Learning Goals

• Compare “flags” (species specific courtship signals)
• Hypotheses for divergence of flags

What are species-specific traits?

Q9.1, Q9.2

- Distinctive behavioral and/or anatomical traits that are characteristic of only one species, e.g.
  - Distinct coloration of each species of reef fish
  - Display actions & feathers of each species of manakin
- Highly heritable
  - Signals in the genotype of senders
  - Receptor mechanism in the genotype of receivers
- Species-isolating mechanisms
- Reliable traits to construct hypotheses about evolutionary history

Manakins: species-specific signals

Q9.1

Manakin.mpg Source: Trials of Life “Courting”
Q9.2 For two closely related species, what is an hypothesis about why species-specific signals diverged?

Source: Trials of Life “Courting”

Bowgold.mpg Source: Trials of Life “Courting”;

UE: Satin bowerbird- dry environment

Source: “Courting” Trials of Life

UE: Golden bowerbird- moist environment

Source: “Courting” Trials of Life

UE: Bowerbirds- divergence

Satin: Drier habitat
- Lane- temporary
- Sticks stuck in ground
- Blue objects

Golden: Wetter habitat
- Tower- permanent
- Fungus “glue”
- White/light green objects

Key author: Borgia, G.

Shared ancestor
- male presented food gifts to female near nest (blue berries)
- female attraction to blue evolved
Change in environment-
- food so plentiful,
- no functional value to additional nutrition
divergence related to habitat
Slide 7

**UE: Black Grouse (moors/woods edge)**

Q9.1, Q9.2

Source: “Courting” Trials of Life

Slide 8

**UE: Attwater’s prairie chicken (grouse)**

Q9.1, Q9.2

Source: “Parenthood Game”

Slide 9

**UE Grouse- divergent evolution**

Q9.1, Q9.2

- **Attwater’s (more derived)**
  - Habitat: open prairie
  - Display on lek (cluster of male territories); inflate air sacs

- **Black (intermediate)**
  - Habitat: moors on the edge of birch forests
  - Display on lek; no air sacs

- **Capercaillie (more ancestral)**
  - Habitat: dense forest
  - Display on territory of 1-3 females, no sacs

SOURCE: Johnsgard (1983)

Q9.2

**blakgrou.mpg** SOURCE: Sierra Club

“Parenthood Game”

**Atwater.mpg** SOURCE: Sierra Club

“Parenthood Game”

All have combs and bow; the black puffs up its neck, but does not have the specialized skin air sacs of the Attwater’s. The hypothesis would be that the Attwater’s were more visible on the open prairie, so there was selection for those that had showier traits more likely to attract females.

SUMMARY: species-specific signals “flags”

- **Proximate Q9.1**
  - Compare signals within a taxonomic group of similar species
  - Highly heritable signals (anatomical & fixed action patterns)
  - Instinctive responses to only the species-specific signal

- **Ultimate- phylogenetic divergence Q9.2**
  - Emancipated males, climate change
  - H1. Bowerbirds: dry => wet environment (lane vs tower)
  - H2. Grouse: forests receded => forest edge => prairie

### Action Items - Species specific signals

- Prepare answers for
  - 9.1. Species-specific signals- how different....
  - 9.2. For 2 related species, why did signals diverge...
- Some recommended searches on Web of Science:
  - “Borgia, G” AND “bowerbird”
- Recommended searches on scholar.google.com
  - “manakin”
  - “grouse”
- Dialogue
  - Volunteer to chat on Q9.1, Q9.2
  - Post examples/sources to Blog3 Unit 9

### Learning goals

- Asexual strategies- function
- Asexual strategies- evolution

### We have addressed

Q9.1 Within a taxonomic group of your choice, how have species-specific signals diverged?  
Q9.2 For two closely related species, what is an hypothesis about why species specific signals diverged?

What are some more examples of the diversity of species-specific signals?
PC: Coral reef fish- species-specific signals

Source: “Courting”
Trials of Life

Q9.1

Reefish.mpg Source A: Trials of Life “Courting”;

• Many species on the reef
• “flag” coloration helps them recognize own species
• Reduces hybridization

PC: Ducks- species-specific signals (sexually dimorphic)

Source: “Parenthood Game”
Sierra Club

Q9.1

Ducks.mpg Source: Trials of Life “Courting”
Mallard
Merganser
Goldeneye

Bird of Paradise: divergence of species

Source: “Parenthood Game”
Sierra Club

Q9.2

bparadi2.mpg Source: Trials of Life “Courting” appreciate the distinctiveness of the plumage and displays of different species of birds of paradise
Bird of Paradise: divergence re. forest “islands”

Source: “Courting”
Trials of Life

Bparadis.mpg Source: Trials of Life “Courting”
I do not know of an hypothesis about why they diverged- see if you can find one in the literature, or develop one yourself.
Q9.3 What are 3 alternative hypotheses about the stimuli influencing female choice of mates?

Q9.4 For a species of your choice, how would you test an hypothesis about female choice of mates?

To test:
- H1: more F mate with males w/good territories
- H2: more F mate with caring males
- H3: more F mate with males w/high endurance
- H4: more F mate with males that attract other F

Source: Andersson & Simmons (2006)
Slide 4

Test: H1.1 Territory quality?

- Measure resources on different territories (correlation)
- Manipulate resources (field test)
  - Add resources to some territories
  - Subtract resources from other territories
- Measure time spent by females on each territory
- Predict: females spend more time on territories with higher quality resources

Q9.4 For a species of your choice, how would you test an hypothesis about female choice of mates?

Slide 5

H1.2. Care-giving abilities: Marsh harrier hawk

Source: “Courting” Trials of Life

harrer.mpg Source: Trials of Life “Courting”

Slide 6

Test: H1.2. care-giving?

- Measure male differences in care-giving
  - gift size and/or quality
  - frequency that gifts are delivered
- Manipulate size, quality or frequency of gifts
- Prediction: females choose males that give higher quality gifts

Females choose males on basis of care-giving potential in species where “both parents work”
**Slide 7**

**H4.1 Crested crane ("good genes")**

Source: "Parenthood Game" Sierra Club

**Slide 8**

**H4.1. Victoria's riflebird "good genes"**

Source: "Courting" Trials of Life

**Slide 9**

**Test: H4.1 "good genes"?**

- **Measure variation of male display (e.g. duration)**
  - Young males display with shorter duration
  - Parasite infection reduces quality of display
- **Manipulate display**
  - Cut male feathers (less stimulating, same endurance)
  - Add/paste feathers on other males (more stimulating)
  - Control conditions (no manipulation)
- **Measure**: female rejection rate
- **Predict**: females choose males with mechanisms that indicate health and endurance

**Cranes.mpg** SOURCE: Sierra Club "Parenthood Game"

**riflbird.mpg** Source: Trials of Life "Courting" Females choose on basis of stimulation/endurance where "only mothers work".

Females choose on basis of stimulation/endurance where "only mothers work".
Summary: female choice (PC)

- **H1.1:** Territory quality - resources
  - e.g. redbacked salamander

- **H1.2:** Predictors of care-giving ability
  - e.g. nutritious nuptial gift: marsh harrier

- **H4.1:** Endurance of male - “good genes”
  - e.g. Crested crane “athletic” dance display
  - e.g. riflebird “dramatic” dance display

To test:
- H1: more F mate with males w/ good territories
- H2: more F mate with caring males
- H3: more F mate with males w/ high endurance
- H4: more F mate with males that attract other F

Action Items - Female choosiness

- Prepare answers for
  - 9.3. Mechanisms of mate choice - 3 hypotheses...
  - 9.4. Test an hypothesis about mate choice...

- Some recommended searches on Web of Science:
  - “Sexual selection and mate choice”
  - Andersson, M
  - “riflebird”

- Recommended searches on scholar.google.com
  - “salamander mate choice”

- Dialogue
  - Volunteer to chat on Q9.3, Q9.4
  - Post examples/sources to Blog3 Unit 9

We have addressed

Q9.1 Within a taxonomic group of your choice, how have species-specific signals diverged?

Q9.2 For two closely related species, what is an hypothesis about why species specific signals diverged?

Do female ungulates really have a choice, or do they just reject males when they are not yet in standing heat?
Who says females are choosy? guanaco

Source:
“Parenthood Game”
Sierra Club

Is parental care-giving a precursor to nuptial gifts in birds?

Symbolic nuptial gift (cormorant, grebe)

Source:
“Parenthood Game”
Sierra Club

Guanchoo.mpg SOURCE: William Franklin
Questions about

• Q9.5 What effect does testosterone have on secondary sexual traits in males? (PC)
• Q9.6 What would be the costs of courtship rituals in males? (TIP: UF answer in terms like “those that...”)

Handicap principle (FP)
“Those that can survive all year despite these adornments must be high genetic quality”

Secondary sexual traits - Ostrich

- At puberty, plumage darkens with testosterone
- Year-round feather signals
- Behavioral signals can be “turned on/off”;

Source: “Parenthood Game” Sierra Club

Ostrich.mpg SOURCE: Sierra Club “Parenthood Game”
Secondary sexual traits - year round

- i.e. black coloration associated with testosterone
  - Black feathers of mature male ostrich
  - Black hair of mature male blackbuck
  - Females with high adrenal activity produce androgens
- Sexual dimorphism i.e. horns on males only
  - Blackbuck (gazelle)
  - Thomson’s gazelle
- Species specific, i.e. combs, waddles, throat patches, feathers
  - Skin shape persists throughout the year
  - Coloration and display of ornaments may change seasonally

Handicap principle (FP)
“Those that can survive all year despite these adornments must be high genetic quality”

Secondary sexual traits - Tragopan pheasant

- At puberty, plumage changes and fleshy waddles grow
- Skin colors intensify with testosterone during breeding season
- Camouflaged when not in display condition

Source: “Courting” Trials of Life

Secondary sexual traits - seasonal

- Seasonal testosterone cycles turn on and turn off the male ornaments
  - Skin coloration (e.g. combs & horns of tragopan)
  - Feathers (e.g. Lyrebird, peacock)
- Display behaviors - controlled by testosterone
  - Heritable fixed action pattern (e.g. tragopan pop-up, lyrebird dance)
  - Learned vocal mimicry (e.g. lyrebird song repertoire)

Handicap principle (FP)
“Those that can survive all year despite these adornments must be high genetic quality”
Secondary sexual traits - Lyrebird

- Plumage - species specific
- Fixed action patterns in display of plumage
- Learned mimicry of diverse sounds

Source: "Courting" Trials of life

Costs of seasonal ornaments: Peacock

- "handicap"
- Energy & nutrients required for seasonal growth

Source: "Courting" Trials of life

UF: Costs of "being too attractive"

- H1: Ornaments increase vulnerability to predators
  - e.g. tragopan pheasant
- H2: Growth of structures diverts body resources from maintenance
  - e.g. peacock tail, antlers on red deer
- H3: Physical exhaustion from exertion & loss of appetite
  - e.g. topi, moose, red deer

Q9.5 lyrebird.mpg Source: Trials of Life "Courting"

Q9.6 What would be the costs of courtship rituals in males? (TIP: UF answer in terms like “those that..."
SUMMARY: male attractiveness

Q9.5, 9.6

Secondary sexual traits & testosterone (PD & PC)
- Year-round after puberty (PD): e.g. ostrich plumage
- Seasonal cycles (PC): e.g. feathers, skin coloration, displays

Ultimate costs of elaborate displays (UF)
- H1. vulnerability to predators
- H2. growth of structures diverts resources from maintenance
- H3. physical exhaustion from active displays

Learning goals
- Asexual strategies- function
- Asexual strategies- evolution

Action Items - Male attractiveness

- Prepare answers for
  - 9.5. Effect of testosterone....
  - 9.6. Costs of elaborate displays...
- Some recommended searches on Web of Science:
  - “testosterone” “secondary sexual” “costs of elaborate displays”
  - AND “Animal Behavior”
- Recommended searches on scholar.google.com
  - “costs of elaborate displays” “testosterone male displays”
- Dialogue
  - Volunteer to chat on Q9.5, Q9.6
  - Post examples/sources to Blog3 Unit 9

We have addressed

Q9.1 Within a taxonomic group of your choice, how have species-specific signals diverged?
Q9.2 For two closely related species, what is an hypothesis about why species specific signals diverged?

Could you explain more about the costs of ornaments and displays?
Costs of ornaments: Frigatebird

- Seasonal cycles of testosterone
- Reduced costs in non-breeding season
- Signals can be "turned off" when not displaying
- Minimizes vulnerability to predators

Source: "Parenthood Game" Sierra Club

Costs of active displays - topi

- Body condition declines
- Energy expended in displays
- Loss of appetite or access to food while on lek territory

Source: "Courting" Trials of Life

Frigateb.mpg SOURCE: Sierra Club "Parenthood Game"

topicost.mpg Source: Trials of Life "Courting"