

## AS 91605

### Demonstrate understanding of evolutionary processes leading to speciation.

#### Level 3, 4 Credits

This achievement standard involves demonstrating understanding of evolutionary processes leading to speciation.

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of evolutionary processes leading to speciation.	Demonstrate in-depth understanding of evolutionary processes leading to speciation.	Demonstrate comprehensive understanding of evolutionary processes leading to speciation.

☐ **Evolutionary processes** involve the following biological ideas:

- role of mutation
- gene flow
- role of natural selection and genetic drift
- modes of speciation (sympatric, allopatric)
- reproductive isolating mechanisms that contribute to speciation (geographical, temporal, ecological, behavioural, structural barriers, polyploidy)
- patterns such as divergence, convergence, adaptive radiation, co-evolution, punctuated equilibrium, and gradualism

☐ **Scientific evidence** for evolution, which may include examples from New Zealand's flora and fauna, will be selected from:

- fossil evidence
- comparative anatomy (homologous and analogous structures)
- molecular biology (proteins and DNA analysis)
- biogeography

#### Learning Outcomes:

At the end of this topic I can –

- ☐ Show how natural selection and genetic drift can lead to evolution. Including the importance of mutations.
  - best suited individuals have greater chance of reproductive success
  - survival of species is promoted
  - individuals with more suited / better adapted phenotypes will compete more favourably than others and are more likely to reproduce, passing on their favourable alleles
  - favourable alleles increase in frequency within the population
- ☐ Explain ways in which speciation (process of forming new biological species) occurs
  - sympatric (e.g. penguins could undergo speciation in the same place by occupying different niches/habitats)
  - allopatric (e.g. penguins could undergo speciation in different geographical areas)
  - instant speciation (polyploidy)

- ❑ Understand and describe how isolating mechanisms that contribute to speciation (pre zygotic, post zygotic and others)
  - geographical boundaries (e.g. different islands, uplifting causing formation of mountain ranges)
  - ecological (habitat) (e.g. different, genetic differences to cope with different ecological habitats i.e. temperature & humidity)
  - temporal (e.g. different breeding time)
  - behavioural (e.g. different mating rituals)
  - structural barriers (e.g. incompatibility in anatomy)
  - polyploidy (e.g. different numbers of chromosomes so even if gametes fuse / pollen fertilises other species the embryo cannot develop to maturity)
  - post zygotic isolating mechanisms
    - hybrid sterility
    - hybrid inviability
    - hybrid breakdown
  
- ❑ Identify and explain the different patterns of evolution
  - convergent evolution (where similar selection pressures result in similar adaptations in species from different ancestors)
  - divergent evolution including adaptive radiation (individuals with slightly different adaptations fill a variety of available niches, leading to adaptive radiation)
  - co-evolution (species evolving in response to each other, mutualistic relationship)
  
- ❑ Explain the two theories for the rate of evolution
  - punctuated equilibrium. (long periods of stasis with sudden speciation/periods of evolution leading to genetic change)
  - gradualism (slow genetic change over a long period of time)

**Terms:**

*Demonstrate understanding* involves using biological ideas to describe trends in human evolution.

*Demonstrate in-depth understanding* involves using biological ideas to explain how or why trends in human evolution occur.

*Demonstrate comprehensive understanding* involves linking biological ideas about trends in human evolution. The linking of ideas may involve justifying, relating, evaluating, comparing and contrasting, and analysing using scientific evidence.