

Evolution and speciation

Define evolution.

Evolution and speciation

Why are acquired characteristics not evolution?

Evolution and speciation

Lamarckism

Evolution and speciation

What do sequence differences between two species show?

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Why do base sequences show more differences than amino acid sequences?

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How is selective breeding evidence for evolution?

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Name crop varieties bred from wild cabbage.

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Homologous structures

They are not genetic in origin, so they are not passed to offspring.

Change in the heritable characteristics of a population.

Fewer differences in base or amino acid sequences mean more recent common ancestry.

The rejected idea that characteristics acquired during an organism's life are inherited.

Breeds and crop varieties differ greatly from wild ancestors, showing how rapidly heritable characteristics can change.

The genetic code is degenerate, so some base substitutions do not change the amino acid.

Structures with the same basic structure, inherited from a common ancestor, that may have different functions.

Cabbage, kale, broccoli, cauliflower, Brussels sprouts and kohlrabi (all *Brassica oleracea*).

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Bones of the pentadactyl forelimb

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Analogous structures

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Give an example of analogous structures.

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Speciation

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Is gradual change within one species speciation?

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Two processes needed for speciation

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What separated bonobos and common chimpanzees?

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Allopatric versus sympatric speciation

Structures with the same function but different evolutionary origins, produced by convergent evolution.

Humerus; radius and ulna; carpals; metacarpals; phalanges in five digits.

Formation of new species by splitting of a pre-existing species. It increases the number of species; extinction decreases it.

Wings of birds and insects; camera eyes of octopuses and vertebrates; fins of sharks and dolphins.

Reproductive isolation (stops gene flow) and differential selection (gene pools diverge).

No. The number of species does not increase.

Allopatric: geographic isolation in different places. Sympatric: same place, behavioural or temporal isolation.

The Congo River: bonobos to the south, common chimpanzees to the north.

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Temporal isolation

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Adaptive radiation

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Example of adaptive radiation

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Why is a mule sterile?

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**What often prevents hybridization
between animal species?**

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**How does polyploidy cause abrupt
speciation?**

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**Plant genus with many species formed
by hybridization and polyploidy**

Conservation of biodiversity

Biodiversity

Rapid evolution of many species from one ancestor, each using a different niche, so related species coexist without competing.

Populations breed or flower at different times of day or year, so they do not interbreed.

It has 63 chromosomes (32 horse, 31 donkey) that cannot form homologous pairs in meiosis, so no viable gametes.

Galápagos finches, with beaks adapted to seeds, insects, cactus flowers or larvae.

A sterile hybrid doubles its chromosome number, becomes fertile and is reproductively isolated from both parents.

Courtship behaviour: species-specific signals mean individuals mate only with their own species.

The variety of life in all its forms, levels and combinations: ecosystem, species and genetic diversity.

Persicaria (knotweeds and smartweeds).

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Genetic diversity

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Current versus past numbers of species

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Splitters and lumpers

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Why did the North Island giant moa become extinct?

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Why did the Caribbean monk seal become extinct?

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Causes of loss of mixed dipterocarp forest

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Local case of ecosystem loss: UAE coral reefs

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Species richness and species evenness

Fossil evidence suggests more species are alive today than at any time in the past.

The variety of alleles within a species or population.

Hunting and egg collection by human settlers, forest burning, and slow breeding.

Splitters recognise more species than lumpers in a taxonomic group, so species counts depend on classification.

Logging of hardwood, clearance for oil palm plantations, fire, roads and mining.

Hunted for blubber oil, meat and skins; overfishing of its food; disturbance of beaches.

Richness: number of species. Evenness: how similar their population sizes are.

In 2017 a marine heatwave bleached about 95 % of corals off Abu Dhabi; about 73 % died. Climate change, dredging, land reclamation and sewage add stress.

Conservation of biodiversity

What is IPBES?

Conservation of biodiversity

One benefit and one concern of citizen science

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Causes of the current biodiversity crisis

Conservation of biodiversity

In situ versus ex situ conservation

Conservation of biodiversity

Rewilding

Conservation of biodiversity

Rationale of the EDGE of Existence programme

Conservation of biodiversity

Name an EDGE species.

Benefit: many more sites and years covered. Concern: misidentification and uneven methods or effort.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, which reports evidence of a biodiversity crisis.

In situ: in natural habitats, e.g. nature reserves. Ex situ: away from habitat, e.g. zoos, botanic gardens, seed banks.

Human population growth, with over-exploitation, urbanization, deforestation and land clearance, pollution, and invasive species, pests and diseases.

Prioritise evolutionarily distinct, globally endangered species, whose loss would remove unique evolutionary history.

Reintroducing lost species and letting natural processes restore an ecosystem, e.g. wolves in Yellowstone.

Aye-aye, Chinese giant salamander, a pangolin or the gharial.