LIFE HISTORIES

4K

8 × 50 min.

4K, 5.1 + Stereo

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TERRA MATER
Factual Studios

Why do plants and animals look the way they do? Why do they live where they do? In short, why is life like it is?

To answer these questions, we set out on an epic journey that takes us across the whole planet, from poles to tropics, and through 4 billion years of life's history. Our story ranges from the greatest animals to walk the Earth, to the unseen world of microbes and even molecules, from the workings of the whole planet to the world of quantum mechanics—and everything between. In the last decade, scientists have revolutionised our view of the natural world, and in this unique series we'll paint a new picture of life on Earth—the greatest story ever told.

In eight episodes, we lay out the great sweep of the story of life on Earth, using stunning blue chip-cinematography, high-end CGI, and the latest imaging techniques from the world of science. These include environmental scanning electron and confocal microscopy, which produce startling images of normally unseen worlds, along with moving X-rays and time lapse CT scans that reveal the inner workings of life in a completely new way. There will also be contributions from some of the top scientists in the many and varied fields that add to this unique story.

'Life Histories' brings together many different scientific disciplines for the first time in a TV series, to tell the definitive story of life on Earth. For example, recent discoveries show that we must explore the world of quantum mechanics to understand how birds use the Earth's magnetic field to navigate—how, thanks to the strange phenomenon of entanglement, they can literally "see" the magnetic field.

The episodes will not have a simple chronological or geographical structure. Instead, each will pick a key turning point in the story of life and unfold the story from that perspective. Each of these turning points (for example, the evolution of eyes, movement, brains, co-operation, etc.) had huge ramifications, both for life itself and for the planet as a whole. As we trace those ramifications, we must ask some of the biggest questions in the natural sciences: where did life come from, why do we have sex, why do we die, what is consciousness and why did it evolve? The latest science suggests answers to some questions, yet deepens the mystery of others.

Each film unfolds in a roller-coaster journey across the planet and through time, which reveals some unexpected connections. Can an understanding of why some animals are hot-blooded also explain why sauropod dinosaurs grew into the biggest creatures ever to walk the planet? Some scientists think so. As we draw together stories from the molecular and cellular worlds and from our dynamic planet, with more familiar views of the natural world, we'll come to understand the living world in a different way. We present a more complete picture of the natural world than ever before, and we will realise that only with this deeper understanding can we appreciate the true beauty of life on Earth.

Episode 1: Patterns of Life

Life is everywhere on planet Earth—a dazzling array of animals, plants, fungi and unseen but spectacular microorganisms. All life exhibits patterns: distribution patterns, patterns of growth and development, patterns of evolution. But where do these patterns come from? The first episode sets out the scale of the series by exploring all the different levels that contribute to these patterns, from the workings of the whole planet to the interactions of individual molecules. Strange distribution patterns—and even some behaviour—are explained by the slow movements of continents across the globe, and the advance and retreat of ice sheets. Today's patterns of plants and animals are also influenced by mass extinctions, including the most severe—when life almost died. Yet, the body plans of mammals, dinosaurs and birds emerged from the aftermath.
We visit the boiling springs of Yellowstone and New Zealand to find one of the most basic patterns in life, generating two fundamentally different life forms—bacteria and archaea. Understanding this fundamental split in life

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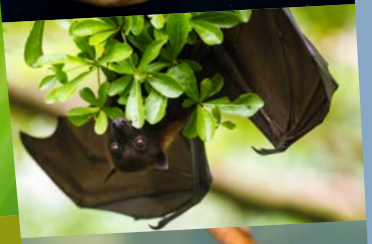


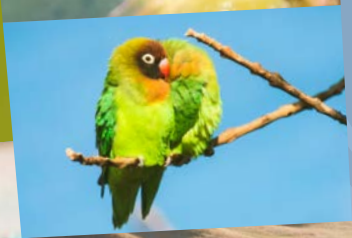




leads us to look for the origins of life itself.
In the deep sea, the magical world of the Lost City is a landscape of towers and chimneys—an alkaline vent. These structures likely sparked the first stirrings of life, leaving us to conclude that the last common ancestor of all life on our planet was—a rock …

Episode 2: Living together

Evolution by natural selection is driven by competition, but to understand why life is as it is, we explore the very opposite—cooperation.
Many animals and plants co-operate, but, in a world of selfish genes, it isn't clear why.
We explore some strange partnerships, such as that between a wasp and a virus, and between single-celled algae and spotted salamanders. But the most extreme examples of living together are the great insect societies. We now know that termites are actually social cockroaches, so find the origins of this complex society in a rotting log in the southern Appalachian Mountains.
Here, wood roaches live in small village societies, compared to the metropolis of a termite mound.
But ants, bees and wasps developed societies, because their strange genetics makes co-operation an advantage for the selfish genes. And co-operation in nature takes place at many levels. Every animal and plant is a collection of trillions of cells, all working in harmony. So what drove this partnership? This is the quest for the origin of animals, which depended on an even earlier partnership. In episode 1, we met two fundamentally different life forms—bacteria and archaea. Yet, all other life is a combination of both of these. Complex cells arose when a bacteria entered an archaean host cell and multiplied, becoming tiny structures, a mitochondria, bringing almost unlimited energy to its host, allowing the evolution of today's familiar animals and plants.

Episode 3: The Joy of Sex

It's said that sex is a ludicrous and messy business, yet is a major influence on the shape of life. But it's not obvious why it's such a good idea.
The driving force of life is the 'selfish gene'—that 'wants' to make as many copies of itself as possible, and sex is not the most efficient way to do this. Far better for females to reproduce asexually, without mating. A few animals (and many plants) do this, from whiptail lizards in the American desert, to a group of tiny creatures called rotifers that could be living in your garden pond. But most asexual species don't last long in terms of evolution—except the rotifers that have existed without sex for millions of years, confounding scientists. Sex generates a bigger variety of genomes, so organisms adapt more quickly to new conditions, but there are disadvantages. Males and females contribute different amounts to the next generation, with females usually putting in most of the effort, an inequality that began when only the female contributed mitochondria to her offspring.
This creates a battle of the sexes that has raged for billions of years and underpins some curious aspects of the natural world, such as why nearly one third of penduline tit nests are abandoned and the chicks left to starve, or why some animals have reversed the normal sex roles, with females becoming gaudy to attract males.

Episode 4: Seeing Daylight

Look around the natural world—eyes seem to be everywhere, peering back at you.
The many different forms of eyes all do the same thing—gather light and send an image of the world to the brain. Only 6 out of the 36 major groups of animals evolved eyes, yet they are so successful that they make up 96% of living species. The ability to detect light shapes the world around us. On any piece of land, there are more ecological niches (ways of making a living) during the day than at night. And there are more niches in the sunlit world than in the dark of the deep sea or caves. Evolution seems to be faster in the light (for animals that can see).
We'll find that giant deep sea amphipods and peculiar cave-living crustaceans called remipedes have changed little compared to their relatives in daylight.
Light is such a pervasive influence, it may have even caused the amazing flowering of life around 500 million years ago—the Cambrian explosion, when an extraordinary diversity of animals seemed to appear suddenly in the fossil record. The first complex eyes belonged to arthropods, which became lethal predators. The rest of life had to evolve defences rapidly to cope with this new world, which created all the bizarre forms we see in ancient rock formations in China and Canada, and which have preserved a world in turmoil.

Episode 5: Life in the Fast Lane

When exploring the patterns of life, one factor splits the animal world in two: warm blood.
Put simply, mammals and birds are 'warm-blooded'—their body temperature stays constant, while 'cold-blooded' animals' temperatures vary with the surroundings. But some cold-blooded creatures can maintain a constant body temperature—large pythons become warm-blooded when they incubate their eggs, curling their vast bodies around their clutch. Some cold-blooded creatures regulate their temperature by complex basking behaviour. Lizards can pool blood in 'blood sinuses' in their heads, so warm up in the morning sun by poking their heads out of their burrows. Bumblebees and moths warm up by disconnecting their flight muscles and shivering them—one bumblebee can even live in the Arctic! So, if being cold-blooded is so effective, there's a big mystery. Warm-blooded animals generate heat from within their bodies, even when doing nothing—a huge waste of energy.

To find out why, we visit the greatest mass extinction of all at the end of the Permian, which killed 95% of all life. Conditions were inhospitable on Earth for tens of millions of years afterwards—low oxygen levels and searing temperatures, so many reptiles returned to the sea. But some animals evolved ways to extract what oxygen there was, among them the ancestors of mammals, and the ancestors of birds and dinosaurs. Both these groups evolved warm-blood independently, probably because rising oxygen levels gave them enough spare oxygen to fuel their energy-rich life styles.

Episode 6: Green Machines

Flying over the canopy of a tropical rainforest, there is no doubt that plants dominate the planet. From the massive trees of the rainforest, to the trillions of microscopic plants in the ocean, they provide food, they are the lungs of the Earth, and now we know they helped to shape the direction of all life on Earth.
So why are plants like they are? Why do they behave as they do (yes, plants do have behaviour)? Where did they come from? How have they influenced the patterns of life—and the Earth itself?
We begin in the spectacular Valley of Flowers in the Himalayas. Flowers and insects evolved together, each driving the evolution of the other, creating the diversity we see today. But where did the first flower come from? We visit New Caledonia in the Pacific, to look for clues in the world's most primitive flowering plant. Plants are the Earth's lungs, because they produce oxygen by photosynthesis—but initially, this nearly killed off all life. Life existed for hundreds of millions of years in an atmosphere free of oxygen, until one kind of bacteria (cyanobacteria) evolved photosynthesis, generating oxygen as a by-product. But life adapted to this new gas, using it to 'burn' sugars, generating more energy than was possible before. So, plants not only feed the world, they established the chemical reactions that allow complex animals to exist at all.

Episode 7: Restless Life

Look into a full-length mirror and think about what you see. Most of your body has been shaped by the simple fact that you move (as did your ancestors). We'll see that in asking why life is as it is, much of that answer is because creatures evolved to move around. Starting with our own body form, we'll uncover a story that takes us back to the origins of animals—and even further back into the invisible world of bacteria. We are unusual amongst mammals in walking on two legs, but new research suggests this evolved in ancestors who lived in trees, long before we descended to the ground. In a similar manner, all vertebrates had to evolve a means of walking before they could invade the land and again, contrary to popular belief, our ancestors learned to walk while still in the water.
This episode highlights the phenomenon of "pre-adaptation" in helping shape the familiar patterns of life—in other words, the 'ingenuity' of evolution in 'inventing' new roles for old structures. This is even true for the proteins that make up our muscles, which began their evolutionary life as structures to help bacterial cells divide.

Episode 8: Awakening

Life on Planet Earth has evolved from single celled, primitive organisms to a species that changes the planet, creates art, understands many of the mechanisms that drive the world around it and asks questions about the universe itself. Life has become conscious. From the first glimmers of problem solving and intelligence, we discover how the nervous system—and hence the brain—evolved, and debate whether the human brain can ever fully understand itself. Many scientists now believe that consciousness first arose during the Cambrian explosion, with the evolution of eyes. If so, then vertebrates, along with insects and crabs, all have some form of consciousness. Even 'higher consciousness' is not limited to humans. Recently, scientists have realised that they have been fooled by the different structure of birds' brains—bird brains are just as complex as those of higher mammals, and we witness some remarkably sophisticated behaviour and cognitive skills in birds from many places. We even find that insects, with brains the size of a grain of sugar, can learn complex tasks, as well as count.

The series has taken us from the origins of life to the flowering of consciousness and at each stage, we've seen that life is not always what it seems and we are not as unique as we once thought.

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