Mates, Families and Societies

Male Prairie Chickens on Lek (Booming Ground)
displaying male Prairie Chicken

two male Prairie Chickens fighting at boundary of territory on booming ground
A flirtatious hen (left)
A receptive hen (bottom left)
The triumphant moment (below)

**Costs and benefits of vocalizing.** Call of male Tungara frog attracts females and predatory bats. Both prefer complex songs.

Males compromise by giving simpler calls; reproductive success is lowered, but so is risk of predation.
Behavioral Ecology addresses questions regarding:

•The advantage an animal derives through behaviors
  •Net advantage = difference between costs and benefits
  •“Advantage” yields insight on behavior as adaptation that increases, perhaps maximizes, fitness (reproductive success)
•The function of behaviors in an ultimate sense

Behavioral Ecology investigates how evolutionary forces shape behavior.
•Adaptive significance of behavior

Areas of interest in the field of Behavioral Ecology...
•Interface of behavior, ecology and evolution
•Costs and benefits of behavior
•Territoriality, Reproduction, and Mating tactics
•Costs and benefits of social behavior
•Evolution of altruism
•Evolution of animal societies
Psychophysical constraints (e.g. memory, intelligence)

Neurobiology

Hormonal processes

Cellular, molecular, foundations

Male Banded Jawfish orally brooding its eggs. Male retrieves female’s spawn and incubates the eggs until they hatch. He leaves eggs in burrow briefly to feed himself.

External effects

Decision processes

Development

Components that account for generation of particular behavioral actions

Natural Selection

Mating

Social Organization

Interspecific Interactions

Feeding

Specific behavioral actions result in ecological effects, which constitute the context within which natural selection can operate to shape internal processes and behavioral responses.
Reproduction involves many behavioral “choices” that are shaped by natural selection.

**Successful reproduction depends on:**
- obtaining a place to nest/breed/raise young
- obtaining a mate
- rearing young

**Associated choices include:**
- seeking/defending a particular territory
- choosing a particular mate
- deciding how much energy to devote to rearing young
Mating Tactics and Mating Systems

Basic components of sexual reproduction in animals

• Courtship (maybe, maybe not)
• Fertilization
• Parental Care (maybe, maybe not)

Generalization regarding sex-specific differences in mating

Males usually initiate courtship and fight or otherwise compete with other males for opportunities to mate with females.

Basic mating “systems” in animals

Pair bond, relationship forms;

• Monogamous relationship; one male and one female
• Polygamous relationship;
  • Polygyny; one male and two or more females
  • Polygamy; one female and two or more males

No pair bond, no relationship

• Promiscuity

Courtship and sperm transfer in pygmy salamander. Male judges her receptiveness by presence of her chin on his tail, then deposits spermatophore. Both move forward and she recovers spermatophore in her vent while he arches his tail.
Parental care in female dusky salamander. She rotates eggs and protects them from fungal infections and predation by arthropods and other salamanders.

Female cheetah stands guard as her two cub feed on a kill.
Anisogamy

- **Females** produce limited number of energy expensive gametes
- Males produce virtually unlimited number of small, inexpensive gametes

Sexual *generalization* on mating tactics

- **Females**, having limited number of gametes to pass on to next generation, tend to be selective, choosy, to get high quality male, to maximize reproductive contribution to next generation.
- **Males**, conversely, may maximize reproductive contribution by being rather non-selective, inseminating as many females as possible

Female Brown Kiwi (Gill 1995)
Anisogamy, sexual Selection, explain broad patterns of mating behavior and morphological sexual dimorphism

- Males typically initiate courtship
- Males typically compete with each other for females
  - Males compete to be chosen by a female; often involves highly ritualized displays, ornate coloring of males
  - Males compete for exclusive access to females; often involves ritualized or real aggression and physical combat, where males use large body size, antlers, spurs, etc., as weapons

Intense competition to be a successful breeder is sexual selection; evolutionary consequence is exaggerated traits

- Ritualized displays
- Ornate plumage, pelage, etc.
- Fighting gear and large body size

Male Anolis Lizard. Hormonal stimulation prompts males to extend fleshy dewlap to court females. This behavior stimulates hormone release and egg-laying in the female; it’s a sign stimulus/releaser.

Male elephant seals engage in mock battle for females.

Male armament; products of sexual selection

Moose skull

Male hercules beetle from South America

Male and female Lucanid beetles

(Grier 1984)
**EXPERIMENT**

**Question:** Did sexual selection affect the evolution of long tails in African long-tailed widowbirds?

**METHOD** Artifically lengthen or shorten tails on birds by cutting feathers or gluing on feathers.

**RESULTS:**

<table>
<thead>
<tr>
<th>Average number of nests per male</th>
<th>Artificially lengthened</th>
<th>Normal</th>
<th>Artificially shortened</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>0</td>
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</tbody>
</table>

**Conclusion:** Sexual selection in widowbirds favors long tails.
High variance in reproductive output correlates with high fitness variance, which drives intense sexual selection

One corollary of this evolutionary fact is that dimorphic secondary sexual traits, the consequences of sexual selection, should be most exaggerated in polygynous species, and that tends to be true.

*As potential male reproductive success increases, so does the value of traits* such as large size, ornamental feathers, or any other trait by which males maximize that potential reproductive success.

(increased reproductive success may be mediated through intrasexual competition, intersexual selection, or some combination of the two)

Male Blue Peafowl (Peacock) displaying his magnificent train. The species is a native of India, inhabiting open country with some scrub, near cultivated areas (from Gooder 1975)
Variation in the sizes of harems of male Red-winged Blackbirds in Washington state (from Searcy and Yasukawa 1983)
Territorial Behavior

**Home range:** area occupied, traversed by an animal

**Territory:** Some, not all animals are territorial. *Territory* is a portion of home range *defended* for exclusive use of one or more resources

- Individuals (many birds), or groups (e.g., lions) may be territorial

  **Resources** include nest sites, foraging sites, water….

**Behavior of territorial defense:** Varies; in many birds, males defend, singing from conspicuous location in territory deters would-be intruders

Lions form territorial groups, usually including several females and their offspring, accompanied by a coalition of males, generally brothers, who are unrelated to the females. Successful breeding appears related to having a territory.
This display, which is accompanied by a song, warns other males to stay away from the territory but attracts females searching for breeding sites.

Feeding areas extend outside the territory boundaries.

Each outlined area is the territory of a single male red-winged blackbird.

A Territory with Nesting Sites and Some Food
**Possible Benefits:** exclusive use of resources increases, perhaps maximizes reproductive success associated with resources per se, or exclusive access to female

**Possible Costs:**

* Risk Cost: vulnerability -- territorial behavior increases risk of injury or death

* Opportunity Cost: cost associated with not performing other, beneficial behaviors while defending territory

* Energetic cost: difference between energy expended performing territorial behavior and energy that would have been expended had it been resting instead
**Territoriality occurs when resources are economically defensible**

**Economic approach:** Assess energy cost and energy benefit

**Sunbirds:**

- Defender has exclusive access to nectar in defended flower patch
- Sunbird may spend 3000 calories per hour routing intruders
- Energy gain from exclusive access outweighs energy cost of defense, when flower density exceeds a critical lower threshold
- When flower availability/density exceeds critical upper threshold, no advantage accrues to defending
- Territoriality favored at “intermediate” levels of flower abundance
Territories of intermediate size (A to B) are economically defensible because the benefits exceed the costs. Optimum territory size is X, where difference between cost and benefit is greatest.

**Natural Selection**: Differential reproductive success.

**Sexual Selection**: Differential reproductive success that results from advantages in attracting or competing for mates.
Reproduction; Individuals Engaged in Cooperation and Conflict

• Between partners
• Between parents and offspring
• Between offspring

Male Great Frigatebird inflates his red throat sac as part of courtship ritual

Male and female Egret performing highly ritualized courtship dance.

(Solomon et al. 1999)
Cooperation among Florida Scrub Jays. Helpers at the nest are young from previous seasons that have stayed on to help parents with feeding, territory defense, predator defence, etc., instead of attempting to breed themselves.