Bio1B Evolution 6

Last lecture:
Evolutionary processes
• Selection
  – Fitness
  – Forms of selection
  – Heterozygote advantage - eg. sickle cell anaemia
  – Directional selection - eg. coat color in mice, experimental evidence

Today
Evolutionary processes
• Selection
  – genome signatures
• Coevolution - mutualistic & antagonistic
• Why have sex? - cost of sex, alternatives, proposed advantages
• Sexual selection - intro
Genomic signatures of recent selection

New mutation arises that increases fitness

Under directional selection increases to $p = 1$; drags linked sites with it

Results in a region of low variation relative to others

Storz 2005
Genomic signatures of selection; localized reductions in diversity

A Single IGF1 Allele Is a Major Determinant of Small Size in Dogs

What’s with my crazy dog?

Sutter et al. 2007
Science 316:112
Coevolution

species 1  selection  species 2

selection

Mutualistic
• Symbioses, mutualisms; eg.
  attine ants ↔ fungi

Antagonistic
• Host ↔ pathogen
• Predator ↔ prey

Leaf-cutter ants (Fig 31.22)

Garter snake and poisonous pacific newt
Why have sex?

Alternatives - asexual:
- **parthenogenesis** in animals (pp 998-999);
- **apomixis** in plants (pp. 812-813)

Why not sex?
Inefficient, risky, breaks up good gene combinations

*Parthenogenetic whiptail lizards*  
*Apomictic dandelion*  
*Daphnia* - asexual in good times, sexual in harsh conditions

Cost of sex (Fig. 46.3)
Hypotheses for advantages of sex (pp 998-999)

1. Reduces accumulation of disadvantageous mutations ("Mueller’s ratchet")
2. Brings together independent mutations that together increase fitness
3. Generates genetically diverse offspring
   - Advantage in variable environment
   - Increases ability to resist pathogens & parasites (coevol “arms race” => Red Queen hypothesis)

Long-term and only if sexual populations are large (weak drift)
Sex and genetic variation

Sexual reproduction produces genetically variable offspring through:

- Random mating
- Independent assortment across loci
- Recombination between loci
- See pp. 258-260
Evolution & consequences of parthenogenesis in an Australian gecko (*Heteronotia binoei*)

Rapid spread, but more parasites

Sexual population

Parthenogenetic population

Mite load
The things males do....

Irish Elk (extinct)
Intra v inter sexual selection

Competition and mating success in male elephant seals

Female choice: manipulation of tail-length in male widowbirds

A few males dominate reproduction

Number nests per male

Futuyma, Evolution, 1st Ed.