

# Darwin's Birthday

This information gap relates Darwin's life, the impact and development of theories of evolution and the conflicts between scientific and religious ideas about life on earth and the natural world. This first draft is probably best suited to Year 9 up, but I am looking at ways in which a series of shorter texts with key visuals could be developed. I would welcome suggestions and corrections since I have rushed it a bit to make sure it is available for the birthday in February.

The webaddress for this activity is:

<http://www.collaborativelearning.org/darwinsbirthday.pdf>

Last updated 4th February 2009

## COLLABORATIVE LEARNING PROJECT

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We support a network of teaching professionals throughout the European Union to promote inclusive education. We develop and disseminate accessible talk-for-learning activities in all subject areas and for all ages.

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## BRIEF SUMMARY OF BASIC PRINCIPLES BEHIND OUR TEACHING ACTIVITIES:

The project is a teacher network, and a non-profit making educational trust. Our main aim is to develop and disseminate classroom tested examples of effective group strategies that promote talk across all phases and subjects. We hope they will inspire you to develop and use similar strategies in other topics and curriculum areas. We want to encourage you to change them and adapt them to your classroom and students. We run teacher workshops, swapshops and conferences throughout the European Union. The project posts online many activities in all subject areas. An online newsletter is also updated regularly.

\*These activities are influenced by current thinking about the role of language in learning. They are designed to help children learn through talk and active learning in small groups. They work best in non selective classes where children in need of language or learning support are integrated. They are well suited for the development of speaking and listening . They provide teachers opportunities for assessment of speaking and listening.

\*They support differentiation by placing a high value on what children can offer to each other on a particular topic, and also give children the chance to respect each other's views and formulate shared opinions which they can disseminate to peers. By helping them to take ideas and abstract concepts, discuss, paraphrase and move them about physically, they help to develop thinking skills.

\*They give children the opportunity to participate in their own words and language in their own time without pressure. Many activities can be tried out in pupils' first languages and afterwards in English. A growing number of activities are available in more than one language, not translated, but mixed, so that you may need more than one language to complete the activity.

\*They encourage study skills in context, and should therefore be used with a range of appropriate information books which are preferably within reach in the classroom.

\*They are generally adaptable over a wide age range because children can bring their own knowledge to an activity and refer to books at an appropriate level. The activities work like catalysts.

\*All project activities were planned and developed by teachers working together, and the main reason they are disseminated is to encourage teachers to work more effectively with each other inside and outside the classroom. They have made it possible for mainstream and language and learning support teachers to share an equal role in curriculum delivery. They should be adapted to local conditions. In order to help us keep pace with curriculum changes, please send any new or revised activities back to the project, so that we can add them to our lists of materials.

# Darwin's Birthday – notes on information gaps and a guide to further reading

Information gaps are extremely helpful in making dense and complex ideas more accessible by breaking things down into manageable chunks, and providing a structure for discussion and negotiation. They also provide an opportunity for disparate and detailed material to be introduced to small groups, who can then reform to use the material as evidence for broader discussion around big ideas. I hope of course that after doing this activity, children will want to read more and discuss more. I also hope you will provide more pictorial material; there is masses available online at the moment, but I have concentrated in these notes on the information that helped to develop this activity, which has taken a lot longer than most of our gaps to assemble and is likely to change quite a lot after it is more thoroughly tried out. I reread the *Origins of the Species* and the *Descent of Man* and also drew on the following sources:

Although the Darwin exhibition, originally developed by the American Museum of Natural History in New York City, is now on show in London, the detailed webview of the exhibition can only be found on the AMNH site:

<http://www.amnh.org/exhibitions/darwin/>

and is an excellent follow up for pupils keen to find out more. It contains a great deal of the text on show at the exhibition; text which is difficult to read *in situ* because it is written in small type and the light is poor to save damaging the artefacts. The London NH Museum offers a thinner resource, but there is an excellent simulation game on evolution where you become a bird and have to eat bugs to survive

<http://www.nhm.ac.uk/nature-online/evolution/what-is-evolution/natural-selection-game/the-evolution-experience.html>

I drew on Richard Dawkins' books for ideas and his website has a good selection of resources:

<http://richarddawkins.net/forum/viewtopic.php?f=4&t=19713>

I also drew on the CofE Darwin page, but can't find how to get to it from the CofE homepage

<http://www.cofe.anglican.org/darwin>

The Vatican website doesn't provide any links that I can find, but if you google 'vatican darwin' there is a lot of information.

The TED talks (technology, entertainment, design) contain a lot of excellent short videoed talks including one by Dawkins:

<http://www.ted.com/index.php/talks/list>

Lastly atheist and humanist views on evolution can be found on:

<http://www.atheistbus.org.uk/>

<http://www.humanism.org.uk/home>

<http://www.secularism.org.uk/>

This is of course not an exhaustive list and I would welcome suggestions.

## General Information on Collaborative Reading Materials with an Information Gap.

These are a set of different texts with a common question sheet. The principle here is that readers will be unable to complete the questions by simply using the information in their version, but will have to collaborate with other readers, asking questions and eliciting information, possibly arguing and negotiating. There is also an opportunity to draw on their own previous knowledge and other information that might be provided.

We have outlined the following procedure for a class of thirty using three texts, but you can reorganise things in a variety of ways. You can have four texts (as in this activity) or more. You can possibly arrange to pair slower readers with faster ones etc. You could start with threes rather than pairs etc. It is better to organise your groups before the lesson. Teachers who do a lot of group work want everyone in the class to work with everyone else at some point. They give their pupils different identities which will immediately sort them into different groups with different sizes and different composition.

The class works first in pairs or threes and these groups have copies of the same text. For example: five pairs could have Sheet A, five Sheet B etc. Pupils can read the text silently first, and then to each other, and then work together to answer as many questions as they can. They need to know that not all the answers are in their text and that they are very welcome to draw on their own shared knowledge/prior learning. Everyone in the group needs to make notes on their answer sheet since they will subsequently move to a group where their information is unique to them. They become experts.

The pairs/threes then split up and move into colour (or you can organise the name of your new groups around the topic you are studying) groups of six where two participants have Sheet A, two Sheet B etc. They can then go on to complete the questions by interrogating and informing each other.

If you are thinking about producing your own information gaps, you may find it easier if you try this method. Find a suitable whole single text containing the information you wish to teach. Formulate a series of questions for the text. Produce three or four texts where the factual and inferential information is shared between them. Some overlapping of information is fine. You may decide to provide texts of varying difficulty. There is an example of this online at <http://www.collaborativelearning.org/foodandbabies.pdf>

# Darwin's Birthday - Text A

Charles Darwin was born on 12th February two hundred years ago. He hated school, especially learning Latin, but he loved reading and studying the details of the natural world. He had a famous grandfather who was a radical thinker. Erasmus Darwin was the doctor of George III, an inventor of engines and very interested in natural philosophy. In fact, Erasmus had influenced the ideas of Mary Shelley who wrote Frankenstein. His mother, Susannah, was the daughter of Josiah Wedgwood. The Wedgwood pottery was very advanced for its time. The Wedgewoods were radical, technological minded business people.

Charles Darwin went first to Edinburgh to study medicine. He met a lot of radical thinkers. He also met a freed slave who taught him to stuff birds. His father thought he was lazy, and sent him to study theology in Cambridge. He might then have become a clergyman, and spent a quiet life studying natural history. However, he was invited to travel around the world on a government survey ship called the Beagle as a companion for the captain. He thought he was going to be away for two years, but he was away for five years. Everywhere he went he collected specimens. He collected rocks and fossils. He collected plants and animals. He wrote lots of notes and made lots of drawings. He also met a wide variety of human beings. He saw slaves in Brazil, and was very shocked and angry. He strongly disagreed with Captain Fitzroy who thought that slaves were an inferior family of humans who had to be controlled.

After he came back to England, he married another Wedgwood, and moved to Kent. He continued to study plants and animals, and think about how forms of life were linked to each other. He was worried about publishing his ideas, because he thought many people would be angry about them. Only when he heard that someone else was going to publish similar ideas he published "The Origin of the Species" in 1859. This book was about natural selection in animals, but he decided not to write about humans. When others put forward the theory that there were eight different races of men that had evolved separately he decided to publish "The Descent of Man" in 1871. He put all the races in one family and undermined the arguments for slavery. Many thousands of copies of the book were published. It was quickly translated into many languages. His ideas were taken up by sociologists, psychologists, biologists, politicians and philosophers. Many people were worried that his ideas were dangerous.

Many advances in science—the development of genetics after Darwin's death, for example, have greatly increased our thinking about evolution. Even with our new knowledge of genes and DNA, the theory of evolution still persists today much as Darwin first described it, and is universally accepted by scientists.

# Darwin's Birthday - Text B

Some ideas in science are difficult to understand, because our intuitions don't like them very much. Some scientists argue that this may be because our brains have not evolved fast enough, and are better designed to work for small groups of hunter/gatherers. This is what most of us were doing four to five thousand years ago. So, for instance, we think we have a good chance of winning the National Lottery, we see significance in coincidences and we read astrology predictions and only remember when they come true.

We have trouble in comprehending very large and very small things. We have trouble comprehending the distance to the sun and other stars and galaxies. We have trouble getting our heads around the age of the earth.

Sometimes analogy, metaphor and even poetry can help our understanding. Imagine you are lying in the bath looking at your big toe poking up out of the water. Imagine you are the size of the toe, and you are lying in a smaller bath looking at your big toe. How many times would you need to do this to be the size of a cell? A molecule?

The earth is about 4.5 billion years old, and life on earth is much shorter than that: 4,000 million years. Stretch out your arms. From the beginning of life at your left hand fingertips, there is nothing except bacteria until well beyond your right shoulder. Invertebrates turn up at your right elbow and dinosaurs in the palm of your right hand. Dinosaurs go extinct in the last joint of your big finger. A thin nail clipping represents the time 200,000 years ago since homo sapiens appeared. You would brush off the whole of recorded history (5000 years) with one brush of a nail file.

Richard Dawkins, who works hard to make science comprehensible to non-scientists, has an analogy to help to explain evolution through natural selection and the mutations of genes. Imagine a mountain five miles high with a vertical precipice on one side and a gentle slope (4 thousand million miles long) on the other. When we look at a squid (500 million years old) it is difficult to imagine how it evolved into a monkey. It is difficult even to comprehend the five million year journey from chimpanzee to human being. The slope at the back of the mountain is so gentle that you would probably have to pedal down it on a bicycle. Animals have evolved up this gentle slope through natural selection and mutation. The changes have not been steady. They go in spurts for a thousand years or so and then nothing much happens for a few thousand more.

# Darwin's Birthday - Text C

Before Darwin was born, most people in England thought that species were not linked in a single "family tree." They were unconnected, unrelated and unchanged since the moment of their creation. Earth itself was thought to be 6,000 years old. There would not have been time for species to change. People were not part of the natural world; they were above and outside it. They had been created to rule over the animals. Many also believed that there were superior races created to rule over inferior races. Before 1800, only a handful of naturalists in England and France had given the idea of evolution serious consideration. And even they couldn't see how there could have been enough time for evolution to occur.

After Darwin returned from his trip around the world, he began to think about all the different animals and plants he had found. Darwin relied on his notebooks. In them, he jotted private ideas, questions and fragments of conversations related to his thinking on "transmutation"; what we now call "evolution." The notebooks reveal a great mind homing in on a great idea: plants and animals are not fixed and unchanging. Instead, all species are related through common ancestry, and they change over time. By the late summer of 1842 Darwin felt ready to commit an outline of his theory to paper. The main points were clear: plants and animals with useful variations were likely to live longer. That meant they could leave more offspring, some of which would carry the new variation. Over time, species could change through this process of natural selection.

Darwin did not rush to publish. He lived on inherited wealth and was part of the establishment. The world was full of reform and revolution. The 1848 revolutions in France, the 1867 Reform Bills giving richer working classes the vote, the American Civil War, the Fenian uprisings in Ireland created unease. As a young man he wanted to see the end of slavery, but later he showed racial prejudice against the Irish. He did not always agree with social reform. His books when published cost the same as a working man's weekly wage. When Annie Besant and Charles Bradlaugh were accused of obscenity by publishing a birth control leaflet, Darwin refused to support their case.

The tension between scientific theory and social change still exists. The current atheist buses are an example. Even nowadays, atheism is viewed by many as immoral and destructive. The Humanist Society is national charity supporting and representing people who seek to live good lives without religious or superstitious beliefs. Their vision is of a world without religious privilege or discrimination, where people are free to live good lives on the basis of reason, experience and shared human values. They want 12th February to become Darwin Day. Our increasing knowledge of evolution puts us in the strong position of being able to counteract the worse effects of natural selection.

# Darwin's Birthday - Text D

Natural selection is a simple mechanism that causes populations of living things to change over time. In fact, it is so simple that it can be broken down into five basic steps: V.I.S.T.A.: Variation, Inheritance, Selection, Time and Adaptation. Members of any given species are seldom exactly the same, either inside or outside. Organisms can vary in size, colour, ability to fight off diseases and countless other traits. These traits arise from spontaneous mutation and enable the organism to survive and pass them to future generations.

DNA contains a set of instructions for building bodies. When organisms reproduce, they pass on their DNA. The traits are encoded in the DNA and offspring often inherit the variations of their parents. Tall people, for example, tend to have tall children.,

Overwhelming evidence shows us that all species are related – that is, that they are all descended from a common ancestor. One hundred and fifty years ago, Darwin saw evidence of these relationships in striking anatomical similarities between diverse species, both living and extinct. Today, we realize that most such resemblances, in both physical structure and embryonic development, are expressions of shared DNA, the direct outcome of a common ancestry.

Cave-dwelling tetra fish are blind; they have small vestigial eyes that do not work. Then why have them at all? Biologists have long struggled to explain, how natural selection could fully account for such degenerations, and recently they have found another possible answer: genetic mutations that hamper eye development also may increase the number of taste buds. Thus, mutations that happened to give the fish an advantage in tasting and smelling, a huge benefit in a dark environment, might also have caused the degeneration of their eyes. Humans also have vestigial features, evidence of our own evolutionary history. The appendix, for instance, is believed to be a remnant of a larger, plant-digesting structure found in our ancestors.

influenza viruses can evolve very rapidly by frequent mutation. Each year scientists study flu viruses from around the world in order to find out how they have evolved. They then create a vaccine designed to help the body's immune system ward off the most dangerous of the upcoming year's mutants. This process has saved countless lives. Any one vaccine can help immune systems fight only some varieties of flu. The viruses newly evolved survive and reproduce . New flu vaccines are needed every year to fight newly evolved or re-emergent varieties of the virus. This shows how mutations in viruses help them to survive, but humans suffer.

# Darwin's Birthday - Question sheet with space for answers.

1. Can you name two or more historical events that happened in Darwin's lifetime?	2. How did Darwin earn his living?	3. Why was Darwin slow to publish his ideas?	4. How do viruses survive?
5. How do we pass on our traits to our offspring?	6. How was the earth and the origins of life viewed before Darwin?	7. What are vestigial features and can you think of some examples..	8. How did Darwin's ideas influence social change?
9. How do analogies help us to understand difficult concepts?	10. What stimulated Darwin to think about evolution?	11. How did Darwin's views undermine the idea of slavery?	12. Why are Darwin's theories still considered controversial?