

# Animal Behaviour

## Introduction:

- Charles Darwin, HMS Beagle- Galapagos
  - Alfred Wallace, Origin of Species, NS controversy
  - Evolutionary components- variations (mutations), survival and reproduction, heritability (genes- Darwin didn't know of Mendel's experiments)
- Variation in genes
  - Many forms of genes→ alleles, mutations usually not successful or neutral, beneficial ones gives carrier an advantage
- Survival
  - Pops can grow exponentially
  - E.g. sea turtles- 100 eggs/nest, 4-6x/season→ 1M + 1 F= 500 eggs→ 250 M/F= 125,000→ 62,500F = 31,250,000 offspring
- Competition
  - Not all offspring survive, mortality- competition for limited resources, predation→ NS
- Reproduction
  - Fitness- success at reproduction
  - Individual and Inclusive fitness
  - Offspring must be viable to count as fitness unit, i.e. mules sterile
- Heritability
  - Genes unit of heritability, bodies vehicles for genes, genes code for proteins
  - Genome and environment produce phenotype which drives evo

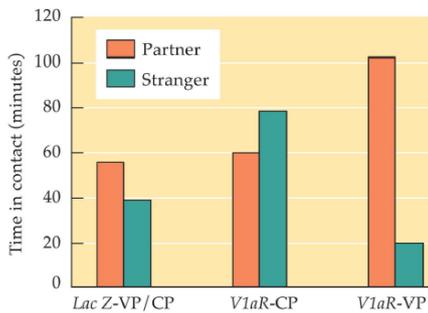
## **Behavioural Ecology:**

- Study of animal behaviour- how it is controlled, develops, impacts on reproduction and survival
- Many complex behaviours→ more than one answer to above q's
- Behaviour more than just muscle movement- pheromones, learning etc.
- Levels of explanation
  - *Proximate causes*: things that occur during the lifetime of an individual including genes, developmental processes, sensory capacities, learning and so on
    - Enviro stimuli that elicits a particular response, often 'how' q's
    - Produce certain behaviours because they are adaptive in some way
    - Genetic developmental mechanisms- effects of heredity on behaviour, development of sensory-motor systems via gene enviro interactions
    - Sensory-motor mechanisms- nervous systems for the detection of enviro stimuli, hormone systems for adjusting responsiveness to enviro stimuli, skeletal muscular systems for carrying out responses
  - *Ultimate causes*: evolutionary history and fitness advantage of a trait
    - Evolutionary significance of behaviour, often 'why' q's
    - Historical pathways leading to a current behavioural trait- events occurring over evo from origin of trait to present

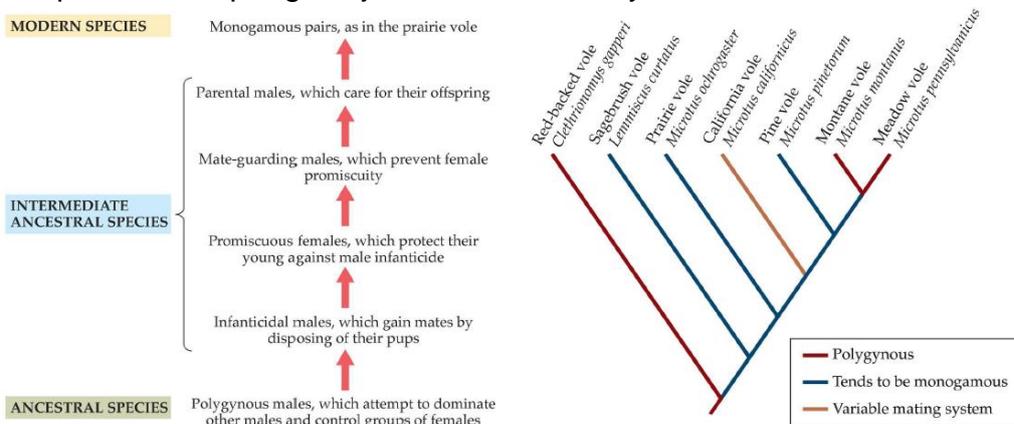
- Selective processes shaping history of a behavioural trait- past and current usefulness of behaviour in promoting lifetime reproductive success
  - E.g. male stickleback attacks other males than invade nesting territory
    - Proximate cause- red belly of the intruding male acts as a sign stimulus that releases aggression in male
    - Ultimate cause- by chasing away males, decreases chance that eggs laid in nesting territory will be fertilised by another male
  - E.g. bluegill sunfish breed in spring and early summer
    - Proximate- breeding triggered by effect of increased day length on pineal gland
    - Ultimate- breeding most successful when water temps and food supplies optimal
- E.g. male behaviour and idiot/aggressive males
  - Proximate- hormones (testosterone), diff in brain organisation, function of Y-chrome
  - Ultimate- aggressive behaviour leads to greater reproductive success in general
  - In beginning all males monogamous- stay with female, parental care, non-aggressive, all genetically identical at this pt
  - Mutation occurs in a single male → lowers prolactin and increase testosterone levels → less parental, in reproductive condition longer
  - Mutant male can now mate with more than one female → mutant alleles increase in freq if females can raise young with less help
  - Mutant allele goes into fixation → all males polygamous, reproductive success limited by no. of females they can mate with
  - Another mutation- mutant males now more aggressive towards other males → excluding males from females, causes dominant males to have more females, hence increases allele freq
  - Goes into fixation and is repeated → idiot male (NB in humans many overriding enviro factors with NS → social conditioning)
- Natural selection acts on individuals → NS determines which survive and reproduce
- Only pops evolve- individuals do not evolve → only allele freq within pop can change over time
- Niko Tinbergen- 4 main Q's for behavioural researchers
  - *How does the behaviour promote an animal's ability to survive and reproduce?* → issues of adaptive value (ultimate)
  - *How does an animal use its sensory and motor abilities to activate and modify its behaviour patterns?* → physiological level of analysis (proximate)
  - *How does an animal's behaviour change during its growth, especially in response to the experiences that it has while maturing?* → developmental cause of behaviour (Prox)
  - *How does an animal's behaviour compare with that of other closely related species, and what does this tell us about the origins of its behaviour and the changes that have occurred during the history of the species?* Historical origins and modification of behaviour (Ultimate)
    - Although ultimate sounds more important than proximate, both are necessary for understanding behaviour → they complement each other

## Vole mating systems:

- Male reproduction potentially great, female reproduction limited
  - Sperm vs. egg, initial fertilisation and development, delivery and care of young
  - Why are male prairie voles monogamous?
- Pup retrieval- male parental behaviour
- Gene for social bonding V1aR → increased sensitivity to hormone vasopressin in ventral pallium (cerebrum)
- Experiment- inject V1aR genes into ventral pallium → should increase bonding with female even without mating
  - Control- V1aR into Caudate Putamen or another gene into pallium
  - Results of time spent with familiar or unfamiliar female



- Proximate cause of monogamy- V1aR gene which increases no. of vasopressin receptors in ventral pallium which makes him bond to a single female
- Ultimate cause- females widely dispersed, unguarded females subject to sperm competition, offspring subject to infanticide by other males



## Infanticide as an adaptation:

- Adaptation- a specially designed process that solves an important problem in the environment
- Infanticide and adaptation?
  - Yes- gets lactating female back into sexual receptivity
  - No- due to abnormal circumstances, i.e. overcrowding
  - No- limit pop because of resource scarcities
- Species- common house mouse, lions (when new male takes over pride), Hanuman langurs (new male in group)