

DECEMBER 2021 | N.° 1 EDITION

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**LIFE ON EARTH: A
FOUR-INGREDIENT
RECIPE**

P. 6

+ ARTICLES

WHAT IS LIFE?

A question that has more than one answer.

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NEANDERTHAL MAN

Closer to us than we think

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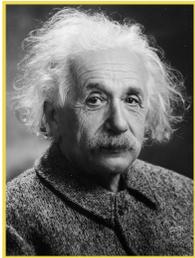


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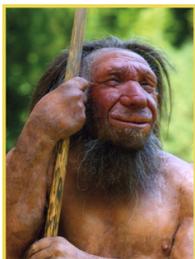


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Sofia: magazine issue, editor's commentary, advertisements, view-tiful, questions and answers, all about earth: origin of the sexes, databout: Alfred Wallace and article: neanderthal man.

Andrea: article: the origin of life on earth and the conclusion.

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A comment from the editor:

For as long as we can remember, human beings have been searching for the reason for their existence, and after hundreds of thousands of years, we finally have the answer to the how, when and where of this question.

I have always asked myself these questions, and it is fascinating to see how Earth's inhabitants have varied over the millennia and how ephemeral our existence is compared to that of the organisms that once tamed the face of the Earth.

During your visit through these pages, you will experience a journey from the moment when life on earth emerged to our birth as a species, where a series of events, curiosities and changes will open up, allowing us to reconstruct the history of our home since its origin, some 4.6 million years ago.

Sofía Martín Cano

The editorial team:

SOFÍA MARTÍN CANO

ANDREA MERLOS RUÍZ

**LUKA GARCÍA
STOPPIELLO**

FREDERIC



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HOW WE WILL LOSE THE PLANET

Glasgow 2021 Earth Summit

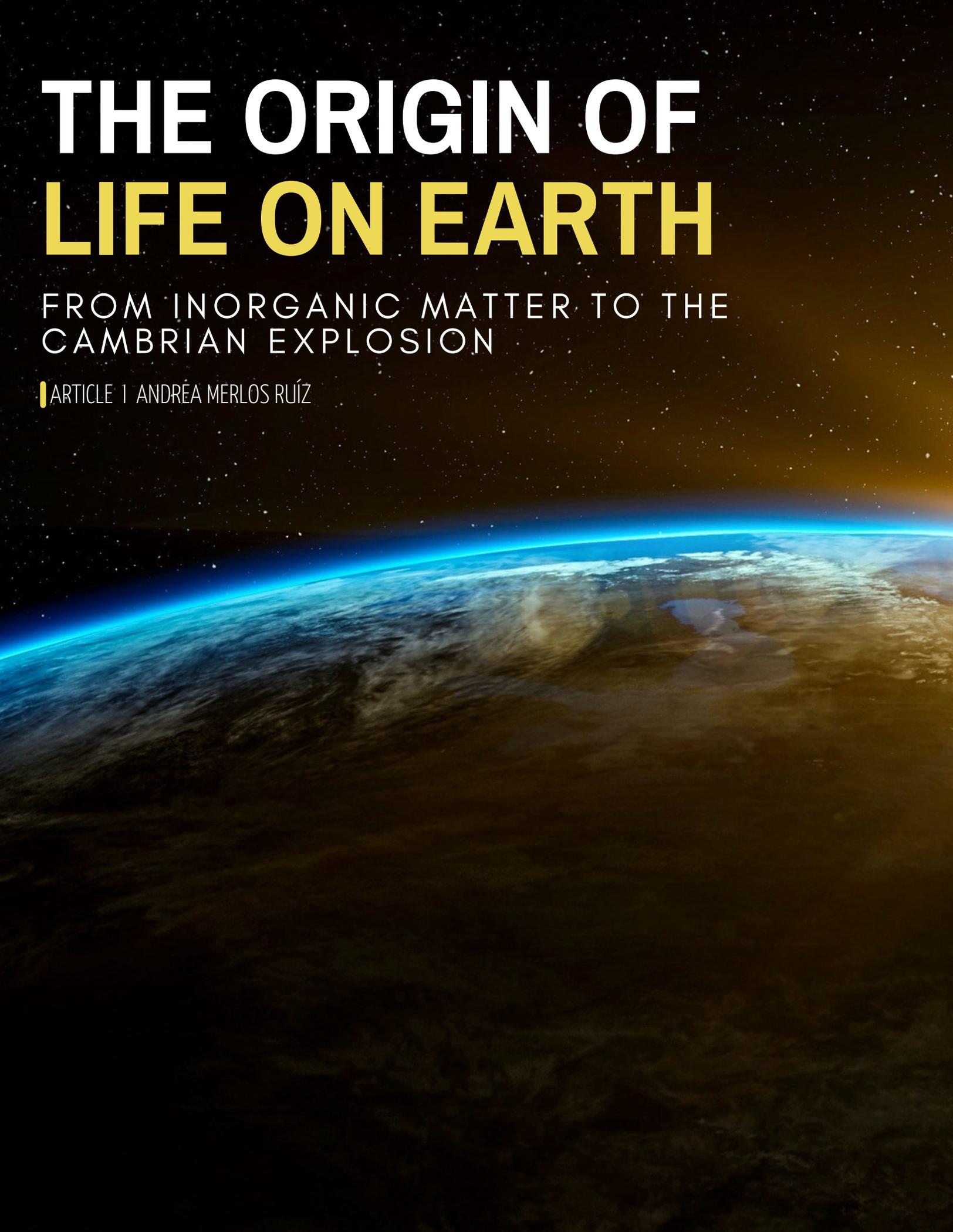


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THE ORIGIN OF LIFE ON EARTH

FROM INORGANIC MATTER TO THE
CAMBRIAN EXPLOSION

ARTICLE 1 ANDREA MERLOS RUÍZ



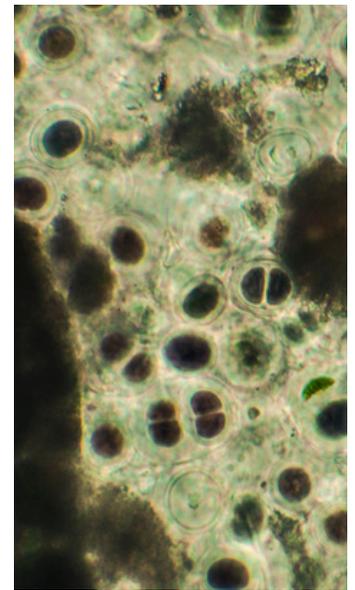
Once, all existing matter was concentrated in a single point.

The question of how the universe originated is still a mystery. However, the most accepted theory by the scientific community about its creation is the well-known Big Bang. According to this, the universe was a tiny point called singularity, in which 13.8 billion years ago there was a supposed large explosion that caused the creation of all matter in the form of particles and antiparticles. In just fractions of a second, there was an expansion from that tiny point of millions of light-years called "cosmic inflation," to a temperature of 1029 k. These particles, which predominated over antiparticles, consisted mainly of protons and neutrons, forming the nucleus of the well-known atoms after the universe had cooled slightly. The first atom that was created was hydrogen, with only 1 proton in its nucleus. Then, for a period of 100.000 years, there wasn't any new progress until electrons started to group with the other particles. After the first neutral hydrogen atoms formed, more clusters were produced creating helium,

lithium, hydrogen isotopes and molecular hydrogen, the future essential component of stars. Later, 300.000 years after the explosion happened, a period called the Dark Age where there weren't any sources of light, which caused the whole universe to be partially dark for 700 millions of years, even though the first stars and galaxies were already emerging. This era longed until atoms started to form the rest of the majority of structures on a massive scale due to gravitational effects that finally illuminated the space as we know it today. This process was called reionization. Moreover, during these new formations, the universe cooled up to 100k and it continued decreasing until 3k, the current temperature.

Our galaxy, the Milky Way originated around 13.5 billion years ago, making it one of the oldest known. This giant structure has between 10 and 30 million stars, one of them being our Sun, located in the Solar System.

It originated 4.5 billion years ago when a supernova situated in the Orion Arm exploded, creating the “presolar nebula”, a big mass of mainly hydrogen and helium. Centrifugal effect caused the particles to gather all the material into a disk. There are nuclear reactions and it starts to rotate and a star begins to create from the dense matter in the center and the remains form planetesimals as the temperature cools, orbiting around the Sun. Then, they transformed into planets, dwarf planets, satellites, and asteroids.



The Earth is one of these planets, the third closest to our star and the only known to have its own life.

It is the same age as the Sun, but it was extremely different from what it is now. It went through 3 phases called geological eons before the Cambrian explosion: Hadean, Archean and Proterozoic. All those periods are the Precambrian period that lasted **4050** millions of years.

At first, during the Hadean period, our planet was only a giant rock at a very high temperature due to the constant impact of asteroids and meteors which prevented most of the rocks from solidifying, creating lava rivers all around the surface. This period was 600 millions of years long and its name is originary from the Greek god Hades. During this period, convection currents produced a geodynamo, a theory that says that the magnetic field generated and maintained by convective flow in the Earth's fluid outer core.

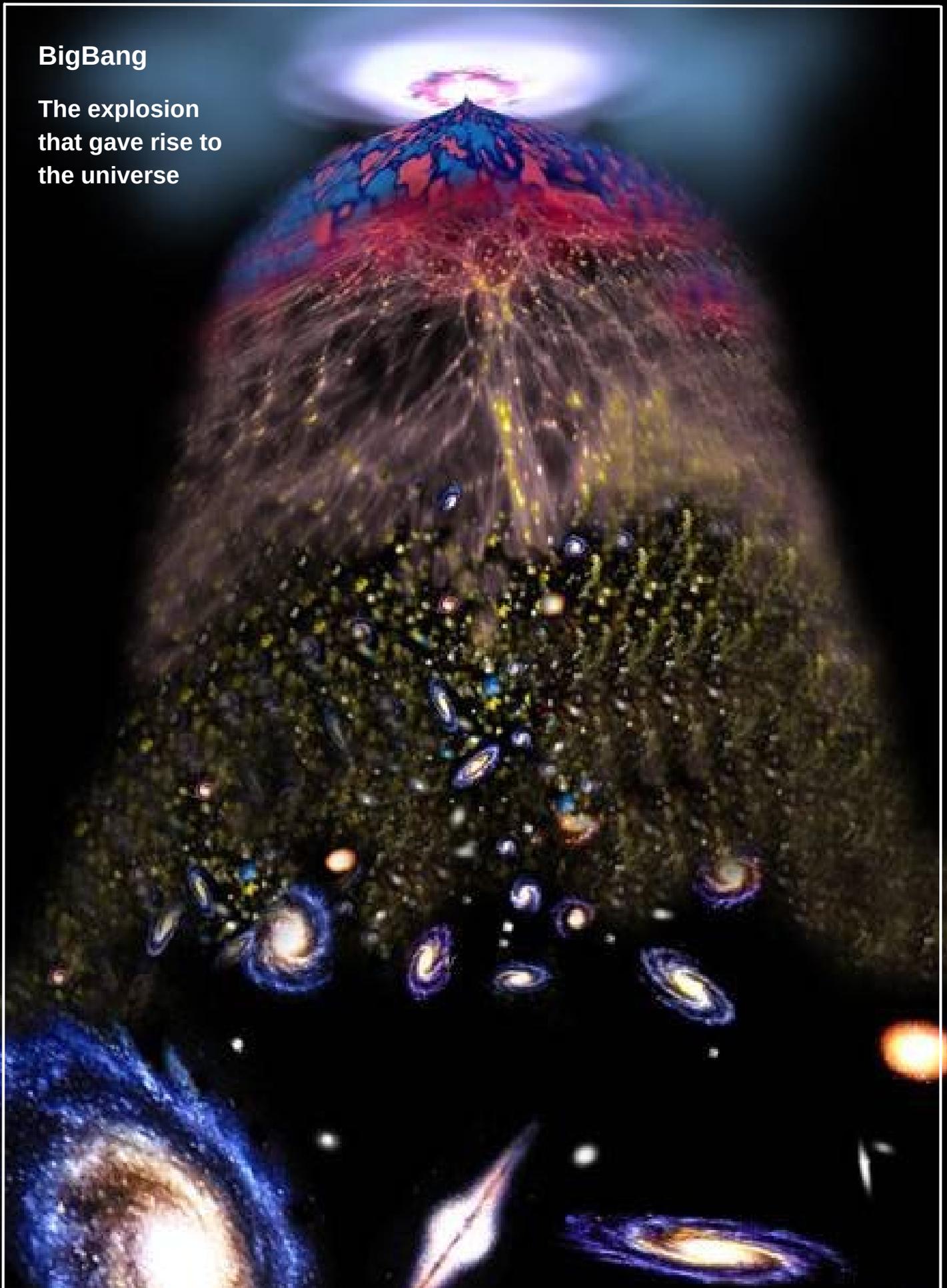
This was the first step for life to persist on Earth. Many theories say that our satellite, the Moon, was created in this period, where a celestial body the size of Mars collided into the Earth and the materials ejected in that accident formed the satellite. This event made the water of the Earth's crust and upper mantle create a rock-vapor atmosphere. Then, these gases would have condensed and mainly formed water vapor and carbon dioxide.

This atmosphere made **rain** possible.

Afterwards, the crust started to cool and it allowed the origin of oceans. The next period was the Archean eon. Its name comes from the Greek word *arkhē* (ἀρχή), meaning 'beginning, origin.' During this age, the temperature of the planet was still three times the one there is today. The earliest proof for life on Earth is graphite of biogenic origin found in metasedimentary rocks that were discovered in Western Greenland.

BigBang

The explosion
that gave rise to
the universe



However, the only form of life during these 1500 millions of years was prokaryotes and cyanobacteria, simple unicellular organisms which fossils were found in hydrothermal vent precipitates. These microscopic creatures lived in the oceans, and they started making photosynthesis, which produced oxygen (O₂) but it didn't accumulate in the atmosphere until the late Archean.

Nevertheless, this was essential for the course of evolution. Through this time there were the first subduction moves of the tectonic plates and the first glaciation, too (Pongola glaciation).

The last defined era before the Cambrian explosion was the Proterozoic time. It is the longest eon on Earth being almost 2000 millions of years long. This period was very important for the history of the planet because of **3 crucial reasons**: the accumulation of oxygen and the subduction processes caused by the movement of the tectonic plates and the most indispensable one: the creation of eukaryota. This allowed a new style of reproduction that many protists adopted, called sexual reproduction, which later would make a lot of diversity possible. Unicellular organisms grouped together and grew faster, constructing the first pluricellular structures. Even though at first they probably had both phases, pluricellular ones ended up thriving due to the success of this new method. Fungi also started to appear during this phase in their unicellular form.

After the Precambrian eon ended, the Phanerozoic eon started, which is still the current one. The first era of this long period is the Paleozoic which started due to the Cambrian explosion. It was the sudden appearance of new species in the biosphere, which began the so-called Cambrian period 541 million years ago. It started a new stage in life and evolution. Creatures like algae evolved, but the most significant advance were armored arthropods, like trilobites. Almost all marine phyla evolved in this period and this would later allow the first vertebrate life, like fishes. During this era, the supercontinent Pannotia began to separate, most of which later became the supercontinent Gondwana.





Australia

A colony of Acropora loripes located on the Great Barrier Reef, home to more than 400 different types of coral

Turkey

A marble figurine over 8,000 years old, representing an obese woman with her hands under her breasts, found in the Neolithic settlement of Catal Hüyük, Konya.



Chile

View of the Osorno volcano, east of Lake Llanquihue, the gateway to Chilean Patagonia.





Spain

A filamentous colony of Nostoc cyanobacteria is enveloped by a mucilaginous sheath. These bacteria are able to photosynthesize and fix nitrogen from the air.

What is life?

A question that has more than one answer.

There are many ways of looking at life, for some it is one way and for others it is another.

Researching we have come to the conclusion that life can be defined mainly in two ways: scientifically and philosophically. And then each person can have his own opinion.

As we have said before, one of the ways to see life is scientific, and what better scientist than

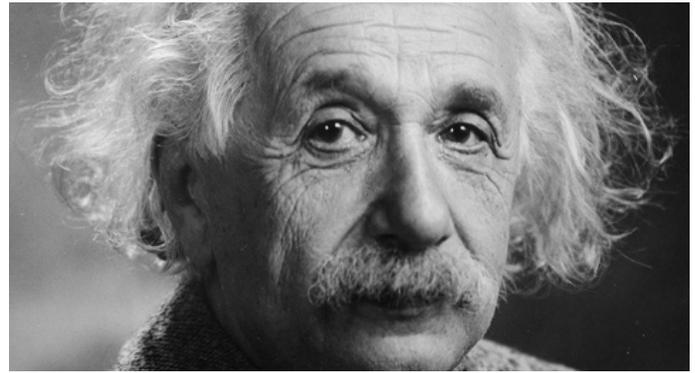
Albert Einstein:

"Life is a preparation for the future; and the best preparation for the future is to live as if there were none."

But apart from Einstein, a scientist like **Hawking** who has been determinant in the study of science, cannot be missed.

"Life would be tragic, if it were not funny."

Some great scientists like **Carl Sagan** simply criticize the ignorance of some people,



and have as their definition of life a brief, fantastic moment:

"Life is only a momentary glimpse of the wonders of this amazing universe, and it is sad that so many are wasting it dreaming of spiritual fantasies."

But there are other ways of looking at life, such as philosophical.

For some philosophers, life is a set of experiences. Within this conception, life cannot be understood by other disciplines since it is something that happens, it happens to living beings, that is why it cannot be defined with exact science.

In **Aristotle's** definition, life is posed as an "*that*" for which no explanation is included. In the same way, the "*by itself*" cancels the possibility of attributing an external (explicable) cause to the being that possesses it.

Socrates describes, in one of his interventions, an idea of good.

For Platonism, the meaning of life lies in the attainment of a higher form of knowledge, which is the idea (form) of the good, from which all that is good and just derives utility and value.



Life has many correct definitions, each one can have and support the one that is, that is why to finish we will give **our** opinion of the definition of this one:

Life: Life is the passage of a living being during time, since it appears to the world, passing through all its corresponding phases of life, until death, giving way to new generations and entering into a loop thus fulfilling the cycle of the history of all matter.

STAY / AND GREEN

REDUCE
REUSE
RECYCLE

AN INITIATIVE OF ECOSPACE

EVOLUTION: its evidence in living fossils



Living beings have evolved a lot, here we are going to compare two species to demonstrate the evolution of living beings, we have chosen the coelacanth and the toad.

The Coelacanth

The coelacanth is an elusive abyssal creature that lives at depths of up to 700 meters. It can reach an enormous size of more than 2 meters in length and 90 kilograms in weight. Scientists estimate that they can live 60 years or more.

The primitive coelacanth was thought to have been extinct since the time of the dinosaurs, 65 million years ago. But its discovery in 1938 by a South African museum curator in a local fishing boat left the world fascinated and opened a heated debate about how to fit this strange lobe-finned fish into the evolution of land animals.

Only two species of coelacanth are known: one living near the Comoro Islands, off the east coast of Africa, and another found in the waters off Sulawesi, Indonesia.

Many experts believe that the unique characteristics of the coelacanth show one of the initial stages of evolution from fish to four-legged land animals, such as amphibians.

The most striking feature of this "living fossil" is its pairs of lobed fins that extend from its body outward like legs and move alternately, like those of a trotting horse.

Other unique features include an intercranial joint that allows it to enlarge its mouth to swallow large prey, a duct called the notochord, filled with an oily fluid that serves as bone marrow, thick scales that have only been seen in extinct fish, and an electro-sensory facial organ located on its snout that it possibly uses to detect prey. Of course, it is not clear how many individuals are left in the population, although studies in the Comoros indicate that there may only be about 1,000 left in those waters. It is considered an endangered species.





The Toad

Toads are small animals that are often confused with frogs. However, toads have dry, rough skin and short legs. Frogs have moist, smooth skin and long legs.

Toads are found all over the world, except in the coldest regions. They are amphibians; that is, animals that live both on land and in water. However, toads usually spend more time on land than in water.

Toads have a stubby, stubby body. They have no tail. They are between 2.5 and 25 centimeters (1-10 inches) long. They usually have brownish olive-green skin, often with darker spots. Spotted toads have long feet on the hind legs and are bright red, green or yellow with black spots.

Typically, toads are covered with bumps that look like warts. When toads feel threatened, they release a venom that they store in the warts. The venom can cause burning in the eyes and mouth of their enemies. The venom of some toads is so strong that it can be lethal.

Toads are usually active at night. They spend the day underground or hiding under leaves and stones. In winter, most toads enter a dormant state called hibernation. Some toads also hibernate when the weather is hot and dry.

Toads move by making short hops or walking. They catch prey with their long, sticky tongues. Toads feed mainly on insects and worms. However, some large toads eat frogs and small rodents.

Toads lay eggs underwater. After a few days, small fish-like creatures called tadpoles hatch from the eggs. Tadpoles have tails and gills. The gills are structures that help them breathe underwater. Tadpoles evolve: they drop their tails and develop lungs and legs. Then, they can leave the water and start living on land.





Conclusion:

It can be said that both species are not related at all, but if we stop to think about it, it can make sense.

The Coelacanth and the Toad not only because there are already expert theories, they are directly related, just look at the bodies of the two beings and their behavior. So, it does seem that there is a relationship between the two.

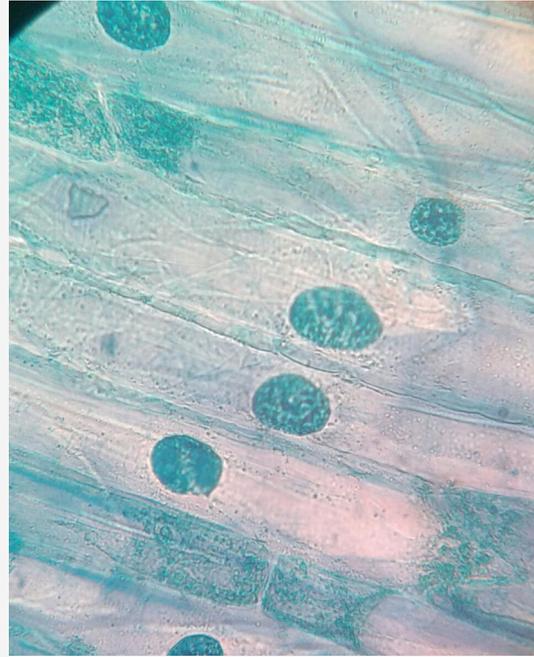
It is clear how things were and that the only solution for survival in nature was that of the largest, but little by little they evolve and the size is not so necessary when this animal leaves the water to become an amphibian, hybrid, the comparison can be made with other amphibians but this one is quite close.

There are more things in common such as their reproduction or that many characteristics fit in the evolution of these two species, but what is clear is that the relationship between primitive animals and those of today exists and this is proof of it.



What is the difference between prokaryotic and eukaryotic cells?

T The main differences between the two major types of cells are the fact that prokaryotes (e.g. bacteria) do not have any organelles (complexes that perform functions) inside them and their genetic material is free inside the free membrane, and not in a nucleus as in the case of eukaryotes.

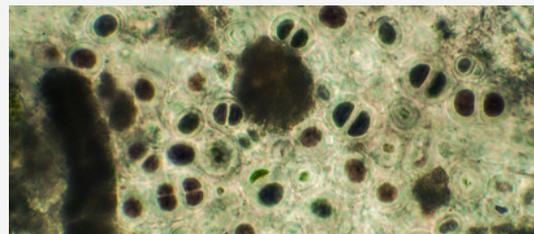


What is the world's longest-living vertebrate animal species?

It is the Greenland shark, or boreal shark (*Somniosus microcephalus*), which is estimated to live up to 400 years.

What does the theory of biogenesis say?

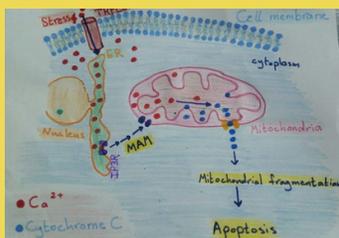
This biology question is related to the previous researcher, since the theory of biogenesis indicates that a previous life is necessary to generate life. That is, life is not generated from nothing.





What is metabolism?

Metabolism refers to all physical and chemical processes in the body that convert or use energy, such as: respiration, blood circulation, regulation of body temperature, muscle contraction, digestion of food and nutrients, elimination of waste through urine and feces, or brain and nerve functioning.



What is apoptosis?

Just as we talk about proliferation, cells also have a programmed cell death. This process is known as apoptosis.

Which tree species is considered a living fossil, having representatives of its genus very similar to it in the middle of the Jurassic period?

Ginkgo biloba is part of a lineage of trees so ancient that its evolutionary branch has no close relatives.



The origin of the sexes

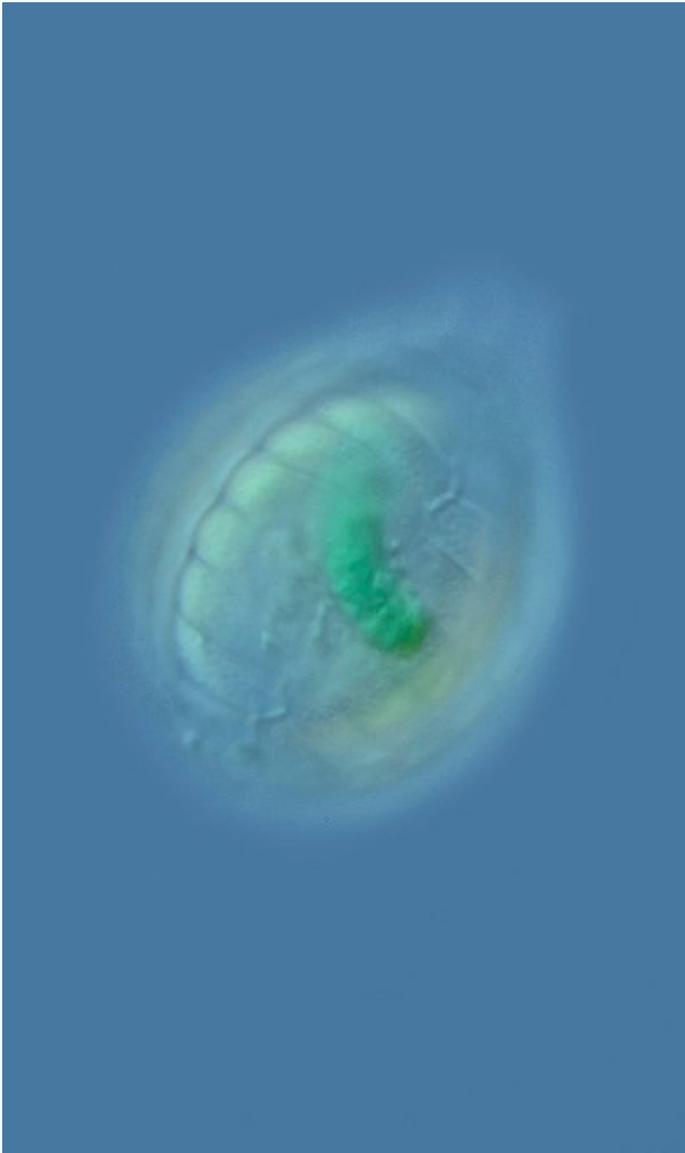
When did this distinctive characteristic arise?

"The great British geneticist and biologist John Maynard-Smith applied game theory to evolution and concluded that the existence of males simply does not add up. Procreating men causes 50% of a living creature's **resources to be wasted** because they cannot reproduce offspring," he says.

"In terms of evolution, the way to be successful is to effectively pass your genes on to other generations, and when we think about sexual reproduction, what we're doing is passing half of our genes on to our offspring, who have half of someone else's genes. **We put a lot of effort into that and it seems to be inefficient,**" says McLysaght.

But sexual reproduction has a reason for being, and in some ways it is what has allowed us to evolve.





GLASS - SHELLED AMOEBEA

It is believed to have originated in the first eukaryotic cells more than 1 billion years ago. The major theory that arises in this regard is that derived from conjugation. Conjugation is the process by which two prokaryotic cells mix their genetic material. Despite not being a type of reproduction, it is believed that sexual reproduction originated from this technique.

Asexual reproduction is a fast way to reproduce, since only one individual is needed, and it is energetically more efficient, as well as being able to give rise to many individuals. But it has a major drawback: it gives rise to offspring that are 100% identical to the parent.

This is the main reason why most creatures with asexual reproduction arose hundreds of thousands of years ago: because when it comes to fighting a disease or parasite, the whole population is vulnerable and destined to die.

When organisms of the same species begin to share their DNA, new mixed sequences are created, so that when there is a fatal disease or unfavorable condition, only a portion of the population will be vulnerable, and the portion that manages to survive will pass this characteristic on to its descendants. In this way nature makes sexual reproduction more conducive and this results in 99% of the species that inhabit the earth having sexual reproduction. This also allows the evolution and acquisition of new genetic characteristics.



As for the origin of the sexes, from the recombination of DNA and the creation of new individuals, they obtain certain characteristics and differentiate themselves from the others, repeating the process until two types of individuals are created that will provide certain information when they reproduce.

It could be said that the origin of the sexes is a product of natural wisdom.



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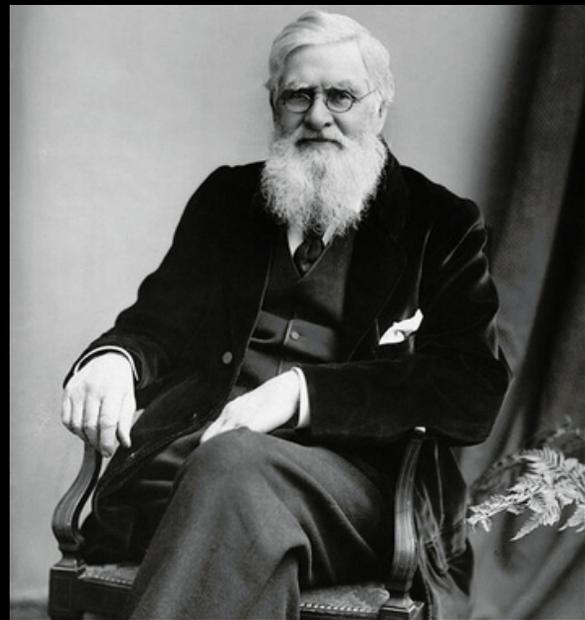
Alfred Russel Wallace was born in Wales on January 8, 1823.

Son of Thomas Vere Wallace and Mary Anne Greenell, he was the eighth of nine children. At the age of 12 he was taken to London to work as a carpenter and was apprenticed to multiple trades such as watchmaker, surveyor and land supervisor for the railroad, thanks to which he learned multiple skills and would awaken his passion for science. During his youth he published several scientific essays and met Henry Walter Bates, with whom he would embark in Liverpool on a trip to the Amazon. Their intention was to collect insects and other animals in the jungle and sell them to collectors in the United Kingdom.

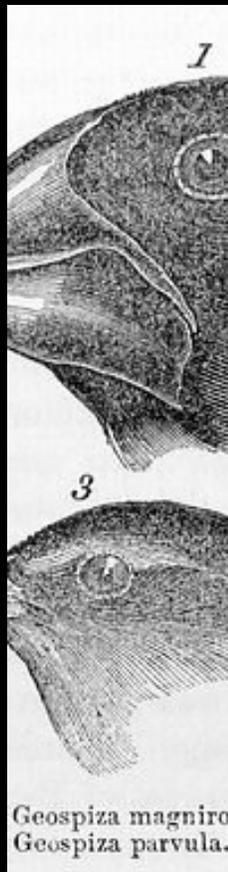
They also hoped to discover evidence of the transmutation of species.

His stay in the Amazon lasted 4 years, and after this, Wallace traveled between 1854 and 1862 through the Malay Archipelago collecting more specimens, and corresponding with several scientists, one of them being Charles Darwin. On this trip he proposed the existence of biological barriers and changes in the species living on islands separated from each other, publishing the book "The Malay Archipelago" in 1869 with the data collected.

After his return from the Malay Archipelago he married and had three children,



WALLACE IN 1885



although a series of bad investments caused him to spend long periods of economic hardship until Darwin managed to obtain a government pension of 200 pounds sterling per month, which kept Wallace in a stable economic position and allowed him to work as a social activist until his death in 1913.

Undoubtedly, Wallace made great contributions to Darwin's theory of evolution, and is known for his "conflict" with him, as Darwin is accused of appropriating Wallace's discoveries.

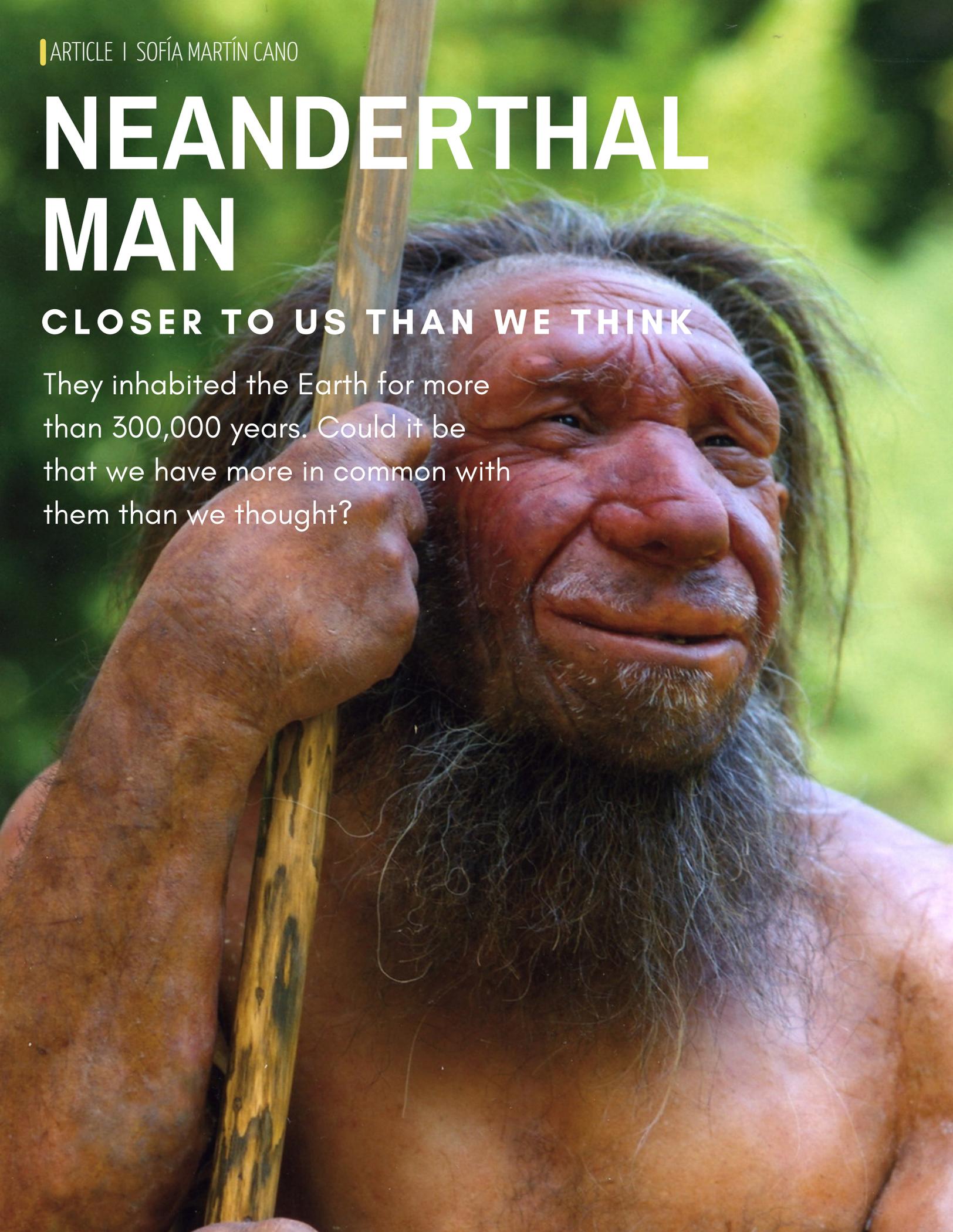
But, nothing could be further from the truth, Wallace and Darwin corresponded and informed each other of their discoveries. In the publication of "The Origin of Species" in 1859, Darwin credited Wallace as co-discoverer of the theory, and Wallace himself expressed that if it had not been for Darwin's prestige, his discoveries would not have been relevant. Thus, this war between authors never came to exist.

ARTICLE | SOFÍA MARTÍN CANO

NEANDERTHAL MAN

CLOSER TO US THAN WE THINK

They inhabited the Earth for more than 300,000 years. Could it be that we have more in common with them than we thought?



"Neanderthals were always presented to us as obtuse, savage, cannibalistic, low intelligence beings, and this is how this image was transmitted in the media".

Rosa María Tristán, science communicator.

Neanderthals inhabited Eurasia from approximately 400,000 years ago until their disappearance 40,000 years ago, the reason for which is still a mystery.

Until not so long ago, Neanderthal man was seen as an inferior hominid, a stupid and savage being, who succumbed to the dominance of homo sapiens.

But nothing could be further from the truth. Recent studies have helped to uncover the true essence of Neanderthal man. An intelligent being, with a very rich spiritual culture and an expert hunter. These are the recent findings that have brought the behavior of Neanderthals closer to that of modern humans.

First, the belief that Neanderthals were savages was based on the presence of fractures and holes in Neanderthal skeletons. After comparison of these fractures with multiple skeletons of homo sapiens, it was found that there were no major differences between them. In fact, the analysis of wounds in the bones of animals caused by Neanderthals shows that they were expert hunters.



Neanderthal skull of the Chapelle aux saints.

Another belief about Neanderthal man was that they had no symbolic or artistic capacity, which belonged only to homo sapiens. However, after the analysis of several sites of cave paintings in Spain, these were dated at 65,000 years old. This shows that they were made more than 20,000 years before the arrival of Homo sapiens to the peninsula, so that the authorship of the rock art was due to Neanderthal man.

Following the findings produced in Saint Cesaire and Arcy-sur-Cure in 2012 (France), it was revealed that Neanderthals also decorated their bodies with ornaments. This discovery was one of the most important, demonstrating the existence of a spiritual world and awareness of death. "These findings produced a strong impact on our understanding of this human group. It was proven that the **Neanderthals had certain symbolic thinking abilities that until then had been reserved exclusively for Homo sapiens**".

Antonio Rosas, paleoanthropologist and CSIC researcher.

Researchers at the Archaeological Center and Museum for the Evolution of Human Behavior in Neuwied, Germany, developed a new theory by analyzing wounds on the bones of two 120,000-year-old deer caused by Neanderthal man.

The scientists were able to get a glimpse of how the wounds were inflicted and even what the impact angles were, thanks to numerous ballistic and microscopic tests. They concluded that the wounds were caused by short-range wooden spears. This hunting technique based on ambush and with long-range weapons suggests that Neanderthals needed cooperation and communication among themselves to carry it out.

Another study conducted on Neanderthal remains in caves in Iraq and Belgium analyzed the teeth and found traces of starch and other foods such as legumes, roots and tubers that showed they were cooked before being eaten. This discovery proved that Neanderthals knew how to cook and were somehow able to control fire.

One of the **most controversial** questions about the abilities of Homo Neanderthalensis is **whether or not they intentionally buried their dead**.

The 50,000-year-old remains found in 1908 in the Chapelle-aux-Saints cave in France led its discoverers to believe that it was buried by a funerary ritual because of the fetal position of the body and the accompanying tools. However, this theory was refuted for more than a century until, in 2013, new studies proved it .

A team of researchers worked for thirteen years in the Chapelle-aux-Saints cave where multiple excavations were carried out. More Neanderthal remains were found, specifically two children and an adult, along with bones of bison and reindeer. In addition, they studied the groove where the first Neanderthal was found one hundred years ago and, thanks to geological analysis, they determined that it was an intentionally excavated cavity. They also made an analysis of the fossil discovered in 1908 and concluded that the body had been covered quickly to protect it. Although they could not determine whether the practice was part of a funerary ritual or purely pragmatic, they did demonstrate the **intentionality** of the burial.



Reproduction of a child's burial found in 1938 in Uzbekistan



One of the most recent discoveries regarding Neanderthals is related to the care of the sick.

In 1957, the body of a 50,000-year-old Neanderthal was discovered in a cave in Kurdistan with multiple injuries and health problems. From a severe blow to the head, the amputation of the right arm from the elbow, serious injuries to the right leg and a progressive deterioration and loss of his hearing.

New analyses conducted in 2017 revealed that of all the injuries suffered, hearing loss is the ailment that made him most vulnerable to predators. This study concluded in addition to the fact that the sufferer lived to an advanced age, he needed the care and help of his conspecifics to survive.

In addition, another study carried out on a body found in the cave of El Sidrón in Asturias showed that this species took medicine. It was discovered that the individual suffered from a dental abscess that must have caused intense pain. The analysis of the studied tartar found traces of DNA of a fungus that acted as a natural antibiotic and that the Neanderthal used to soothe the pain.

In addition, another study carried out on a body found in the cave of El Sidrón in Asturias showed that this species took medicine.

It was discovered that the individual suffered from a dental abscess that must have caused intense pain. The analysis of the studied tartar found traces of DNA of a fungus that acted as a natural antibiotic and that the Neanderthal used to soothe the pain.

"If they decorated, painted, cooked, medicated, buried their dead, took care of their elders, etc., it is clear that they were more similar to us than was thought a few years ago".

Assures Rosa M. Tristán



Neanderthal Man

He could reach about 1.65 m, had a heavy build, prominent teeth and robust musculature.

ARTICLE | SOFÍA MARTÍN CANO

It is clear that Neanderthals are closer to us than we thought, but are they really part of our family tree?

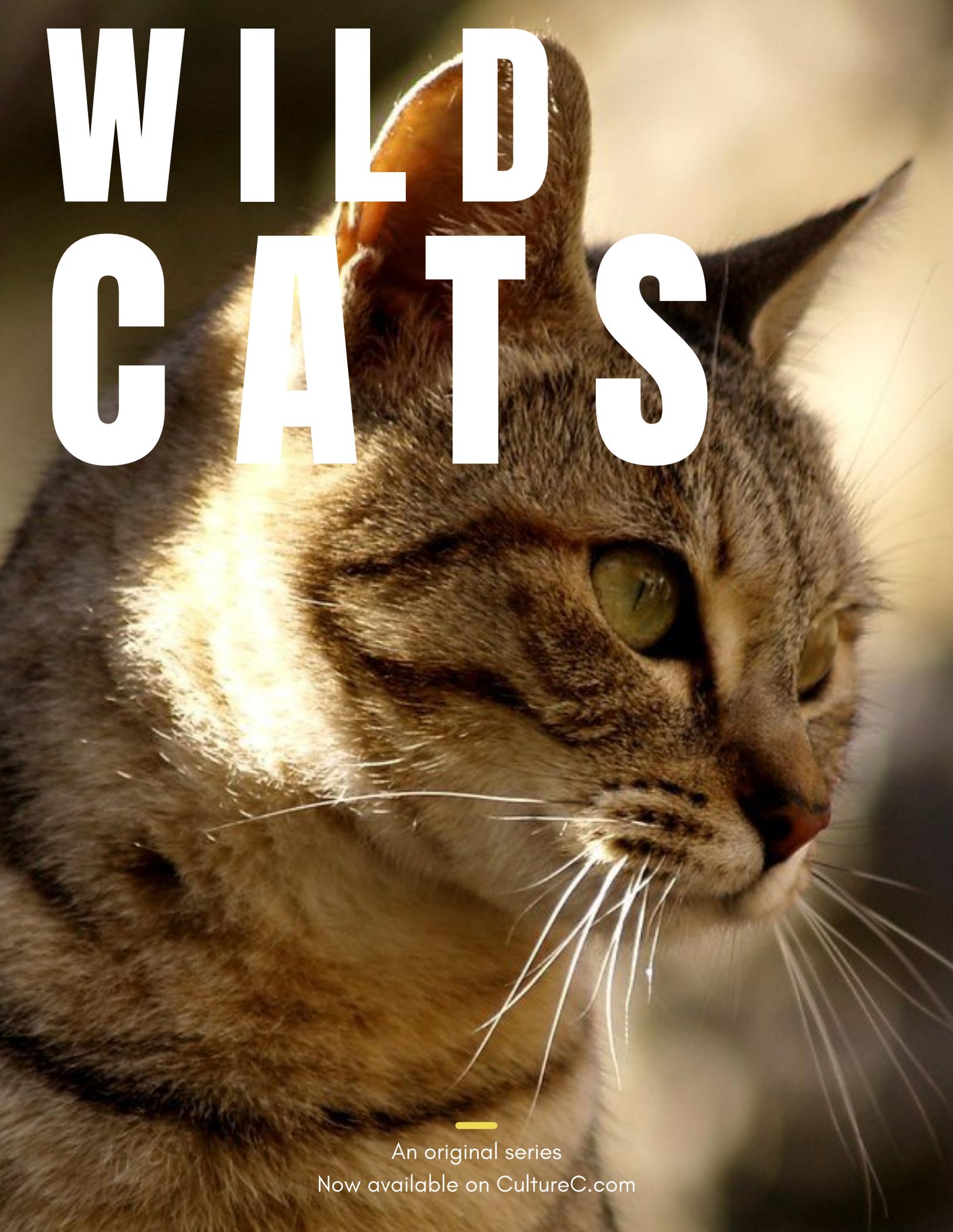
Until ten years ago and due to the relatively short period of coexistence between homo sapiens and homo neanderthalensis, it was thought that they did not become one of our congeners. Their DNA was too different from that of homo sapiens, they could not reproduce with each other.

Recent studies on the human genome and the study of several paleontological remains proved otherwise.

In people of non-African origin (Eurasian) there is between 1% and 3% of Neanderthal DNA, which determines phenotypic characteristics such as blue eyes or red hair color.

It seems that they are part of our great family after all.





WILD CATS

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To Conclude:

Life is something that we should appreciate. It is unique and conserving it must be our priority. As we discover more things about how it works, we are even more amazed at how lucky we are. Through these articles, we have seen some aspects of this surprising occurrence and we have learned that even the least important details were also crucial. We may not be able to tell a reason for everything, but getting to prove such an amazing event like life is surely satisfying. However, we will always continue to find the logic of this long process and its function, even though we won't never be able to explain it.

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