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Support Pack | Grade 12

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Life Sciences

Diversity, change and continuity

This support pack for the **Diversity, change and continuity** strand in the **Life Sciences Grade 12 CAPS curriculum** provides revision summaries on the topic to help prepare for the examinations. Learners can work through these individually at home or these could form the basis of a catch-up class or online lesson. You have permission to print or photocopy this document or distribute it electronically via email or WhatsApp.

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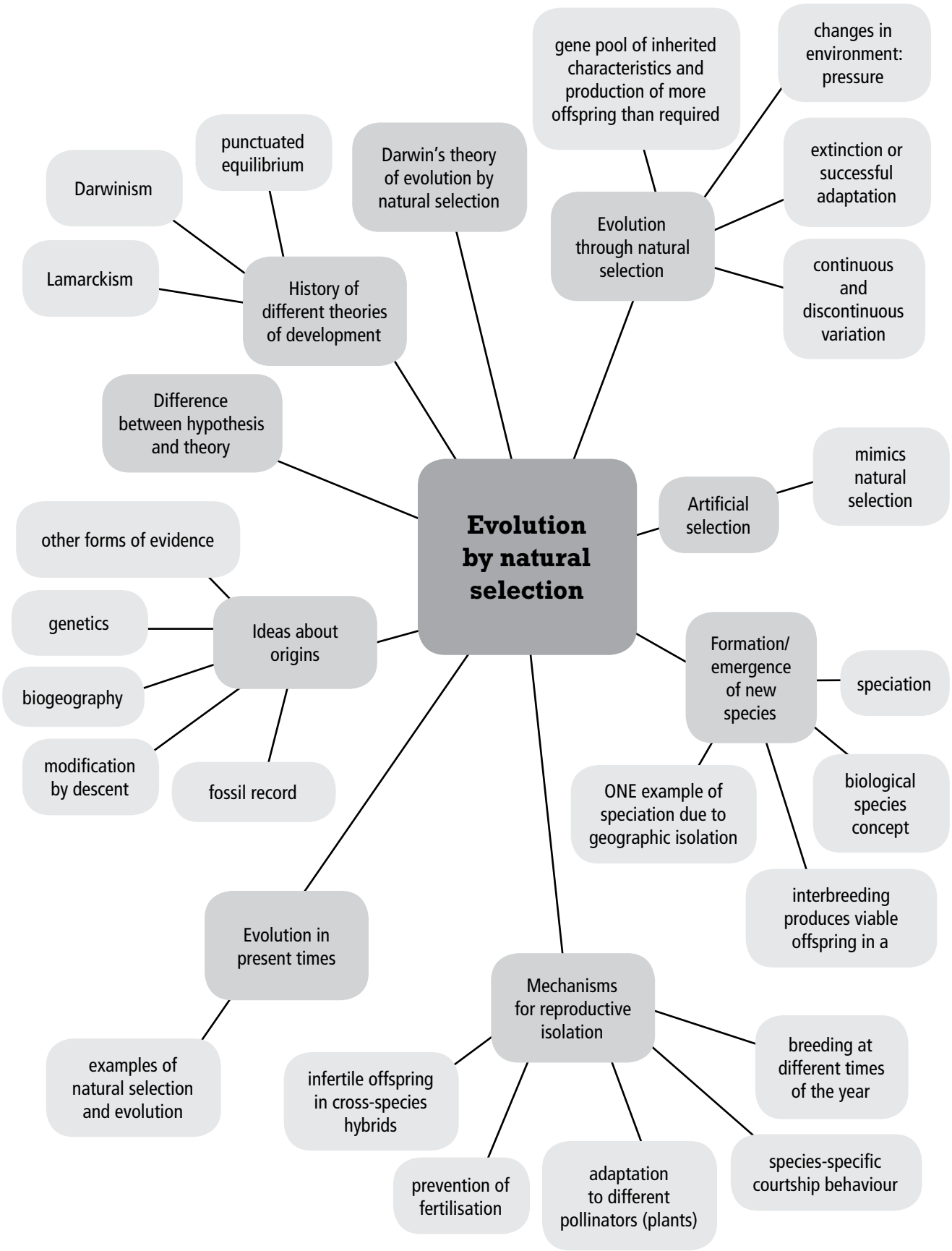
UNIT 1 Evolution by natural selection



UNIT 1 Evolution by natural selection

Ideas about origins

- Biological evolution gave rise to biodiversity, past and present. This can be shown by the fossil record, comparative anatomy (homologous structures), biogeography and genetics.

Difference between hypothesis and theory

- A scientific hypothesis is an idea about the natural world that can be tested by observation and experiment.
- A scientific theory is an explanation or model that makes sense of a large number of facts and observations about the natural world. It has been thoroughly tested scientifically and makes multiple predictions that can be tested against new evidence.

History of different theories of development

- Lamarckism was an early hypothesis for the theory of evolution, but research and Mendel's laws on inheritance proved it to be wrong.
- Darwin's theory of evolution by natural selection has been confirmed by research from many different branches of science and this research is still ongoing.
- Evolution may proceed in a smooth and gradual way (gradualism) over long periods of time, but it may also be that most species remain outwardly unchanged for very long periods of time (a state of equilibrium) and then suddenly evolve into new species over a short period of time (punctuated equilibrium).

Evolution through natural selection

- Natural selection is the mechanism that allows selected genetic traits to become more common in successive generations of a population. This is the way that sexually reproducing organisms adapt to new environmental challenges.
- Continuous variation occurs where *one gene's different alleles have small effects on the phenotype* of a population. This results in a range of the same trait in populations, such as different heights, differences in hair colour, shape of nose, eye colour, feet size and so on.

Artificial selection

- Humans use artificial selection to select desired traits in crops, farm animals and domestic animals.

Formation/emergence of new species

- Speciation is the formation of a new species (or subspecies). A new species is established if the gene pool changes so much that reproductive isolation mechanisms prevent individuals of a species from breeding with individuals of another species.
- Discontinuous variation is variation that does not form a range. Instead, variation forms distinct classes, e.g. men and women (only two classes) and blood groups of either A, B, AB or O (four classes).

- Adaptive radiation occurs when members of a species (such as Galápagos finches) colonise new habitats and adapt in different ways (radiate) so that they can exploit new niches.
- Geographic isolation creates opportunities for speciation. Examples include Galápagos finches, Galápagos giant tortoises, the Baobab family and the Protea family.

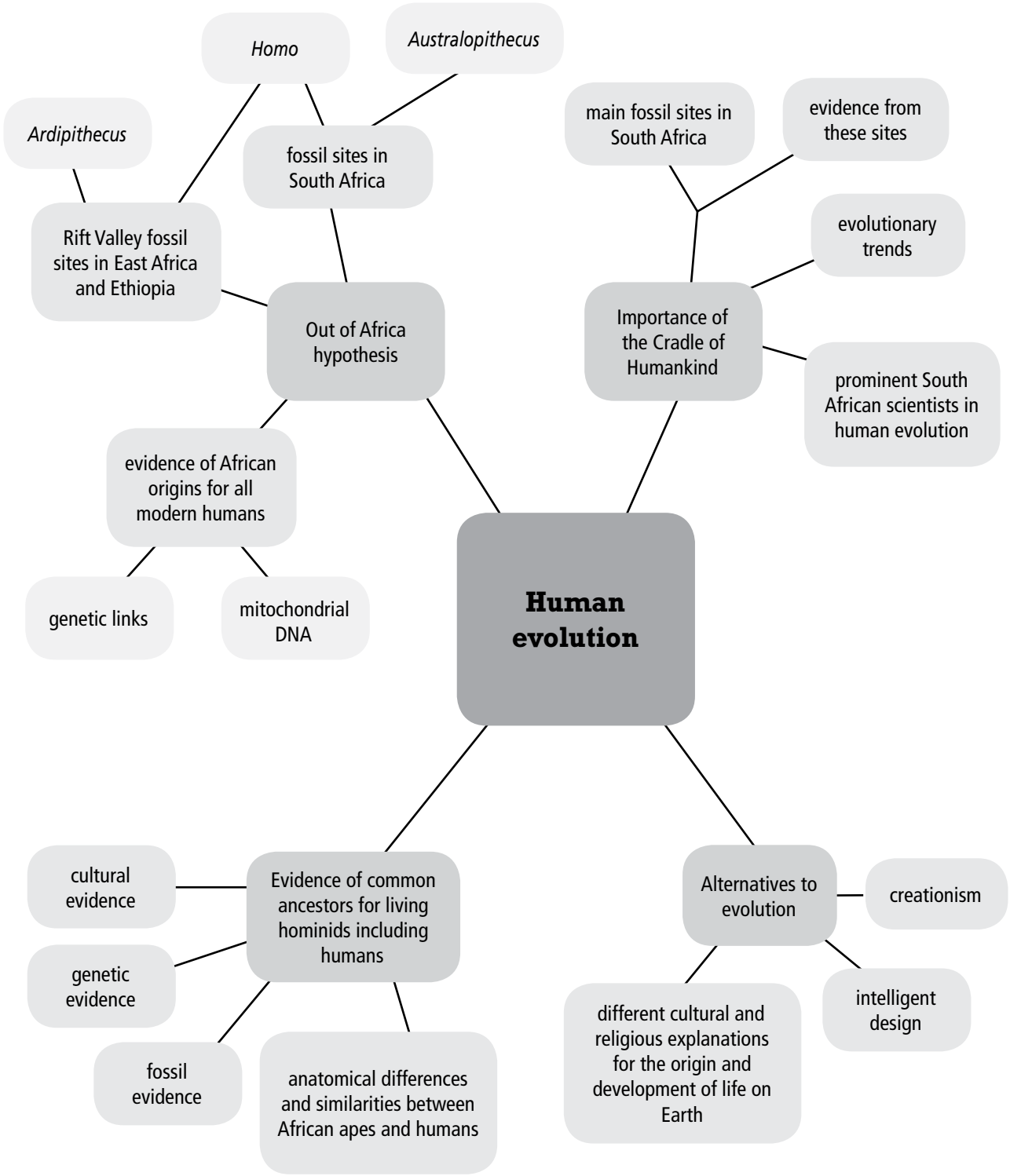
Mechanisms for reproductive isolation

- Reproductive isolation protects the unique gene pool of a species by preventing the establishment of a hybrid species. Examples of reproductive isolation mechanisms include: different breeding times, species-specific courtship behaviour, adaptations to different pollinators, mechanisms to prevent fertilisation and the birth of infertile offspring.

Evolution in present times

- Evolution by natural selection is an ongoing process. This can be seen in the following: insects that develop resistance to insecticides, modern adaptations to survive prolonged drought in Galápagos finches, bacterial resistance to antibiotics, and HIV resistance to antiretroviral drugs.

UNIT 2 Human evolution



UNIT 2 Human evolution

Evidence of common ancestors for living hominids including humans

- Great (African) apes and humans have a common ancestor.
- This is shown by anatomical differences and similarities between African apes and humans.
- Thousands of fossils found mainly in the East African Rift Valley and in the Cradle of Humankind show evolutionary trends in bipedalism, brain size, dentition, prognathism and palate shape, brow ridges and cranial size.
- Genetic evidence for common ancestry comes mainly from research into mtDNA.
- The number of differences in mtDNA between two populations is a measure of the time that has passed since the two populations split from a common ancestor.
- The differences are measured as mutations in the DNA.
- Both humans and the great apes use tools and teach their young to use tools.
- The great apes show evidence of complex social interactions and behaviour – in other words, they have a culture.
- Evidence of tool use and the evolution of culture in early modern humans come from Middle Stone Age archaeological sites, many of which are in South Africa.

Out of Africa hypothesis

- Genetic markers such as mtDNA show us that all humans lived in Africa until at least 60 000 years ago.
- Human genetics provides the evidence that all living populations of humans had African ancestors.
- The first species to leave Africa was *Homo erectus*, which first appeared in Africa about two million years ago and soon afterwards spread rapidly around the continent and then out of Africa.
- The Out of Africa hypothesis describes a small group, probably no more than 100 to 200 individuals, of *Homo sapiens* who left Africa by between 125 000 and 60 000 years ago.
- The East African Rift Valley is the site of major fossil finds of early hominids and hominins – notably *Ardipithecus*, *Australopithecus* and *Homo* species.

Importance of the Cradle of Humankind

- Southern African fossil sites, notably the Cradle of Humankind, have contributed around 35% of all the early hominin fossils found so far in Africa.
- They include three species of australopithecines and three early members of the genus *Homo*.
- These fossils span the time period from 3,5 million years ago to only 100 000 to 200 000 years ago.

Alternatives to evolution

- Alternatives to evolution include creationism, intelligent design and different cultural and religious explanations for the origin and development of life on Earth.