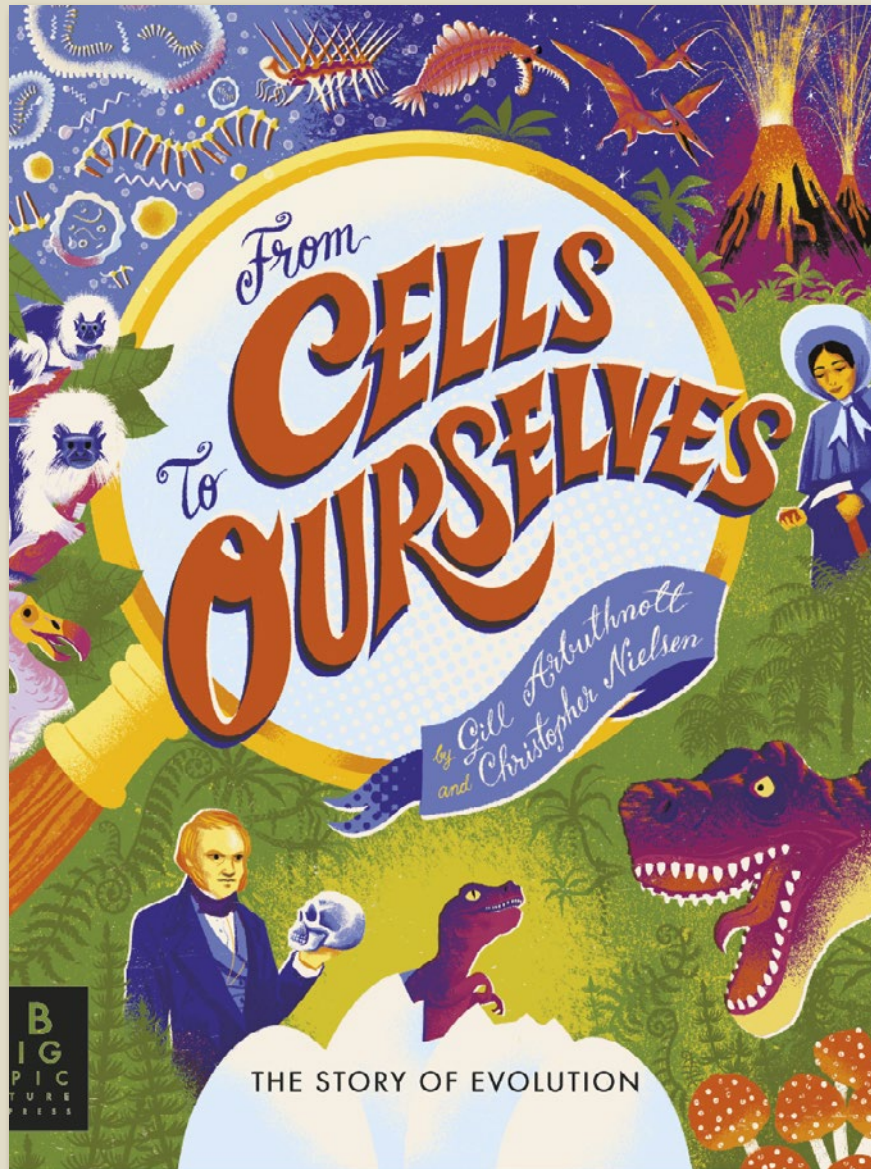


From Cells to Ourselves



From the Big Bang to the abundance of life that surrounds us today, this beautiful book is the story of evolution, from the very first cells to ourselves.

- The third title in the *Balloon to the Moon* series, which won the 12-16 category in the British Book Design and Production Awards 2019
- A wonderful combination of mythology, science and history that takes readers on a journey through one of the most fascinating subjects in natural history
- Gill Arbuthnott is a former secondary school science teacher.
- Cover treatments: 100% foil, uncoated varnish

From Cells to Ourselves

HOW DID LIFE BEGIN?

THE 1920s American chemist Stanley Miller and British biologist Harold Urey conducted an experiment in 1953 that simulated the conditions of the early Earth. They used a mixture of water, methane, ammonia, and hydrogen gas, and subjected it to electrical sparks. The result was the formation of amino acids, the building blocks of proteins.

THE 1950s British biologist Francis Crick and American physicist James Watson discovered the structure of DNA, the molecule that carries genetic information. They proposed the 'double helix' model, which showed how DNA could replicate itself.

THE 1960s American biologist Lynn Margulis proposed the theory of endosymbiosis, which suggested that mitochondria and chloroplasts were once free-living organisms that were taken into a larger cell and became part of it.

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THE 1990s American biologist James Watson and British biologist Francis Crick discovered the structure of DNA, the molecule that carries genetic information. They proposed the 'double helix' model, which showed how DNA could replicate itself.

THE 2000s American biologist Lynn Margulis proposed the theory of endosymbiosis, which suggested that mitochondria and chloroplasts were once free-living organisms that were taken into a larger cell and became part of it.

THE 2010s American biologist James Watson and British biologist Francis Crick discovered the structure of DNA, the molecule that carries genetic information. They proposed the 'double helix' model, which showed how DNA could replicate itself.

THE 2020s American biologist Lynn Margulis proposed the theory of endosymbiosis, which suggested that mitochondria and chloroplasts were once free-living organisms that were taken into a larger cell and became part of it.

THE DINOSAUR DETECTIVES

In the 19th century, scientists discovered, investigated and named many species of dinosaurs. But for the first time, these dinosaur detectives:

MARY ANNING (1799-1847) was a fossil collector in Lyme Regis, Dorset. She discovered the first Ichthyosaurus fossil in 1830. She also discovered the first Plesiosaurus fossil in 1830. She was the first woman to be recognized as a fossil collector.

WILLIAM BUCKLAND (1784-1861) was a geologist and paleontologist. He discovered the first dinosaur fossil in 1824. He was the first to name a dinosaur, Megalosaurus.

RICHARD OWEN (1804-1892) was a geologist and paleontologist. He discovered the first dinosaur fossil in 1824. He was the first to name a dinosaur, Megalosaurus.

OSBORN MARTELL (1790-1852) was a geologist and paleontologist. He discovered the first dinosaur fossil in 1824. He was the first to name a dinosaur, Megalosaurus.

THE GREAT OXFORD RIVALRY was a competition between two paleontologists, Richard Owen and Henry De la Beche, to name the first dinosaur, Megalosaurus.

THE END OF THE DINOSAUR AGE

For a long time, people believed that the dinosaurs were the last survivors of a long line of animals that had lived on Earth for millions of years. But in the 19th century, scientists discovered that the dinosaurs were not the last survivors of a long line of animals that had lived on Earth for millions of years. They discovered that the dinosaurs were the last survivors of a long line of animals that had lived on Earth for millions of years.

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EARLY IDEAS ABOUT EVOLUTION

How long is a million seconds? Have you been alive for one billion seconds? What was happening a million days ago? We find it very difficult to comprehend these huge numbers. If we don't have a feel for how long a million seconds is, how can we possibly comprehend time spans of millions or billions of years? This is one reason why some people have a problem with evolution. The idea that single, primitive cells evolved into all the species that have ever lived seems incredible, unless you get to grips with the timespans involved.

In ancient Greece, philosopher Anaximander suggested that one type of animal could change into another, while Empedocles thought that new types of living things could be made from a range of parts that already existed.

Theologian Gregory of Nazianzus and Augustine both thought that although God had created all the original animals and plants, new types had developed from them. Their ideas were in response to the practical problems that would have arisen from trying to put two of everything into the Ark.

The naturalist George-Louis Leclerc proposed a way for the Earth to have formed from debris in space. Although he believed in spontaneous generation, he thought that animals could change as they migrated to different conditions. This later explains the discovery of elephant fossils in North America, and mammoth fossils in Siberia, although living elephants are today only found in Africa and South Asia. He suggested the American ones had become extinct, while the mammoths had changed as they migrated south.

Erasmus Darwin was Charles Darwin's grandfather. He was a doctor, poet and naturalist, and in his book Zoonomia, or 'The Laws of Organic Life', he was one of the first people to propose a theory of evolution. He never hit on the idea of natural selection, but did recognise the importance of sexual selection (see page 59) and realised it could cause changes in species.

GRADUAL CHANGES

In the early 1800s Jean-Baptiste Lamarck, inventor of the terms 'invertebrate' and 'biology', was the first person to develop a coherent theory of the development of life on Earth and its evolution. He believed that life had originated by spontaneous generation, rather than creation by deity, and had then become more complex and varied over many generations. Lamarck suggested how this could happen. His idea is often called the 'Theory of Evolution by Acquired Characteristics'. In simple terms, he thought that the more an animal used an organ during its lifetime, the more well-developed it would become and that these changes could be inherited by offspring if both parents had the same developments.

THE EVOLUTION OF THE GIRAFFE'S NECK, ACCORDING TO LAMARCK:

- 1) Early giraffes had short necks.
- 2) Giraffes reach upward to graze on leaves.
- 3) This stretches their necks very slightly over their lifetimes.
- 4) The next generation of giraffes inherits these slightly longer necks.
- 5) This process is repeated over many generations until we arrive at modern, long-necked giraffes. Lamarck was not suggesting that their necks suddenly shoot out like telescopic poles!

THE PROCESS ALSO WORKED THE OTHER WAY:

- 1) Early penguins had wings with which they could fly.
- 2) Penguins spend most of their time swimming and very little flying.
- 3) Their wings become smaller, with smaller feathers, from lack of flying.
- 4) The next generation of penguins inherits these smaller, more flipper-like wings.
- 5) This process is repeated over many generations until we arrive at the modern penguin, which can no longer fly and whose wings are now adapted to help it swim instead.

Pub Date	15/02/2024
Pub Price	£16.99
ISBN	9781800781368
H x W	300 x 235mm
Binding	Hardback
Age Range	7-9 years
Author	Gill Arbutnott
Illustrator	Chris Nielsen
Extent	80pp
Word Count	12000 words
Rights Available	World