Parental Behavior 2

• Cost-Benefit Analysis of Parental Care
  – Mothers vs Fathers
  – Exceptions to the Rule

• Discriminating Parental Care
  – Brood parasitism

• Evolution of Parental Favoritism
12.19 An avian mafioso

http://www.youtube.com/watch?v=4Mb0GOITRUE
One cuckoo chick can imitate the begging of four reed warbler chicks.
Host species

Parasite of the Splendid fairy-wren

Parasite of another species

Shining bronze-cuckoo

Splendid fairy-wren
Brood parasitism

• Why would some bird parents give their eggs to others?

• How might this parasitic behavior have evolved?
  – Cumulative evolution
Specialized brood parasitism by cuckoos

- Brood parasitism is rare
- Specialized parasitism has evolved 3 times in cuckoos
  - 60 million years ago (MYA)
- Brown = care for own young
- Blue = specialist parasites
- Red = occasional parasites

- Ancestral species likely showed parental care
- Parasitism initially may have been within the same species – but this is still not clear ("gradual shift hypothesis" vs "abrupt shift hypothesis")
Evolution of brood parasitism among cowbirds

- North America
- Outgroup is a cowbird that does not show parasitism
- Parasitism evolved 3-4 MYA
- Variation in # of host species
- What do these data suggest?
Why accept a parasite’s egg?

- Some species take action against a parasite’s egg in their nest – remove parasite’s egg or abandon nest.

- Constraint: Lack the perceptual mechanisms to detect the parasite’s egg.
- Cost: Might destroy or abandon their own eggs by mistake.
- Cost: Would have to abandon the whole nest and their own eggs. Nest sites may be limited, and time to start over may be limited.
- Cost: Retaliation by brood parasite! “Mafia hypothesis”
An avian mafioso

- Interactions between European magpies & cuckoos
- Magpies that did not eject a cuckoo egg: rate of predation on magpie eggs was 12%
- Magpies that did eject a cuckoo egg: rate of predation on magpie eggs was 87%
- Problem with interpreting these data?

- Researchers randomly assigned magpie nests to control or removal groups (experimentally removed cuckoo egg)
- In removal group, cuckoos returned, saw their egg was missing & destroyed the magpie eggs!
Researchers hypothesized that birds who are parasitized by cowbirds choose to rear the parasite’s eggs because they are afraid of retaliation by the adult parasite parent if they remove or destroy the egg (mafia hypothesis). To test this, scientists observed predation of warbler eggs and survivorship of nestlings in the field of nests that had been parasitized by cowbirds. They had 3 treatment groups. In group 1, they removed the cowbird egg from the host nest; in group 2, they left the cowbird egg untouched in the nest; and in group 3, they removed the cowbird egg but made the nest inaccessible to cowbirds. Data are to the left.

Propose a follow-up experiment that would test the same hypothesis in the same species. Use your creativity.
Why respond to parasite chick’s begging calls?

- The novel environment hypothesis suggests that recent changes in the environment mean that selection has not yet had enough time to act. Recent habitat fragmentation by humans has increased the exposure of many interior woodland songbirds to brood parasitism (cowbirds live in edge habitat).

- The exploitation hypothesis suggests that the benefits of responding still outweigh the costs.
Outline

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Snowy egret

Parental favoritism

• Parents often favor certain offspring (e.g., those that beg vigorously)
• In some cases, parents even set the stage for siblicide.
  – e.g., snowy egret, cattle egret etc.
• The parents begin incubating as soon as the first egg is laid.
• Therefore, the first egg hatches earlier, giving the first chick a head start on growth.
• What if the parents started incubating after the entire clutch was laid?

Cattle egret
Parental favoritism

- Of the 3-4 eggs laid, the first two egg yolks are dosed with androgens by the mother.

- The first chick is more aggressive, often killing siblings that hatch later.
A hormonal mechanism for parental favouritism


Proximate explanation
Adaptive brood reduction?

• Parent egrets not only tolerate siblicide, they promote it
• How could this be adaptive?

• Hypothesis: Mothers are laying the last one or two eggs in case it is a good year with lots of food. If not, then it is in the parents’ interest that the extra chicks are killed, leaving the parents with only 1-2 young to take care of.

• If this hypothesis is correct, then experimentally eliminating some of the bias towards early-hatching eggs should also reduce the reproductive success of the parents...
Optimal asynchrony

- The idea that hatching asynchrony is optimal for parental fitness was tested by moving chicks around in egret nests, creating synchronous broods or exaggerated asynchronous broods or control broods.

- Survivorship was better for asynchronous broods - and parental efficiency was highest for normal asynchronous broods (control).

<p>| Table 12.1: The effect of hatching asynchrony on parental efficiency in cattle egrets |
|---------------------------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Mean survivors per nest</th>
<th>Food brought to nest per day (ml)</th>
<th>Parental efficiency $^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous brood</td>
<td>1.9</td>
<td>68.3</td>
</tr>
<tr>
<td>Normal asynchronous brood (control)</td>
<td>2.3</td>
<td>53.1</td>
</tr>
<tr>
<td>Exaggerated asynchronous brood</td>
<td>2.3</td>
<td>65.1</td>
</tr>
</tbody>
</table>

Source: Mock and Ploger$^{992}$

$^a$The number of surviving chicks divided by the volume of food brought to the nest per day $\times 100$. 
Who to feed?

• In other species, parents also bias survivorship but in different ways...use cues about offspring health to decide who to feed.

• The gapes (mouth interiors) of many songbirds are red. This redness comes from carotenoid pigments in the blood, which are taken up by the skin in the mouth.

• Carotenoids are also used by the immune system during infectious challenges. Could be a limited resource.

• Hypothesis: A bright red gape is an honest signal of nestling health.
Better red than dead: carotenoid-based mouth coloration reveals infection in barn swallow nestlings

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Red gapes & barn swallows

- Experimentally manipulated gape color with food coloring...and measured parental feeding rate

- Experimentally challenged nestlings with a novel antigen to simulate infection (sheep red blood cells, SRBC)...and measured gape redness

- Gave SRBC challenge with or without supplemental lutein (a carotenoid)...and measured gape redness
Feeding rates before and after application of food coloring to the gapes of nestling barn swallows
All nestlings immunized with SRBC

- Unprovisioned
- Fed with oil
- Fed with oil and lutein

- Treatment of immunized nestlings

\[ z = 3.57 \]
\[ N = 43 \]
\[ p = 0.0004 \]

\[ z = 4.01 \]
\[ N = 42 \]
\[ p = 0.0001 \]

\[ z = 0.42 \]
\[ N = 40 \]
\[ n.s. \]