# Human Biology – ATAR Year 12

## Unit 4 Evidence for Evolution extended response

**Assessment type:** Extended response

**Conditions**

Time for the task:

Part A: Two lessons to research topic and complete notes. You may not use these notes for Part B.

Part B: One lesson for in-class validation – examination-style extended answer question.

## **Further evidence for evolution: comparative biochemistry, comparative genomics and bioinformatics**

**Part A: Research notes (5 marks)**

On November 24, 1859, *On the Origin of Species* was published. In this book, Charles Darwin introduced a scientific theory – the Theory of Evolution. Darwin’s work illustrated that populations evolve over time through a process of natural selection. Darwin based his theory on the evidence available to him at the time – personal observations from his travels on the *HMS Beagle* and fossil evidence. He also used the writings of Sir Charles Lyell and Thomas Malthus to support his views.

Further evidence to support this theory comes from the relatively new fields of comparative biochemistry, comparative genomics and bioinformatics.

1. (a) Research the following:

* the human genome project
* comparative biochemistry, comparative genomics and bioinformatics
* processes involved in comparative genomics and comparative biochemistry
* the use of comparative biochemistry, comparative genomics and bioinformatics as evidence for the Theory of Evolution
* the benefits of using comparative genomics, comparative biochemistry and bioinformatics
* applications that exist for the use of comparative genomics and comparative biochemistry.

(3 marks)

(b) You must include your references in a standard referencing format of your choice; for example, APA, MLA, Harvard or Chicago. Hand this in as a separate sheet attached to your note-taking sheet. (2marks)

**Part B: In-class assessment (20 marks)**

Answer each part of the following question on the lined paper provided.

Responses could include clearly labelled diagrams with explanatory notes; lists of points with linking sentences; clearly labelled tables and graphs; and annotated flow diagrams with introductory notes.

2. (a) A source of evidence for evolution is the examination of fossils and their surroundings.

Different comparative studies may also be used to support the theory of evolution. Two of   
 these involve studies in biochemistry; namely, protein sequences and DNA.

Describe the **two** comparative studies, protein sequences and DNA, and explain how they   
 show evidence for evolution. (10 marks)

(b) The Human Genome Project has provided more supporting evidence for the theory of evolution

by providing a better comparison between the DNA of modern humans and hominids and extinct humans and hominid species. Explain how the project could also help to treat genetically inherited diseases. (3 marks)

(c) Discuss how comparative genomics works with bioinformatics to determine evolutionary relationships. (7 marks)

# Marking Key for Unit 4 Evidence for evolution extended response

## Further evidence for evolution: comparative biochemistry, comparative genomics and bioinformatics.

1. (a)Research the following:

* the human genome project
* comparative biochemistry, comparative genomics and bioinformatics
* processes involved in comparative genomics and comparative biochemistry
* the use of comparative biochemistry, comparative genomics and bioinformatics as support for the Theory of Evolution
* the benefits of using comparative genomics, comparative biochemistry and bioinformatics
* applications that exist for the use of comparative genomics and comparative biochemistry.

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| --- | --- |
| **Description** | **Marks** |
| Research presented in a note-taking format | 1 |
| Notes are concise and do not include irrelevant information | 1 |
| Notes cover all recommended research areas | 1 |
| **Total** | **3** |

(b) You must include your references in a standard referencing format of your choice; for example, APA, MLA, Harvard or Chicago. Hand this in as a separate sheet attached to your note-taking sheet.

|  |  |
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| **Description** | **Marks** |
| Minimum of four references | 1 |
| Correct format used for selected referencing type | 1 |
| **Total** | **2** |

2. (a) A source of evidence for evolution is the examination of fossils and their surroundings. Different comparative studies may also be used to support the theory of evolution. Two of these involve studies in biochemistry, namely protein sequences and DNA.

Describe the **two** comparative studies, protein sequences and DNA, and explain how they show evidence for evolution.

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| --- | --- |
| **Description** | **Marks** |
| **Protein** **sequences**   * proteins made of long chains of amino acids * determines the type and sequence of amino acids/describes a method of sequencing * Western blotting to detect specific proteins in a sample * using similar/ubiquitous proteins (e.g. cytochrome c) in different species * compares the sequence in different species | 1–4 |
| Species that are distantly related have more differences in their amino acid sequence/closely related, more similarities/more time has passed since common ancestry | 1 |
| **DNA**   * code/sequence in DNA is different for different species * determines the sequence * hybridisation/forming hybrid DNA from different species/more heat required to separate strands that have been fused from two species, more similar DNA/electrophoresis/other new methods of sequencing use of ERVs/virus inserting into a gamete DNA to compare non-functional DNA * compares the sequence in different species | 1–4 |
| Species that are distantly related have more differences in their DNA/closely related, more similarities/more time has passed since common ancestry | 1 |
| **OR** |  |
| **Mitochondrial DNA**   * code/sequence in DNA is different for different species * determine sequence * hybridisation/forming hybrid DNA from different species/more heat required to separate strands that have been fused from two species, more similar DNA/electrophoresis/other new methods of sequencing * inherited only from the mother * higher rate of mutation than nuclear DNA * amount of mutation corresponds to amount of time passed | 1–4 |
| Estimate closeness of relationship through maternal ancestry/useful for same species or closely related species/more time has passed since common ancestry | 1 |
| **Total** | **10** |

(b) The Human Genome Project has provided more supporting evidence for the theory of   
evolution by providing a better comparison between the DNA of modern humans and   
hominids and extinct humans and hominid species. Explain how the project could also help   
to treat genetically inherited diseases.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Three** points discussed on how the project could help to treat genetically inherited diseases |  |
| **Answer could include, but is not limited to:** |  |
| * allows faulty/mutated genes to be identified * once identified, the reason for the dysfunction/abnormal protein can potentially be identified * potentially, then, genes can be replaced/switched off/bypassed/gene therapy * treated with correct protein to cure the disease/genetic engineering * genetic counselling * develop individually specific treatments | 1–3 |
| **Total** | **3** |

(c) Discuss how comparative genomics works with bioinformatics to determine evolutionary relationships.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Seven points discussed on how comparative genomics and bioinformatics are used | 1–7 |
| **Total** | **7** |
| **Answer could include, but is not limited to:** |  |
| * the genome is a complete sequence of the base pairs that make up all of the DNA of an organism/including genes * comparative genomics allows the comparison of two or more genomes * the base sequences in DNA can be expressed as data that is easily read by computer software * bioinformatics provides the IT platform for the data provided by genomics * this platform is capable of storing and managing the large amount of information provided by genomic studies * bioinformatics allows for the analysis and comparison of genomes * by analysing the similarities and differences between the genomes, it is possible to determine the evolutionary closeness of the organisms * the more DNA two organisms have in common, the closer the evolutionary relationship * comparisons of genomes provide information on genes essential for life which, in turn, can lead to a possible mechanism for evolution | 1–7 |