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91606



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Level 3 Biology 2022

91606 Demonstrate understanding of trends in human evolution

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of trends in human evolution.	Demonstrate in-depth understanding of trends in human evolution.	Demonstrate comprehensive understanding of trends in human evolution.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (▨). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Excellence

TOTAL

19

2 *unusually large brain size, an
linked to its size.* ←

QUESTION ONE: *HOMO BODOENSIS*

Source: www.dailymail.co.uk/sciencetech/article-10140669/Meet-Homo-bodoensis-Newly-identified-ancient-human-species-lived-Africa-500-000-years-ago.html

Source: <https://atlasvirtual.com.br/homobodoensis.htm>

Researchers suggest that a skull found in Bodo D'ar, Ethiopia, East Africa in the 1970s belongs to neither *Homo heidelbergensis* or *Homo rhodesiensis*, but instead, is a new species entirely. Both mitochondrial DNA (mtDNA) and nuclear DNA (nDNA) have yet to be sequenced.

Homo bodoensis has been suggested as a direct ancestor of our species *Homo sapiens*. The *Homo bodoensis* species hasn't been identified from new fossils, but on the re-examination of old ones. *Homo bodoensis* is currently estimated to have lived between 770 000 and 126 000 years ago, with the specimen shown dated to around 500 000 to 600 000 years ago.

The fossil of the skull has an enlarged cranium compared to *Homo erectus*, but smaller than *Homo sapiens*, which suggests it is an intermediate species between them. *Homo bodoensis* is not thought to be an ancestor of the Neanderthals or the Denisovans, as the cranium does not share similar features. The endocranial capacity is estimated to be approximately 1250 cm³.

A number of other remains previously thought to be *Homo heidelbergensis* have also been reclassified as *Homo bodoensis*. Based on these remains, there are suggestions that *Homo bodoensis* may have reached south-east Europe, but died out there about 200 000 years ago.

Discuss how new knowledge can lead to changes in human evolution theories.

In your answer:

- describe what is meant by the terms hominin and endocranial capacity
- explain how new DNA evidence (from mitochondria (mtDNA) and nuclear (nDNA)) can be used to approximate times of species divergence, and how this DNA evidence might support the Out of Africa Theory of modern human origins
- discuss how changes to the cranium and hand bones would benefit the lifestyle of *Homo bodoensis* compared with earlier hominins.

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nerick's or be
further developed*

(replacemnt)

hominin ~~mean~~ refers to modern humans and their immediate ancestors. endocranial capacity is ^{related to} the size of the brain case in the skull and how much room there is for the brain to grow and develop. Using DNA evidence from mitochondria and nuclear, we can trace a direct line of ancestors all from the remains of *H. habilis*, allowing us to approximate the time of divergence by looking for a common ancestor the species shared with another species. (Mitochondria DNA is useful as it is only inherited by the mother allowing a direct line of ancestors to be traced) This DNA evidence might support the replacement theory as it could show that *H. habilis* originated in Africa and did not interbreed with other ~~early~~ human species before migrating out into Asia & Europe. It ~~could also explain some~~ ~~work~~

Changes to the cranium would benefit the lifestyle of *H. habilis* as his larger cranium ^{and brain case} indicates a larger brain capacity than earlier hominins such as *H. erectus*. This would allow for higher brain function and the ability for complex thought, planning, and communication. This would benefit *H. habilis* as this would allow for greater collaboration with other individuals and enable the development of complex tools which, due to the changes in hand bones, would be significant in

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increasing ~~that~~ survivability, ~~and~~ success in hunting, and thus reproductive success. The hand bones being better adapted to hold tools while walking upright would improve the lifestyle of the H. bodoensis because it could more effectively carry food or young, or use a weapon or tool. This ^{improvement} ~~increase~~ in tool making and use would allow the H. bodoensis to hunt larger prey and have a supply of high grade meat food, allowing for more time developing social evolution such as language, interacting, caring for young and shelter building. The larger skull allowed for such a large brain and brain capacity, 1250cm^3 , which would have further benefited H. bodoensis as it could coordinate better, ~~but~~ build better tools, and plan smarter, improving the lifestyle of this species. Increasing survivability and reproduction success.

QUESTION TWO: NEANDERTHALS



<https://www.smithsonianmag.com/science-nature/rethinking-neanderthals-83341003/>

Neanderthals evolved in Europe and Asia while modern humans were evolving in Africa. Judging from fossil evidence from northern Spain and England, Neanderthals were already well established in Europe by 400 000 years ago.

Neanderthals ranged widely – from Portugal and Wales in the west across to the Altai Mountains of Siberia in the east. The range changed a lot, due to the effects of the ice age, when at times, there were land bridges and at other times, ice or water. Around 300 000 years ago Neanderthals developed a stone tool technology known as the Levallois technique. This involved making pre-shaped stone cores that could be worked into a finished tool at a later time. It meant Neanderthals were free to travel away from sources of raw material and yet be able to make tools when needed.

The bone damage found on Neanderthals suggests they were assisted in their recovery after injury.

Ancient DNA began to be recovered from Neanderthal fossils in 1997, and this has led to the reconstruction of several complete genomes. These indicate that Neanderthals living from Spain to Siberia were relatively low in both population and diversity during their last 20 000 years. The genome of one female individual from the Altai Mountains also shows signs of long-term inbreeding in her population.

It seems that regular, and sometimes extreme, climatic fluctuations continually fragmented Neanderthal groups during the last 100 000 years, preventing them from building up large populations and continuous distributions across their range.

Discuss reasons for both the success of, and the extinction of, Neanderthals.

In your answer:

- describe how the ice age influenced the movement of populations of Neanderthals
- explain an advantage and a disadvantage to Neanderthal society of caring for injured group members
- discuss how even though Neanderthals were advantaged by having the Levallois technique for tool manufacture, the species did not survive past approximately 39 000 years ago.

The ice age cause neanderthals to move further south to escape the dropping temperatures and lack of resources, however they also cause a lowering of sea levels creating land bridges to islands and other continents, allowing for greater dispersal in order to find resources & reduce intraspecies competition. An advantage of ~~the~~ caring for the injured to the neanderthal society is that it reduced mortality rates and ^{helped} maintain the population of the group and if the individual recovered it meant they could continue contributing to the group, collecting food, hunting, caring for others & however a disadvantage of caring for the injured is that it takes time and energy from other group members who could be focused on reproduction or ~~food~~ collecting/hunting food, or making tools. And if the injured dies, there is no long term benefit for the group and they have wasted food, energy, time, and resources to keep them alive. The replacement theory states that the neanderthals were out competed by H. sapiens, causing them to die out. This is the main reason why neanderthals did not survive past approximately 39,000 years ago. The upper

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of sapiens

paleolithic tool culture was far superior to the mesolithic tool culture of the neanderthals and with a larger brain capacity the sapiens could ~~not~~ survive in the same ecological niche of the neanderthals better and so ~~was~~ had a better reproductive success and eventually out competed the neanderthals who did not have a sufficient resources to continue their population. Despite neanderthals having a head start on the sapiens, having evolved from erectus in europe and Asia well before sapiens left Africa, it was not able to establish a large stable population or continuous distribution due to extreme climatic fluctuations such as glacial period. This, along with the ~~near~~ neanderthals inferior tool culture of flint axes, elaborates, and other tools compared with the sapiens' flint spears, arrows and knives, caused the neanderthal to not survive past 39,000 years ago.

The upper paleolithic tool culture enabled sapiens to hunt prey much more successfully & effectively than the neanderthals despite having the Levallois technique, which was soon adopted by sapiens, enabling them to out compete the neanderthals and drive them to extinction.

QUESTION THREE: MOVEMENT OF HOMININS

Fossil evidence shows that our ancestors became bipedal first, and this was followed by changes to the teeth and jaws. It was only much later that our larger and more complex brains set us apart as *Homo sapiens*, leading to the domestication of animals such as the dog about 10000 years ago, and the pig about 8000 years ago.

Discuss aspects of *Homo sapiens* evolution and movement into the Pacific.

In your answer:

- describe how a cooler and drier Africa resulted in a selection pressure for bipedalism
- explain what smaller teeth can tell us about the hominin lifestyle
- discuss how the more complex brain would have led to the success of domestication of dogs and pigs and how these enabled *Homo sapiens* to successfully migrate through Europe and into the Pacific.

The cooler and drier Africa lead to the selection pressure of new niches opening up in the new habitat of the savannah. With no trees to swing through and tall grass to see over, bipedalism was selected for as long distance walking was now possible in a cooler drier Africa while forests shrank increasing competition and causing early bipedalism to be favoured as a way to find food better in a new unoccupied niche. Smaller teeth tell us that the early hominin lifestyle involved eating soft, higher grade food than apes as ~~smaller~~ less energy could be afforded to be put into teeth as the new foods such as fruit, vegetables and meat through scavenging/hunting required smaller teeth to digest.

The more complex brain led to the domestication of dogs & pigs as the ~~an decrease~~ increased brain capacity would have allowed for more efficient hunting due to communication and improved tools/weapons. This would lead ~~make more~~ less time needing to be spent on ~~the~~ finding food, and more time ~~on~~ for less important tasks such as domestication. The efficiency of hunting would also allow for the keeping of dogs and pigs as there would be excess food to feed their people as well as their animals. Further development in the frontal lobe would have enabled planning and reasoning which would have allowed sapiens to ~~think~~ realize the advantages domestication would bring. This domestication of dogs and pigs would have enabled sapiens to successfully migrate through Europe and into the Pacific as they would have provided ~~an~~ additional meat readily available that they could ^{easily} bring ^{without it going off} with them (pigs) enabling them to ~~not~~ spend more time walking and less time hunting. The dogs would also ease migration as their tracking skills would facilitate ~~finding~~ finding prey, and their speed and bite would make it ~~possible~~ to hunting more successful and the bringing down of larger prey possible. This increase in hunting success and ease would enable migration as it would make it much easier for sapiens to feed themselves while on the move and enable

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leave enough time in the day for walking in order to reach the pacific. The dogs would also increase protection of the group, preventing predator attacks killing the sapiens in the new areas across asia. These reasons are why the pig and dog being domesticated enabled sapiens to migrate from Europe to the pacific through asia as the process was facilitated through better hunting and food collection and protection.

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Standard	91606	Display ID 614656	NSN 136237589 School 77	Total score	19
Q	Grade score	Annotation			
1	5	Attempts to cover all aspects including mentioning earlier hominins however no indepth knowledge of the difference or use of mtDNA or nDNA.			
2	7	The link between the ice age and travel across land bridges is well established, as is the information about caring although the reason for caring could be better. The links to the technique used by Neanderthal is very clear with specific given on the tools.			
3	7	This answer is clearly linked to the question with clear links to the reason for bipedal locomotion selection and also the brain linked to specifics that would then link to domestication and the advantage while travelling.			