Interspecific Communication

Interspecific communication: General types

1. Predator - prey communication
    a. Communicating your fitness to potential predators (as in beaver tail slapping?)
    b. Inadvertent communication by prey to predator, and vice versa
    c. Aposematism
2. Cooperative hunting; and passive use of signals
3. Defending territory against members of other species (and the corollary: brood parasitism)
4. Plant – animal communication (we'll discuss this some next week)

How to avoid being eaten: evolutionary mechanisms (Ref: Hauser MD, 1988. How Infant Vervet Monkeys Learn to Recognize Starling Alarm Calls - the Role of Experience. Behaviour 105:187-201.)

How ground squirrels avoid being eaten by snakes

California ground squirrels respond to two species of snakes (Pacific gopher snakes, and Pacific rattlesnakes), by staring at them, flagging their tails, throwing dirt. If that fails, adults will bite the snakes

Young are likely to have startle responses to snakes, guinea pigs, and other novel objects, gradually developing the ability to discriminate. (Hauser 2000:302-306).

Recognition of interspecific alarm calls: vervets

- Vervets, even infants, recognize alarm calls of many birds (e.g. superb starling, *Spreo superbus*) (Hauser 1988).
- Vervets listen more attentively to interspecific vocalizations that "matter": Cows are always in close proximity to the Masai, who don't hunt vervets, but do throw sticks and rocks at them. Presence of wildebeest has no effect on vervets.
- Duration of looking towards speaker after playback of wildebeest and cow vocalizations. Duration of responses was significantly longer after playback of cow vocalizations. (From Cheney and Seyfarth 1985, also reported in Hauser 2000:532.

Evolution of cooperation between mongooses and birds (Rasa, O.A.E. 1983. *Dwarf mongoose and hornbill mutualism in the Taru desert, Kenya.* Behav. Ecol. Sociobiol. 12:181-190.)

- In the Taru desert of Kenya, dwarf mongooses and six species of birds, including 3 hornbill species, are sympatric, and form feeding aggregations by day. Mongooses and hornbills have almost identical diets—which would suggest a high degree of competition.
- These aggregations are actively sought by both mammal and bird: mongooses sleep in termite mounds, and birds (specifically two *spp*. of hornbill) hang out in nearby trees, waiting for the lazy mongooses to get up, before they begin foraging for the day. Similarly, mongooses wait for birds to show up before they leave to search for food.
- Raptors prey on both mongooses and hornbills. Both mongooses and hornbills warn vocally when a raptor is sighted. Mongooses have sentries that visually guard against

predators. The mongooses modify their guarding behaviour to compensate for the warning behaviour of the birds in two ways:
- fewer mongooses guard when large numbers of birds are present and vice versa,
- the frequency of the mongooses' intraspecific warning calls is significantly reduced in cases where birds are present in comparison with those where they are absent.

Advantages to mongooses

Advantages to hornbills

1b. Inadvertent communication to would-be predators
Classic example: Túngara frogs (Tuttle and Ryan 1981, and in Hauser 2000:371-374).

Inadvertent communication to would-be prey: phenotypic plasticity
- Phenotypic plasticity: capacity for marked variation in the phenotype as a result of environmental influences during development
- Benefit in freshwater ecosystems: highly variable environmental conditions, including an uncertain risk of predation, mean that individuals that can maintain plastic defenses against predation will increase their survival when predators are present, but will not incur the costs of these defenses when the risk of predation is low and the defense is not induced.
- Larvae of the pond-breeding anuran *Hyla chrysoscelis* develop a conspicuous phenotype in the presence of predators (dragonfly larvae) consisting of a brightly colored tail and a deeper tail fin. (Richardson JL, 2006. Novel features of an inducible defense system in larval tree frogs (*Hyla chrysoscelis*). Ecology 87:780-787.)
- What signals do *Hyla chrysoscelis* perceive, which induce phenotypic plasticity in tadpoles?

1c. Aposematism

- Definition: In prey species, the combination of repellent antipredator defenses (toxins, stings, spines) with some advertisement (warning signal) of this defense that is often visually conspicuous to predators.
- Hypothesis: the strength of the warning signal might reliably indicate the strength of defense. That is: the nastiest prey might "shout loudest" about their unprofitability. (Speed & Ruxton 2007). Likely results?

Unken reflex in newts

2. Cooperative hunting: fish

- Groupers (*Plectropomus pessuliferus*) and giant moray eels (*Gymnothorax javanicus*) hunt cooperatively in the Red Sea. (Bshary *et al*, 2006. Interspecific communicative and coordinated hunting between groupers and giant moray eels in the Red Sea. Plos Biology 4:2393-2398. Url for videos: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1750927#supplementary-material-sec)
- Morays hunt by entering crevices in the coral reef; groupers hunt in open waters around the reef. Prey can escape from the grouper by hiding in a crevice and from the moray eel by leaving the reef, but prey has nowhere to go if hunted by a combination of these two predators.
- Evidence for cooperation between groupers & morays:
    - The two predators seek each other's company, spending more time together than expected by chance (Figure 1)
    - Groupers actively recruit moray eels by shaking their head close to the moray eel's head. Morays respond by emerging and swimming off with the groupers.
    - Joint hunting was significantly more likely to occur after a grouper "head shook" at a moray, than when it did not (χ^2_1=8.4 n=158, p<0.01).
    - Groupers made different head shakes, which attracted morays, to indicate the presence of a prey fish.
    - Groupers were more successful when hunting with morays, than when hunting alone, as were morays more successful when with groupers.
    - Satiated groupers didn't signal to morays.

2b. Passive use of heterospecific signals: a smattering (Reviewed in Seppanen *et al*, 2007. *Social information use is a process across time, space, and ecology, reaching heterospecifics.* Ecology 88:1622-1633.)

- Permanent mixed-species groups of callitrichids exist with similar but not identical body size and ecology. Likely advantages: food finding, predator avoidance.
- Presence of black-browed albatrosses used by other pelagic seabirds as indication of food source.

- South African *Platysaurus* lizards and several bird *spp*. share food source (*Ficus*—figs), and lizards go to where birds are to find food (even when birds are put in cages away from fruit trees).
- Marbled newts go toward the courtship call of natterjack toads (sympatric, share breeding requirements), but not towards those of allopatric European green toads. This may help newts find new breeding ponds.

3a. Defending territories against interspecific competitors
- If territories are limiting resources that multiple species use, communication between interspecific competitors can occur.
- Under these conditions, individuals may emit defensive vocalizations, or give warning displays, to intruders (e.g. *Plethodontohyla notostica* dads in wells when *M. laevigata* try to go in.)

3b. Failing to defend territories against parasites
- Brood parasitism: the use of a host species to brood the young of another ("parasite") species. Best known in birds.
- Parasite species evolve to match host species young, often by gape, plumage, and/or vocalizations. By thus deceiving their hosts, brood parasites get parental care without their own parents incurring costs.
- Example: African indigobirds (*Vidua spp*.), 10 species of which are parasites of various estrildid finches.

Brood parasitism, & implications for speciation
- Cameroon indigobirds (*V. camerunensis*) lay eggs in the nests of both African firefinchs and Black-bellied firefinchs. Resulting indigobirds learn the songs of their respective finches, and have developed into two "races." All Cameroon indigobirds can still mate with one another, and otherwise appear to be identical, but

So by several measures of pre-mating reproductive isolation, this particular form of brood parasitism may be leading to speciation (Balakrishnan & Sorenson, 2006. Song discrimination suggests premating isolation among sympatric indigobird species and host races. Behavioral Ecology 17:473-478.).