



Tuesday 13 January 2015 – Morning

LEVEL 2 AWARD THINKING AND REASONING SKILLS

B902/01/RB Unit 2 Thinking and Reasoning Skills Case Study

RESOURCE BOOKLET (CLEAN COPY)

Duration: 1 hour



INSTRUCTIONS TO CANDIDATES

- This is a clean copy of the Resource Booklet which you should already have seen.
- You should refer to it when answering the examination questions which are printed in a separate booklet.
- You may **not** take your previous copy of the Resource Booklet into the examination.
- You may **not** take notes into the examination.

INFORMATION FOR CANDIDATES

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- This document consists of **12** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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DOCUMENT 1

Background information

De-extinction, sometimes referred to as resurrection biology, is an area of science that works on bringing extinct species 'back to life'. It is controversial for many reasons, especially because some people feel it is altering the natural order of things. The two methods currently used are cloning and selective breeding.

'Dolly' the sheep was produced by cloning in 1996. DNA from one sheep was injected into an egg. After many failed attempts, one egg was successfully fertilised and was then implanted into a surrogate ewe. The egg developed and Dolly was born in the normal way.

When Dolly was born she had identical DNA to the sheep from which the injected DNA was taken, but shared no DNA with the ewe that gave birth to her. Dolly was initially healthy, but had to be put down in 2003 due to a lung disease that was a side-effect of the cloning process. This cloning was a scientific breakthrough, but people were concerned about its scientific and ethical implications.

Scientists have since applied this method of cloning to de-extinction. They have injected the DNA from the remains of an extinct animal into the egg cell of a similar living species. There have been several films and novels produced that present creative plots about the risks of using this technology to bring back extinct species. For example, 'Jurassic Park' is about the chaos created by the de-extinction of dinosaurs. To 'resurrect' any dinosaur species is not really possible as they existed too long ago, but scientists have experienced some degree of success in cloning a bucardo (an extinct wild goat) and they are working on other projects, such as the passenger pigeon and the woolly mammoth.

The other technique used in de-extinction is selective breeding. This takes much longer to produce substantial results as it encourages changes over multiple generations. Only close relatives of a living species can be produced in this way.

Stem cell technology is another option for de-extinction, but it is not yet advanced enough to produce the results achieved by cloning.

DOCUMENT 2

A report published in the Daily Mail newspaper, 2013**How woolly mammoths could roam Earth again: Scientist who cloned Dolly the sheep believes ancient beast CAN be resurrected**

Woolly mammoths could roam Earth again, according to one eminent scientist who believes frozen DNA from newly discovered frozen mammoths could be the key to the species' resurrection. While he believes the ancient animal could be re-introduced to the world – an idea reminiscent of Jurassic Park – there are ethical dilemmas.

Stem cell scientist Sir Ian Wilmut who is best known for cloning the world's first mammal, Dolly the sheep, thinks modern techniques could be used to create a replica of a woolly mammoth. Sir Ian said "I think it should be done as long as we can provide great care for the animal. If there are reasonable prospects of them being healthy, we should do it. We can learn a lot about them."

Just last month, the most complete body of a woolly mammoth was recovered from the Siberian permafrost. This captured the imaginations of the science community and the general public about the possibility of seeing the giant creatures walk Russia's plains again. The baby mammoth, called Yuka, lived around 39,000 years ago and her body is currently on display in Yokohama, Japan, where visitors can see her incredibly preserved fur and tissue. Samples from the little mammoth have been sent to laboratories in South Korea and Russian researchers hope to clone her.

Interestingly, Sir Ian said he is not terribly optimistic about the scientists' chances as there are many technical challenges. The process of cloning also requires a female – in this case probably an Asian elephant – to provide eggs and carry a baby, but elephants themselves are rare. Sir Ian believes it is 'inappropriate' to collect 500 eggs from the animals when they themselves are at risk of extinction.

He suggests that the best way to create a woolly mammoth is to re-programme good quality cells extracted from frozen mammoths using modern stem cell techniques, which have already been used to give birth to mice. Sir Ian thinks it could be 50 years before the technology is developed enough to create a woolly mammoth, but at least the time frame could give scientists a chance to work out if the idea is a good one, in order to avoid a disastrous scenario reminiscent of Jurassic Park.

People are worried that the science must be developed enough to create friends for a mammoth very quickly in order to care for the animal's welfare. This concern would not matter if scientists cannot get good quality cells from bodies of frozen mammoths and while Sir Ian says the prospects of reintroducing the mammoth to the Earth is 'fairly unlikely' he thinks there is a chance.

DOCUMENT 3

Readers' responses to Document 2

Comments

why why why!!! nature intended for them to die out for a reason stop messing!
Common Sense UK, United Kingdom

Scientists are so heartless. In my biology lesson I learnt they wasted 276 sheep eggs before they produced Dolly the sheep. If they did this with elephant eggs to try to revive the woolly mammoth then elephants would soon become extinct themselves.
Craig, Newtownards

Resurrecting a woolly mammoth is well worth doing because it's the biomedical equivalent of putting a man on the moon. After the moon landings lots of children wanted to be an astronaut, and this will inspire a whole generation of children to become biomedical scientists.
David, Bromley

I've no idea why people are obsessed with bringing back a woolly mammoth. It's just a hairy elephant!
Bobby, Cardiff

They should also bring back sabretooth cats and giant ground sloths so we can have the stars of the movie Ice Age in the flesh.
Jonathan, Bangor

We don't know how they behaved, they could be exceptionally aggressive for all we know and end up wiping out other endangered species.
Akiba, Bourne

Oooh, I so want to see a T-rex before I die (er, hopefully not JUST before I die...)
Donna, United Kingdom

DOCUMENT 4

An extract from an article published in National Geographic in 2013

The revival of an extinct species is no longer a fantasy. But is it a good idea?

On July 30, 2003, a team of Spanish and French scientists reversed time. They brought an animal back from extinction, if only to watch it become extinct again. The animal they revived was a kind of wild goat known as a *bucardo*. The bucardo was a large, handsome creature, reaching up to 220 pounds and sporting long, gently curved horns. For thousands of years it lived high in the Pyrenees, the mountain range that divides France from Spain, where it clambered along cliffs, nibbling on leaves and stems and enduring harsh winters.

Then came the guns. Hunters drove down the bucardo population over several centuries. In 1989 Spanish scientists did a survey and concluded that there were only a dozen or so individuals left. Ten years later a single bucardo remained: a female nicknamed Celia. A team from the Ordesa and Monte Perdido National Park, led by wildlife veterinarian Alberto Fernández-Arias, caught the animal in a trap, clipped a radio collar around her neck, and released her back into the wild. Nine months later the radio collar let out a long, steady beep: the signal that Celia had died. They found her crushed beneath a fallen tree. With her death, the bucardo became officially extinct.

But Celia's cells lived on, preserved in labs in Zaragoza and Madrid. Over the next few years a team of reproductive physiologists led by José Folch injected nuclei from those cells into goat eggs emptied of their own DNA, then implanted the eggs in surrogate mothers. After 57 implantations, only seven animals had become pregnant. And of those seven pregnancies, six ended in miscarriages. But one mother—a hybrid between a Spanish ibex and a goat—carried a clone of Celia to term. As Fernández-Arias held the newborn bucardo in his arms, he could see that she was struggling to take in air. Despite the efforts to help her breathe, after a mere ten minutes Celia's clone died. A necropsy later revealed that one of her lungs had grown a gigantic extra lobe as solid as a piece of liver. There was nothing anyone could have done.

The dodo and the great auk, the thylacine and the Chinese river dolphin, the passenger pigeon and the imperial woodpecker—the bucardo is only one in the long list of animals humans have driven extinct, sometimes deliberately. And with many more species now endangered, the bucardo will have much more company in the years to come. Fernández-Arias belongs to a small but passionate group of researchers who believe that cloning can help reverse that trend.

DOCUMENT 5a

A selection of different arguments against de-extinction**Source A** John Macintyre, manager of a Museum of Natural History

Bringing animals back to life is a bad idea. Creatures go extinct when they are no longer able to survive in changing environments, so bringing them back is just inviting them into an unsuitable, dangerous environment that they won't survive in for long anyway. To quote my favourite line from *Jurassic Park*, 'just because we can doesn't mean we should'.

Source B Harry Johnson, an environmentalist

The cloning technology being developed for de-extinction could better be used to help preserve endangered species that don't breed easily in captivity. For example, zoos have had to resort to some very weird methods to get giant pandas to mate so that they don't go extinct. Cloning them now would prevent them from going extinct in the first place. There are 20,000 species in danger of extinction that need our help. The problem with bringing back a species that has already gone extinct is that we don't have a suitable environment to put them back into safely. So, we should put our cloning efforts and expertise into endangered, not extinct, animals.

Source C Helen Carter-Lee, an American evolutionary biologist

There is an urgent need to save threatened species and habitats, but there is no urgent need to bring back extinct ones. Why invest millions of dollars in bringing a handful of species back from the dead, when there are many thousands still waiting to be discovered, described, and protected?

Source D Stephen Green, an animal rights activist

It is cruel to experiment in this way. Remember, the surrogate for a mammoth would be an elephant. Elephants are smaller than mammoths and are pregnant for nearly two years. Most of the pregnancies will fail, which might be traumatic for the elephant, but that might be kinder than if the mammoth baby is too big for an elephant to give birth to. Elephants are intelligent, emotional creatures that were not designed to be woolly mammoth factories. If we let this go ahead, before we know it we'll be seeing tabby cats giving birth to sabretooth tigers and spider monkeys giving birth to Neanderthal humans!

People will stop trying to prevent species from going extinct if we can just bring them back anyway, so de-extinction will undermine conservation efforts.

DOCUMENT 5b

A selection of different arguments in favour of de-extinction**Source E** Edward Peters, a British scientist working on the Bucardo Research Project

We have an obligation to try to bring a species back that died out because of us. Some people argue that reviving a species that no longer exists is like 'playing God', but I think we played God when we exterminated these animals. So, we should continue to work on correcting the mistakes of our ancestors.

Source F Alexei Petrov, a Russian ecologist

Woolly mammoths and other herbivores would have benefits for the ecosystem, because they used to break up the soil and fertilise it with their manure. After they had gone extinct, the grassland deteriorated. Therefore, we ought to do everything we can do to bring back the woolly mammoth. I only wish they would breed quickly, so that I could be alive to see them roam the Earth freely again.

Source G Graeme Kelly, a zoo owner

Reviving long lost species will really help to restore the Earth's deteriorating biodiversity. We would all benefit from being able to see and study as many species as possible.

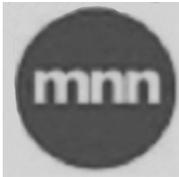
We are facing big problems as a result of global warming, and so we need all the help we can get. Global warming was not a problem back when these creatures were around, so we should bring them back to solve the problem.

Source H Jacinta Da Silva, a scientist

We can do it so we should try. It's not just for curiosity, we may gain some benefits we would never have anticipated. The genes of extinct species might have enormous potential for many applications including the development of new biomedicines.

DOCUMENT 6a

Extract from a conservationist website in 2013



Mother Nature Network



Neanderthal

The Neanderthal is perhaps the most controversial extinct species eligible for cloning and resurrection because the surrogate species would be *us*. As the most recently extinct member of the *Homo* genus, Neanderthals are widely considered a subspecies of modern humans. Cloning them might be controversial, but it could also be illuminating.

A Neanderthal clone would also probably be most viable. Scientists have already completed a rough draft of the Neanderthal genome, for instance.

The question is not so much “could we do this?” but “should we?”

DOCUMENT 6b

Readers' Comments**Jennifer, Bakewell**

Has the world gone mad? And for the Neanderthal to be spoken of as if they would be dumb makes me sick! Yes they were not as advanced as us but now in society they would more than likely flourish! Science has gotten out of hand! Human beings have gotten out of hand! If it wasn't for deforestation, pollution, greed, etc. many of these creatures would still be walking the earth now!

Jonathan, Dundee

Neanderthals actually had a larger brain cavity than us, so they should have the same rights as us, and if they are raised the same way as a human, I think they'd have the same capabilities.

Daniel, Rhyl

If we could reserve an uninhabited island somewhere and place a family of Neanderthals there it would be amazing to watch them live out their lives and see what they build!

Simon, St. Ives

I would be worried about the ability of this primitive man to fit into a 'modern' society. And would he be discriminated against? Also, would they be at odds with humans, once they're brought back? Where would they live? This is one curious case, for sure. Very interesting, to say the least.

Lisa, Dudley

Please please please do not resurrect Neanderthal, they are pretty much cavemen, a less evolved version of us! It scares me to think what could happen if we brought these back ...

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