Mating Systems
Mating systems

-- The way animal populations are structured in relation to reproductive/sexual behavior.

Some of the mating systems generally recognized in animals:

1. **Monogamy**: One male and one female have an exclusive mating relationship, serially or for a lifetime.

2. **Promiscuity**: Any male mates with any female in a population or social group.

(These are the extremes!)
3. **Polygamy**: One or more males have a relationship with one or more females.

Three types are recognized:

- **Polygyny**: One male has a relationship with two or more females.

- **Polyandry**: One female has a relationship with two or more males.

- **Polygynandry**: Two or more males have a relationship with two or more females (almost promiscuity).
• Relationships are rarely exclusive for any individuals in a species. DNA studies: even in species that form pair-bonds for life, extra-pair copulations occur often.

• Some species show different mating systems in different circumstances
  - in different parts of their geographical range
  - under different conditions of food availability

• Various mixtures of mating systems (previous slide) may occur in different species.
Mating systems evolve from other systems, in any direction.

Ecological/environmental factors make it more/less likely to control what mates do, and therefore whether you can pass into polygamy.
How polygamy evolves…
If possible to monopolize mates → drives sexual selection re: who gets to monopolize (e.g. male-male competition) → polygamy.

1. How polygamy evolves…

- Ecological factors
- Phylogenetic factors
- Environmental potential for polygamy
- Ability to capitalize on environmental potential for polygamy
- Degree of mate monopolization
- Mating system

(modified from Emlen and Oring, 1977)
Preconditions for the evolution of polygamy

*In order to have more than one mate, resources to attract them must be defendable by individuals.*

Environmental factors such as spatial and temporal patterns affect the potential for this.

1. The *environmental* potential for polygamy depends on the level to which having multiple mates, or the resources necessary to gaining multiple mates, are economically defensible.
Monogamy makes sense when you can’t control mates

Polygamy makes sense when mates or resources are clumped

dotted circles are defended territories, solid dots are resources

Uniform distribution. Little polygamy potential

Clumped distribution. High polygamy potential

ecological factors example

How polygamy evolves…
Preconditions for the evolution of polygamy, cont’d

2. Animals must also be able to utilize the environmental potential. Even if necessary resources are economically defendable, for some species the potential for polygamy depends largely on the level of parental care required for successful rearing of young.

• Polygamy is more prevalent in species where one sex is freed from parental care of young, where parental care requirements are minimal, and/or when a large amount of a food source enables one parent to provide full parental care.
How Monogamy evolves...

Recall from reproduction lecture (Drosophila expts that male reproductive success proportional to the number of matings, but not female reproductive success.

So males are preadapted to promiscuity unless...
Female reproductive success is not dependent on # mates, so females preadapted for monogamy.

Males must be compelled to monogamy.
What compels males to monogamy?

3 hypotheses:

1. **Mate assistance hypothesis**

   - males remain with one female because ecological factors make parental care/protection of mother and offspring advantageous.
   
   - Example: Seahorses- male synchronizes reproductive cycle with females, carries egg clutch, & gains more by sticking with 1 female so he can get more eggs as soon as his pregnancy is over (pg. 371).
2. *Mate guarding hypothesis*

- females would use sperm of other males if left free to mate. More likely if females stay receptive after mating and if mating groups are scattered (Rock-haunting possum example, pg. 387, 9\textsuperscript{th} Ed.)

3. *Female enforced monogamy*

- females show aggression toward partners who show sexual interest in other females. (Example-burying beetles pg. 382, 9\textsuperscript{th} Ed.)
Despite all the good ecological, evolutionary reasons for monogamy, cheating is the norm in birds and mammals.

Molecular genetic field sampling....

Social monogamy is not uncommon, but genetic monogamy is very rare. Only about 10% of bird and mammal cases studied show genetic fidelity to the social partner.

See: Emory University: Mating for Life?
http://www.emory.edu/COLLEGE/HYBRIDVIGOR/issue1/mating.htm
In primates, the **only** documented cases of genetic fidelity are some micromonkeys:

(1) marmosets and (2) tamarins

See: Emory University: Mating for Life? 
http://www.emory.edu/COLLEGE/HYBRIDVIGOR/issue1/mating.htm
Examples of:

1. Monogamy (bird, then mammal examples)
2. Polygamy
Monogamy

The conventional definition of a monogamous mating system occurs when a male and a female pair mate only with each other during a particular breeding season.

*serial monogamy*: Individuals are monogamous for a breeding season, but switch partners each season.

*lifetime monogamy*: A pair mates for life. (duh)
Conditions favoring monogamy from the male’s perspective:

1. Imposed by female to prevent polygamy

2. Females are scarce and hard to monopolize

Note that ovarian cycling synchrony in a population favors monogamy... receptive females are temporally scarce.
Why social monogamy in birds?

Social monogamy occurs in the vast majority of birds, in at least 90% of the species studied, and is due primarily to the inability of most species to take advantage of any environmental potential for polygamy.

Considerable parental care by both parents is often necessary for successful rearing of young: Large eggs, need protection, warming, rotating, young altricial (with 1 exception).

So....

Gain from both parents giving care to offspring $>\$ Gain from courting and mating with additional mates.
Example of monogamy in birds

1. Mate assistance advantage in starlings:

Nests with attention from both parents have greater reproductive success compared with one parent (97% hatching vs 75% hatching).
Canada Geese form life-long pair bonds

Long lifespan => matings over many seasons.

Advantage to have partner ready at hand.

Females sit on eggs, males defend nest.

After hatching, but not before, males tolerate other male geese.
Why not social monogamy in mammals?

Compared with birds, in mammals social monogamy much less common.

Why?

It is more difficult for male mammals to share energetic costs of development (more lengthy in utero development, and males can’t lactate).

Remember, males must be compelled to monogamy.
Amongst mammals, monogamy more common in rodents, or smaller mammals.

Example: Rock-haunting possum

- females live well apart from each other, so in their territories, males monitor female and young.

The ecological factor that females to live in small, defendable territories make male guarding beneficial, and therefore, leads to male monogamy.
There is also monogamy due to the need for bi-parental care in some rare cases.

*Peromyscus* (mice):

Both parents necessary to keep young warm…

Differential survival shown experimentally when temperature altered and one parent removed.
Example 3: dik-dik

(see discussion question 11.3)

How come these guys are monogamous?

Another example of how different hypotheses can be posed and rejected...
Hypotheses: Monogamous because…

• both parents needed to raise young?

• males control territories of a size that contains a single female?

• guarding female prevents polygyny by females wandering into neighboring male’s territory?

• guarding female prevents neighboring male from sneaking copulation with female in your territory?
Observations:

1. Need both parents to raise young?

*Many young raised successfully by a single parent.*

2. Monogamy is the apparent result of males controlling territories of a size that contains a single female?

*There are males that have territories with multiple females who wander in and out.*

3. Female guarding to prevent polygyny by females wandering into neighboring male’s territory?

*Males spend only 1/2 their time with pair-bonded female. There is plenty of opportunity for her to wander off.*
4. Female guarding to prevent neighboring male from sneaking copulation with female in your territory?

Females urinate and defecate at margin of pair-bonded male’s territory. When this happens the male immediately goes to the spot and kicks on dirt, presumably to cover estrous scent of female.

So mate guarding is the most likely hypothesis.
Examples of Polygamy: Polyandry
1. **Resource defense polyandry:**

Females compete for and defend resources essential to males.

The degree that females can monopolize multiple males depends on the degree to which resources are clumped and can be monopolized.

Example: Female Sandpipers can have a 4 egg maximum per clutch, for maximum survivorship.

In the case of a superabundant food source females can lay more than one clutch, but...

...to lay multiple clutches female must find more (cuckholded) males.
Resource-defense polyandry notes:

1. Young sandpipers are relatively precocial, so one parent can care for more than one nest. To lay multiple clutches, must find mates to care for sequential clutches.

2. This is a rare case where female fitness is limited by access to mates rather than gamete production.
2. Female access polyandry:

Females do not directly defend resources essential to males, but through interactions among themselves, may limit access to males.

Females sometimes defend males. Female must remain with male until the clutch is completed and incubation begins.
Example: Phalaropes

Shorebirds that nest in wetlands, near populations of aquatic invertebrates.

Food source very unpredictable/ephemeral so courting areas change weekly.

Males provide all parental care -- there is no opportunity for a stable resource defense.

The degree of polyandry in the population increases throughout the breeding season...

cont’d…
Nesting failure is frequent, but the breeding season is long, so females want multiple nesting attempts/fathers.

Males arrive asynchronously on the breeding grounds, and females compete to “entrap” them.

As population density increases in the season, females become aggressive with each other to hoard males.

Some females are prevented from mating.

(see Emlen, and Oring, 1977 for more info)
When does it make sense to move from monogamy to polyandry?

In general, the extra male(s) must add something (better genes, nest defense, etc) that outweighs the advantage of monogamy.

Consider the costs where the female takes only sperm but from multiple partners:

• It takes time and energy to search for the males.

• Being caught by your social partner in an extra-pair copulation may lead to loss of parental care.
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<th>Genetic benefits polyandry</th>
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<td>1. Fertility insurance hypothesis</td>
<td>Mating with several males reduces the risk that some of the female’s eggs will remain unfertilized because any one male may not have sufficient sperm to do the job.</td>
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<td>2. Good genes hypothesis</td>
<td>Females mate with more than one male because their social partner is of lower genetic quality than other potential sperm donors, whose genes will improve offspring viability or sexual attractiveness.</td>
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<td>3. Genetic compatibility hypothesis</td>
<td>Mating with several males increases the genetic variety of the sperm available to the female, increasing the chance that some sperm will have DNA that is an especially good match with the DNA of her eggs.</td>
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<td>1. More resources hypothesis</td>
<td>More mates mean more resources or parental care received from the sexual partners of a female.</td>
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<td>2. Better protection hypothesis</td>
<td>More mates mean more time with protectors who will keep other males from sexually harassing a female.</td>
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<td>3. Infanticide reduction hypothesis</td>
<td>More mates mean greater confusion about the paternity of a female’s offspring and thus less likelihood of losing offspring to infanticidal males.</td>
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1. **Fertility insurance hypothesis**: Extra-pair fertilizations could reduce the risk to a female of having an infertile partner as a social mate.

- **Example 1**: Eggs of a polyandrous female red-winged blackbird are more likely to hatch than the eggs of monogamous females.

- **Example 2**: Female polyandrous Gunnison’s prairie dogs become pregnant 100% of the time, monogamous females become pregnant 92% of the time.
2. **Good genes hypothesis:** Extra-pair copulations can ensure superior genes from at least one male (in terms of viability or attractiveness).

**Example 1:** Female fairy-wrens and female mallard ducks favor males that have molted early. Females will mate with a non-pair male who molts early.

Early molts suggest that the males are in good physical condition, and these males might be able to pass this on to their offspring (genes that promote offspring survival).
Good Genes Example 2: Field crickets: (sexy sons hypothesis text pg. 397, 9th Ed.)

Sons of successful crickets (s) have higher probability of being attractive to females.

The attractiveness is *not directly correlated with male quality*, rather with female preference.
Female choice can select for an arbitrary feature, not related to fitness, if it is not too deleterious.

If females prefer the feature, males with it will be more successful, even if the feature has nothing to do with good genes.
An arbitrary feature may have been selected for an initial good reason. (Historical)

Suppose a female bird picks a male mate with superior plumage, due to his regular preening.

This is a ‘good genes’ case for sexual selection.

Over evolutionary time, females cue in on a particular plumage feature as a surrogate for good preening in general.

Males with that feature exaggerated will be more successful, and the gene controlling the preference is fixed in the population.

Immunological competency is higher in offspring sired by the extra-pair father.

WPY = within pair young, EPY = extra pair young
Material benefits Polyandry: Females sometimes mate with several males to secure resources useful to the female, not to acquire better genes.

1. Material Benefits – resources.

Example: Dunnocks (next time)
Go over exam 2