3. Reproductive isolation is necessary for large scale divergence
- interbreeding inhibits divergence, reproductive iso allows speaes to evolve independently
ex1. pre-zygotic isolation - different mating; habitats (aq & terrestrial Garter snakes)
ex2. post-zygotic isolation - hybrid inviability (N. Am frogs), hybrid sterility (mules)
can mate but off can't survive
can't produce gametes

4 Allopatric & sympatric speciation
Speciation via geo isolation - allopatric - gene flow stoped, no interbreeding, differences in pop lead to divergence when pop meet again they can't mate - reproiso is the consequence!

Evolution 3: Evolution, diversity and speciation

Nick Colegrave (N.Colegrave@ed.ac.uk)

- life is very diverse
- how to explain it?

ex Harris's antelope squirrel and white-tailed antel. squirrel separated by Grand Canyon

Outline

Levels of diversity: within pop, btw pops, btw species

1 Diversity within populations
2. Diversity between populations of the same species
3. Reproductive isolation
4. Allopatric speciation
5. Sympatric speciation
6. Modes' importance

biological species concept - gp of organisms that interbreed in the wild

allopatric the most common and significant

Learning objectives

At the end of the lecture, you should be able to

1. 1 Understand some of the ways that genetic variation can be maintained within a population.
2. Give examples of characters which vary within populations and explain how the variation is maintained
2. 3. Describe examples where local adaptation maintains diversity within a species
3. 4. Understand why reproductive isolation is necessary for large scale divergence
5. Discuss some of the ways in which two species can be reproductively isolated
4,5 6. Describe, with examples, the processes of allopatric and sympatric speciation
6 7 Comment on the relative importance of these modes of speciation in plants and animals

5. Speciation without geo isolation - sympatric - in same place but different conditions
- difficult to achieve due to gene flow (that's why it's less common)
ex Rhagoletis fruit fly - invade new habitat (originally on hawthorn, later on apples)
Mating occurs on developmental host - different for 2 populations so they became reproductively isolated

Key reading

Campbell and Reece. Biology. Chapter 24

Additional reading

If you want a slightly more advanced discussion of species and speciation you could try Evolution, By Douglas Futuyma

Mode of sympatric speciation - speciation in single step → polyploidy in plants
→ polyploidy & hybridization at once
ex. rarely in animals such as frogs but common in plants (sympatric in general)

1. Asexual reproduction

- fission - ex. ciliate protozoa, anenome - identical clones, single cell or an organism divides into two identical ones
- budding - ex. hydra - 1 individual grows on another, can distinguish btw the parent and offspring even though they have identical DNA
- parthenogenesis - ex. Daphnia - ♀ produces ovules that carry genes, no fertilization needed, same DNA

- ex. Whip Tail Lizard - all species made of ♀, reproduce by ~ but to produce eggs need fertilization
  - find males of other species, use their sperm but their genes are never passed

↑ not yet evolved, will be 100% parthenogen.

1.2 Species that reproduce sexualy & asexualy

- ex Daphnia - instead of producing parthenogenetic eggs, produces diploid resting egg that contain DNA for ♀ & ♂ because they were fertilized

2 One sex or two?

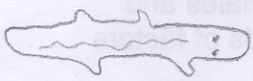
- Hermaphroditism - when individuals have 2 sexes (♀&♂) and reproductive organs

elegant

ex self fertile C.elegans

ex need another individual: flatworms

→ penis fight - both prefer to take ♂ role because spermatites are cheaper to produce so individuals want to conserve their ♀ gametes for as long as possible



When hermaphrodites are favored? When meeting other individuals is hard ex parasites, soil-living, colonizing organisms ← even when you need an indi, it can be ♀ or ♂!

- Two sexes - favoured when different characters are favoured in 2 sexes (characteristics of 1 sex is favoured in 1 only - ex. Raindeer) ← can't do both at once

3 (Fe)Males reproductive strategies - usualy ♂ compete for mates

- ex Peacocks and his tail
  ex Elephant seals fighting with their heads

WHY? - Anisogamy - different gametes size
Isogamy - all gametes the same size

Because of anisogamy male reproductive success is limited by the nb of ♀ he can mate with
Female reproductive success is limited by the nb and quality of offspring she can produce

} need different strategy

a) Ardent males

1. Harem defence - red deers fight to dominate females ← works only if ♀ group is small and not dispersed
2. Territory defence - zebra - protect territory with resources for ♀ Useful when no
   - bullfrog - live next to lakes
3. Displaying - when can't defence females nor territory ex Sage grouse displays how good they are as a potential father
   ex. Widowbird - show off their long tails flying up & down, must be long