Main Points

1) Marginal Value Theorem (continued from last Monday)

2) Competition for mates and sexual selection

3) Trivers' theory of parental investment

4) Mating systems
   -- environmental control of polygamy potential
   -- example: mating systems and conservation of Grevy's zebra

Terms (holy smokes!!!): marginal value theorem, sexual selection, parental investment, Trivers theory, polygamy potential, intrasexual selection, intersexual selection, secondary sex characteristic, runaway sexual selection, polygamy, obligate monogamy, facultative monogamy, promiscuity, resource-defense polygyny, harem-defense polygyny, male dominance polygyny, lek

Prereading Wednesday 18 Oct = Sawyer et al
Monday 23 Oct = Pauli and Buskirk

Optimal Foraging Theory

- **<u>Marginal Value Theorem</u> =**

  an animal should remain in a <u>patch</u> until the energy gain from that patch has declined to the average gain for the habitat.

Giving-Up Times and Patch Quitting Rules

- **Marginal Value Theorem: What factors in the environment influence when I should leave (quit foraging in) a patch?**

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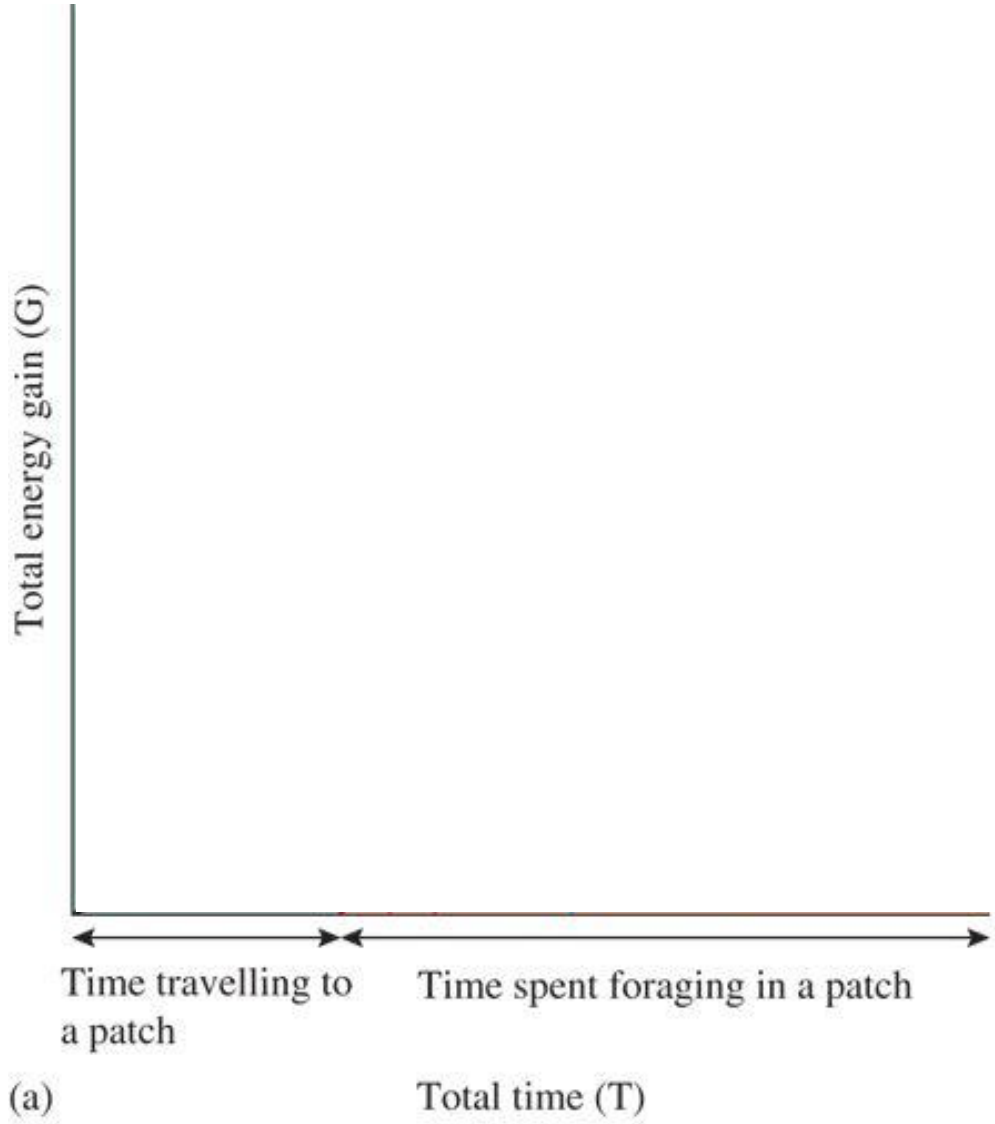
<u>MVT makes three testable predictions</u>
Foragers will stay (i.e., eat) longer…

1) in a more profitable patch

2) when travel time between patches is high

The Marginal Value Theorem



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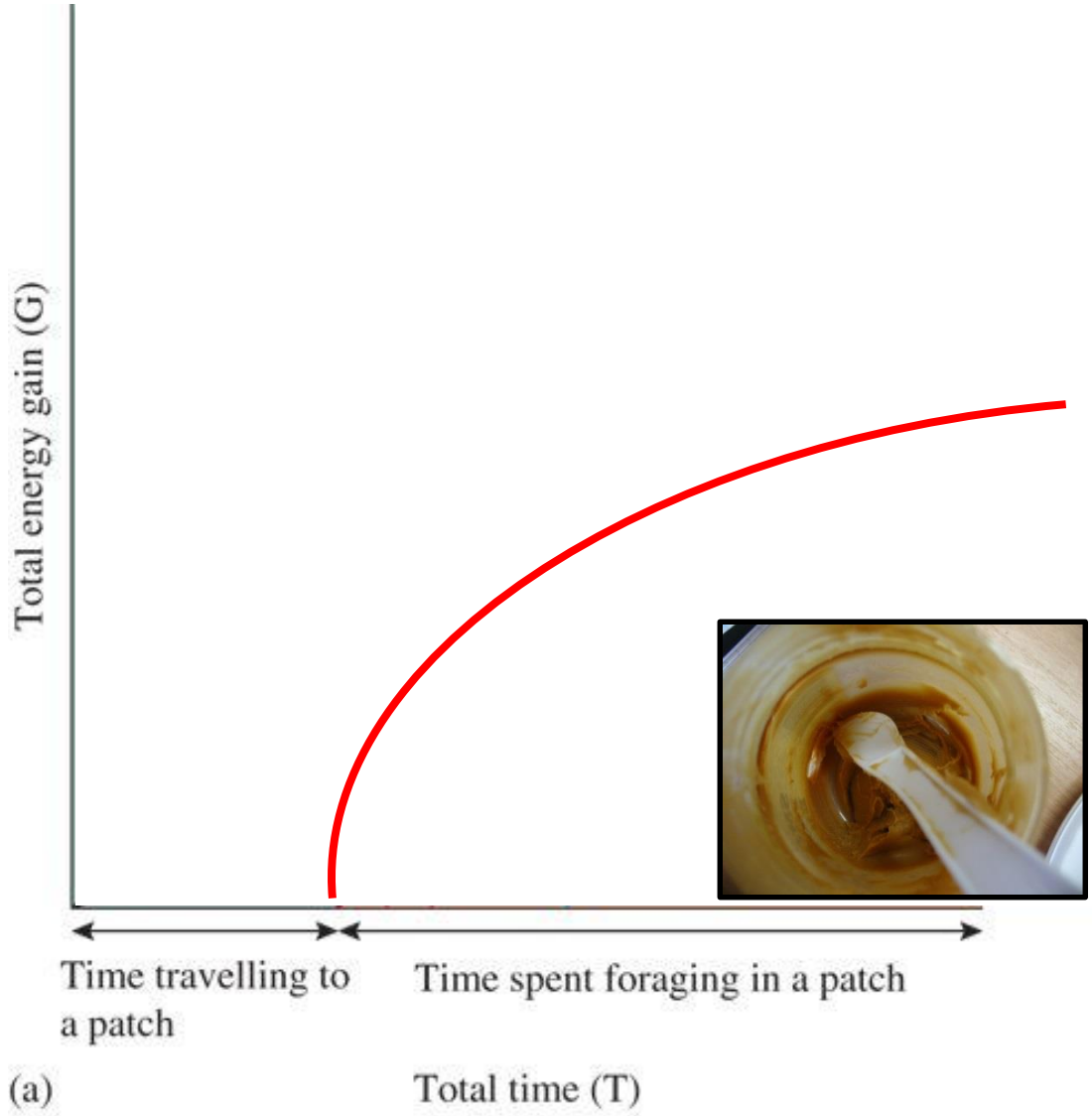

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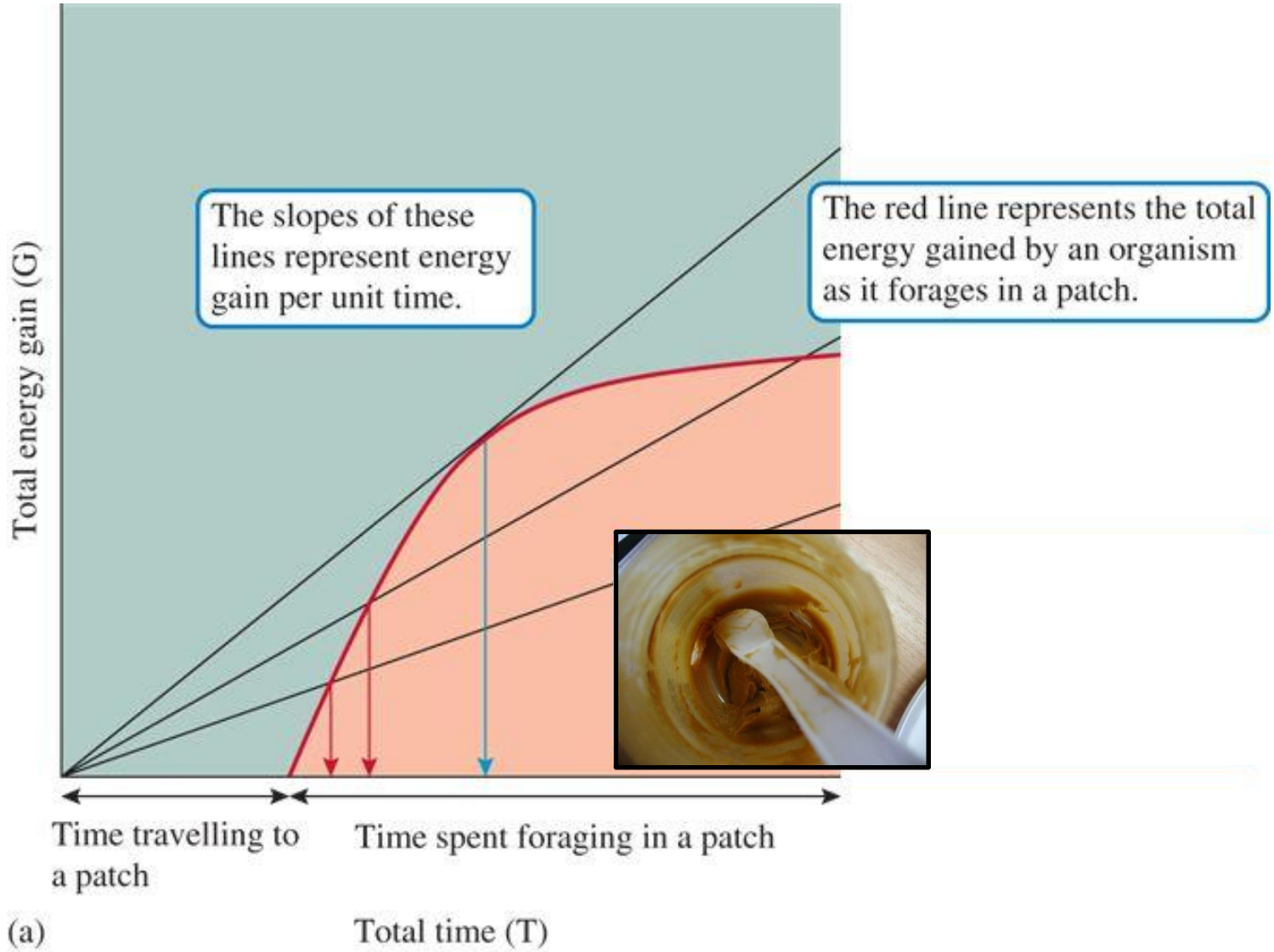

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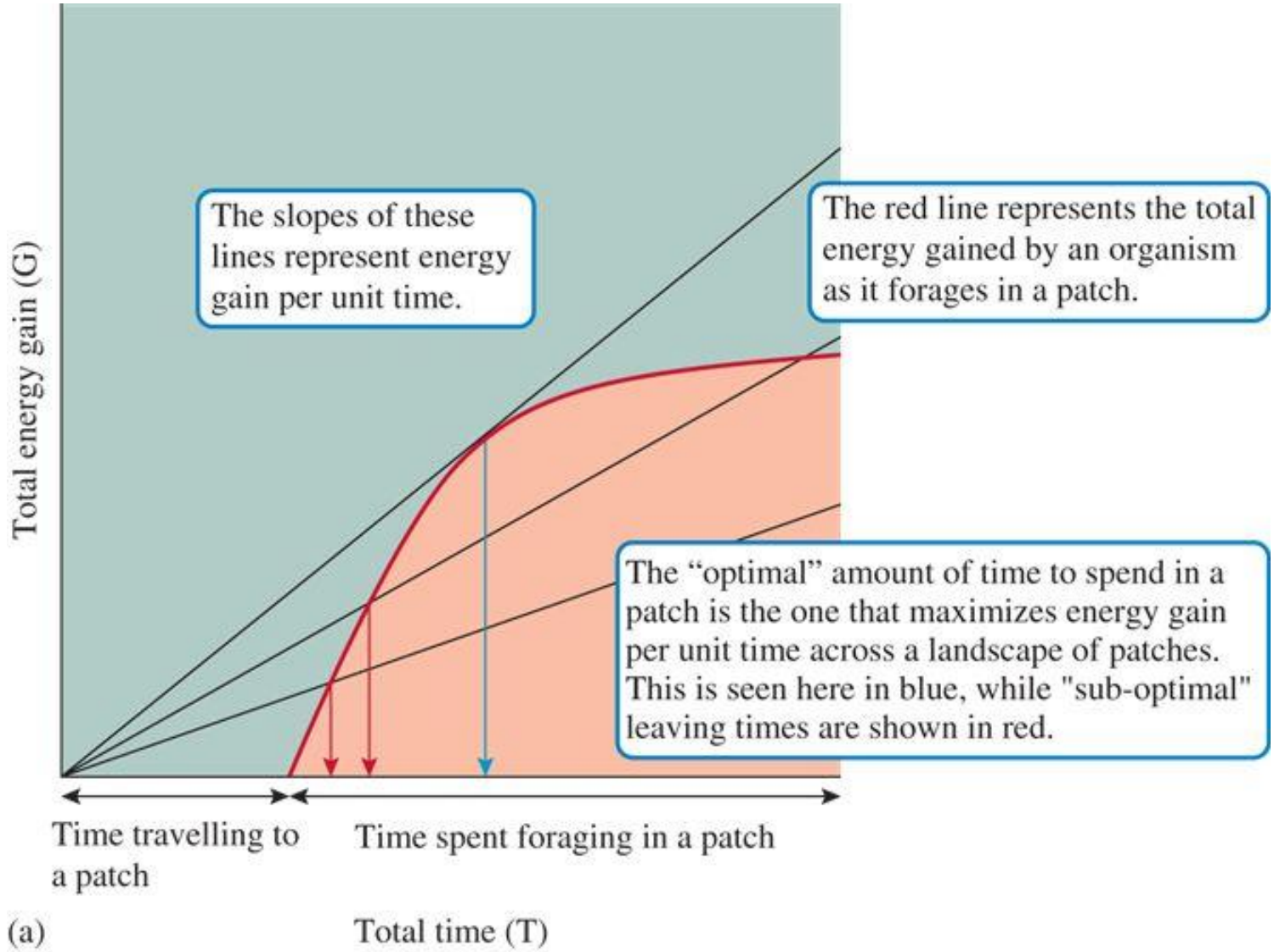

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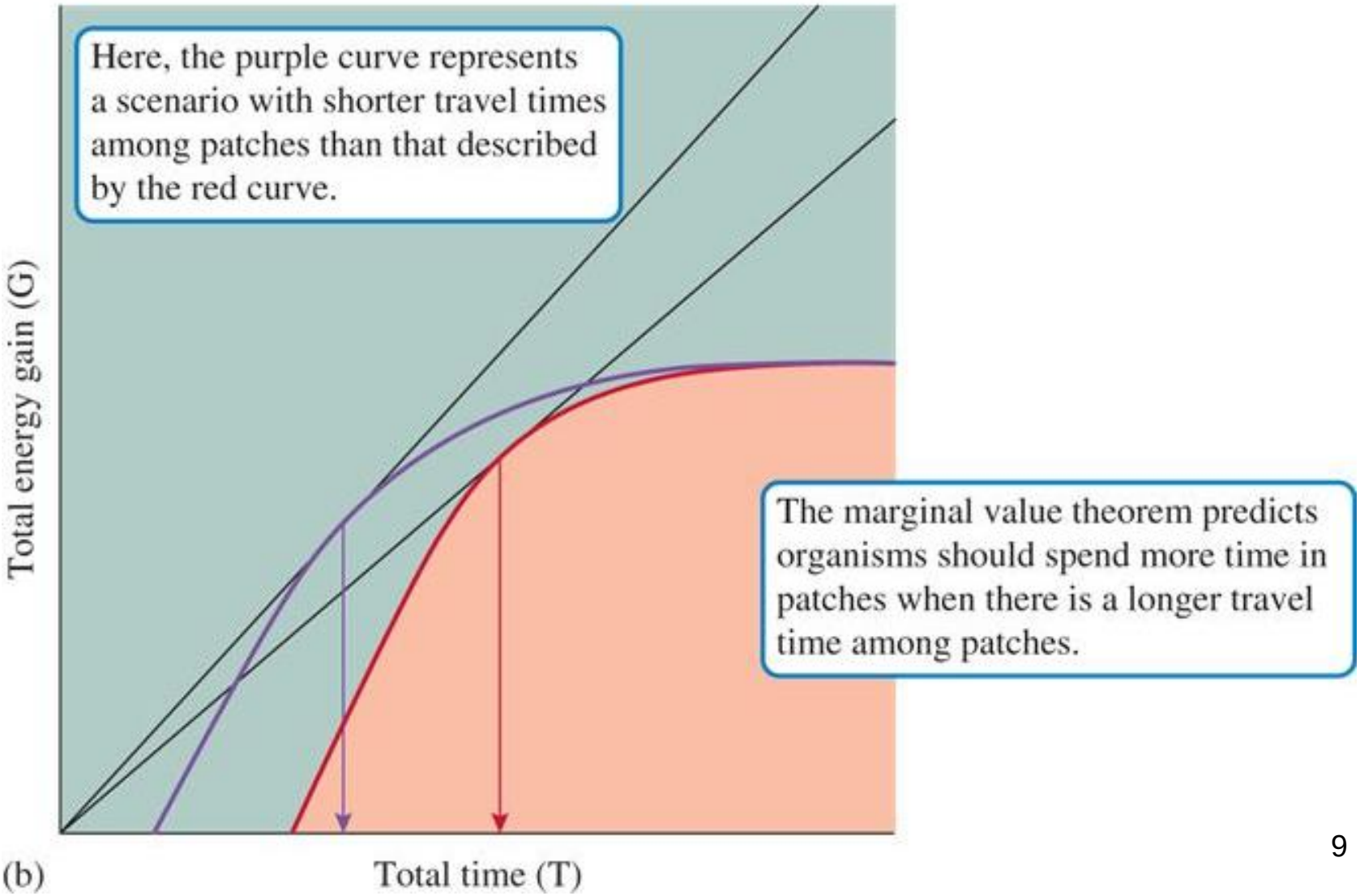

Giving-Up Times and Patch Quitting Rules

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<u>MVT makes three testable predictions</u>
Foragers will stay (i.e., eat) longer…

1) in a more profitable patch

2) when travel time between patches is high

3) when the environment, in general, is of low "quality"

Competition for mates and sexual selection

- **Fitness is a measure of survival and reproductive "success" of a individual.**

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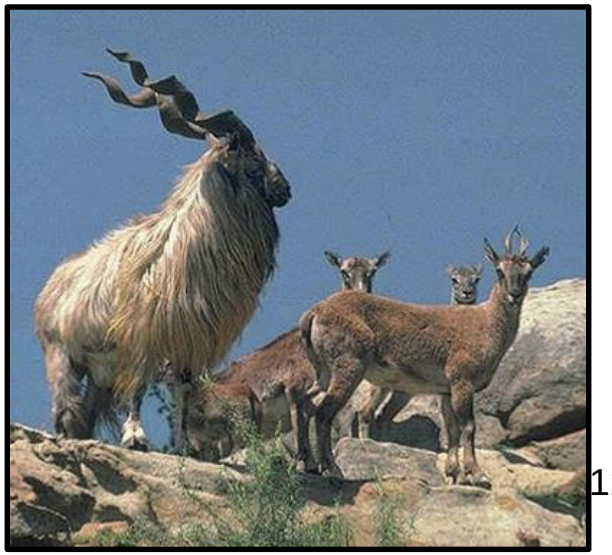
- **Mates as a limiting resource**

  -- when one sex becomes limiting, intraspecific competition increases among members of the opposite sex.



Competition for mates and sexual selection

- **Fitness is a measure of survival and reproductive "success" of a individual.**

- **Mates as a limiting resource**
  -- the greater the shortage of one sex, the more intense the intrasexual competition for the other sex.

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- <u>sexual selection</u> = evolutionary selection for traits stemming from competition of individuals of one sex for access to the other sex.

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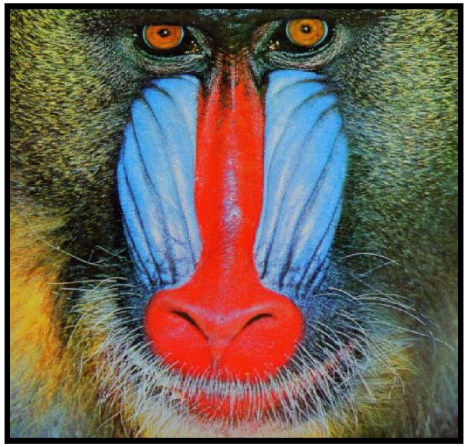
- **<u>Trivers' Theory of PI</u> = individuals are limited in the degree to which they can devote time and resources to producing and raising young. Individuals are naturally selected to maximize the difference between the benefits and costs of PI; when benefits of PI are high relative to costs, heavy investment in young should occur.**

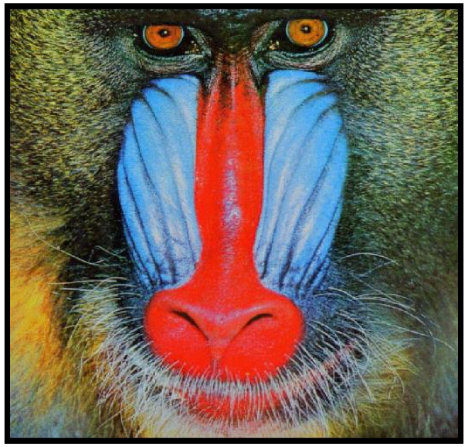
Trivers' Theory of Parental Investment

- **Two predictions of Trivers' Theory of Parental Investment:**
  1) sex making the larger investment in young will be more discriminating in mating (i.e., "choosy").
  2) sex making the smaller investment in young will compete for access.



Trivers' Theory of Parental Investment

<u>Discussion Q:</u> in sexually dimorphic mammals (i.e., those species where males and females look different), males typically are adorned with horns, antlers, facial structures, etc. Combine Trivers' theory and sexual selection to explain why males, and not females, typically have ornaments.



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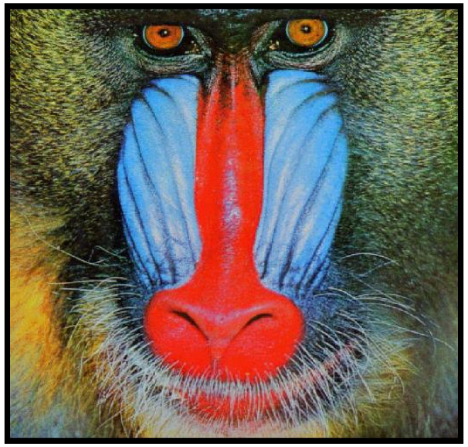

Environmental Control of Mating Systems

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  -- males maximize fitness by fathering as many offspring as possible, and getting females to care for them
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- **Fundamental conflict of interest between males and females**
  -- males maximize fitness by fathering as many offspring as possible, and getting females to care for them
  -- females maximize fitness by being selective in choosing males that can best provide for their offspring

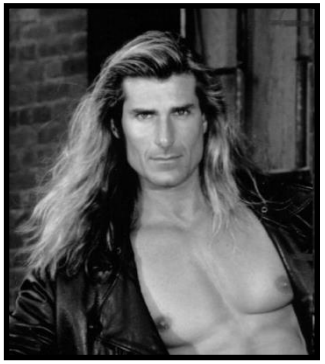
- **Leads to male-male competition, female choice, or some combination, which in turn leads to sexual selection**

Intrasexual Selection

- **<u>Intrasexual selection:</u> one sex (often males in mammals) must physically compete with individuals of the same sex for mating opportunities.**

- **Often leads to male weapons or advertisement of physical strength.**

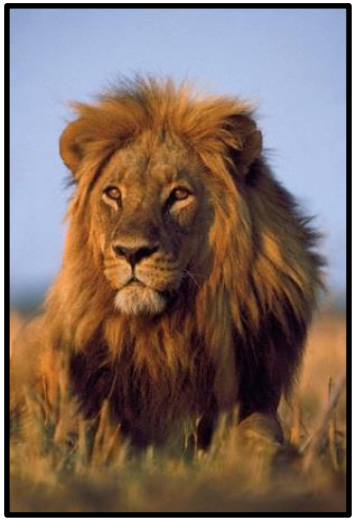
- **AKA "male-male competition".**

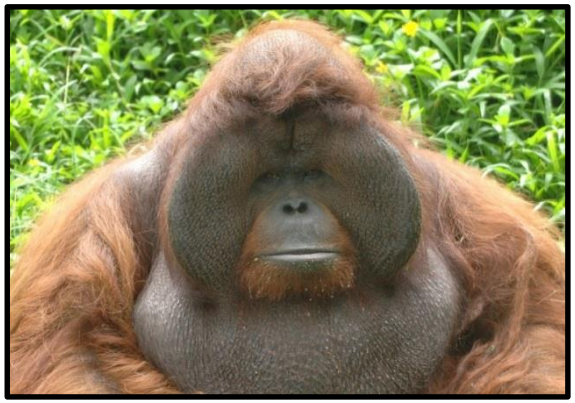


Intersexual Selection

- **<u>Intersexual selection:</u> one sex (often females) chooses to mate with individuals of the opposite sex. AKA "mate choice" (usually "female choice" in mammals).**

- **Often leads to male advertisement of fitness, resulting in <u>secondary sex characteristics</u> = features not used directly in reproduction, but used to advertise fitness and increase attractiveness to mates.**





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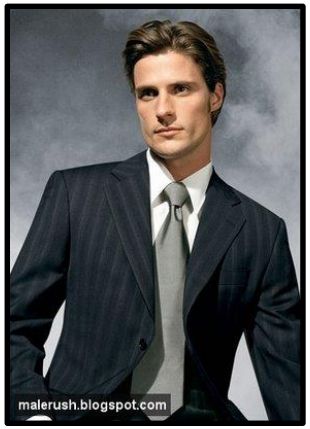
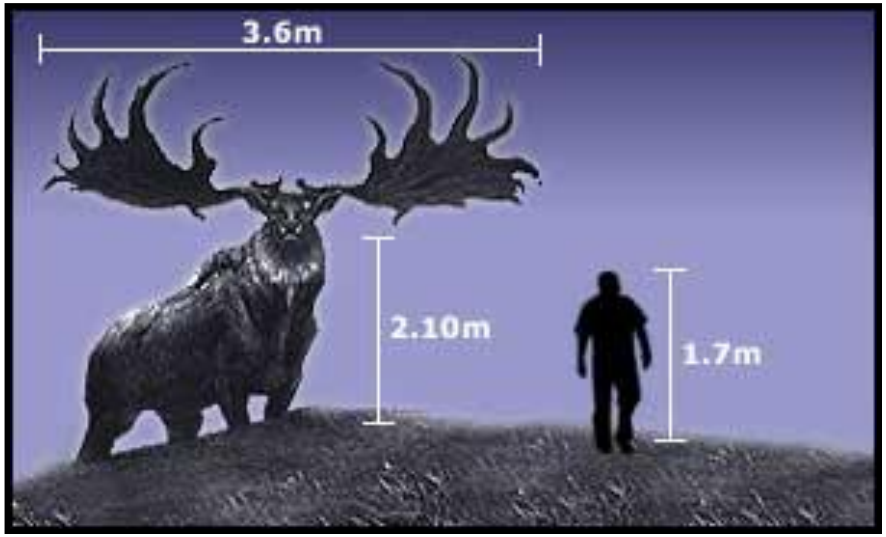


Intersexual Selection

- **<u>Intersexual selection:</u> one sex (often females) chooses to mate with individuals of the opposite sex.**

- **<u>Runaway sexual selection:</u> selection for (male) ornaments that occurs from heritability of a trait, and a (female) preference for that trait. In extreme instances, may become maladaptive.**



Mating Systems

- **<u>Monogamy:</u> a single male and female pair for some period of time and share in rearing offspring.**

- **Obligate vs. facultative monogamy**

Mating Systems

- **<u>Polygamy:</u> a single male or a single female mates with many members of the opposite sex. The opposite sex usually cares for offspring.**

Environmental Control of Mating Systems

<u>Discussion Q:</u> Emlen and Oring discuss 2-3 conditions required for polygamy (i.e., polygyny in mammals). What are these conditions?

Environmental Control of Mating Systems

1) Defensibility of multiple mates by a single individual

male pronghorn

female pronghorn

Environmental Control of Mating Systems: Spatial Distribution of Mates

1) Defensibility of multiple mates by a single individual

Environmental Control of Mating Systems: Spatial Distribution of Mates

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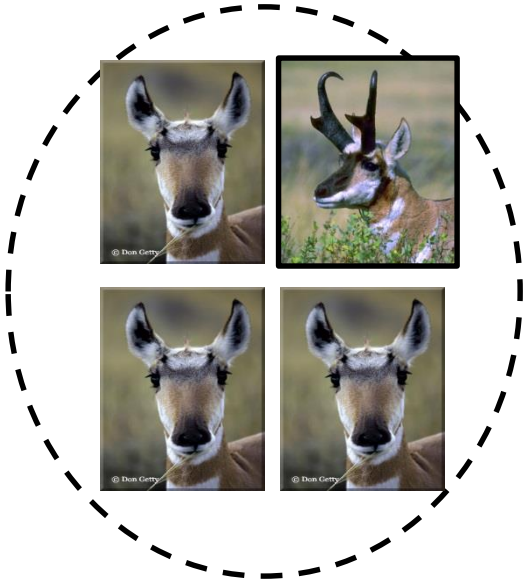
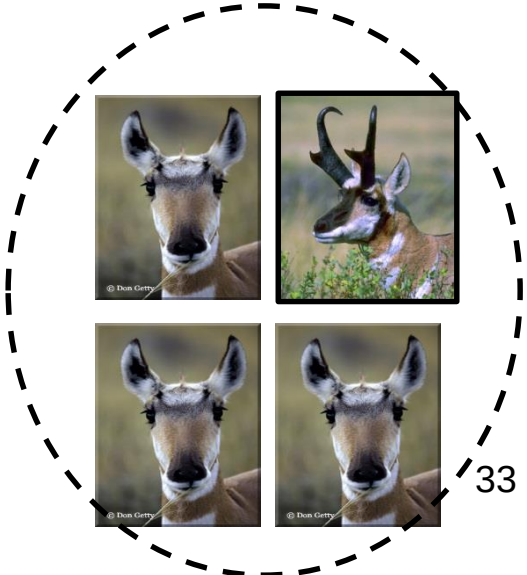
If mates are clumped, may lead to <u>polygamy</u> (usually <u>polygyny</u> in mammals).





Environmental Control of Mating Systems: Spatial Distribution of Mates

1) Defensibility of multiple mates by a single individual

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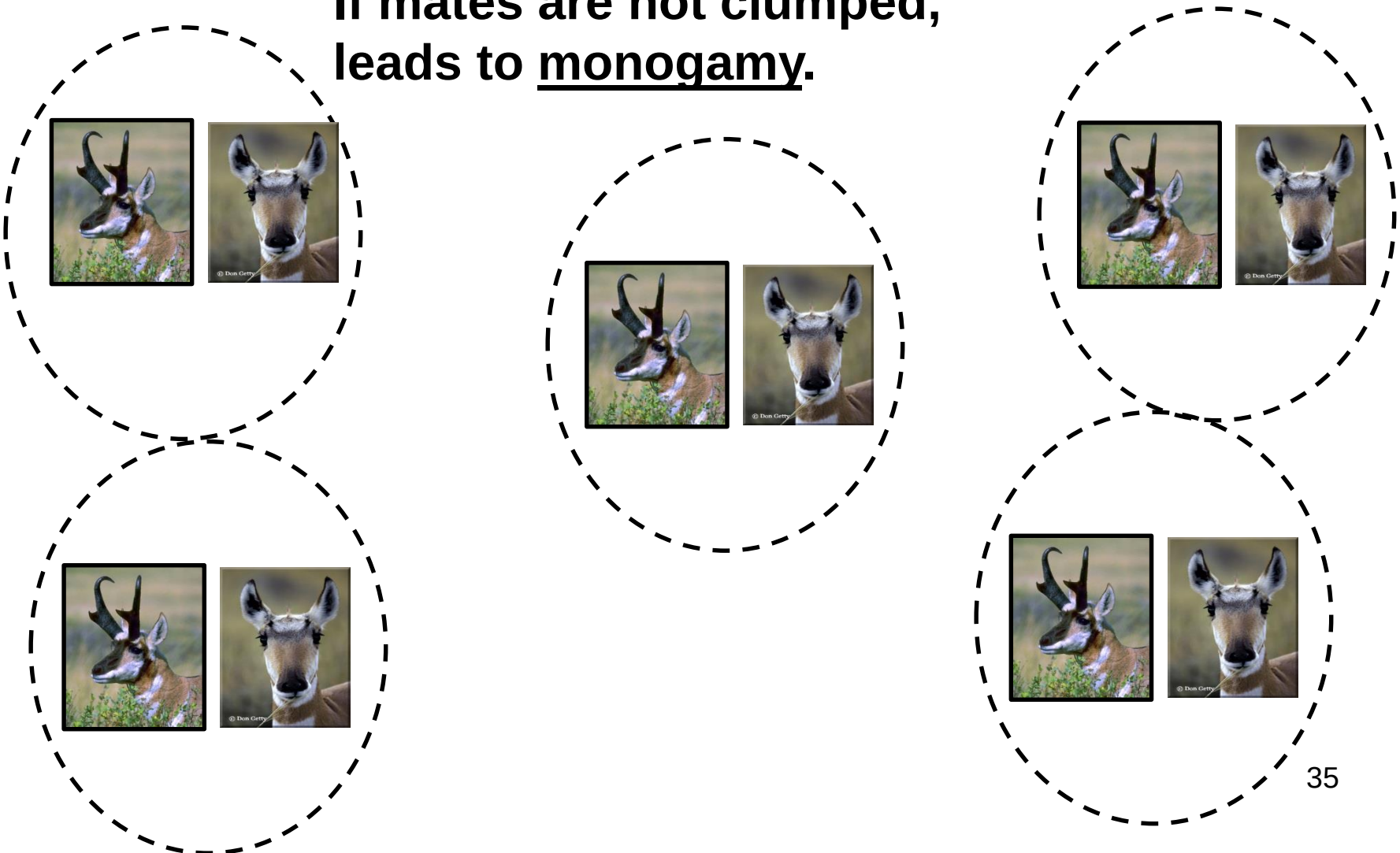
If mates are not clumped, leads to <u>monogamy</u>.

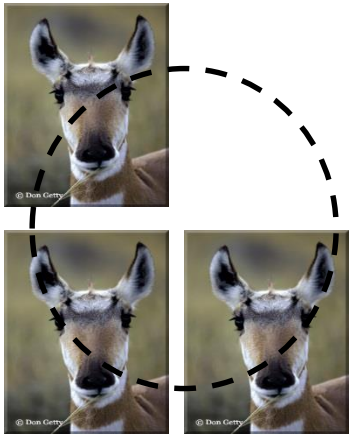


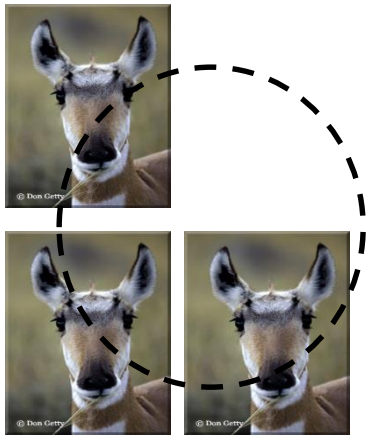
Environmental Control of Mating Systems: Monopolizability

2) Ability of one individual to monopolize defensible (i.e., clumped) mates

Environmental Control of Mating Systems: Monopolizability

2) Ability of one individual to monopolize defensible mates. Even if mates are clumped, individual must be able to defend them. If not, leads to <u>promiscuity</u>.





Environmental Control of Mating Systems: Temporal Distribution of Mates

3) Synchrony vs asynchrony in timing of receptivity of limiting sex (usually females).

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-- for most mammals, receptivity only occurs during a limited time of the year.

Environmental Control of Mating Systems: Temporal Distribution of Mates

3) Synchrony vs asynchrony in timing of receptivity of limiting sex (usually females).

-- when many females are receptive all at once (absolute synchrony), polygamy potential is low because male can't initiate courtship and reproduce with many females.

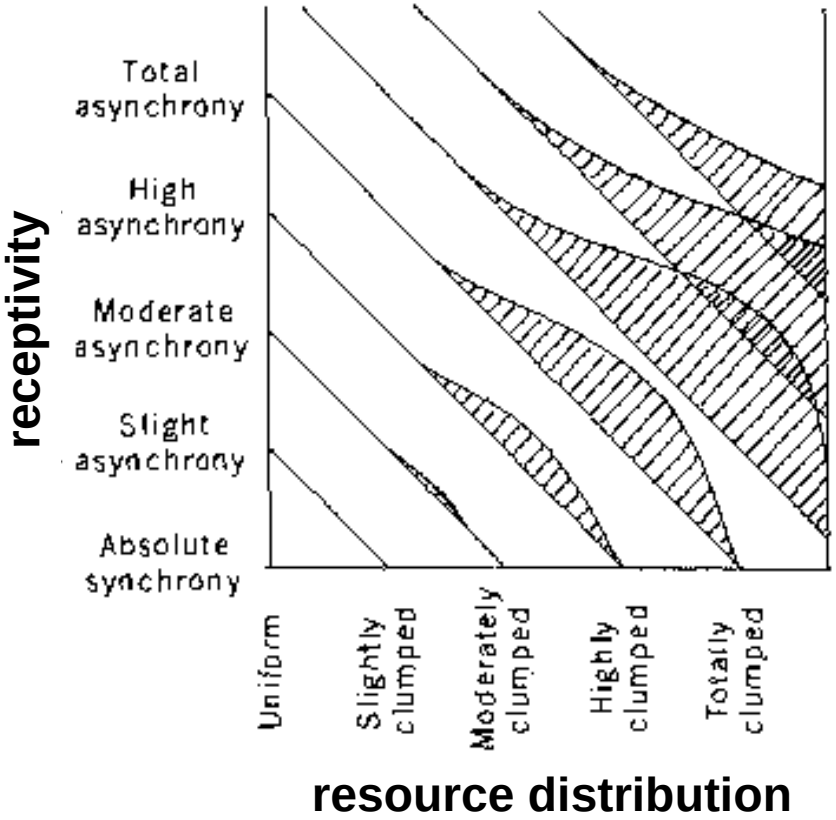
Environmental Control of Mating Systems: Temporal Distribution of Mates

3) Synchrony vs asynchrony in timing of receptivity of limiting sex (usually females).

-- when females are totally asynchronous (no no overlap in timing of receptivity), cost of continued defense for attracting additional mates is very high, and polygamy potential is also low.

Environmental Control of Mating Systems: Temporal Distribution of Mates

Altogether, polygamy potential should be highest where receptivity of limiting sex (females) is moderate, and clumping of females is high.



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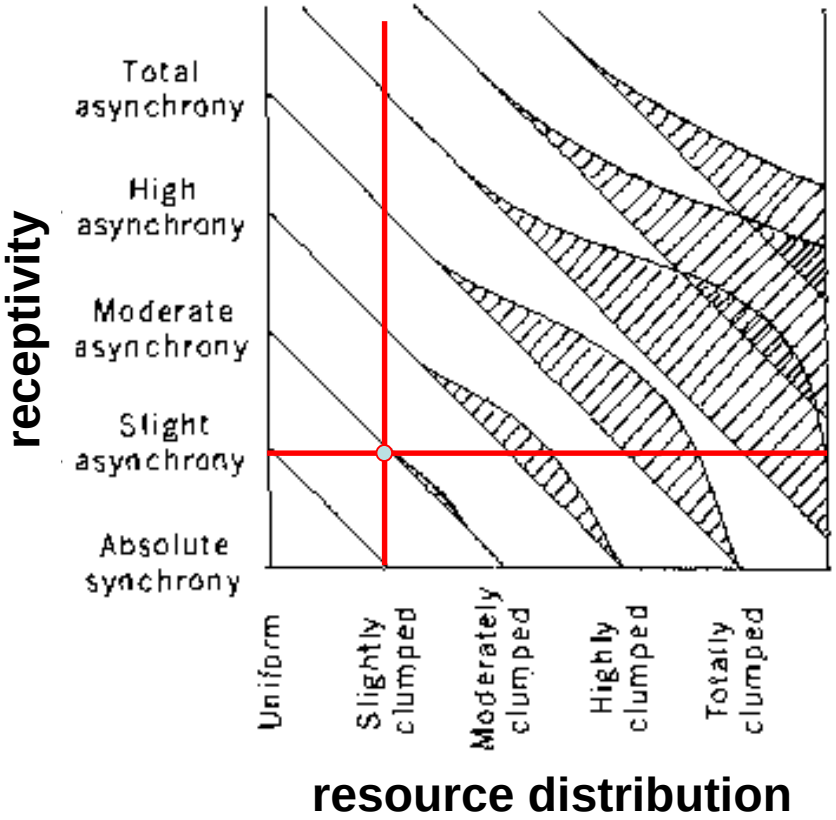

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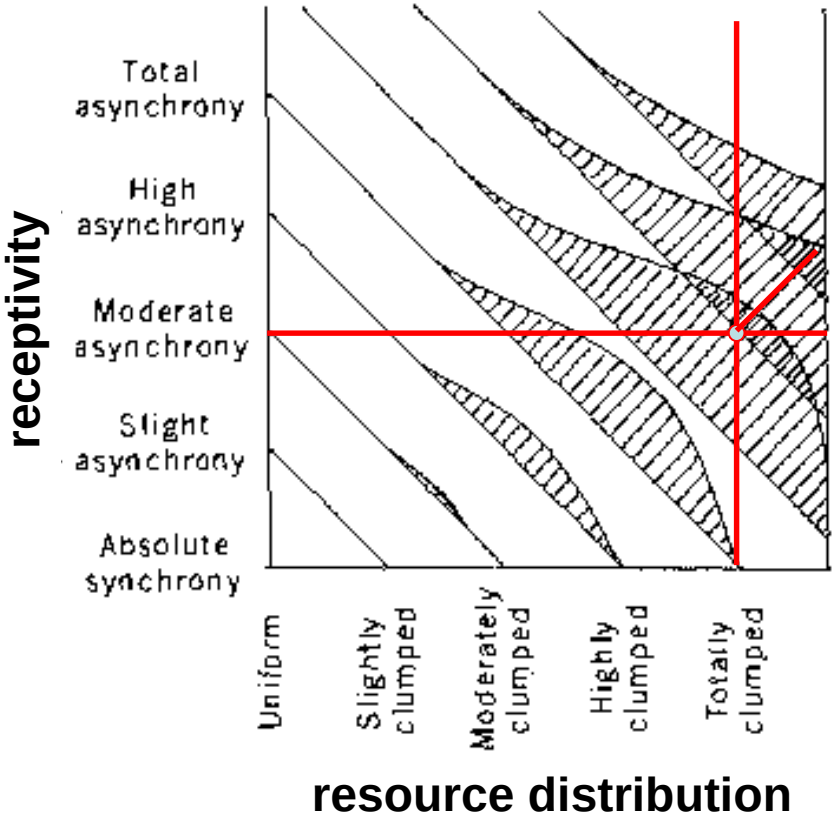


Types of Polygamy

- **<u>Harem-defense polygyny</u>:**
  males compete directly for females, and actively defend harems

- **Typically occurs when females aggregate for reasons unrelated to reproduction**

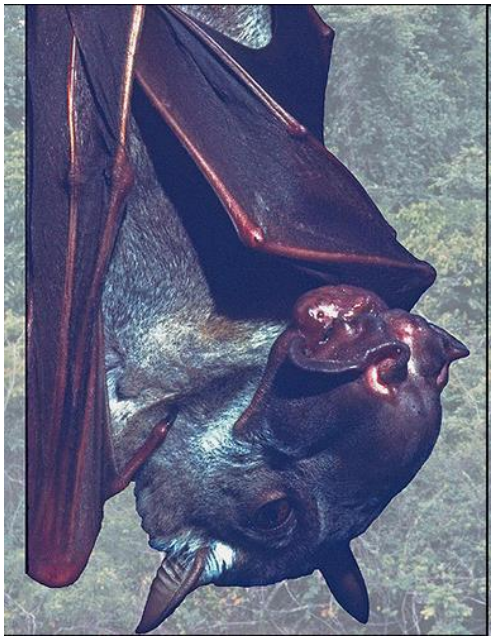
Types of Polygamy

- **<u>Resource-defense polygyny</u>:**
  males compete indirectly by defending resources essential to females

Types of Polygamy

- **<u>Male dominance polygyny</u>:**
  males do not defend females or resources, but sort themselves out by dominance and let females choose

- **Leads to <u>lekking</u> in extreme instances**



Example: horse mating systems and conservation

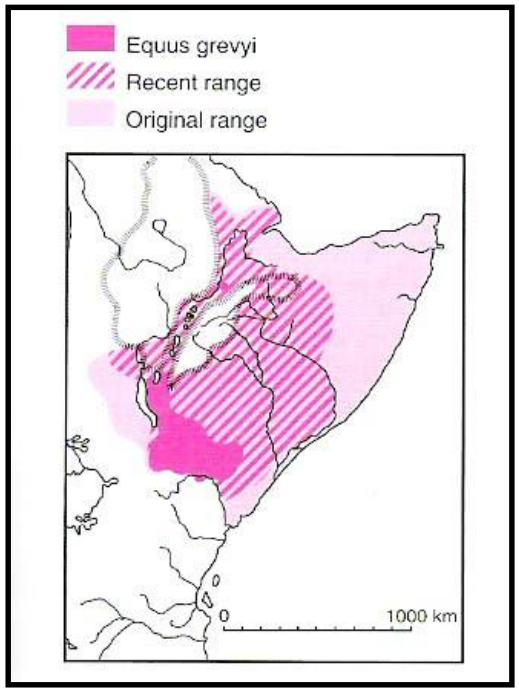
Grevy's zebra

Resource-defense polygynist

plains zebra

Harem-defense polygynist

Rubenstein, 1986



Grevy's zebra:

-- rapid range collapse

Plains zebra:

-- only wild equid with stable populations