Growing Up in the Universe

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Design your own organisms!

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In this unit students can learn:

- the world contains objects that have been designed, like bowls or microscopes, but also living objects that look like they have been designed but have in fact not been
- that evolution by natural selection accounts for this appearance of design
- that organisms can evolve to be interdependent

How this learning fits into the National Curriculum

Art: In addition to learning in science, this unit can allow pupils to produce 'imaginative images, artefacts and other outcomes that are both original and of value.' (Art Key Stage 3 – Key Concept 1.1). It can allow pupils to 'develop ideas and intentions by working from first-hand observation, experience, inspiration, imagination and other sources…make purposeful images and artefacts, selecting from a range of materials, techniques and processes…draw to express perception and invention, to communicate feelings, experiences and ideas, and for pleasure' (Art Key Stage 3 – Key processes 2.1). It allows pupils to make links between art and design and other subjects and areas of the curriculum. (Art Key Stage 3 – Curriculum Opportunities 4).

English: In addition to learning in science, this unit can allow pupils to 'make fresh connections between ideas, experiences, texts and words, drawing on a rich experience of language and literature…[use] inventive approaches to making meaning, taking risks, playing with language and using it to create new effects…[use] imagination to convey themes, ideas and arguments, solve problems, and create settings, moods and characters' (English Key Stage 3 – Key Concept 1.2). It allows opportunities for pupils to 'write clearly and coherently, including an appropriate level of detail…write imaginatively, creatively and thoughtfully, producing texts that interest and engage the reader…generate and harness new ideas and develop them in their writing' (English Key Stage 3 – Key processes 2.3 Writing: Composition). It allows pupils to 'develop ideas, themes, imagery, settings and/or characters when writing to imagine, explore and entertain' (English Key Stage 3 –

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Range and content 3.3). It allows pupils to make links between English and other subjects and areas of the curriculum (English Key Stage 3 – Curriculum opportunities 4). Philip Pullman, an extract from whose work appears in this unit, is a recommended author at Key Stage 3.

Notes for teachers

Activity	*Extra information and guidance*	*Video clips*
Simple objects, Designed objects and Designoid objects	This exercise clarifies the differences between what Richard Dawkins refers to as Simple, Designed and Designoid objects. It explores the fact that the world contains objects that have been designed, like bowls or microscopes, but also objects that look like they have been designed but have not been and have in fact arisen through evolution by natural selection – this lecture calls those objects 'designoid'. The video clips give definitions and discuss examples of each type of object.	This first extract clarifies the difference between objects which are designed and those which might appear to be designed but are not. *Design and Designoid objects* (from 00:53 'Today's lecture is about the problem...' to 08:17 '...billion of times more complicated than the microscope.') This extract briefly summarise the processes of natural selection and also discusses artificial selection. *Design and Designoid objects* (from 23:49 'Well, I hope that's enough...' to 28:36 '...smaller and smaller wolves.)
Co-evolution of organisms	This exercise defines what is meant by co-evolution and is an important lead-in to the 'Alternative Earth' activity. Co-evolution is defined and then some examples are offered, drawn from the video	This first extract illustrates some examples of organisms adapting to their environments, not co-evolution but includes important examples of camouflage. *Climbing Mount Improbable*

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	clips. Students should add in further detail to the activity sheet based on their viewing of the video clips.	(from 00:54 'This is a stick insect...' to 3:33 '...and the bird mistakes it for a thorn.') This extract includes several examples of co-evolutions which should be examined to complete this activity. Particularly, the interdependence of bees and flowers is described: what bees gain from flowers and what flowers gain from bees. *The Ultraviolet Garden* (from 5:56 'Flowers, the bees might say...' to12.30 '...using their wings to carry pollen about.')
Wheelies and seed pods	This is a further stimulus for students' creative work. This is a world as imagined by Philip Pullman in his novel *The Amber Spyglass*. An example of co-evolution in an imaginary, alternative world is described.	
An alternative Earth	Students can produce a piece of creative writing where they imagine they are transported to an alternative earth, where evolution has produced different plants and animals from those found on our earth. It is important that they explain in their stories how the different animals and plants fit together, to demonstrate their understanding of how evolution works. Alternatively, students can produce sculptures or pictures	

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	of the life found on their alternative earth – they should be able to explain how the shape and function of their organism has come about.	

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Simple objects, Designed objects and Designoid objects

Using your own examples as well as those from the video clips, complete the table below.

Type of object	*Description*	*Examples*
Simple	*Objects which are not designed and came about by physical processes only*	
Designed	*Objects which are designed by humans for a particular purpose*	
Designoid	*Objects which appear to be designed but are not, instead coming about through evolution by natural selection*	

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Co-evolution of organisms

Co-evolution just means ‘evolving together’. For example, imagine a predator and its prey. The prey may evolve over a long period to become faster and nimbler and so is more likely to avoid the predator. The predator may also evolve to become faster too and so more likely to catch the prey. The predator and its prey have co-evolved.

How have the following pairs of organisms co-evolved? Use the video clips to help you answer.

Organisms	*How have they co-evolved?*
Bees and flowers	
Hammerhead orchids and wasps	
Bucket orchids and bees	

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Wheelies and seed pods

In this extract from *The Amber Spyglass* by Philip Pullman, we have a picture of a world where evolution has produced very different animals and plants from those on Earth, but where the animals and plants are **interdependent** in similar ways. Mary Malone has stepped from our Earth into another world, where she has noticed strange creatures with legs arranged in a diamond shape, 'two in the centre, one at the front, and one under the tail' and massive trees with huge wheel-shaped seed pods.

'What she saw made her head spin. At first it looked like a motorcycle gang. Then she thought it looked like a herd of wheeled animals. But that was impossible. No animal could have wheels. She wasn't seeing it. But she was.

There were a dozen or so. They were roughly the same size as the grazing creatures, but leaner and grey-coloured, with horned heads and short trunks like elephants'. They had the same diamond shaped structure as the grazers, but somehow they had evolved, on their fore and rear single legs, a wheel.

But wheels did not exist in nature, her mind insisted; they couldn't; you needed and axle with a bearing that was completely separate from the rotating part, it couldn't happen, it was impossible –

Then, as they came to a halt not fifty yards away, and the dust settled, she suddenly made the connection, and she couldn't help laughing out loud with a little cough of delight.

The wheels were seed-pods. Perfectly round, immensely hard and light – they couldn't have been designed better. The creatures hooked a claw through the centre of the pods with their front and rear legs, and used their two lateral legs to push against the ground and move along.' (The Amber Spyglass *(Scholastic, 2001) pp. 91-2)*

In the story, it turns out that the animals need the seedpods to travel the long distances from their huts to their herds of animals more quickly, and that the hard seed-pods need the constant battering of this travel to finally crack and for their seeds to be released and germinate to grow more trees. This interdependence of organisms is a feature of life on our earth too.

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An alternative Earth

Imagine that you have transported to an alternative Earth, where the process of evolution has produced difference plants and animals from those found on our Earth. Think about how the shape and structure of these plants and animals and how they might have co-evolved to be interdependent like bees and flowers on Earth, or the organisms from 'The Amber Spyglass.'

- *Write a story or poem describing the animals and plants that you have found on the alternative Earth and explaining how they are dependent on each other.*

You could also:

- *Draw pictures of the animals and plants from your alternative Earth, showing how they have co-evolved. You can label your drawings to give more information on how they are dependent on each other.*
- *Produce a sculpture or model of some of the organisms from your alternative Earth. Explain how they are dependent on each other.*