

Lecture 2: *Game theory and evolution of cooperation.*Game theory

- Strategic study of the best strategies for interaction with other parties.
- The prisoners dilemma shows that during single encounters it is best to defect, however cooperation can emerge because players consider the future and multiple encounters. Computer simulation suggests that the greatest payoff comes from a tit-for-tat strategy.

Why do animals cooperate? *Requires multiple encounters and animals to recognise each other.*

Kin selection: Help those related to you, some of your genes are passed on when they reproduce.

Reciprocity: If individuals have to repeatedly interact with each other, then they can increase their fitness by cooperation, avoiding punishment for mutual defection.

Example: Stickleback will cooperate if the predator looks like it is cooperating, if not it will only copy its behaviour.

Spitefulness

- Humans (and even monkeys) have been shown to be spiteful, with cooperation only for an equal reward. **Example:** Ultimatum game where individuals would decide to take nothing, rather than taking less than the other person; Monkeys trade tokens for food rewards, the one with the worse reward will throw it back and get nothing.

Aggression and submission *The hawk and dove simulation.*

- Contests or conflict can arise over resources, however many aggressive acts are maladaptive so many encounters end only in display without physical interaction.
- When two individuals meet, the outcome depends on the genetic tendency to be submissive or aggressive and the payoff for the attacker depends on the strategy the opponent adopts.
- Submissive individuals do well in populations with many aggressive individuals; Aggressive individuals do well in populations with many submissive individuals. Thus, a mixture of aggressive and submissive individuals is likely to be stable.

Evolutionary stable strategies

Strategies that cannot be invaded by a new strategy.