Asymmetry between the sexes in relationship between number of mates and reproductive success (fitness) is the foundation of sexual selection.

**WHAT UNDERLIES MALE SEXUAL MOTIVATION AND PERFORMANCE**

- How does the interaction between the endocrine and nervous systems mediate male mating behavior?
MALE REPRODUCTIVE BEHAVIOR

• What do males do and why do they do it?
• Sex: division of gamete types
• Sexual behavior: Behavior that evolved to bring the two gamete types together
• Hormones of gamete maturation (sex steroids) co-opted for regulation of sexual behavior

MALE SEXUAL BEHAVIOR: TWO PHASES

• Appetitive (long phase) = courtship: opportunity for assessment
  • Behaviors male uses to gain access to females
  • Searching, fighting, advertising, providing food, ...
• Consummatory (short phase) = copulation/mating
• Separation into 2 phases is artificial but useful as different hormones affect each phase
FOR MALE REPRODUCTION TESTOSTERONE (T) IS KEY

• T isolated in pure form in 1935
• Synthesized 1936
• Injections can maintain male behavior after Gonadectomy (GDX; in males = castration)
• Note: not 1 hormone = 1 behavior

DO ANDROGENS CAUSE MALE SEXUAL BEHAVIOR?

• Sex drive and puberty
• Castration / T restoration of sexual behavior
• Androgens affect the likelihood of mating behavior by reducing the threshold in the presence of the appropriate neural substrates and social stimuli
IN RODENTS: T NECESSARY FOR MATING

- Castration (loss of testes) leads to:
  1. low motivation for sex
  2. longer to initiate mounting
  3. fewer intromissions prior to ejaculation.
  4. cannot mate to ejaculation.
  5. decline in the number of mounts with intromissions,
  6. no mounts.

IS IT T OR E2 THOUGH?

- Giving T can maintain mating behavior in castrated rodents.
- Dihydrotestosterone (DHT) cannot prevent post-castration decline in male sexual behavior
- Estradiol (E2) + DHT can restore mating behavior after castration.
  - DHT acts peripherally (sensory neurons) to maintain tactile feedback.
  - E2 acts centrally to promote reproductive behavior.
- T is a prohormone in target cells that then produce both E2 and DHT
BRÀIN MECHANISMS OF MALE RODENT MATING BEHAVIOR

- Pre-Optic Area = POA
- POA Lesions → no sexual performance, but motivation unaffected
  - won’t mount, but will overcome obstacles to gain access to females

DOPAMINE AND THE POA

- POA contains dopamine (DA) neurons
- Lesions kill cell bodies that send axons to other brain regions
- Treating lesioned males with a DA mimic transiently activates copulation
- DA inhibitors suppress sexual behaviors
- Dopamine is NECESSARY!! (BUT --- Important role of social behaviors too!)
OLFACTION AND THE VOMERONASAL ORGAN (VNO)

• Key role in male sexual behavior in rodents (but lost in many primates including humans).
• MOB and AOB have specific functions

OLFACTORY IMPAIRMENT

• Bulbectomized male rats fail to achieve ejaculation and do not initiate copulation.

• Bulbectomy: neural damages and irreversible
  • Damages both main olfactory bulbs and accessory bulbs
  • Cannot determine contributions of olfactory and vomeronasal inputs
    • requires manipulation of respective sensory receptors.
HORMONE IMPLANTS

- T in the MPOA mediates mating behavior
- T implants in POA of GDX males increase copulation
- T+ aromatase inhibitor is less stimulatory than E2 implants
- Behavior seems to be highly mediated by E2
Most steroid receptors clustered in POA, lateral septum, the amygdala, hypothalamus, hippocampus, and pituitary.

**Immediate Early Genes (IEGS)**

- In neurons: activated early during signal transduction → extracellular signals result in expression of specific genes.
- Products indicate initial activation of the genetic machinery of neurons.
SOCIAL STIMULI AFFECT MALE MATING BEHAVIOR

• Presence of a novel female
  • the “Coolidge Effect”
  • Some species are very different
  • Monogamous prairie voles. Novel females trigger greater copulation with his mate!!!

• Social and physical environment
  • female pacing
  • Previous experience and conditioned stimuli

• A non-conditional stimulus (presence of a female) and a conditioned stimulus (wintergreen odor) both stimulate hormonal release
HORMONAL CORRELATES OF PRIMATE (HUMAN) MALE SEXUAL BEHAVIOR

- Sex behavior peaks in 20’s then declines...
- Hormone levels correspond well with the behavioral data
- Mirrors fecundity and sperm count

MALE REPRODUCTIVE BEHAVIOR IN BIRDS

- Mating behavior wanes rapidly after castration
- Treatment of castrated male birds with androgens restores courtship and mating behaviors
- T or DHT restores most aspects of mating behaviors to precastration levels
- DHT alone does not restore copulation; just precopulatory displays.
BIRDS AS STUDY ORGANISMS

- Blood concentrations of androgens in birds covary with their breeding season
  - Androgen concentrations typically highest at the beginning of breeding season and lowest during the summer molt and early winter
  - Changes in steroid concentrations linked to seasonal fluctuations in day length
- Female birds do not provide consistent stimuli to males following treatment with estrogens (associated with progesterone), unlike female rodents.
  - Consequently, behavior of male less easy to separate from behavior of female.
SIMILARITIES/DIFFS ACROSS TAXA

- The same brain regions underlying rodent sexual behavior appear to be involved in the hormonal mediation of primate sexual behavior
  - But not the olfactory system.
- Female primates, like female rodents, affect sexual behavior and hormone concentrations in males.
- Birds also require androgens to maintain sexual behavior like primates and rodents.
  - Androgens converted into estrogens in the preoptic medial nucleus (POM) to mediate copulatory behavior, or to DHT in other regions to mediate vocalizations.