

# Bio1B Evolution 7

## Last lecture:

### Evolutionary processes

- Selection
  - Directional selection - expt evidence; genome signatures
- Coevolution - mutualistic & antagonistic
- Why have sex - cost of sex, alternatives, proposed advantages

## Today

### Sexual selection

- Mating systems (pp 1136-7)
- Intra vs intersexual selection (481-482)
- Female preference: Direct benefits (resources) vs indirect (good genes)

Evolution of sacrifice (altruism)

1

The things males do....



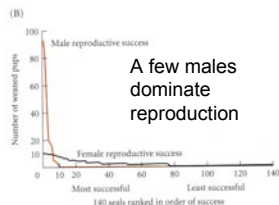
Irish Elk (extinct)



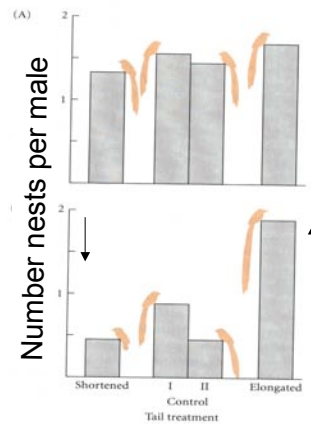
2

## Intra v inter sexual selection

Competition and mating success in male elephant seals



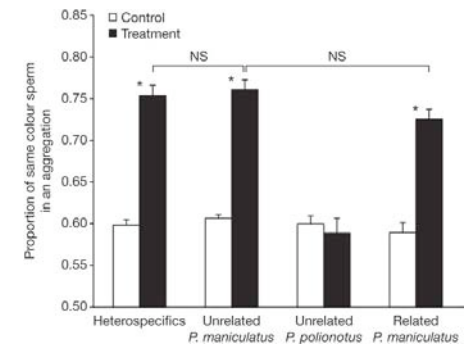
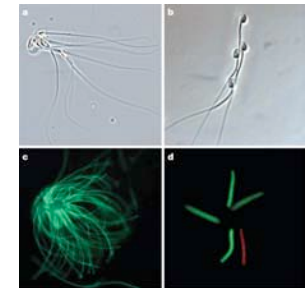
Female choice: manipulation of tail-length in male widowbirds



3

Sperm competition & cooperation in *Peromyscus* mice (Fisher & Hoekstra 2010 Nature 463:801)

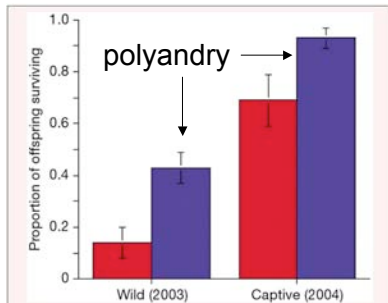
- Sperm in groups swim faster => fertilization advantage
- In species with multiple mating (*P. maniculatus*) sperm aggregate with themselves vs sperm from relatives
- This is not seen in monogamous species (*P. polionotus*)



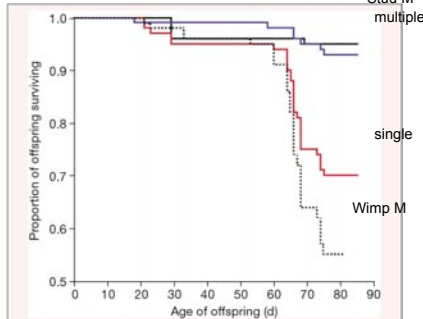
Benefits of multiple mating:  
sperm-competition winner =>  
increased survival of offspring  
(Fisher et al. 2006 Nature 444: 89-92)



*Antechinus* -  
marsupial "mouse"



Survival in the wild is estimated from the number of offspring that were captured at weaning. We released 100 offspring from 17 monandrous females and 139 offspring from 19 polyandrous females into the wild. Survival in captivity is calculated from the number of offspring that survived until weaning. There were 121 offspring from 18 monandrous females and 118 offspring from 18 polyandrous females in the captive experiment. Red bars indicate monandry, blue bars indicate polyandry. Data are the mean  $\pm$  s.e.m.



Mean survival curves are presented for monandrous females mated to more competitive males ( $n = 41$  offspring from five litters; unbroken black line) or less competitive males ( $n = 80$  offspring from 13 litters; dotted black line) and polyandrous females ( $n = 116$  offspring from 18 litters; blue line). The pooled curve for all 18 monandrous females that gave birth is also shown (red line).

Intersexual selection: female choice =>  
dimorphism, displays, ornamentation

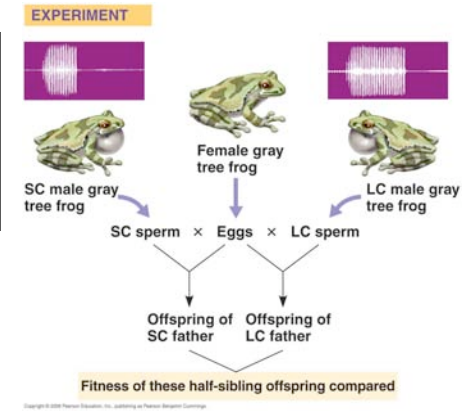


EVOLUTION 2e, Chapter 15 Opener

## Female choice - good gene hypothesis

Do females select males based on signals that indicate high fitness of offspring?

Females prefer males with long calls (LC)



RESULTS

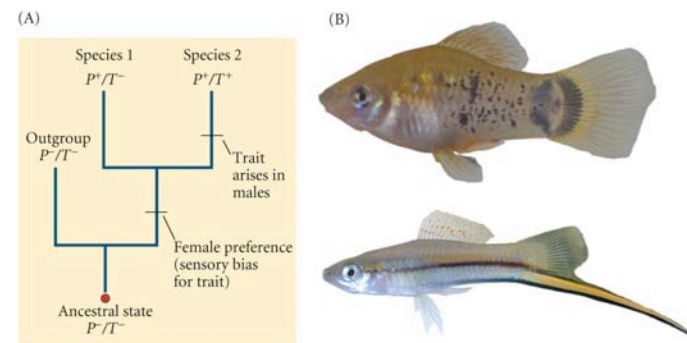
Fitness Measure	1995	1996
Larval growth	NSD	LC better
Larval survival	LC better	NSD
Time to metamorphosis	LC better (shorter)	LC better (shorter)

NSD = no significant difference; LC better = offspring of LC males superior to offspring of SC males.

Offspring of LC males have higher fitness

Fig. 23.16

Sensory bias - males exploiting pre-existing preferences of females



Evidence from phylogeny - P = F preference, T = M trait

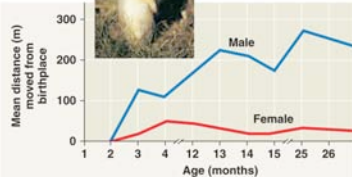
EVOLUTION 2e, Figure 15.22

# When to sacrifice? - if it helps a relative - lots... [pp 1138-1140]

- “Kin selection theory” (W. Hamilton)
- Help if:  $rB > C$ :  $r$  = %shared genes,  $B$  = benefit,  $C$  = cost
- Haldane: “I would not lay down my life for a brother, but would do so for 2 brothers or 8 cousins)”
- Social insects: inheritance system => higher “ $r$ ” => increased cooperation



Tuco tuco - co-parenting by females in social groups (Eileen Lacey, IB)



Belding's ground squirrels: females more related and give more alarm calls (Fig. 51.29)

## Kin selection and cooperative courtship in wild turkeys

Alan H. Krakauer (2005) Nature 434:69



## Estimates of relatedness from molecular data

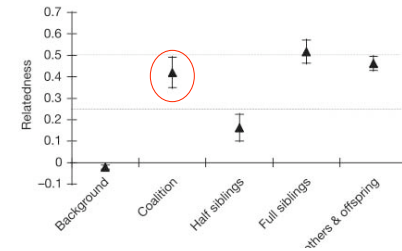


Table 1 Calculation of Hamilton's rule,  $rB - C < 0$

Variable	Description	Calculation	Value*
$r$	Coefficient of relatedness	Mean pairwise relatedness of subordinates to their dominant display partner	0.42
$B$ †	Benefit to dominant	(No. of offspring per dominant male) – (no. of offspring per solo male)	6.1 (9.0)
$C$ †	Cost to subordinate	(No. of offspring per solo male) – (no. of offspring per subordinate male)	0.9 (2.3)
	Net benefit†	$rB - C$	+1.7 (1.5)