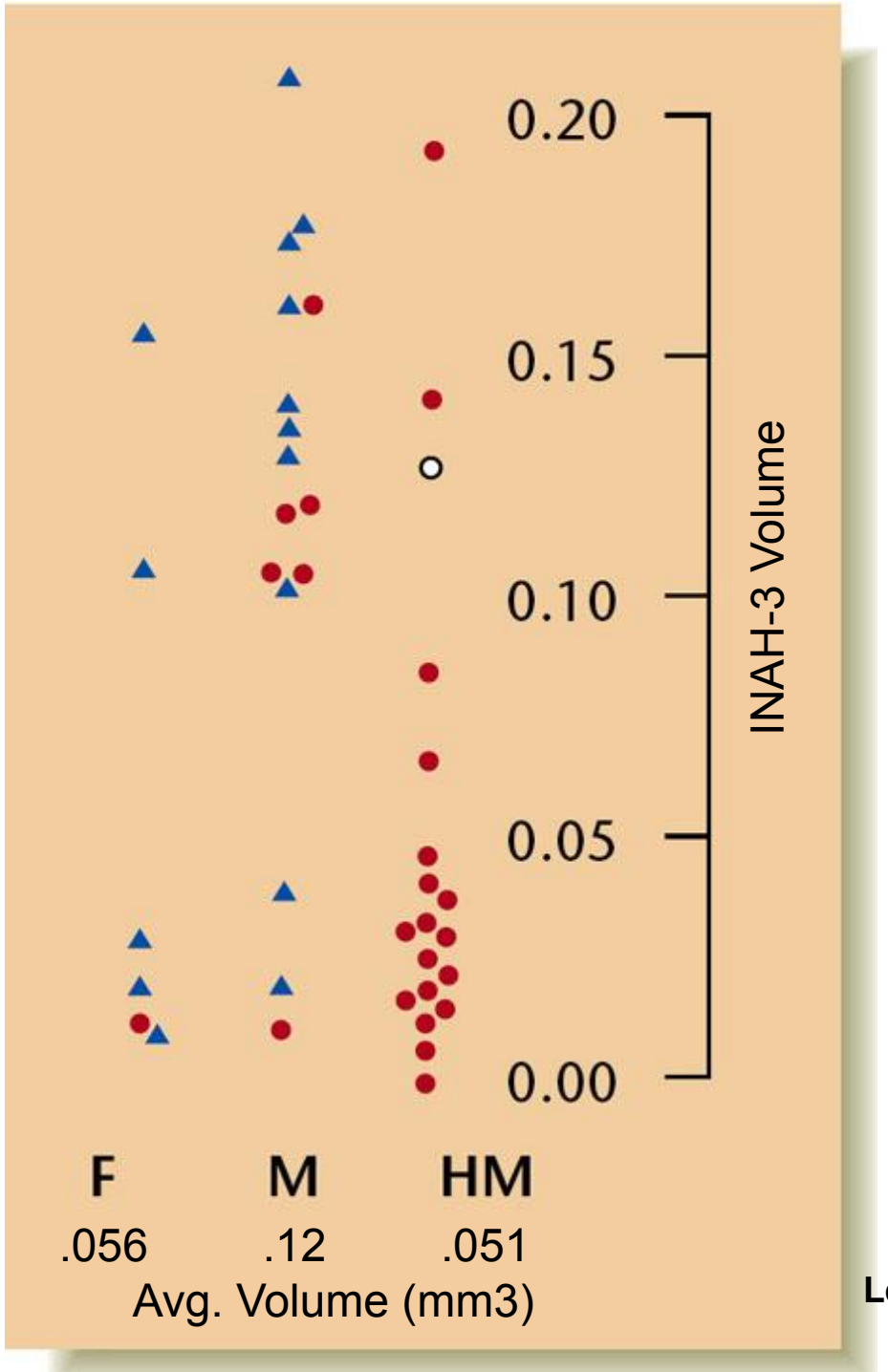
- On average, differences in brain anatomy exist between heterosexuals and homosexuals
- Homosexual men tend to have:
  - Larger anterior commissure (like women)
  - Larger suprachiasmatic nucleus
    - Prefs for male and female partners varies with time of day
  - Smaller neurons in the third interstitial nucleus of the anterior hypothalamus (INAH-3)

INAH-3

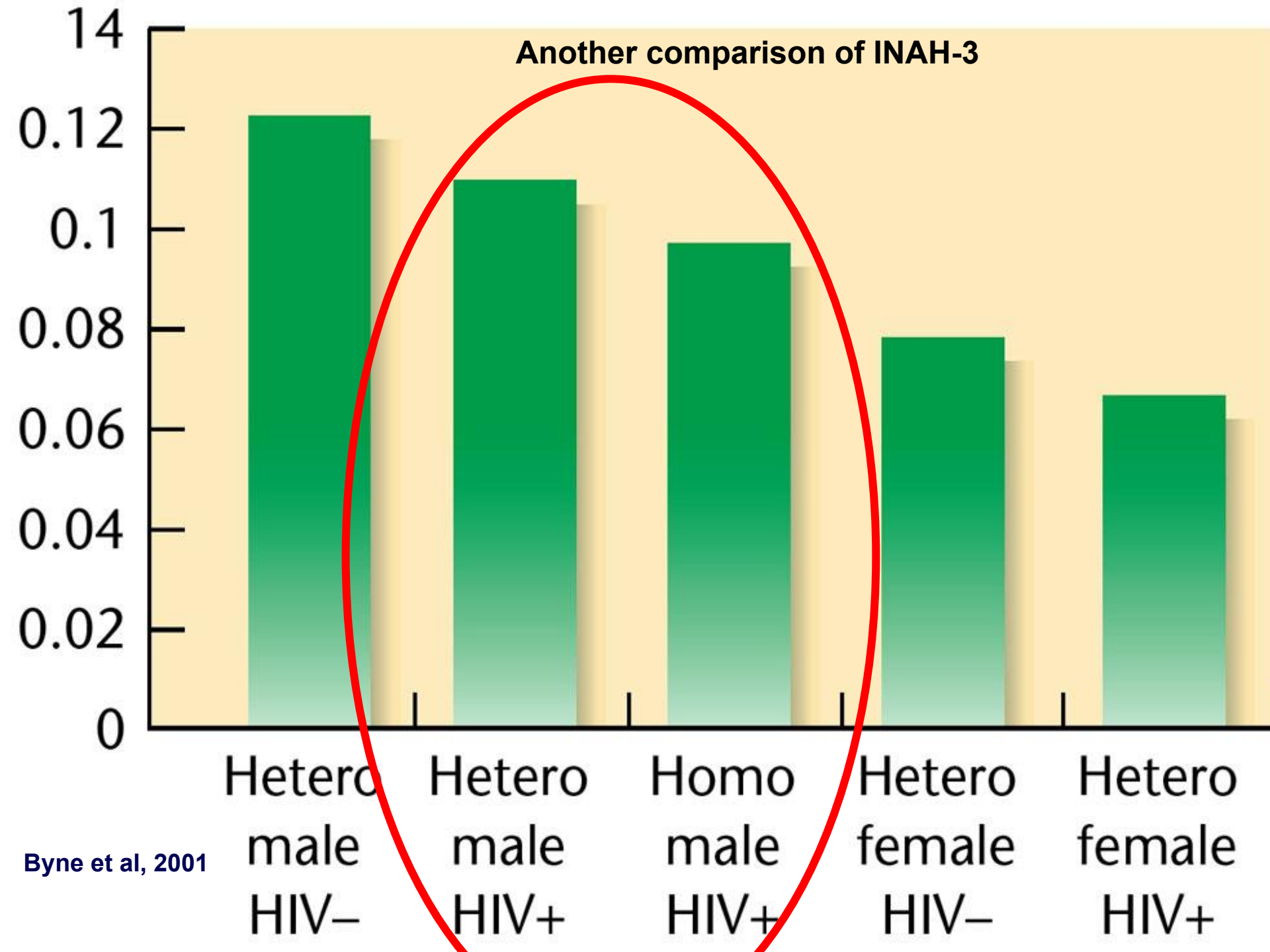


Volumes of INAH-3

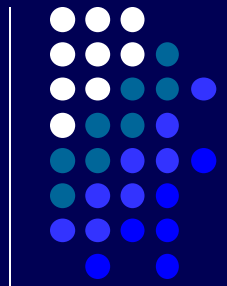
Red circle: died of aids
Blue triangle: other causes
Open circle: bisexual, died of aids



LeVay, 1991


Another comparison of INAH-3
14
0.12
0.1
0.08
0.06
0.04
0.02
0
Hetero male HIV–
Hetero male HIV+
Homo male HIV+
Hetero female HIV–
Hetero female HIV+
Byne et al, 2001

Sexual Orientation



- Difficult to decipher why differences exist.
  - Causal direction? Any causality?
- How did evolution bring this about?