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What is communication?

Communication is the transfer of information from a signaller to a receiver.

Does communication only occur between members of the same species?

Is communication mutual?

Is communication in mutual interest?

Sexual swindle by *Ophrys apifera*

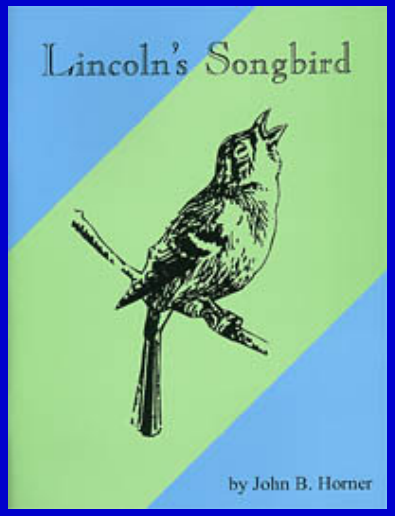
Plant gets pollinated by mimicking female bees.

Communication often involves the *manipulation* of the receiver's behaviour by a signaller!

Dawkins and Krebs 1978: "When an animal seeks to manipulate an inanimate object, it has only one recourse – physical power. A dung beetle can move a ball of dung only by forcibly pushing it. But when the object it seeks to manipulate is itself another live animal there is an alternative way. It can exploit the senses and muscles of the animal it is trying to control... A male cricket does not physically roll a female along the ground and into its burrow. He sits and sings, and the female comes to him under her own power."

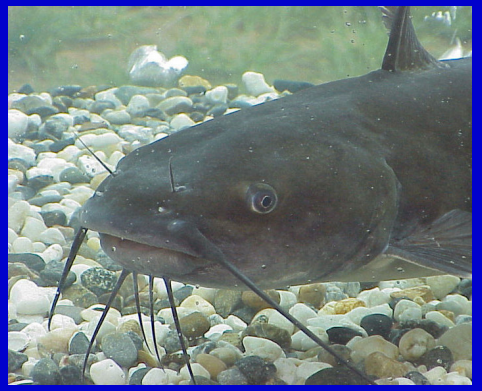
How do animals communicate?

visual signals (including ultraviolet)

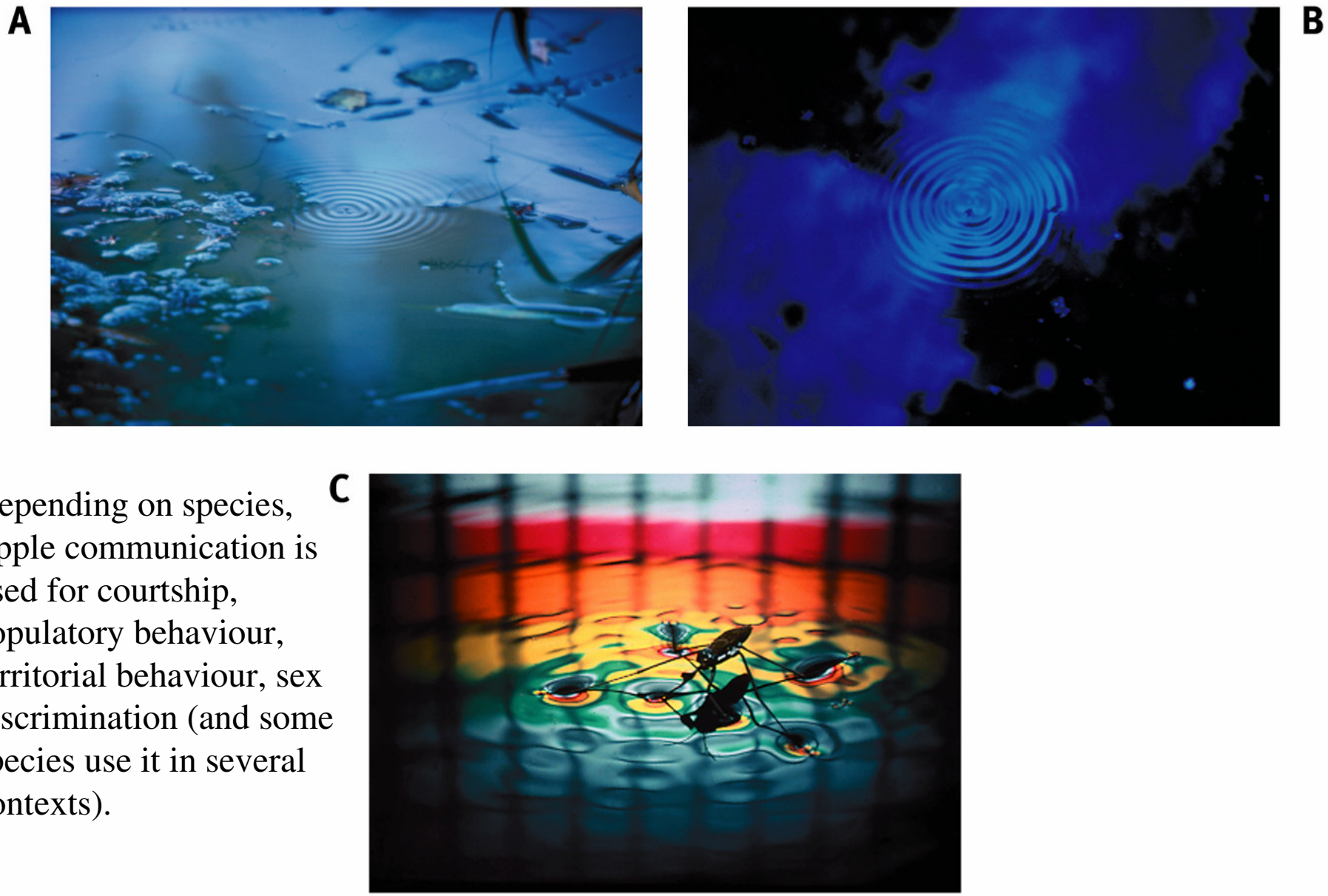


Sound (including ultrasound)

Olfactory signals (e.g. pheromones)



electrical signals, mechanosensory signals (including vibration), tactile (direct touch)



Depending on species, ripple communication is used for courtship, copulatory behaviour, territorial behaviour, sex discrimination (and some species use it in several contexts).

FIGURE 12.11: Ripple communication by water striders

Multimodal signals for the same information

Successful forager returns to the nest and releases a pheromone (scent), deposits nectar (taste) and jostles (tactile) other bees to recruit other bees

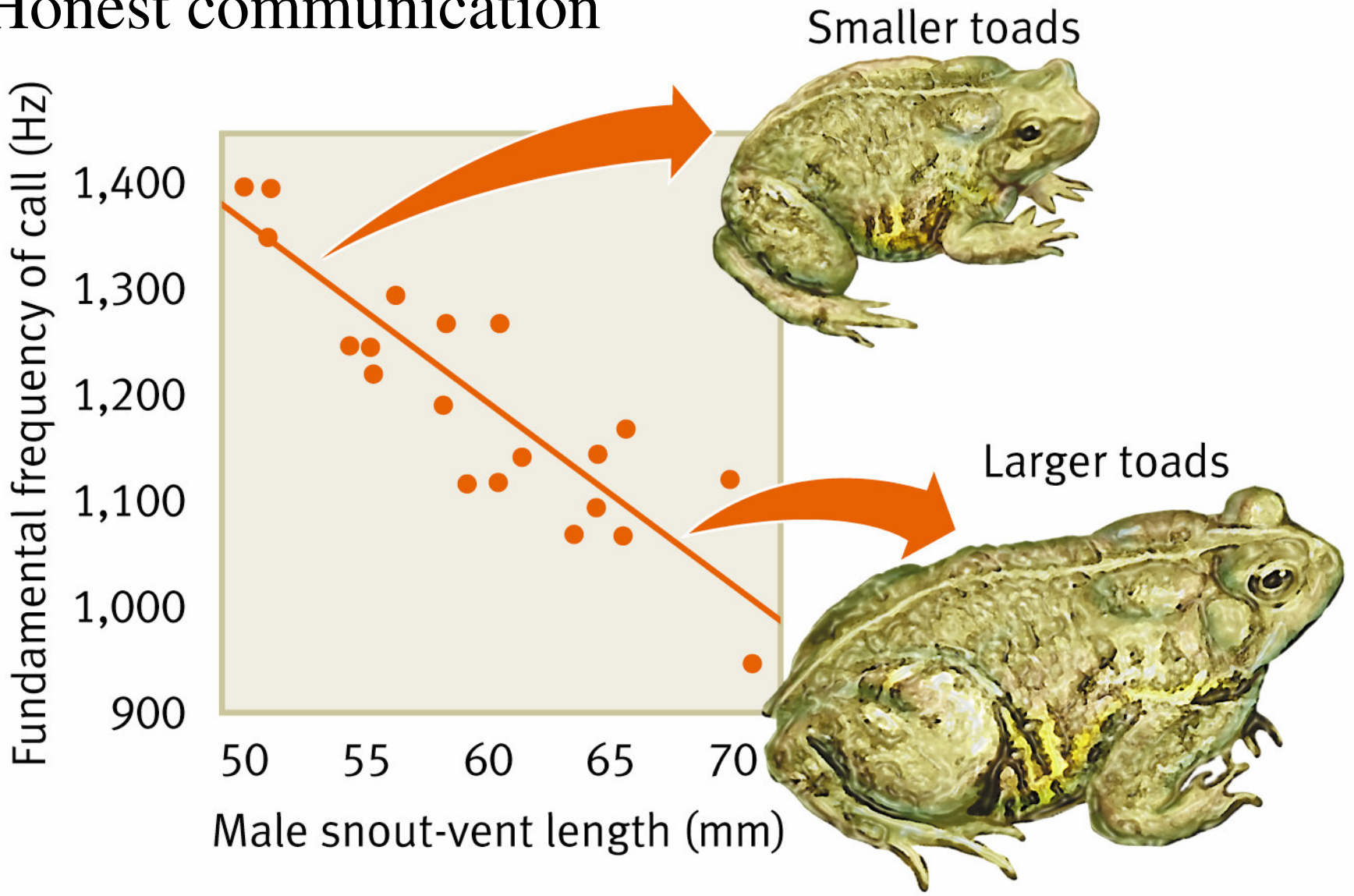
Communication is not always honest!

Io moth
(*Automeris io*)

Coral snake (venomous)

Milk snake (harmless)

Honest communication



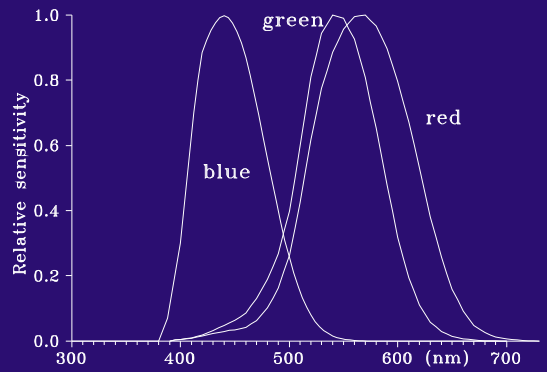
Principles of Animal Behavior

What do animals communicate about?

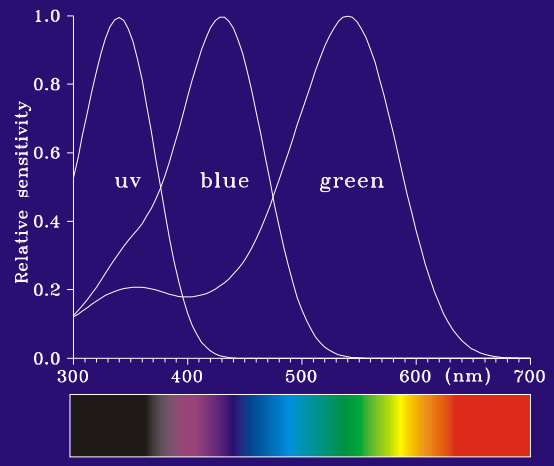
- Foraging options
- Mating (readiness to mate, mate quality)
- Danger (e.g. predation threat)

Communication in the UV

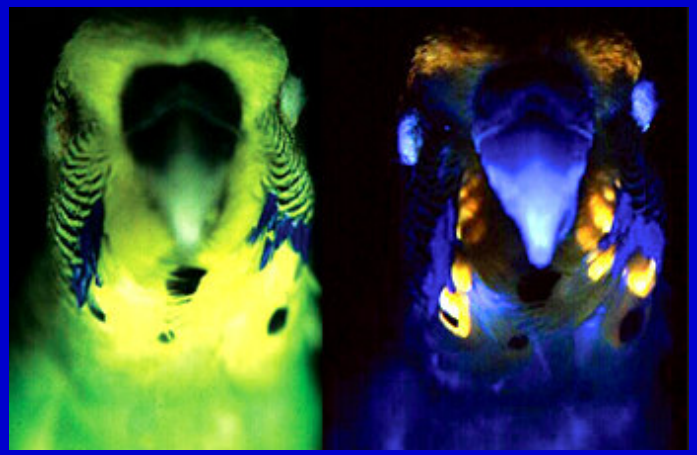
Human



Bee



UV signalling in birds



Frequency spectrum in different species

- offer the possibility for “private channels”

• Human	20	-	20000 Hertz
• Cat	100	-	32000
• Dog	40	-	46000
• Elephant	16	-	12000
• Bats	1000	-	150000
• Locust	100	-	50000
• Dolphin	70	-	150000

Some animals are deaf, e.g. snakes and ants

Ultrasound communication (and echolocation) by bats

Eavesdropping by moths to avoid capture

Whistling moths use sound for courtship

Evolution of a communication signal

3-spined stickleback

Males develop red colouration during breeding season

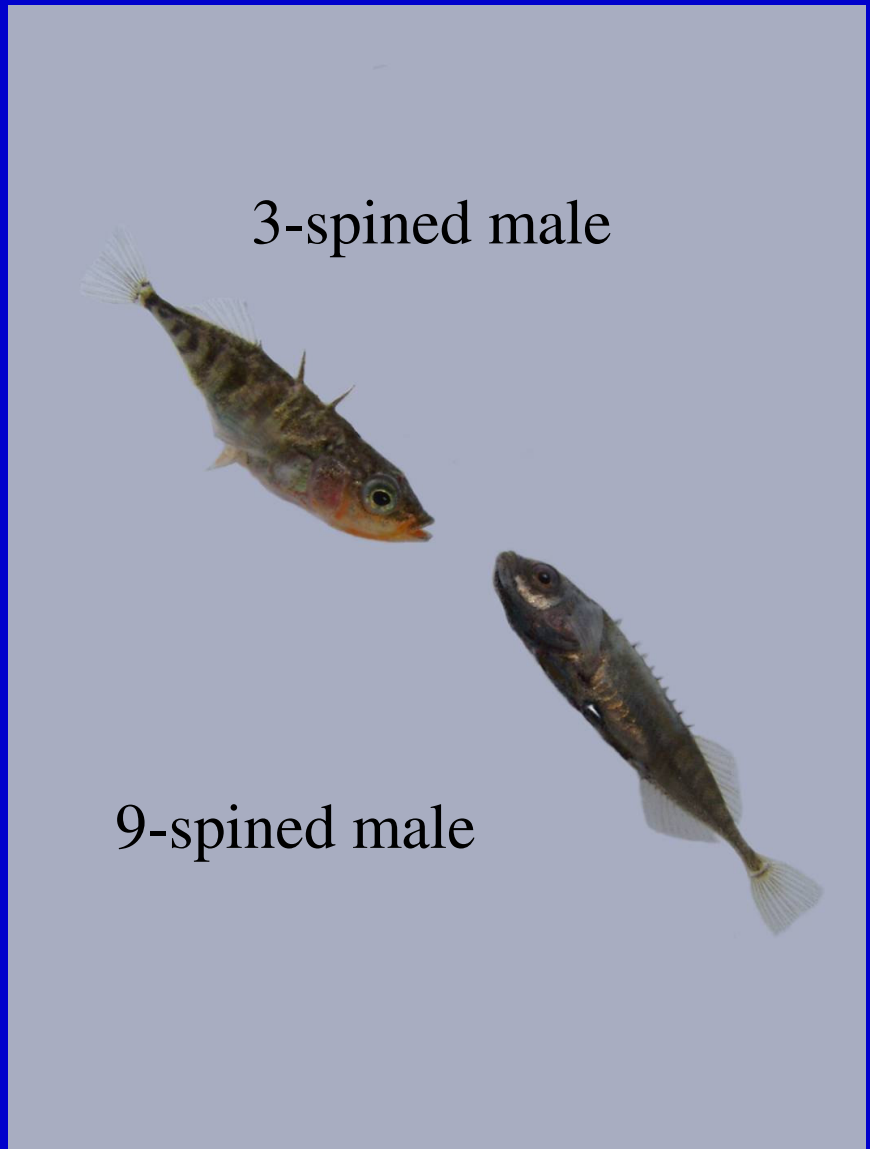
Females prefer ‘reddest’ males

‘Reddest’ males are in the best condition – so female preference makes sense

But…..

In some species of sticklebacks, the males are not red!

So how did red signalling evolve?



Stickleback males

9-spined stickleback (*Pungitius pungitius*)

blackspotted stickleback (*Gasterosteus wheatlandi*)

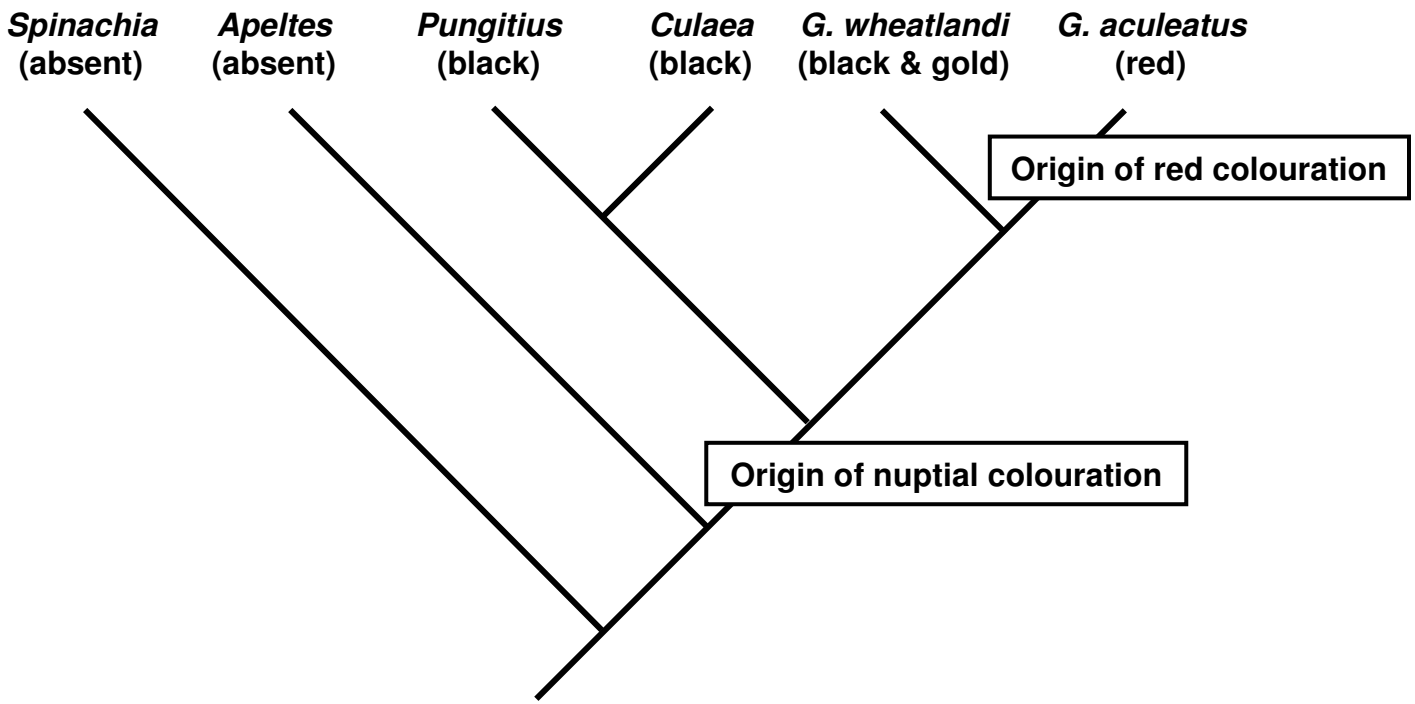
3-spined stickleback (*Gasterosteus aculeatus*)

brook stickleback (*Culaea inconstans*)

4-spined stickleback (*Apeltes quadracus*)

15-spined stickleback (*Spinachia spinachia*)

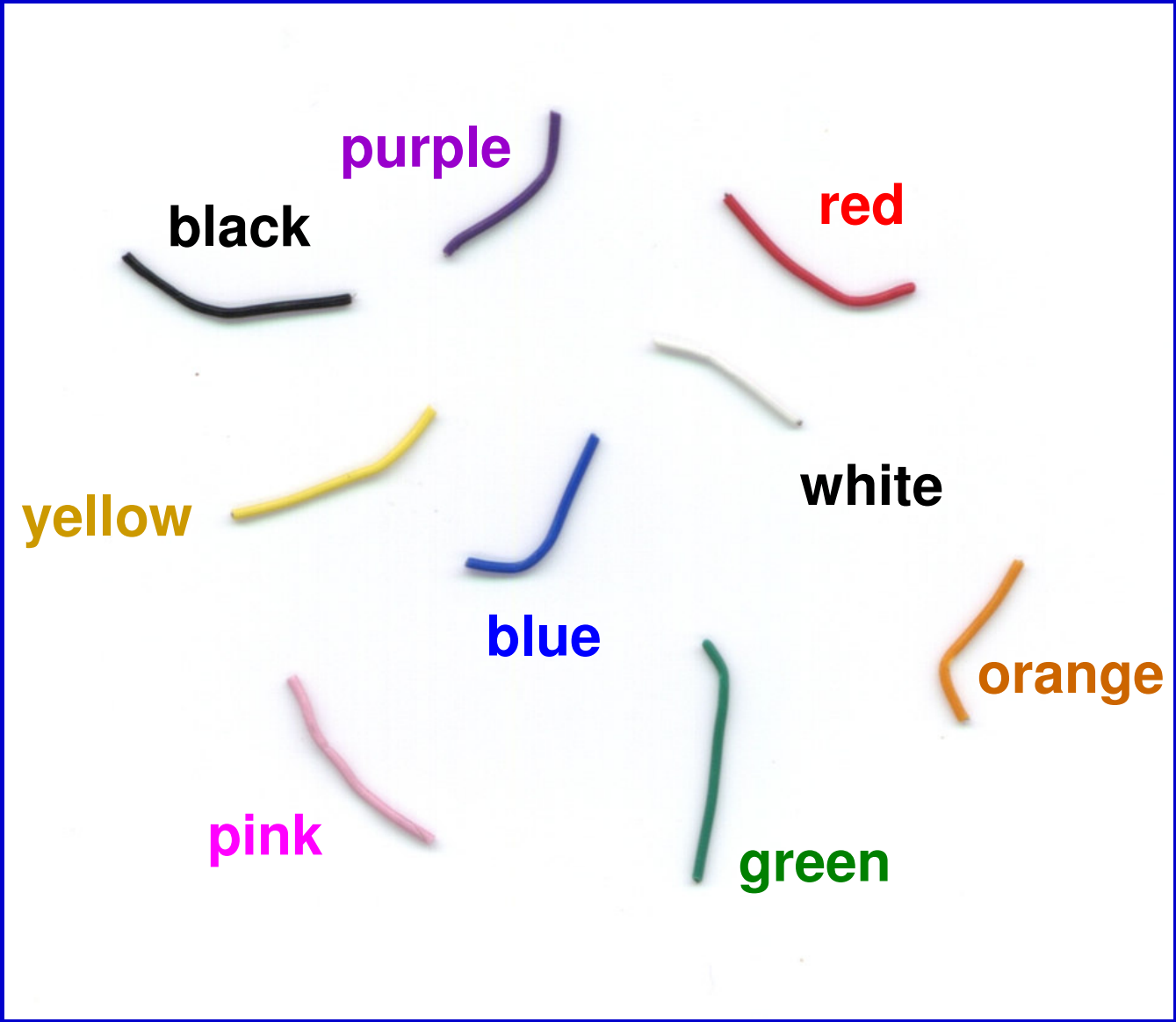
A phylogenetic tree of the family Gasterosteidae



Smith et al (2004) Proc Roy Soc B 271: 949

What about colour preferences in another context?

Do sticklebacks prefer food of a particular colour?

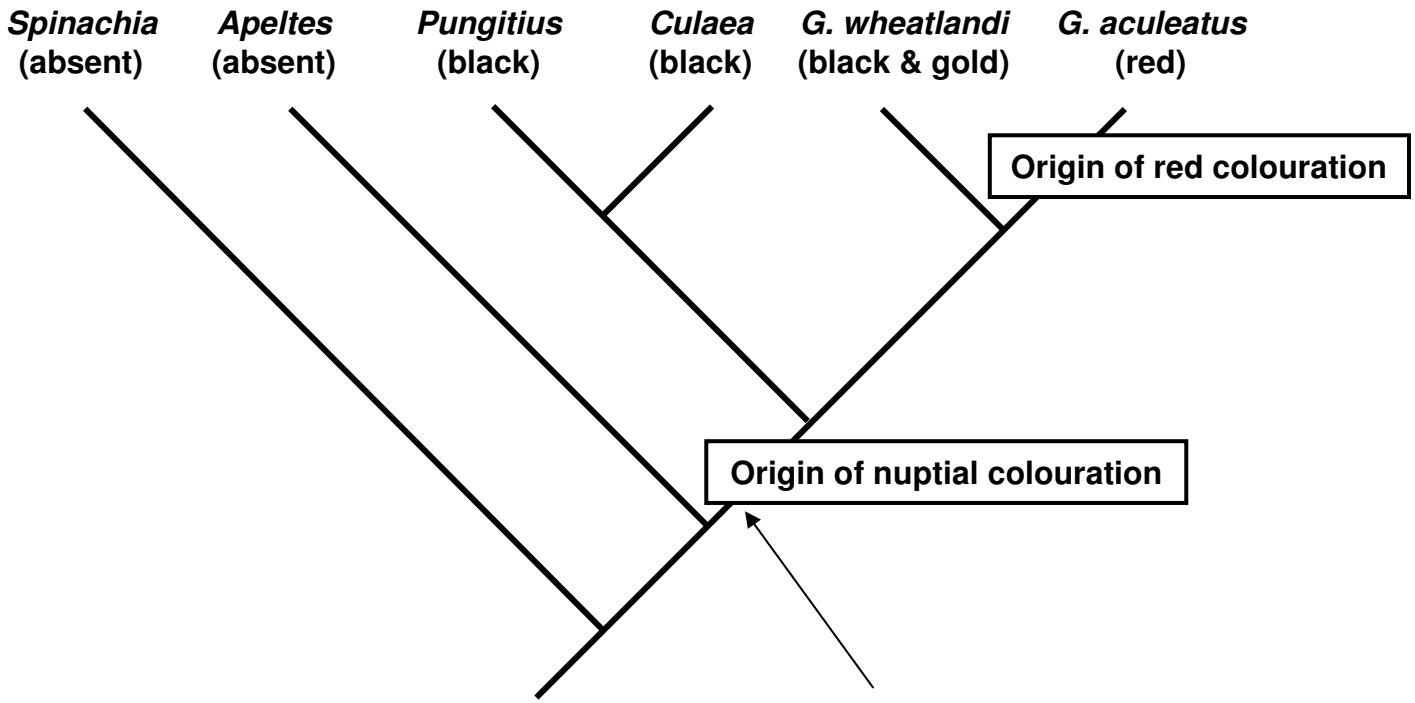


Test with green artificial worm

Test with blue artificial worm

Test with red artificial worm

A phylogenetic tree of the family Gasterosteidae



Origin of red preference?

often, evolution of a new communication signal makes use of a pre-existing bias on the receiver side!

Summary

1. Consider communication from the point of view of the animals (and/ or plants) involved:

    i) What can the signaller/ receiver perceive?

    ii) Who benefits from information transfer?

2. Animals communication in different ecological contexts which affects the types of signals used: e.g. compare courtship vs. anti-predator signals.

3. Information transfer occurs via many sensory modalities: often constrained by ecology or phylogeny