CHAPTER 27: BEHAVIORAL ECOLOGY

CHAPTER SYNOPSIS

Behaviors help an animal or its offspring survive and reproduce. Behavioral ecology examines how natural selection shapes such behaviors to increase an animal's overall fitness. Foraging behaviors are associated with the selection and collection of food, a necessary behavior for heterotrophs. Animals that are foraging specialists feed on only a few types of organisms while those that are generalists feed on many kinds. The optimal foraging theory attempts to explain how evolution favors foraging efficiency. Territoriality is closely related to foraging and reproduction and has adaptively important consequences. When resources are limited, territoriality helps to ration those resources.

Mating and reproductive behaviors are among the most complex behaviors. These actions help ensure that the expenditure of gametes and reproductive energy will result in viable offspring. Reproductive behavior also extends to rearing of the young. Mate choice is directly related to the overall expenditure each parent in a species makes in raising the offspring. The parent with the greatest investment should be the one that makes the choice. Mate choice is a process of sexual selection frequently based on secondary sexual characteristics and dependent on reproductive competition. In intrasexual selection, individuals of one sex (usually males) compete. Only a few males do most of the breeding, the rest do not breed at all. The three most common types of mating systems are monogamy, polygyny, and polyandry. Recent quantification of paternity through DNA fingerprinting shows that there is substantial "cheating" in the bird world. Other species have evolved unusual mating tactics where unobtrusive males sneak in undetected to breed with females and continue their genetic linage.

Animal behavior includes an unusual activity called altruism where the activity of an individual may benefit the group at the expense of the individual. Such behaviors contradict evolution unless one considers the concepts of inclusive fitness and kin selection. One can maximize inclusive fitness by sacrificing one's self for one's relatives. Most animals opt for reciprocal altruism, the proverbial "I'll scratch your back, if you scratch mine." The best strategy to optimize the transmission of one's own genes may be to cheat and selfishly get others to sacrifice themselves and then not return the favor. This rarely occurs in nature when the altruistic act is inexpensive because the gain to the cheater is not worth the future lack of reciprocation. Two of the most studied vertebrate altruistic acts are cooperative breeding and alarm calling. The former sets up a family-like structure in which young, non-reproductive, but related, individuals assist a breeding pair in raising their young. In alarm calling, sentries are willing to draw attention to themselves by calling out to alert others of the presence of a predator. Alarm calls by an individual are more likely if the caller and its neighbors are related.

Eusocial insect societies are complex and exhibit altruistic activity in defense and reproduction within the colony. The high degree of genetic relatedness in a colony may be one of the reasons for such extensive altruism. Most insects possess the haplodiploidy system of sex determination. Males are haploid, females are diploid, and the female workers share nearly 75% of their genes. Altruism allows workers to maximize inclusive fitness. Vertebrate societies are neither as complex nor as altruistic as eusocial insect societies. The individuals in vertebrate societies also share significantly less genetic heritage. Naked mole rats are unusual mammals that organized into societies very much like eusocial insects. They have functional and reproductive division of labor, workers of both sexes perform various tasks according to body size, and a single female is responsible for all breeding.

Two processes have led to adaptive change in human societies: biological evolution and cultural evolution. Biological evolution in humans is quite similar to that in animals, especially in non-human primates. Only humans exhibit cultural evolution, a nongenetic mode of adaptation passed on by tradition. It is difficult, but possible, to identify the biological components of human behavior by examining cross-cultural traits like greeting patterns.

CHAPTER OBJECTIVES

- ä Understand the evolutionary importance of animal behavior.
- ä Define behavioral ecology. Understand its association with adaptive significance and fitness.
- ä Compare foraging behaviors of generalists and specialists and understand how the optimal foraging theory explains foraging efficiency.
- ä Explain the need for territoriality in animals and the economic risks associated with such behavior.
- ä Understand the associations between parental investment and mate choice and how these interactions affect the evolution of mating systems.
- ä Explain how sexual selection and secondary sexual characteristics affect reproductive competition.
- ä Explain how inclusive fitness is related to kin selection and under what circumstances it can lead to altruistic behavior.
- ä Explain the benefits of engaging in reciprocal altruism.
- ä Understand the genetic basis for behavior among eusocial insect societies.
- ä Compare the complexity of vertebrate societies with that of eusocial insects. Understand the value of such activities as cooperative breeding and alarm calling in vertebrate societies.
- ä Define sociobiology. Cite advantages and disadvantages of living in social groups.
- ä Understand how biological evolution and cultural evolution combine to shape human sociobiology.

KEY TERMS

adaptive significance
altricial
behavioral ecology
biological evolution
caste
cultural evolution
eusocial insects
eusociality
evolutionary psychology
extra-pair copulation
fitness
group selection
Hamilton's rule
handicap hypothesis
haplodiploidy
helpers at the nest
home range
intersexual selection
intrasexual selection
kin selection
mate choice
optimal foraging theory
parental investment
precocial
reciprocal altruism
reproductive strategy
secondary sexual characteristics
sexual dimorphism
sexual selection
survival value
territoriality

CHAPTER OUTLINE

27.0 Introduction

I. THE ADAPTIVENESS OF BEHAVIOR

A. The Function of Behavior Is Its Survival Value

B. Behavior Allows Animal to Increase Its Reproductive Success fig 27.1

27.1 Evolutionary forces shape behavior

I. BEHAVIORAL ECOLOGY

A. Behavior Has Survival Value
1. Evolutionary analysis of how behavior helps an animal or its offspring stay alive
2. Example: Tinbergen's gull egg shell experiments fig 27.2
a. Gull parents remove hatched eggshells from nest
b. If broken shells replaced, predation increased
c. White shell interior cues predators
d. Shell removal behavior is adaptive, increases survival of offspring
3. Behavioral ecology is the study of how natural selection shapes behavior
4. Adaptive significance of behavior
a. How behavior increases survival and reproduction
b. Recent studies examine animal's fitness or reproductive success
c. How behavior is related to fitness equals the study of adaptation itself
5. Natural selection acts on genetic component of behavioral differences
a. Behavior favoring reproductive success becomes more prevalent
b. Test hypothesis by measuring fitness, demonstrating its correlation with behavior
c. May also measure other factors associated with reproduction

II. FORAGING BEHAVIOR

A. Example of Indepth Examination of One Well-Defined Behavior
1. Foraging trade-offs between food energy content and availability
a. Large food contains more energy, harder to capture, less abundant
b. Net energy = energy of prey – energy cost of pursuit and handling
2. Optimal foraging theory
a. Expect evolution to favor foraging efficiency
b. Feed on prey that maximizes energy intake per unit foraging time
3. Foragers preferentially use prey that maximize energy return
a. Shore crabs feed on intermediate-sized mussels
b. Large mussels provide more energy, but take more to crack open fig 27.3

B. Two Assumptions Made by Optimal Foraging Approach
1. Natural selection favors maximal energy acquisition if it leads to reproductive success
a. Sometimes true
1) Direct relationship between net energy intake and offspring raised in ground squirrels and zebra finches
2) Reproductive success of some spiders related to amount of food captured
b. Animals have needs other than energy acquisition, often conflict
c. Must avoid predators
1) Energy gaining behavior may not minimize predation risk
2) Tradeoff between eating and being eaten
3) Foraging behavior altered when predators present
d. Finding mates also changes foraging behavior
1) Reduce feeding rate
2) Enhances ability to attract and defend females
2. Optimal foraging has resulted from natural selection
a. Natural selection lead to change only when a genetic basis exists
b. Few studies to determine if maximizing energy intake is heritable
1) Female zebra finches passed energy acquiring ability on to offspring
2) Removed young from mothers, ability not learned

c. Differences in foraging behavior may be age-related
   1) Inexperienced animals cannot handle large prey efficiently
   2) Costs of eating are higher than benefits
   3) Focus on smaller prey
   4) With experience include larger prey in diet

III. TERRITORIAL BEHAVIOR

A. Animals Move Over a Large Area
1. Home range: Daily activity site
   a. May overlap with others in time or space
   b. Portion of range is exclusive and actively defended
2. Territoriality fig 27.4
   a. Individual exclusively uses area with some limited resource
   b. Resources may include food or potential mates
   c. Defense of area via displays or overt aggression
   d. Example; Bird song to defend territory
      1) Done to prevent takeover of territory by neighboring birds
      2) Intruders not deterred may be attacked
   e. Defense of territory has cost
      1) Singing is energetically expensive
      2) Attacks can lead to injury
      3) Advertisement by song or display may attract predators

B. Economic Risks of Territorial Behavior
1. Energy costs versus energy benefits
   a. Increased food intake
   b. Exclusive access to mates
   c. Access to refuges from predators
2. Example: Flowers and nectar-feeding birds fig 27.5
   a. Cost depends on amount of food available, efficiency of collection
   b. If flowers scarce, not worth defending since they do not provide enough energy
   c. If abundant, not worth defending, easy to get enough energy
   d. Defense practical only for intermediate quantity of flowers
3. Access to females may be more important to territoriality than food availability
   a. Example: Male lizards
   b. Maintain enormous territories that encompass territories of several females
   c. Territories larger than needed to supply food, defended vigorously
   d. Territory decreases in non-breeding season as does aggressiveness of defense

27.2 Reproductive behavior involves many choices influenced by natural selection

I. A COLLECTION OF REPRODUCTIVE BEHAVIORS

A. Components of Reproductive Behavior
1. Include finding nesting places, mates, and rearing young
2. Involve seeking and defending particular territory
3. Mate selection involves intense natural selection

B. Decisions Made About Mate Choice During Breeding Season
1. Reproductive strategy: Behaviors that maximize reproductive success
2. Include mate choice, number of mates, and parental care
3. Evolved in response to ecology, food resources, nest sites, distribution of mates

II. PARENTAL INVESTMENT AND MATE CHOICE

A. Males and Females Differ in Reproductive Strategies
   1. Mate choice first observed by Darwin
      a. Female evaluate male's quality
      b. Decide whether or not to mate
      c. Subsequently described in many invertebrate and vertebrate species
   2. Mate choice by males less common
   3. Compare parental investment by males and females
      a. Compare contributions of each parent to raising offspring
      b. Estimate energy spent by male and female in offspring care
   4. Females generally show higher parental investment
      a. Size of gametes: Egg significantly larger than sperm
      b. Nutritional value of gametes: Egg more than sperm
      c. Care costly to females that gestate and lactate
   5. Sexes face different selective pressures
      a. If female investment is greater than male investment
      b. Any single reproductive event is generally cheap for males
      c. Increase fitness by mating with as many females as possible
      d. Reproductive even for females more costly
         1) Number of eggs produced limits reproductive success
         2) Females can afford to be picky
      e. When both parents contribute to care of young, situation is different
      f. Degree of mate choice equal between sexes
   6. Males may show mate choice if they have high parental investment
      a. Example: Male cricket spermatophore = 30% of body weight
         1) Provides nutrition for female
         2) Helps develop eggs
      b. Females compete for males
      c. Males choose large females to produce more offspring — fig 27.6
      d. Males make investment by defending and feeding young

III. REPRODUCTIVE COMPETITION AND SEXUAL SELECTION

A. Sexual Selection Is the Competition for Mating Opportunities
   1. Sometimes considered distinct from natural selection
   2. Others see it as a subset, another way to increase fitness
   3. Intrasexual selection: Interactions between members of 1 sex
      a. "Power to conquer males in battle" (Darwin)
      b. Evolution of deer antlers, ram's horns
   4. Intersexual selection: Mate choice, production of secondary sex characteristics
      a. "The power to charm" (Darwin)
      b. Evolution of long tail feathers and bright plumage — fig 27.7a

B. Intrasexual Selection
   1. Individuals of one sex compete, usually only males
      a. May occur to own territory in which females reside
      b. May occur to directly control females
         1) Impala and other species travel in large groups
         2) One male exclusively breeds with all females
         3) Vigorously defends rights against other males
      c. Few males do most breeding, most males do not breed at all
         1) Example: Elephant seals
         2) Dominant males control breeding territory on beaches

        3) Eight males on one beach impregnated all 348 females
   2. Selection strongly favors trait that improves ability to compete
      a. Size often determines mating success – bigger is better
      b. Males evolved to be bigger than females
      c. Sexual dimorphism: Physical differences between males and females
      d. Usually males have fighting structures like horns, antlers, large canine teeth

C. Intersexual Selection
   1. Peahens prefer to mate with peacocks with more spots on tail feathers fig 27.7b,c
   2. Female frogs mate with males with more complex calls

D. The Benefits of Mate Choice
   1. Obvious choice if male helps rear young
      a. Choose male that can provide best care
      b. Likely to produce more offspring
   2. Males provide no care, but maintain territory
      a. Provide food, nesting sties, and predator refuges
      b. Best territories maximize female reproductive success

E. Indirect Benefits
   1. Often males provide no direct benefit to females
      a. Not obvious what females gain by being choosy
      b. Benefit to long tail or complex song?
   2. Large/old male choice by female
      a. Large males succeed in living long
      b. Acquire food, resist parasites and disease
   3. Brightness of male's colors indicate good health
   4. Advantage for female to breed with large/colorful males
      a. Male's success due to good genes, passed on to offspring
      b. Healthy males less likely to pass disease to females in mating
   5. Females may choose males with detrimental traits fig 27.8
      a. Long tails in peacocks
         1) Hinderance to flying
         2) Increases vulnerability to predators
      b. Handicap hypothesis: Only genetically superior males survive with a handicap
         1) Female ensures offspring gets superior genes
         2) Handicap genes also inherited
   6. Certain male traits may better stimulate females
      a. May better detect colors or sound frequencies
      b. Males evolve traits to exploit females' biases
      c. Example: Vocalization of Túngara frog fig 27.8
         1) Males include "chuck" sound in calls
         2) Females of even related species particularly attracted to "chucks"
         3) Evolution of preference unknown, males take advantage of it
   7. Great variety of theories to explain mating preference

IV. MATING SYSTEMS

A. Concerned with Number of Mates During Breeding Season
   1. Three common types of mating systems
      a. Monogamy: One male to one female
      b. Polygyny: One male to more than one female fig 27.9
      c. Polyandry: One female to more than one male
   2. System evolves to maximize reproductive fitness

a. Strongly influenced by ecology
b. Potential evolution of polygyny system
   1) Male defends territory with substantial nest sites or food
   2) Resources plentiful enough for more than one female
   3) Female's fitness maximized by mating with male in high-quality territory
   4) Better than mating with unattached male in low quality territory

3. Needs of young also constrain mating decisions
   a. Monogamy favored if both parents needed
   b. Altricial young need extensive care, both parents needed (monogamy)
   c. Precocial young require little care, decreasing need for males (polygyny)
4. Polyandrous systems exist, but are not common
   a. Example: Spotted sandpipers
   b. Males incubate eggs, care for young
   c. Females mate and leave eggs with several more males

B. Extra-Pair Copulations
1. DNA fingerprinting used to determine paternity by behavioral ecologists
2. Can quantify reproductive success of male — fig 27.10
   a. Example: Red-winged blackbirds
   b. Half of nests held egg with father that wasn't territory holder
   c. 20% of offspring due to extra-pair copulations
3. "Cheating" appears to be common in bird world
   a. Occurs even in species believed to be monogamous
   b. Increases reproductive fitness of males
   c. Advantage to females less clear
      1) May genetically enhance superiority of offspring
      2) May increase amount of help to raise young

C. Alternative Mating Tactics
1. Example: Fish with two size classes of males
   a. Large males defend territory to obtain matings
   b. Small males sneak in and fertilize eggs
2. Example: Dung beetles
   a. Territorial males with horns guard females in chambers
   b. Small males dig side tunnels to intercept females
3. Example: Isopods with three class sizes of males
   a. Large males are territorial
   b. Medium males are same size as females, aren't noticed
   c. Tiny males sneak in undetected and mate

27.3 There is considerable controversy about the evolution of social behavior

I. FACTORS FAVORING ALTRUISM AND GROUP LIVING

A. Altruism
1. Performing an action that benefits others at cost to yourself
2. Examples
   a. Altruism in birds
      1) Helpers at the nest
      2) Non-breeding birds help raise young of breeding birds
   b. Altruism in birds and mammals
      1) Alarm calls
      2) Alert other members of group
      3) May call attention to self

c. Lioness allows all cubs to nurse
3. Why does altruism exist from biological standpoint?
   a. How can allele be favored by natural selection?
   b. Such allele should be at disadvantage
   c. Frequency in gene pool should decrease over time
4. Several explanations
   a. Such traits evolve "for the good of the species"
      1) Natural selection acts on individuals not species
      2) Traits detrimental to species exist if they are good for individual
      3) Occasionally group selection acts on groups of individuals
   b. Altruistic acts aren't really altruistic
      1) Helpers at nest gain experience by assisting breeders
      2) Individuals may inherit territory if breeders die
      3) Alarm callers may protect selves by causing others to panic

B. Reciprocity
1. Partnership formed to exchange altruistic acts
   a. Reciprocal altruism benefits both parties
   b. Cheaters are cut off from receiving future aid
   c. If act is inexpensive, gain to cheater is not worth future loss of reciprocation
   d. Example: Vampire bats
      1) Bats that have fed well give up small amount to roostmate
      2) Individual that does not reciprocate excluded from future sharing

C. Kin Selection
1. Haldane's remark to lay down his life for two brothers or eight first cousins fig 27.11
   a. Brothers have 50% chance of receiving same genes
   b. Passes on as many genes as eight first cousins, each shares 1/8 of his genes
2. Costs and benefits of altruism according to Hamilton
   a. Direct aid to kin equals reduction in own fitness outweighed by increased reproductive success of relatives
   b. Selection favors behavior maximizing propagation of alleles
3. Kin selection: Favors altruism directed to relatives
   a. Altruism is likely to be directed to close relatives
   b. Hamilton's rule: $b/c > 1/r$
      1) b = benefit of altruistic act
      2) c = cost of altruistic act
      3) r = coefficient of relatedness
   c. Example: have one less child if it helps half-sibling to have more than four

II. EXAMPLES OF KIN SELECTION

A. Many Examples in Animals
1. Belding's ground squirrel alarm calling
   a. Alarm call given when predator sighted, caller at risk
   b. Colonies female-based, males not related to females or each other
   c. Females with relatives near more likely to alert
   d. Males less likely to alert, not related to anyone
2. White-fronted bee-eaters
   a. Nest in colonies of 100-200 birds
   b. Males remain in colony, females disperse
   c. Helpers assist breeding pairs, doubles number of offspring that survive
   d. Choose pair to help by degree of relatedness
   e. Helpers usually male, not unrelated females

B. Haplodiploidy and Hymenopteran Social Evolution
   1. Composition of a eusocial honeybee hive fig 27.12
      a. Single queen, sole egg-layer
      b. Up to 50,000 offspring of queen, mostly female workers with nonfunctional ovaries
         1) Sterility of workers is altruistic
         2) Offspring give up reproduction to help mother rear more sisters
   2. Possess haplodiploidy system of sex determination
      a. Males are haploid, females are diploid
      b. Workers share as much as 75% of genes
         1) Queen usually fertilized by only one male
         2) All workers get same alleles from father
         3) Share half of alleles from mother, on average
         4) Females in normal systems share half of alleles with offspring
      c. Workers propagate more alleles this way
   3. Similar system possessed by other eusocial animals
      a. Thrips are haplodiploid
      b. Termites and naked mole rats are not haplodiploid
      c. Haplodiploidy helpful but not necessary for eusociality

III. GROUP LIVING AND THE EVOLUTION OF SOCIAL SYSTEMS

A. Most Organisms Live in Social Groups
   1. Definition of society
      a. Group of organisms of same species
      b. Organized in a cooperative manner
   2. Advantage to living in a group
      a. Kin selection: Group composed of close relatives
      b. Other direct benefits
         1) Greater protection from predators fig 27.13
         2) Increased feeding success by acquiring new knowledge on food sources
         3) Advantage to group hunting

B. Insect Societies
   1. Sociality evolved in two insect orders
      a. Hymenoptera include ants, bees, wasps
      b. Isoptera includes termites
   2. Eusocial insects are truly social with division of labor
      a. Include all ants, some bees, some wasps, all termites
      b. Division of reproductive labor (fertile queen, sterile workers)
      c. Provide cooperative care of brood
      d. Have overlap of generations, queen lives alongside offspring
      e. Composed of castes, highly integrated groups of individuals
   3. Queen bee maintains dominance by "queen substance" pheromone
      a. Suppresses ovaries in female workers, makes them sterile workers
      b. Male drones produced only for mating
      c. With hive growth in spring, some females do not receive enough queen substance
         1) Colony prepares for swarming
         2) Workers establish several queen chambers
         3) Old queen and some female workers move to a new hive
         4) New queens battle, winner mates and rules old hive
   4. Natural history of leaf cutter ants
      a. Colonies of millions of ants grow crops of fungi underground from leaf pieces
      b. Division of labor related to worker size
         1) Workers travel from nest to tree, cut leaves into small pieces, carry to nest

        2) Smaller workers chew leaves into mulch
        3) Still smaller workers implant fungal hyphae into mulch
    c. Nurse workers carry larvae to choice spots in fungal garden to graze
    d. Queens produced that disperse from parent nest and start new colonies

27.4 Vertebrates exhibit a broad range of social behaviors

I. VERTEBRATE SOCIETIES

A. Vertebrate Societies Are Less Rigidly Organized than Insect Societies
1. Vertebrates have larger brains, more complex behavior
2. Exhibit lower degree of altruism than insects
    a. Social systems still show reciprocity and kin-selected altruism
    b. Exhibit greater degree of conflict and aggression within society
    c. Conflicts center around food resources and mates
3. Have particular organization
    a. Social group has certain size, member stability
    b. Has certain number of mating males and females, type of mating system
    c. Organization influenced by ecological factors like food and predation fig 27.14

B. Relationships Exist Between Ecology and Social Organization
1. Example: African weaver birds
    a. 90 species divided by type of social group formed
    b. Feeding and nesting habits correlated with mating systems
    c. Forest species
        1) Builds camouflaged, solitary nests
        2) Monogamous males and females
        3) Forage for insects to feed young
        4) Insects hard to find, both parents must cooperate in feeding — monogamous
        5) Nests do not call attention to predators to keep young safe
    d. Savanna species
        1) Nests in colonies in trees on savanna
        2) Polygynous
        3) Feed in flocks on seeds
        4) Hidden nest not an option, protect young by building nests in trees
        5) Few trees forces birds to nest in colonies
        6) Females feed young alone since seeds are abundant
        7) Male free from parenting duties
        8) Polygynous mating system — male spends time courting many females
2. Example: Naked mole rats are exception to general rule
    a. Organized very much like insect societies
        1) Form large underground colonies, running tunnels, central nesting area
        2) May contain up to 80 individuals in one colony
        3) Feed on bulbs, roots, tubers found by constant tunneling
    b. Have functional division of labor
        1) Some work as tunnelers, others perform other tasks depending on body size
        2) Large individuals defend colony, dig tunnels
    c. Have reproductive division of labor like eusocial insects
        1) All breeding via single female with one or two male consorts
        2) Workers are of both sexes

II. HUMAN SOCIOBIOLOGY

A. Unparalleled Complex Society
   1. Humans have intelligence to contemplate social behavior of other animals
   2. Other behavioral characteristics
      a. Kin-selected altruism, reciprocity, elaborate social contracts
      b. Extensive parental care
      c. Much conflict between parents and offspring, violence, warfare, infanticide
      d. Variety of mating systems: monogamy, polygyny, polyandry
      e. Diverse sexual behaviors: extrapair copulation, homosexuality
      f. Adoption
   3. Incredible variety of behaviors within one species
   4. Are behaviors rooted in human biology?

B. Biological and Cultural Evolution
   1. Two processes led to adaptive change
   2. Biological evolution
      a. Primate heritage shared with chimpanzees
      b. Traits are definitely adaptive in non-human primates
      c. Include kin-selected and reciprocal altruism
      d. Similar traits likely evolved in early humans
         1) Advantage in reproduction conferred to individuals with these traits
         2) Traits now part of human genome, may influence behavior
   3. Cultural evolution
      a. Transfer of information needed for survival across generations
      b. Nongenetic mode of adaptation
         1) Includes use of tools, shelter construction, marriage practices
         2) Passed from generation to generation by tradition

C. Identifying the Biological Components of Human Behavior
   1. Difficult to identify
      a. Study cross-cultural traits
      b. May have been affected by natural selection
      c. May result from genes fixed in human populations
      d. Examples:
         1) Taboo against incest
         2) Most mammals and human species are polygamous
         3) Many cultures exhibit same greeting pattern
   2. Development of evolutionary psychology
      a. Understand origins of human mind
      b. Diversity of cultures developed from adaptations to ancestral hunter-gatherer lifestyle
      c. Human behavior reflects ancient, adaptive traits
      d. Even behaviors like jealousy and infidelity increased fitness of ancestors
      e. Traits now part of human psyche

INSTRUCTIONAL STRATEGY

PRESENTATION ASSISTANCE:

Observe social behavior within the classroom. Have the students identify their home range and discuss whether or not they defend their territory. If so, why? And if not, why not?

Discuss altruism and reciprocal altruism in terms of class activities like taking notes and studying for exams. When is it worth while for a student to allow another student to copy his/her notes? Is it more valuable to study with others or keep one's knowledge to one's self?

Discuss mate choice with regard to human societies.

Discuss altruism and reciprocal altruism in terms of environmental, economic, and health problems. To what degree should we allow another country to destroy its forests if down the road it affects our climate as well? How charitable are contributions when they are primarily made as a tax break? What are the long term consequences of helping individuals with genetic deficiencies survive?

VISUAL RESOURCES:

Obtain photos of examples of animals (primarily males) that exemplify reproductive competition and sexual selection.

The computer game "Lemmings" is apparently composed of eusocial mammals. I haven't succeeded in the game enough to have any clue about their reproductive strategies. I mostly just blow them all up or watch them fall into various regions of ooze.