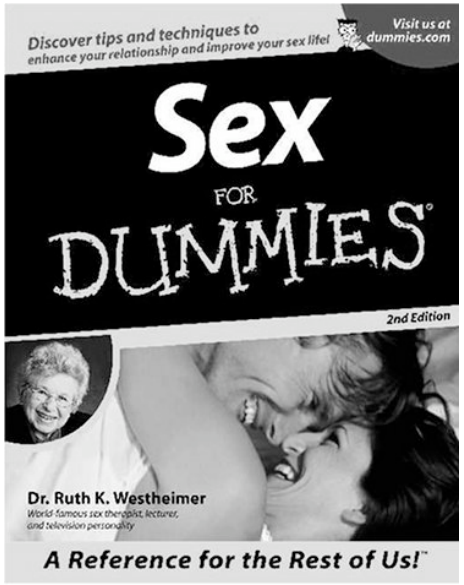

Sexual Selection

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How does female choice arise?

- Several hypotheses have been proposed:
  - direct benefit
  - "good genes" hypothesis
    - "handicap principle"
    - avoidance of hybridization
  - pre-existing sensory bias
  - "runaway sexual selection"
- These aren't mutually exclusive. Real-world cases may be explained by a combination of these causes

Direct benefit to females

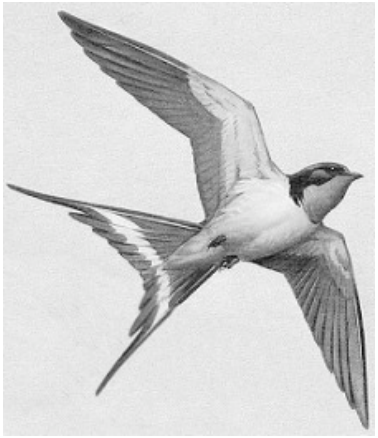
Bittacus chlorocephalus, a hangingfly (Mecoptera)

- A male hangingfly presents a female with a captured prey insect.
- If she accepts, they copulate, which lasts up to twenty minutes—while the female eats the insect that the male gave her.
- The larger the food insect, the more direct benefit the female gets. (If the insect is too small, the female may refuse to mate.)

- The larger the food insect, the longer it takes the female to eat it. . . and the more sperm the male can place into the female.
- The male benefits, too: The larger the insect, the better-nourished the female is, and the more eggs she can produce. . .
- . . . and the less likely that the female will be receptive to another male afterwards.

The "copulatory suicide" of Australian redback spiders may be seen as the ultimate case of sexual selection by direct female benefit. . .

"Good genes" hypothesis



Male barn swallow, *Hirudo rusticalis*

"Good genes": barn swallows

- Male barn swallows have long tail feathers forming a forked tail
- Grafting experiments show that females prefer longer tails—even if the tails are artificially lengthened beyond what is found in nature
- Wild barn swallows with longer tails are less likely to be infested with parasites
- The offspring of wild barn swallows with longer tails are also less likely to be infested with parasites

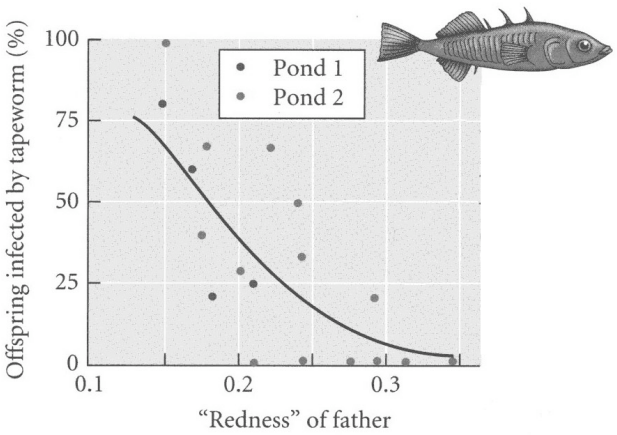
"Good genes": sticklebacks

Threespined stickleback, *Gasterosteus aculeatus*

"Good genes": sticklebacks

- Sticklebacks (*Gasterosteus aculeatus*) are small freshwater fish with complex courtship and mating behaviors
- 2001 study by Barber et al. showed that the degree of redness of a male stickleback was inversely correlated with the parasite load of his offspring
  - In other words, red males had offspring with few parasites, and drab males had parasitized offspring

This graph gives Barber's data, plotting redness of males against their offsprings' parasite loads.

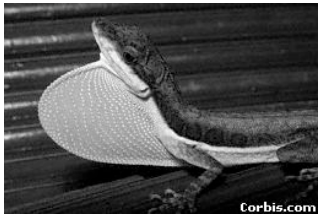


The handicap principle

Male Gouldian finch, *Chloebia gouldiae*, from northern Australia

The "handicap principle"

- You could consider the handicap principle as a variation of the “good genes” hypothesis.
- Many male traits that are sexually selected would seem to be disadvantageous. (Bright colors, for instance, make an animal more visible to predators.)
- According to the handicap hypothesis, if a male has a disadvantage like this, but still survives, the disadvantage shows that he must have very good genes otherwise. The disadvantageous trait becomes a “mark of genetic quality.”

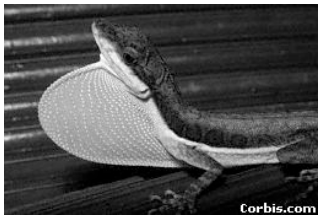


- There are over 350 species of anole lizard in Central America and the Caribbean.
- Males display to females with a colored throat pouch (called a *dewlap*) and a set of nodding or “push-up” movements.
- Different species of anole have different dewlap patterns and do “push-ups” in different rhythms.

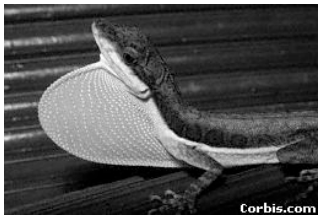
Hybridization avoidance

American anole, *Anolis carolinensis*

Four male anoles in four different species.
(Check out http://www.anole.net/ for more.)



- Females who mate with the wrong species will probably have decreased fitness. . .
- Females with strong preference for their own species have increased fitness. . .
- . . . and males that can match the females' preferences will also have increased fitness.
- Result: Each species should evolve a specific display pattern.

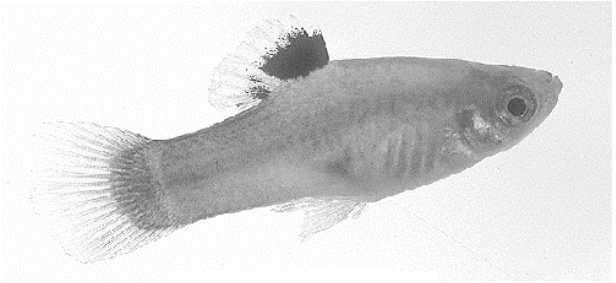


- But this isn't the whole story!
  - Males also use their displays to challenge other males—and to challenge predators.
  - It's been shown that the males who display to predators the longest are also the best at escaping predators.
  - So natural selection, male-male competition, *and* "good genes" sexual selection are also important for understanding why *Anolis* lizards display

Pre-existing sensory bias

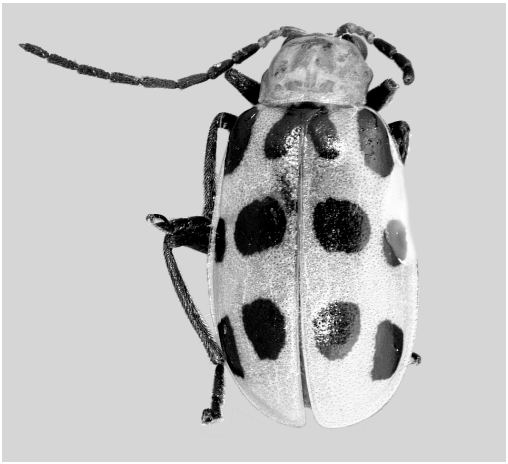
Male and female banded swordtails, *Xiphophorus multilineatus*

- *Xiphophorus* is a genus of small freshwater fish native to Mexico (about twenty species, including some popular home aquarium fish).
- Males in some species of *Xiphophorus* have elongated "swords" on their tails, as in this male green swordtail, *X. helleri*. Females never have swords.
- In other species, the males lack swords.



- Females of species with swords show preference for males with swords.
- Females in swordless species of *Xiphophorus* also show preference for males with swords.
- It has been shown that female *Xiphophorus* prefer larger males—and swords make a male fish look larger.

"Runaway selection"



Spotted cucumber beetle, *Diabrotica undecimpunctata*

"Runaway selection"

- Suppose we have males that have some variable trait.
- And suppose we have females that vary in their degrees of preference for this trait.
  - And let's assume that both the trait and the degree of preference for the trait are heritable.
- Females with a strong preference will choose males with an extreme trait. . .
  - Over time, the genes for the trait and genes for the preference become linked

"Runaway selection"

- If genes for a male trait and a female preference are effectively linked, then anything that happens to favor one to become more common will cause the other to become common.
- Given the right conditions, we may end up with "runaway sexual selection"
  - The preferred traits don't confer any particular benefit on either the male or the female, nor do they assure genetic quality. . .
  - . . . *except* for one thing: Females that prefer "sexy" males will tend to have "sexy sons".

"Runaway selection"

- Female spotted cucumber beetles prefer males that stroke them with their antennae during the first phase of copulation
  - This confers absolutely no benefit on the females
  - It also confers no benefit on the offspring: the offspring of fast-stroking males are no more or less likely to survive or reproduce than the offspring of slow strokers
  - HOWEVER: Fast-stroking males tend to have fast-stroking sons, which females prefer to mate with
    - SOURCE: Tallamy et al., 2001, *Proc. R. Soc. London B* 270: 77-82.

The same explanation has been proposed to explain the traits of Malaysian stalk-eyed flies (*Cyrtodiopsis* spp.)

It also plays a role in understanding barn swallows!

- Males with long tails attract mates more quickly than short-tailed males
- This means that long-tailed males have a better chance of raising two clutches in the summer. . .
- . . . so long-tailed males *and* long-tail-loving females have greater fitness, and produce offspring with both traits.