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NZQA

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Level 3 Biology, 2017

91606 Demonstrate understanding of trends in human evolution

9.30 a.m. Thursday 16 November 2017
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 and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

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

Achievement

TOTAL 11

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QUESTION ONE

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Biological evolution of the hand has been important in hominin evolution. Below are the hands of *Ardipithecus ramidus* and *Homo neanderthalensis*. Changes in the evolution of the hand are strongly linked to changes in the environment.

Ardipithecus ramidus

http://scienceblogs.com/laelaps/2009/10/02/will-the-earliest-known-homini/
http://science.sciencemag.org/content/326/5949/70.full

Homo neanderthalensis

https://iphesnews.wordpress.com/2015/06/30/why-did-neander-thals-use-the-teeth-as-a-third-hand/
http://pubpages.unh.edu/~jel/images/Neanderthal_grip.jpg
http://kids.britannica.com/students/assembly/view/202300

Analyse the evolutionary trends displayed in the hands shown above, AND discuss how changes in the environment and bipedalism would lead to these evolutionary changes.

In your answer:

- describe two evolutionary trends in the structure of the hands shown above
- explain how changes in the environment are likely to have led to the changes you have identified
- discuss the adaptive advantages that changes in the hand and bipedalism could have provided.

opposible thumb
power grip
tools

There are 2 evolutionary trends in the structure of the hands, shown above. One of these is the structure of the thumb. The thumb in H.s Homonins, in this case, H. neanderthalensis is opposible. This allows for the hand to grip onto tools. This adaptive advantage allows for the individual to make much more ~~tools~~

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complex tools and use the hand for griping and ~~throwing~~ fully functioning tools, by ~~no~~ holding them, and not dropping them. This evolving of the hand allows for an evolving of much more complex tools, because individuals are able to be precise with their blows to the tool material. The change in ~~the thumb structure~~ is inline with the ~~evolutionary trend of bipedalism.~~ change in the environment. As the environment became much hotter, and therefore forest areas became much smaller and spread out. This allowed for bipedal individuals to move from one area to another. The opposible thumb allowed for individuals to hold on to weapons well travelling. It also allowed for individuals to make tools for hunting, when a change of diet, into a more protein focused diet occured. H. neanderthalensis, had a much more complex brain, than that of A. ramidus which is evident in the ability to make much more complex tools. It wouldn't be possible to hold and blow more intricate tools if the ~~#~~ hands of H. neanderthalensis wasn't as complex. Also a change in environment resulted in a hunter-gatherer lifestyle meaning the picking of berries and grip of tools for slicing meat was essential for their survival. ~~Another~~

There is more space for your answer to this question on the following page.

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structural difference is the long ~~hands~~ ~~of A. ramidus~~. The long fingers and short thumb in A. ramidus no longer was needed due to no brachiation occurring in the change in environment H. neanderthalensis didn't need to swing from tree to tree finding food resources, instead it travelled on foot to find its resources, that where no longer solely plant material, instead protein from meat was much more prominent. The adaptive advantage of bipedal movement allowed for hominins to move from one place to another with less expenditure of energy. It freed up the hands, allowing for the evolutionary structural changes of the hand to occur, so they could make and add tools with precision grip aswell as allowing the hand to grab and change the cultural evolution of painting/drawing. The evolution of the hands and bipedalism provided many advantages to survive in their habitat by providing them a energy efficent way to move from one location to another aswell as making it easier to survive by making tools and gathering resources,

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The examination continues on the following page.

QUESTION TWO

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Oldowan chopper
www.aggsbach.de/wp-content/uploads/2014/07/fighcehd.jpg

Acheulean hand axe
https://nz.pinterest.com/pin/79376012161481249/

Neolithic axe
https://chw3m1.wikispaces.com/Neolithic+Types+of+Tools+or+Weapons-+Materials+and+Use?responseToken=e872917f8c94dca9e00d062639f33374

Fire
http://wonderopolis.org/wonder/how-was-fire-discovered

Birthing canal of selected hominins
https://aspergerhuman.files.wordpress.com/2014/10/800px-homo_erectus_pelvis21.jpg

Average size of cranial capacity in selected hominins
http://fhs-bio-wiki.pbworks.com/w/page/24003004/Hominid%20evolution

The advancement in cultural evolution such as the development of clothing, tools, language, and the use of fire has had an effect on biological evolution.

Explain how cultural evolution can affect biological evolution. AND justify the effect this had on the evolutionary trends of the skull and pelvis.

In your answer:

- describe the difference between cultural and biological evolution
- describe the trends in cultural evolution and biological evolution of the skull and pelvis, and explain the selective pressures that could lead to these cultural changes
- justify how cultural evolution has affected biological evolution of the skull and pelvis.

Cultural evolution is the change in the development in areas such as tools, language

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and the use of fire, whereas biological evolution is the change of the body such as skeletal structure, ~~enzymes~~ and brain size. There are two structural changes that have occurred due to a change in cultural evolution. One structural change is the size of the skull. As ~~humans to~~ H sapiens brains became more developed, so did the complexity of tool culture. For example A. afarensis only had the brain capacity to do 1 to 2 blows to make their tools from cedemential rock. This is reflected in the size of their brain and therefore the skull size, the skull of A. afarensis is much ~~smaller than that~~ of H. sapiens. This is ~~because~~ reflected in the ~~evolu~~ cultural evolution of the tool culture. As seen in the size of the H. sapiens of the new borns skull, H. Sapiens have a much larger cranial size than that of both A. afarensis and H. erectus. This is reflected in the tool culture of the neolithic axe. The axe is made up of 3 differently sourced materials. The brain needed to comprehend carving wood, weaving to attach the large metal to use as an axe. This comprehension required a large brain to be able to do this. This is evident because the circumferenc

There is more space for your answer to this question on the following page.

of a H.sapiens newborns head is 320 - 370mm whereas H.erectus is ~316mm. The culture Another factor is the discovery of controlling fire. The ability to do so allowed for longer days which meant they could hunt for longer and do more work. It also allowed for people to stay up longer and create language. The formation of the broncas and wernicks area was crucial for comprehending and remembering language, which resulting in brain capacity, and subsequently the enlargement of the skull. Because the skull size increased, the pelvis underwent biological evolution to prevent complications of child birth, by being larger enough for the child to be birthed though. This is evident because the pelvis has increased from ~353mm in H.erectus to ~355mm in H.sapiens. This goes hand in hand with the increase in skull size. The pelvis is much wider and narrow than that of early hominins to support the larger skull of a newborn in modern H.sapiens, and needs less surface area to attach strong leg muscle, like a hominids head.

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A3

QUESTION THREE

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There is a lot of debate about how modern humans dispersed throughout the world. As more fossil evidence is discovered, and DNA is extracted and analysed, the ideas of human dispersal have changed in recent years. The two main widely accepted theories are the multiregional theory and the replacement theory (out of Africa theory).

Multiple sources of evidence are used to support each theory, such as DNA analysis, mtDNA analysis, and fossil structure.

Replacement theory (out of Africa theory)

Multiregional theory

Adapted from: http://anthro.palomar.edu/homo2/images/models_of_Hss_evolution.gif

Compare and contrast the replacement theory (out of Africa theory) with the multiregional theory, explaining how different evidence supports each theory, and any challenges involved.

In your answer:

- describe the replacement (out of Africa) and multiregional theories
- explain how different sources of evidence are used to support each theory, and the challenges with using fossil evidence
- compare and contrast the replacement theory (out of Africa theory) with the multiregional theory.

The out of Africa theory believes that early ~~H. erectus was~~ H. sapiens where established in Africa and then dispersed to euro-asia, and then evolved into modern humans. In contrast the multiregional theory believes that H. ~~habilis~~erectus left africa into euro-asia and evolved independently, but remained related due to continous gene flow. fossil analysis and discovery

There is more space for your answer to this question on the following pages.

has been researched, and ~~some~~ people in Europe and Asia have more neanderthal DNA than people from Africa, this discovery supports the multi-regional theory. However mtDNA analysis shows that everyone has a bit of 'Lucy' found in Africa ~~H. erectus~~ DNA, supporting the out of Africa theory. MtDNA is only inherited ~~through~~ maternily, and undergoes very little mutated and therefore is a good indication of evolution. Also the discovery of 'lucy', A. afarensis, in Africa, her fossil remains support the out of Africa theory. ~~The~~ Both theorys believed that H. habilis originated from Africa, however only the multi-regional theory believes that ~~but~~ evolution of early humans occurred independtly, with gene flow. Only the out of Africa theory believes that all early H. sapiens originate from Africa and that other hominin species died out (extinction). The mutti-regional theory however believes that modern humans resulted from all 5 areas and gradually, through gene flow, evolved into H. Sapiens, and the european and asian inhabitated species didn't become extincted.

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Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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Subject:	Biology	Standard:	91606	Total score:	11

Q	Grade score	Annotation
1	A4	The candidate described evolutionary changes in the structure of the hands between *A. ramidus* and *H.neanderthalensis.* In addition, the candidate was able to describe the changes in the environment as well as describing the advantages that bipedalism provided in this new environment. In order to gain Merit the student needed to clearly **link** and **explain** in depth how this new environment favoured or suited changes to the hand or the evolution of bipedalism.
2	A3	The candidate did not provide a clear definition of the terms: biological and cultural evolution. The candidate was able to identify trends in the biological evolution of both the skull and pelvis from the resource provided. In order to gain Merit the candidate needed to explain how specific cultural changes such as tools, fire etc from named hominin species provided the selective pressures which lead to changes in the biological evolution of these early hominins. The candidate only provided depth in reference to the skull and not the depth required for changes to pelvis.
3	A4	The candidate was able to accurately describe the Replacement and Multi-regional dispersal theories. The candidate was able to briefly provide evidence for both of these theories, however, in order to gain Merit the candidate needed to explain the challenges involved when interpreting fossil evidence.