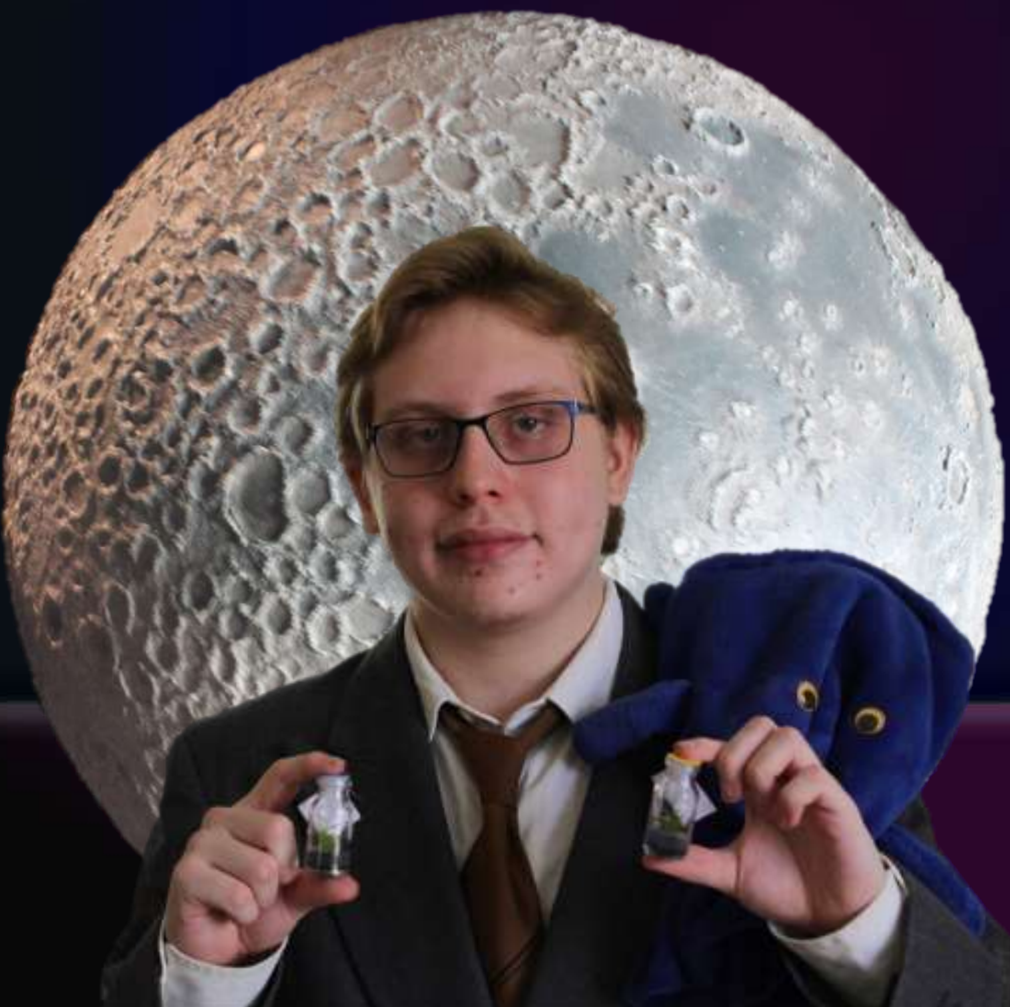
Astrobiology, know to recognize.

Cátedra Internacional Galileo



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By way of introduction

"Raising your eyes to the sky and dreaming of touching the stars is the longing to be part of the genesis of everything again.".

Aldebarán Martínez

Star Travelers, and Space Travelers, are two phrases that not only inspire but also describe man's desire to answer some of the original questions

Are we alone?

What lies beyond?

Do we come from another world?

Figure 1.
Representation of the Copernican universe

Just a few centuries ago, the man saw the world we inhabit as immeasurable. These were times of adventure and discovery, each mountain was the new frontier, and each sea voyage promised access to previously unknown places.

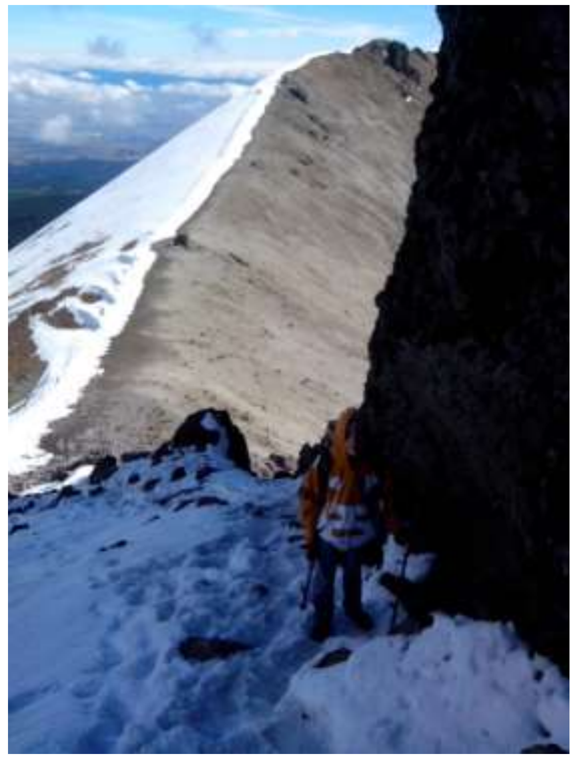

Figure 2.
Ascent to Nevado de Toluca.

In this way, the navigators and explorers were, in more than one sense, the promoters of dreams and promises. Little by little, each frontier was reached (Amundsen, on December 14, 1911, reached the South Pole and on May 12, 1926, the North Pole, this time accompanied by Nobile), and each mountain was climbed (Hillary and Norgay, on May 29, May 1953 reach the top of Everest), the depths of the sea are reached (Picard and Walsh, on January 23, 1960, landed in the Mariana Trench), and although our world still contains an infinity of places to discover and wonders to show, our gaze, driven by a desire that seems to be embedded in our nature, it is launched into infinity and we dream of going beyond our satellite which we reached on July 16, 1969. In less than 60 years (58) it seems that the great milestones of human exploration. We pass 75 years from the first flight by Otto Lilienthal, in 1894, to reaching the Moon, the first step in the exploration of our deepest origins in space.

Figure 3.

Evolution of planes.

Certainly, the new frontier (space) will require us to open our minds in ways similar to the first explorers who found themselves in places that, for them, were completely outside the familiar, where a mango was as strange as it was dangerous. to their senses, climates that, being unprepared, led to great discomfort and even death. We are not aware of what we are going to find outside our beloved planet, however, we can learn how they faced the challenges by learning from those who preceded us in this great effort to extend the frontiers of knowledge, we can learn from the models that we have within our reach. , in such a way that we can prepare different scenarios and thereby provide more tools to those who are going to undertake this journey of discovery.

Figure 4.

Simulator of the spacial chair, in Ontario science center.

An example of that, how they solve the problem of the ignition system from the lunar module in Apollo 11, they use a boligrafe that allow them to fly away from the moon, or the time when the people learn how to transform the barren lands on fértil lands, or the time when the people build a city in a lake, how the human learns to survive don´tmatterr how even in the worst situation.

Figure 5.

Visit Ontario science center.

We must be able to learn, adapt and create new paradigms that explain more efficiently the conditions that we are going to face in unexpected environments, being able to observe and free ourselves from old ties, in such a way that, like Darwin, we can observe and not only see, we can understand and obtain valuable information where others only see an endless succession of events that they consider normal, to be able to contribute revolutionary thoughts like Tesla, to be able to learn every day like Faraday, to have the courage of Galileo to break schemes, to use the tools at our disposals such as Aristarchus or Eratosthenes to make inferences of great value.

Figure 6.
Sensorial camera. Ontario science center.

The new frontier appears promising and full of challenges. Above all, it is generous in its ability to share with those capable of understanding discoveries that could radically change our way of living and thinking.

Figure 7.
First planes. Ontario science center.

Suffice it to reflect that until a few decades ago, man used the strength of his arms as his main source of wealth, that land travel was limited by the speed of horses and nights were a natural frontier to stop human work, challenging just for the candlelight and oil lamps. We are witnessing technological advances that many could describe as magic and Will surely continue advancing at a dizzying pace.

Figure 8.

The speed of a horse rider and the power of their muscles were the engine of the world.

Figure 9.

The experience and the power of the blacksmiths in the forge were the production meter.

Figure 10.

Usage of air and water in the production

The purpose of the Beta mission is to provide its members with frontier knowledge that will be useful to identify elements of astrobiology and astrogeology, in such a way that knowing the parameters of both common order and those that are out of the ordinary on Earth, obtain a frame of reference to be able to recognize similar conditions in the possible missions that participate, that is, they are provided with knowledge so that, through knowledge, they are capable of identifying similar conditions in environments outside the Earth, this considering the phrase “to know to recognize”.

Figure 11.

Rosetta Stone with inscriptions in Egypt, Delmonico, and ancient greek, allow us to understand the egipt jeroglifics.

Figure 12.

The study of the V2 rocket helped humanity in its space career, to the soviets and the united states in similar ways.

Figure 13.

Salt mine of Zipaquirá, in Colombia.

Figure 14.

Las Coloradas in Yucatán.

Figure 15.

Ascent to a high mountain.

The above lines serve to invite the kind reader to read this book, which has within its objectives the dissemination of knowledge and offers in a very basic way a first approach to the topics developed by the members of the Beta missions.

Figure 16.

Understanding the actual technology allows to us see new horizons.

It is important to highlight that this work intends to serve as a point of an impulse to have a first approach to these exciting topics and inspire its readers to be able to consult specialized works or participate in groups that can provide more detailed information.

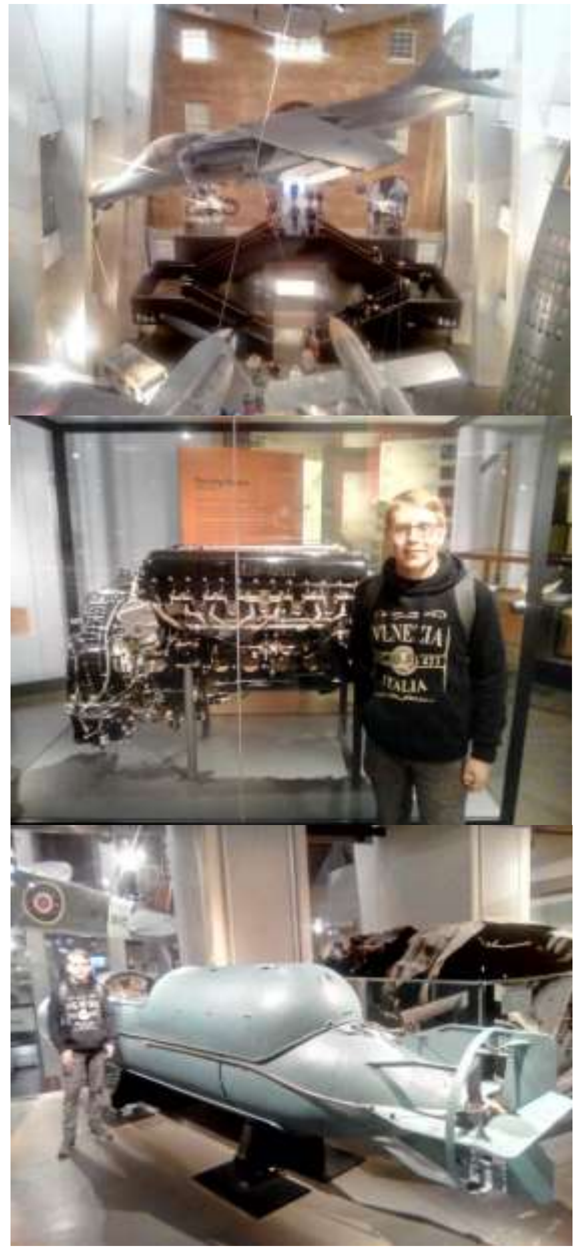

Figure 17.

The power of knowledge allows to us don´t reinvent the same kind of things.

First steps

"Recognizing and learning from those who preceded us is laying the foundations for our construction on firm foundations"

Aldebarán Martínez

First steps

Know to recognize

There is a saying "he who does not know is like he who does not see", certainly this seems obvious, however, it happens so often that when someone notices it they say, "but it is obvious".

Let's look at some examples:

The sunspots observed by Galileo are related to solar cycles and these to solar minimums that greatly impact our world. The decline of different civilizations (Teotihuacan and Maya among them), coincides with the solar minima. We are in a new solar minimum and it seems that nobody wants to notice.

Figure 18.
Composition of the sun. UNIVERSUM.

Figure 19.
Green birds in the temple of the feather snails in Teotihuacan.

Figure 20.

Representation of the Green goddess´s wall in Teotihuacan. MNa.

Figure 21.

Representation of Huehuetéotl, Lord of ancient fire in Teotihuacán. Until a few years ago we don't have any information about this Civilization but now we can connect the solar minimums and their fall down. MNa.

Figure 22.

Representations of Maya columns. MNa.

Figure 23.

Representation of a mural from Bonampak. MNa.

Figure 24.

Representation of K´inich Janaab´ Pakal, Maya lord. MNa.

Figure 25.

Representation of a Maya city. MNa.

The study of space is intimately linked to our life on Earth and although we have the technology and knowledge to see beyond the obvious, it seems that we are blind to close our eyes and suffer the same fate as the dinosaurs who saw that a star was approaching towards them and they could not do anything.

Figure 26.
Sun representation, the earth, and the moon. UNIVERSUM.

The unfortunate thing about our position is that we possess not only the knowledge, the technology, the will, and the resources to expand the frontier of the body of knowledge, to solve many of the problems we face and take us one step further in a search that curiously, the more we learn about space, the more we understand our world (it is enough to know a little about the work carried out on the international space station to visualize how its research helps us understand our world). In this sense, we can say that the more we see outside, the more we understand our interior. However, we mention that our position is unfortunate since there is an inversion of values, where the most important thing is not to be, but to appear, where having is superimposed on being and research seems to lag behind a culture that tends to reward the superfluous and states of thought whose premise is not to think. The above lines may seem harsh (and they are), but it is necessary to raise the voice so that it reaches those who keep the flame of knowledge burning and the desire to contribute to the body of knowledge. To those who not only see, but are capable of observing, inferring, correlating, and, naturally, making projections that allow appropriate decisions to be made, considering not only a reductionist vision limited to human and/or short-term interests but also that, on the contrary, it be a vision that is as broadly inclusive and as long-term as possible.

Bearing the above in mind, we can understand that Analogue Astronauts (AAs) will greatly benefit from disciplines such as history, anthropology, paleontology, archaeology, biology, and virtually any scientific discipline. For this reason, AAs, ideally, should be enthusiastic, full of curiosity, and with a great facility to relate adequately with the most diverse professionals, having a great capacity to implement the knowledge acquired in the solution of immediate problems (of this survival depends), and on being able to implement comprehensive and inclusive solutions for all forms of life and the environment, transcending as a species depends on this.

Figure 27.
Representation of a tree fossil. UNIVERSUM.

Figure 28.
Geode quartz purple amethyst. UNIVERSUM.

Figure 29.
Geoda cuarzo amatista. UNIVERSUM.

Figure 30.
Representation of a plant fossil. UNIVERSUM.

Figure 31.
Representation of a marine fossil. UNIVERSUM.

In this way, it is possible to understand the importance of knowing everything that is within the reach of AAs, to increase their conceptual framework, and be able to transfer that knowledge to hitherto unknown fields, in such a way that without losing their amazement (a lucky characteristic of humanity), can appreciate like Darwin an iguana that is capable of swimming, or Faraday the effect of an electromagnetic field and light using a glass bar (which, it should be noted, was the only thing he kept from a very bitter previous experience), for AAs, it would be convenient to remember the words of Galileo, to be universal in knowledge and to be like cosmopolitan Diogenes (citizen of the world in Greek) to learn as much as possible about the world and be able to transpose it wherever they go.

Knowing not only about what is familiar to us but also about extreme environments (deserts, salt-saturated areas), organisms that survive in conditions that would seem impossible (extremophiles), and materials that come from outside the Earth (meteorites, moon rocks). In this way, they will have a greater possibility of identifying what they find in their path when they are in external environments.

Figure 32.

Representation of a crocodile fossil. UNIVERSUM.

Figure 33.

In the superior part of a representation of the Aramberri fossil.

Figure 34.

"Treasures, Fossils and Minerals de México". UNIVERSUM.

Figure 35.

Representation of Quetzalcoatlus fossil.

Figure 36.

Representation of Edmontonia fossil, and Coahuilaceraptor. UNIVERSUM.

Figure 37.

Representation of Dilophosaurus wetherilli and Heterodontosaurus tucki fossils. UNIVERSUM.

Figure 38.

Representation of Tyrannosaurus Rex fossil. UNIVERSUM "Treasures, Fossils and Minerals de México".

Conceptualizing life

One of the great challenges we face is precisely that of broadening our minds to be able to be part of the magnificent cosmos that opens in front of us, for this we can take a first step, simple but decisive to start the search for life and in some way, one of the deepest questions of humanity What is life? because the objective of this work is to spread the knowledge we will adhere to the beautiful and brief concept of the National Aeronautic and Space Administration NASA(2015, p. 20) ***"Self-sufficient system capable of Darwinian evolution"***. This concept allows us to open our minds, unleashing preconceived ideas of beings with a humanoid shape, with tentacles, and allowing our minds to be able to be attentive to all the possibilities that may exist.

Figure 39 y 40.

Representation of DNA. UNIVERSUM.

Conceptualizing astrobiology

Let's start by mentioning the Greek terms bio (life) and logos (treat, study), in this way, it is possible to consider biology as the study of life, and derived from the above, it is possible to conceptualize astrobiology as, the discipline that seeks a life beyond the confines of the Earth.

Certainly, it is a discipline that should be nourished by a large number of frontier areas and knowledge such as biotechnology, biology, mathematics, geology, astronomy, and as many as can be added to provide the most complete panorama possible. That is to say, one must have the ability to dominate a large number of disciplines and have interdisciplinarity capable of transforming that knowledge into results and understanding of the processes, and phenomena that are observed, always maintaining the highest standards of safety and ethics, understanding that we are responsible for our actions and that these can have repercussions far beyond our biological life.

Figure 41.

Development of skills (Chain reaction of the Polymerase)

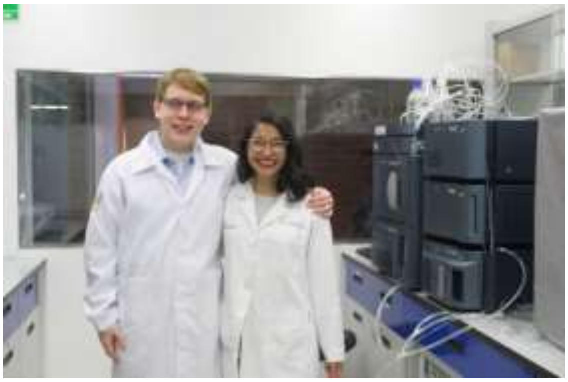

Figure 42.

The capacity of team work is that we can go further in the cientific field faster than singular efforts. IBt.

Figure 43.

It is a great value to stablish relations with professionals that stay in other área of the scientific knowledge, this allows to us have a lot of diferent points of view. FES-I.

Figure 44.

Have te access to the original pices is a great value to develop skills to distinguish and identify fossils bringing this knowledge to the future missions. FES-I.

Figure 45.

The frontier laboratories are the way to stablish a relation with frontier researchers, this enable to extend our horizont in science for them who want to increase the knowledge in astrobiology. CENIBiot. Costa Rica.

Figure 46

The place where the science frontier is develop. CENIBiot. Costa Rica.

Figure 47.

Visit the nuclear reactor of Instituto Nacional de Investigaciones Nucleares. ININ. México.

Figure 48.

The posibility to have contact with privilege minds became in a extraordinary fact. Dr. John Mather. Nobel prize of physics, 2006.

Figure 49.

The unit of Electronic Microscopic (UME), IBt, this is were we can find the electronic transmition microscope (MET), present by Dr. Enrique Galindo Fentanes (Plaid shirt).

Figure 50.

Surrounding by Doctor Nadima Simón Domínguez, Maestro Emérito from UNAM, Red shirt and Dra. Andrea García Valerio, National research prize.

Figure 51.

The development of habilities with the microscope is very important for that people who want to participate on astrobiology field. In the photograph the course of Microscopy in IBt.

Figure 52.

Mexican astronaut José Hernández Moreno.

It is important to note that a fundamental aspect is to remember that one must be ready to recognize life in ways that at this time may seem foreign or simply impossible, if not, it would be like walking past a stick insect and thinking that there is life only because we do not see it, or taking a rock and thinking that it has no life, only because we have not seen the organisms that live and proliferate inside it, or entering a cave and thinking that it can't be inhabited so just because there is no sunlight and suddenly, searching, we find ourselves surrounded by thousands of beings who call that grotto their home.

Figure 53.

Even in extreme environments the life finds the way to survive and proliferate, we just have to see.

In this way, it is possible to provide a small point of impulse for those who are going to participate in this fascinating world of astrobiology.

Figure 54.

Without sun light, but with wáter access it´s possible to find life in caves and remote places.

Figure 55.

Places were at first sight seems without life but you just have to know where to find it (more than 4000 msnm, en el Nevado de Toluca).

Figure 56.

A lake of salt, a Paradise for extremophiles. Yucatán.

Figure 57.

Places that has to be abandon because of the bachterias that now control the entire place. El Salto en Tequendama. Colombia.

Figure 58.

The phisical preparation is an important element to get in the best places to obtain samples.

Conceptualizing astrogeology

For this book, astrogeology will be conceptualized as the discipline that studies the composition and structure of materials outside our world. At this time it is important to make a brief reflection. If we consider the Greek terms geo (earth) and logos (treatise) that is, study or treaty of the earth, it might seem a bit complex that astrogeology can be applied to study structures and materials outside our planet, however, let us remember the phrase know to recognize, in such a way that, to prepare ourselves for what we will find abroad, we have the opportunity to use the knowledge that we already have consolidated on Earth and translate useful techniques to be able to provide certainty in procedures to be carried out for those who leave of our Earth.

The importance of understanding how the geosciences (seeking to understand how the enabling conditions were created) and the biosciences (to understand how life could develop in the existing conditions), form an inseparable link in the search for answers.

Figure 59.

Meteor. Ontario science center.

II

Astrobiology

"Commitment, discipline, vision and teamwork, ingredients for the formation of a crew"

Aldebarán Martínez

Astrobiology

Possible scenarios for the rise of the life on earth

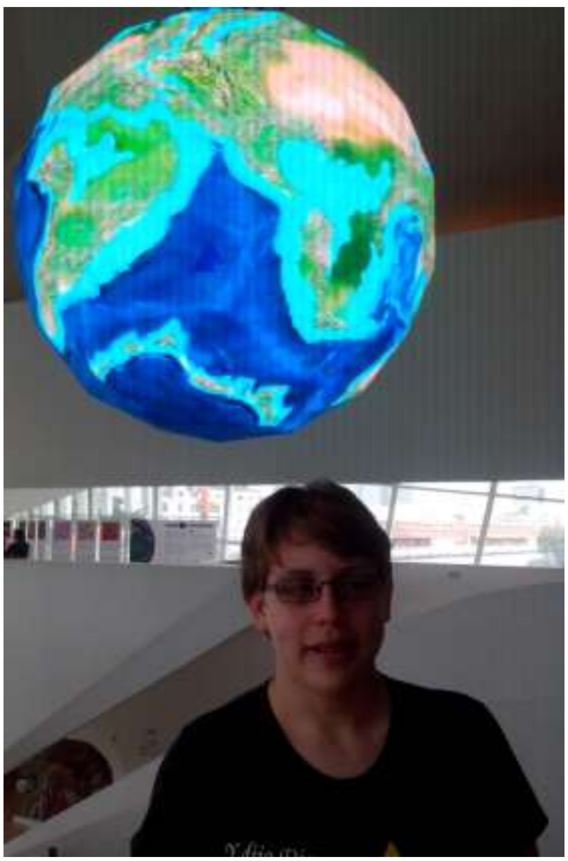

Figure 60.
World representation. Tomorrow museum. Brasil.

In the hope of providing a brief and clear picture of the most accepted theories of the formation of the Earth today, we could use a wild phrase to summarize it “a lucky chain of accidents”, but wait, how can an accident happen? Being lucky? We go in stages.

If it were possible to go back in time before the formation of the Earth, we would likely find a cluster of rocks floating in a chaotic manner that begins to violently collide with each other (first, electromagnetic forces brought the rocks together). were close and later gravity performed the magic of creating a planet), over time (a long time), amazing as it may seem, it begins to take a form that will seem familiar to us, the Earth, but wait a moment, when we say "form" we just mean a dark and inert quasi-sphere that is at a distance of approximately 8 minutes 32 seconds (considering the speed of light) from its star. But let's see, how can the world as we know it to be possible to arise from this inert rock?

The conditions that allowed sustaining life are the result of a string of events that each individual can be described as disastrous. In the spirit of being brief, we can give a "tour" of some of the main events identified with the evolution of our Earth.

Figure 61.
Simulation of the universe. UNIVERSUM.

First lucky event:

Let's start with our location. Of the more than 100 planets that make up our solar system... Wait, how about more than 100? Well, let's remember that we are giving a brief introduction, therefore, without going into details, it is possible to mention that if we consider that to give it the category from planet to a celestial body of our solar system we have two premises:

First, it must be orbiting around our star (the sun);
Second, their size must be such that their gravity allows them to do two things, take on a quasi-spherical shape and clear celestial bodies similar in size to themselves.

Figure 62.
Representation of the solar sistem. UNIVERSUM.

Taking these two conditions into account opens the way to a huge list of objects that revolve around the sun, however, for this book, it is possible to consider:

a) Eight major planets.
   To understand the distance between the Earth and the other celestial bodies, the time it takes for light to travel if it left the Earth towards them is mentioned (to have a better parameter, it is important to remember that:
   a) From the Earth to the moon, light takes 1 minute 3 seconds and;
   b) What the distances are at a given time (considering their orbits)

Mercury, 5 minutes 10 seconds;
Venus, 2 minutes 3 seconds;
Land, selected reference point;
Mars, 4 minutes 35 seconds;
Jupiter, 34 minutes 95 seconds;
Saturn, 1 hour 18 minutes;
Uranus, 2 hours 52 minutes;
Neptune, 4 hours 3 minutes.

b) Four dwarfs:
Pluto, 4 hours 6 minutes;
Eris, 13 hours 18 minutes;
Ceres, 30 minutes 2 seconds;
Sedna, 129 hours 5 minutes.

Of the 12 celestial bodies mentioned, only our planet is at the right distance to support life as we know it, not too close to the sun (otherwise we would burn), not too far away (or we would freeze), so this **first event** gives step to all the others, later we will talk about the goldilocks region.

Figure 63.
Representation of the earth. UNIVERSUM.

Second lucky event:

The Earth was subjected to an incessant bombardment of meteorites that made the Earth more like the third chamber of the seventh circle of Dante's hell, a place where it rains fire. This is an apocalyptic vision then, why do we call it lucky? Because this meteor shower brought with it a large number of elements that will be very useful in shaping the world as we know it.

Figure 64.

Meteor coleccion. UNIVERSUM.

Third lucky event:

A planet approximately the size of Mars collided with our planet generating an event of unimaginable dimensions, and giving rise to two fundamental events:

The birth of the moon (which could be verified in July 1969 when the Apollo 11 mission returned with samples of the moon) and;

Figure 65.

Representation of the moon UNIVERSUM.

The tilt of 23.5 degrees (which allows the existence of the seasons and the possibility of life on the entire planet), in conjunction with other factors, achieves homeostasis in the temperature and conditions of the planet conducive to life (and the wonderful diversity that we have).

Fourth lucky event:

An incessant shower of meteorites falls on Earth, bringing with it a fundamental element for life, water. Indeed, a widely accepted theory mentions that water came from space.

Figure 66.
Morito meteor. PM.

Figure 67.
Meteor coleccion. UNIVERSUM.

Fifth lucky event:

The proximity of the moon creates an apotheotic interaction, where:

Gravity slows down the movement of the Earth (we went from having days of 5 hours to the current duration of 24 hours);

It changes the tides and helps to form the surface of the Earth as we know it and; possibly, it allows the basic elements to begin to mix.

Figure 68.
Representation of the moon. UNIVERSUM.

Sixth lucky event:

A new meteor shower now received by the Earth's water brings with it amino acids and it is likely that, in conjunction with geological forces, the proximity of the moon, lightning, and solar energy, they have given way to the possibility that it existed a lucky mix that gave way to the first forms of life. Cells at the beginning, cells that were able to develop a cell wall that gives them their own identity and that separates them from their environment, cells that began to reproduce and thus take the first steps towards life. Right now we are talking about LUCA (later we will see it in more detail).

It is important to remember that in 1953 Miller and Urey made a first approximation to what was considered at the time a primordial broth, from which it is possible that life evolved, water, methane, ammonia, and hydrogen were used, which were subjected to electrical discharges that sought to emulate lightning in an isolated environment. The result was that they obtained organic molecules among which there were 13 amino acids. At this moment the kind reader is surely thinking, wow, they missed adding many elements, but it is important to remember that we are talking about 1953, so at that time knowledge was limited, and now we know that the forces that were probably involved in the appearance of life they require energy levels much higher than those that can be replicated in a laboratory,

Figure 69.
Chemist models. UNIVERSUM.

Seventh lucky event:

The appearance of stromatolites is a particularly significant event to obtain the living conditions that we currently have. These colonies of bacteria that look like rocks or even "underwater trees" are the first identified organisms that manage to use the sun's energy to transform it into food and release an elemental gas for life, oxygen, and the action of stromatolites along Over a long period, it provides the necessary O2 for organisms to grow (without oxygen, the size of the beings we know is limited to the microscopic world, the appearance of O2 allows organisms to grow.

Figure 70.

Stromatolite.

It is important to mention that some animals benefit from photosynthesis in a much more direct way, we can say, in a symbiotic way, as examples of them are sea slugs, some mollusks, and a salamander (as far as we know). In the case of slugs, they acquire algae from their environment and incorporate them into their body, it is important to mention that they do not pass them on to their offspring and must replace them when the half-life of the acquired chloroplasts decays based on the half-life of the algae of the parent. where it comes from, why we emphasize this process, because, at some point in history, a microbe carried out something similar to endocytosis (it ate another), and for some reason, instead of digesting it, it carried out a symbiosis giving way to mitochondria and with it, Eighth lucky event:

Volcanic activity generates a condition known as "snowball", which is related to volcanic activity due to the expulsion of CO_2, and this ice age ends due to volcanic activity, since, as volcanic activity increases promote the melting of ice, a process that leads to an increase in oxygen (O_2) and hydrogen peroxide (H_2O_2), creating a new type of more benign atmosphere for life as we know it, being precisely this period where the appearance is identified of the first plants and the Wiwaxeas, which give way to a flourishing life in the Cambrian period.

Figure 71.
With the blue of the ozone layer.

Nineth lucky event:

The ozone layer (O_3) is created, which provides a protective shield that opens the way to live on the mainland initially with plants (mosses and ferns) and later with animals such as the Tiktaalik. The O_3 layer is a kind of protective shield that prevents the sun's rays from destroying its DNA (Deoxyribonucleic Acid) and, therefore, allows life outside the water.

Figure 72.
With the blue of the ozone layer.

Tenth lucky event:

The Permian period was the largest mass extinction on Earth (there have been as far as we know 5 mass extinctions, Ordovician, Devonian, Permian, Triassic, and Cretaceous). Wait, why is the extinction of 96% of life on Earth fortunate? It's very simple, had this extinction not existed, there would have been no possibility of success for our species,

Figure 73.
Representation of megalodon jaw. UNIVERSUM.

Eleventh lucky event:

Dinosaurs, diatoms, the Chicxulub meteorite, and mammals appear. Wow, at the moment we feel very comfortable because images of dinosaurs of all sizes and shapes appear in our minds together with a large number of images of asteroids, however, the true hero of this period is the appearance of diatoms.

Figure 74.
Representation of a T-Rex. UNIVERSUM.

Very well, let's go parts, what is a diatom, we refer to the set of unicellular (microscopic) algae, which have a fundamental role in life one of every two breaths we take every day comes from them, but That's not all, their cell wall has a critical factor for life since, instead of having carbon, it is based on silica, in such a way that, when they are alive they give us O2 and when they die, they fertilize the earth.

Figure 75.
Representation of a dinosaur in Toronto.

Although the dinosaurs dominated the planet for around 135 million years, there was an event that extinguished them, there are certainly new theories about it, we can for the sake of conciseness of the book mention that, if the meteorite was the size of Mount Everest that it crashed into the Earth right in the sulfur deposit that was in what we know today as the Yucatan Peninsula, it would have been delayed an instant or a blink of an eye ahead it would have crashed into the water and our chances of inhabiting the world would have diminished alarmingly.

Figure 76.
Representation of fossils in Toronto.

But, here the question arises, how can we know that the Chicxulub impact is related to the extinction of approximately 75% of life at that time?

The answer is as interesting as it is beautiful since it shows us the importance of multidisciplinary work and the sharing of information to be part of the body of knowledge.

Let's take our imagination to Gubbio, which is one of the many medieval towns embedded in the Umbria region of Italy. Nearby is the Cañada de Botaccione. In

1963, Isabella Premoli Silva identified an important variation in the foraminifera (some of them are considered index fossils), which she shared with Walter Álvarez, in such a way that a sudden and decisive change occurred and created what we know today as the KT Boundary (or K/Pg Boundary), which lies between the Paleogene (tertiary) and the Cretaceous. This limit is characterized by the presence of clay rich in iridium, an abundant metal in some meteorites, and with it, the link with Chicxulub is found. This evento can relation with the impacto of the meteor with the earth and the masive extinguish, this give us the oportunity to understand the foraminífera and finding of iridium, with apocaliptic magnitude that extinguish the mosto of the part of the earth.

Figure 77.
Dinosaur model.

Figure 78.
Dinosaur model.

Figure 79.

Walrus skull.

Figure 80.

Representation of a whale. Toronto.

Figure 81.

Skeletons of sea citizens. UNIVERSUM.

Figure 82.

Aramberri Monster Fossil. UNIVERSUM.

An important fact is that we are currently experiencing what can be called a little ice age, which has allowed us to flourish as a civilization.

Twelfth lucky event:

The geological activity of the Earth creates a protective shield called a magnetic field (it has been proposed that, due to the lack of this, Mars, a planet similar to ours, lacks life). With the desire to encourage the kind reader to delve into the subject, we invite you to imagine a burning nucleus of iron, zinc, and other materials that together create a protective electromagnetic field, which, although it is invisible to our view (except in some formidable events such as the northern lights), allows us to live and flourish on Earth, it is important to mention that clear minds like those of Michael Faraday, already sensed the presence of said protective shield.

Thirteenth lucky event:

A lucky balance between the oxygen in the air (20.5%) and carbon dioxide thanks to multiple factors such as rain. But why do we talk about this balance, this is essential because if there was too much oxygen we would face a flammable atmosphere, little oxygen and we would suffocate, in some way, there is a regulatory system that allows a balance to be achieved that despite conditions as extreme as the uncontrolled increase in the human population, the amount of waste we generate or ruthless deforestation, the balance is preserved.

Figure 83.
The frágil equilibrium of the oxygen with the earth.

Life makes its way into extreme environments

At this moment we can understand that life makes its way despite all the circumstances it may have started in a place that seems almost impossible at first sight, we refer to the marine fumaroles, also known as sources hydrothermal. These places meet such extreme conditions as pressure, temperature, and lack of light, among others. Suffice it to mention that there is currently a snail that has attracted great attention, the scaly foot gastropod, which covers its shell and the small plates of its skin with iron Certainly this is a macro example (because of its size) of the multiple creatures that inhabit places that seem impossible for life, however, these examples are multiplied in such a way that places that simply seem deserted, upon closer inspection, they made them home

Figure 84.
Getting samples in cenotes. Yucatán.

Now, let's take our mind to the most inhospitable place that we can visit without the need for special suits or sophisticated machines, we go to the bottom of a cave (really at the bottom), where it seems that nothing can live, supported by basic equipment we can, with something of an effort, to reach a point so far away where life seems impossible in fact, we cannot stay long and our stay is limited by the number of supplies and energy we carry with us. Now, if we pay attention, it is possible that we can observe that there are small beings that live in this place, possibly without eyes (they don't need them because they have never seen the light), lacking colors and, however, proliferating in an environment that seems just sterile. Now, in some caves when turning off the light, several living beings that we could not have previously imagined are shown before our eyes, they shine with their light and give the ceiling of the grotto an aspect of the spectacular sky.

Figure 85.

Getting samples in cenotes. Yucatán.

Figure 86.

Getting samples in cenotes. Yucatán.

Figure 87.

Getting samples in cenotes. Yucatán.

Figure 88.

Getting samples in cenotes. Yucatán.

Figure 89.

Getting samples in cenotes. Yucatán.

Figure 90.

Getting samples in cenotes. Yucatán.

Figure 91.

Mines of salt, in Colombia.

Figure 92.

Getting samples in cenotes. Yucatán.

Figure 93.

Las coloradas. Yucatán

However, this is not exclusive to grottos and caverns, if we can travel to the desert we will find that the name is not exactly appropriate, it will be enough to dig a little in its sands to find that there is life in it, in fact, a dedicated observer he could see that there is life around him, where others only see desolation. These examples multiply ad infinitum, in such a way that we must learn to observe, to look beyond the obvious, it is possible that on other planets we find forms of life that are there, but that, due to our conventions, simply go unnoticed, in fact, thanks to James Webb telescope we´re be able to found CO_2 in the exoplanet name WASP-39b at 700 light years away

Figure 94.

Getting samples in cenotes. Yucatán.

Figure 95.

Getting samples in cenotes. Yucatán.

Figure 96.

Identification of microorganisms in extreme environments. NT.

Figure 97.

Identification of microorganisms in extreme environments. NT.

Figure 98.

Identification of microorganisms in extreme environments. NT.

Figure 99.

Identification of microorganisms in extreme environments. NT.

Figure 100.

Identification of microorganisms in extreme environments. NT.

Figure 101.
Identification of microorganisms in extreme environments. NT.

Figure 102.
Diving.

Figure 103.
Rotary chair. UNIVERSUM.

A possible starting point

Who is LUCA?

Luca is the acronym for Last Universal Common Ancestor. We are talking about a being, a bacterium that could have existed 4,000 million years ago in the initial stages of the Earth, to better understand LUCA, it is necessary to know the tree of life.

The Tree of Life

It is an extremely useful image to be able to imagine that life as we know it comes from a tree with three large branches, corresponding to bacteria, archaea, and eukaryotes (plants and animals are found in this last branch).

But who started the search for LUCA?

It all started with William F. Martín and his team from Heinrich University in Germany, who sought to identify an organism that shared a common origin, bacteria, and archaea. They found 355 genes that seem to meet these requirements and surprisingly, the search result points to a LUCA being, which probably lived in a fumarole (like the one previously mentioned), in such a way that life has likely been gestated in extreme environments where there have been not only the elements necessary for the creation of life but also the energy (perhaps provided by different sources), which allowed the birth of life. It is important to remember that the forces in question were formidable,

At this point, we want to propose the possibility of adding a fourth branch to this tree of life, we refer to viruses, although this proposal comes out of current paradigms, this book is focused on the minds of those who will face unprecedented challenges and to do so, they must learn to create new paradigms.

Archaea, bacteria, eukaryotes

Although, until recently, the social imaginary focused on the field of eukaryotes and even the search came to focus on humanoids, today the attention is directed to archaea and bacteria.

But before continuing, it will be very useful to briefly identify the members of these three branches.

Archaea (prokaryotes) are organisms without a nucleus, which allows them to be differentiated as one of the branches of the tree of life, however, they have some other characteristics that make them very special, such as the fact that they can take advantage of inorganic compounds to feed themselves. (chemotrophs), present methanogenesis, that some of them can live in extreme environments, receiving the name of extremophiles, and although their metabolism is diverse, as far as is known it does not include photosynthesis.

While reading the previous paragraph, many kind readers thought, Hey, bacteria also lack a nucleus! But as far as is known, no pathogenic archaea have been reported, and bacteria do not exhibit methanogenesis.

For their part, eukaryotes do not present methanogenesis like bacteria, but unlike the previous two, they do present a nucleus.

Figure 104.
Evolution tunnel. UNIVERSUM.

Fossil record evidence

Searching for evidence of past life is extremely complex since organisms degrade and disappear, however, that does not mean that they did not exist, the key question here is how to identify them. Let's see a macro example. Some of the first explorers of the Amazons were looking for traces of the ancient civilizations that had settled along the river and after many attempts and finding no trace of them, they deduced that there had been no inhabitants in that area. Their deductions, although today we know they were wrong, are understandable considering the criteria they used to arrive at them.

Figure 105.
Representation of the decay. UNIVERSUM.

a) They were looking for large stone constructions such as pyramids or cities. This is largely due to the influence of ancient cities such as Teotihuacan, Uxmal, and Machupicchu. However, it does not require much reflection to understand that civilizations use the materials available in their environment to build, once the expeditions took this into account, they searched "under the ground", the remains of foundations, and found a large number of them and it was possible to identify roads that led to other cities, the hypothesis now points to the fact that the cities that existed were made using the organic materials that they had within their reach, which naturally degraded over time;

b) The forest soil is so poor that it could not support large numbers of people. As soon as discoveries of cities began to be made, black earth was also found, made up of highly rich organic elements that would allow several harvests to be achieved per year (when analyzing this land, it was possible to conclude that it had been made by the communities that inhabited the city because within its components was fish).

Figure 106.

Construccions with ephemeral material. MNa.

These examples serve to invite the kind reader to understand that there may be living in other worlds, but we are simply not using the appropriate criteria to identify them or, perhaps, our beloved robots, when drilling the rocks and extracting samples to identify if there is or was life. in them, unintentionally, they destroy it in the process by exposing it to the atmosphere, and therefore, we believe that there is no life, when in reality, what fails is how we are looking for it or our inability to recognize it.

Figure 107.

Representation of a hunt. MNa.

Figure 108.

Representations of Fossils. MNa.

Let us remember, to know to recognize, for our Earth, the first evidence of life that we can identify is contained in fossil records. It is possible to mention that the word fossil comes from the Latin, fossils, which can be interpreted as what is removed from the earth by excavating, or unearthing, in such a way that our minds are immediately transported to those beautiful fossils of ammonites or trilobites that many of us have had the opportunity to hold hands, however, the first fossils are more related to micro-organisms such as bacteria or groups of bacteria, later on, it is possible to find larger fossils and, therefore, easier to identify, In this way, we can understand that the first signs of life that we have been able to identify are since at a given moment,

Figure 109.

Mural about wildlife extinct of the Pleistocene. MNa.

Figure 110.

Fossil of Mammut. MNa.

Microbial mats

It is possible to conceptualize microbial mats as ecosystems that are distributed through very thin layers (thus giving the idea of a mat), which are stratified.

Figure 111.
Stromatolites.

Figure 112.
Stromatolites.

These mats are not only of great interest to learn about the past, but also to understand how processes were carried out that allowed life to take place, suffice it to mention that one of the most important organisms related to these mats are the stromatolites, which we will study further. detail shortly.

Figure 113.
Stromatolites.

Solvents that contribute to life

There is a simple but very significant reflection. Without wishing to be reductionist, there have been cases of people dying after an average of 90 days on hunger strike, while without water, life is extinguished in a few days.

Therefore, the question arises, what is the value of water for life?

The name that water commonly receives as "the universal solvent" is revealing, this gives us an insight into the role of water. It is possible to mention that solvents are critical for many of the chemical interactions necessary for life. Adding to it that:

a) Hydrogen is the most common elements identified in the universe;
b) Water is Polar, that is, it has areas of positive and negative charges, allowing it to be a great solvent for polar substances;
c) It has a high degree of cohesion;
d) Its density, that is, when it freezes, it floats, in this way, it allows that under this ice there is fluid water;
e) The amount of heat needed to heat and evaporate water is higher than other substances, which serve to store heat and regulate temperature.

Therefore, water is simply indispensable. Now, let's send our eyes to another horizon, what would happen if in other worlds the basic solvent for life was another? This invites us to reflect on the importance of finding signatures of other solvents so that we can see different scenarios and possibilities.

Stromatolites

In 1974 Awramik and Maguilis identified stromatolites (from the Greek stone bed), as organo-sedimentary structures produced by capture, unión, and precipitation, resulting from the metabolic activity of microorganisms composed mainly of cyanobacteria.

Figure 114.
Stromatolites.

They are formed employing the sediment that is stratified layer by layer, in the lower part by anaerobic bacteria, and cyanobacteria are located in the parts that get more light, with the help of organisms that achieved photosynthesis called cyanobacteria and generate oxygen.

To date, they are the oldest identified evidence of life on Earth, thus being the most important fossil record of early microbiological life.

Figure 115.
Stromatolites.

It is feasible to identify the stromatolites as part of the oxygen precursors on Earth with an age close to 3,500 million years.

At first glance, they look like rocks, but the fascinating thing is that they are living beings.

In Mexico, it is feasible to find them in Quintana Roo, Coahuila, and Puebla.

In the world, it is possible to find them in Australia, the Bahamas, and the Persian Gulf.

The microorganisms that make up the stromatolites take carbon from the air and place it on the bottom of the lake for storage, delivering oxygen to the environment.

Figure 116.
Stromatolites.

The Bacalar lagoon is fed by an underground water system, rich in minerals, which is considered to favor the growth of stromatolites.

Figure 117.
Stromatolites.

The knowledge of the terrestrial stromatolites allows us to have parameters to compare them with laminated rocks that can be found in missions outside the Earth.

Figure 118.
Stromatolites.

Figure 119.
Stromatolites.

III

Extremophiles

"The creation of a new paradigm is rowing against the current one and being able to share the vision of the new one with others"

Aldebarán Martínez

Extremophiles

Beings that can live in:

a) Extreme temperatures (either very high or near freezing);
b) In places with pressures impossible to imagine;
c) Places with a complete absence of sunlight;
d) Sites with little presence of water, etc.

We will begin by conceptualizing the extremophile organisms (cells, plants, or animals), as those capable of living in conditions that, as their name indicates, are extreme and could be considered incompatible with the standards of life that we are usually accustomed to, their study has a value significant because it is not possible to recognize what is not known and if we limit our search parameters for life on other planets to those beings that we commonly see, it is likely that we will go unnoticed many forms of life existing in environments that we daily consider hostile and sterile.

The information presented below is intended to provide a first approximation to the field of extremophiles, providing their name and the environment in which they have been identified.

Anhydrobiotics, Xerophiles. On the ground of the Atacama desert. They do not require water to live or resist desiccation.
Acidophilic. With high acidity, with a pH of less than 3.
Alkaliphile. In very alkaline environments, with a pH greater than 9.
Anaerobe. It requires very little or no oxygen.

- Barophile, Piezophile. They thrive in environments with very high liquid or gaseous pressures.
- Halophile. Very salty.

Figure 120.

Las Coloradas. Yucatán.

- hyperthermophiles. Capable of proliferating in environments with high temperatures (over 100° centigrade).
- Hippolytus. On rocks of cold deserts.
- Cryptoendoliths. They have been found in a deep soil and inside rocks. These organisms are of particular interest due to the hypotheses that point to the possibility that, if there is life on Mars, part of it has taken refuge inside the rocks and crusts of the planet.
- lithoautotrophs. In the deep underground. They get their energy from the reduction of mineral compounds.
- Metallotolerant. They can develop in environments with high concentrations of metals.
- Oligotrophs. They can develop in environments with significant nutrient limitations.
- Osmophiles. They thrive in environments with a high concentration of sugars.

- Psychrophiles, Psychrotolerant. They can develop in environments with very low temperatures below -15° Celsius.
- Radiophilic, Radioresistant. They thrive in environments with high levels of radiation.
- Thermophiles. Capable of proliferating in environments with high temperatures (more than 40° and less than 100° centigrade).

Certainly, these are only some of the most well-known extremophiles, however, for the sake of being succinct, we are going to consider one of the most extraordinary beings in the world due to its characteristics (and certainly, also one of the most beautiful), we refer to tardigrades, also known as water bears.

There are different discussions regarding whether water bears can be classified as extremophiles since extremophilic microorganisms are considered as those that require extreme values of physical and/or chemical factors that are considered unfavorable for most beings for their optimal growth. alive we know. That is, they are microorganisms that develop in extreme environments, characterized by hostile conditions for the life of other organisms. However, some microorganisms tolerate extreme conditions, but they are not necessary for their optimal development, we refer to the microorganisms as extremotrophs, in this case, the tardigrades (water bears). To survive all these conditions, the water bear uses mechanisms such as anabiosis (from the Greek roots and, backward and bios, means of subsistence, which can be translated as a return to vital activity after a period of accidental suspension of activity). ella) is the phenomenon in which an organism slows down its metabolism to survive environmental conditions. And cryptobiosis when a tardigrade is in a cryptobiotic state can withstand environments that are lethal to many other organisms. This is because the "tuns" produced by the body are very hard and resistant to any external agent. which can be translated as a return to vital activity after a period of accidental suspension of it) is the phenomenon in which an organism decreases its metabolism to survive environmental conditions. And cryptobiosis when a tardigrade is in a cryptobiotic state can withstand environments that are lethal to many other organisms. This is because the "tuns" produced by the body are very hard and resistant to any external agent. which can be translated as a return to vital activity after a period of accidental suspension of it) is the phenomenon in which an organism decreases its metabolism to survive environmental conditions. And cryptobiosis when a tardigrade is in a cryptobiotic state can withstand environments that are lethal to many other organisms. This is because the "tuns" produced by the body are very hard and resistant to any external agent.

Figure 121.

Analyzing the samples.

LHB. last heavy bombardment

Approximately 3.8 billion years ago one of the most intense bombardments in living memory took place, although the first meteorites are considered to have brought water, this second wave brought with it minerals, carbon, and primitive proteins, which when received by the water mantle helped to dilute and contribute these elements to the young Earth. It is at this point that it would be possible to locate the "primitive broth", where life possibly begins.

Figure 122.

Meteor Toluca. UNIVERSUM.

CHONPS

It is very likely that if we were asked what the basic elements of life are, we would immediately remember the acronym CHON, which we used to differentiate organic from inorganic chemistry, in such a way that it was thought that having:

Carbon;
Hydrogen;
EITHER
oxygen;
Nitrogen.

We would have the necessary elements for life, however, shortly after this list grew in such a way that the acronym CHONPS was created, adding:

P.Match;
s.Sulfide / Sulphur.

Figure 123.

Meteor Acapulco. UNIVERSUM.

Later, the macronutrients considered essential for life were added to other microelements considered essential, thus increasing our current parameters, in such a way that Williams (1993) and Da Silva (1991) added to the list:

Ace. Arsenic;
B.. Boron;
Ba. Barium;
br. Bromine;
AC. Calcium;
CD. Cadmium;
Cl. Chlorine;
Co. Cobalt;
Cr. Chrome;
Cu. Copper;
Faith. Iron;
Yo. Iodine;
K. Potassium;
mg. Magnesium;
min. Manganese;
Mo. Molybdenum;
no. Sodium;
Neither. Nickel;
I know. Selenium;
Yes. Silicon;
yes. Tin.
Mr. Strontium;
v. Vanadium;
W. Tungsten / Tungsten;
zinc. Zinc.

Having these parameters is essential in the search for life outside our planet. Today, thanks to the James Webb telescope, it is possible to identify signatures on exoplanets that, until a few months ago, were only part of the world of the imagination. Certainly, the photographs obtained are beautiful, but in addition to this, the great value of the analysis will be derived, among many other factors, from the possibility of analyzing the elements that exist in the selected objects.

Figure 124.

Periodic table. UNIVERSUM.

GOE.
Great Oxidation Event.

Breathing is an act so essential and so daily that we hardly realize its relevance, however, just over 3.5 billion years ago, it would have been simply impossible. Remembering that the objective of the book is to provide an initial vision for those who are entering the fascinating world of astrobiology, it is possible to mention that the transition from an atmosphere incompatible with life as we see it now was a long process that was in charge of beings as tiny as they are essential, without whom we simply would not exist.

The process begins with cyanobacteria, microbes capable of carrying out a photosynthesis process, through which they could use water as a fuel source, oxidizing it and generating an essential by-product, oxygen.

without which, life on Earth would be almost impossible since it would be exposed to the effects of the sun's rays. Stromatolites (colonies of cyanobacteria) are therefore a key factor in the creation of the world as we know it today.

Figure 125.

Meteor Allende. UNIVERSUM.

Panspermia?

It is very useful to start by conceptualizing the word panspermia. This comes from two Greek words pan (everything) and sperm (seed), being Anaxagoras (500 - 428 before the common era), the first (that we know) to postulate the idea of panspermia since "Everything is in everything", in such a way that life as we know it is related to everything from which we come. Now we can prove him right, however, he needed to implement his proposal a little more. However, due to Aristotle's ideas on the spontaneous generation that dominated the world until 1864, when Louis Pasteur discredited that position, the possibility that life came from the outside was left aside. Later, Ernst Heinrich Philip August Haeckel, in 1866, and Darwin's bulldog (title granted for his fierce defense of the theory of evolution) Thomas Henry Huxley, in 1868, propose the idea that life can have a chemical origin (a situation that leads us to consider what has already been studied in previous chapters), and in 1871, Charles Robert Darwin mentions his proposal that life could have originated in “a small warm pond”. In this order of ideas, Aleksandr Ivánovich Oparin, in 1924, and John Burdon Sanderson Haldane, in 1929, independently proposed what is currently known as the Oparin-Haldane theory, which postulates that life began in the sea in what they called a "primordial broth", a theory that achieved great notoriety with the experiment carried out by Urey and Miller, which we have previously reviewed. propose the idea that life can have a chemical origin (a situation that leads us to consider what has already been studied in previous chapters), and in 1871, Charles Robert Darwin mentions his proposal that life could have its origin in “a small lukewarm pond. In this order of ideas, that achieved great notoriety with the experiment carried out by Urey and Miller, which we have previously reviewed.

As we can see, we can now understand that it certainly required the delivery of materials from the outside, apotheotic forces that would allow them to interact, and a suitable place that would shelter them to give rise to life. The foregoing is an idea that is born from a little reflection since certainly, the elements that we consider basic for life are common in the universe, but the necessary forces and the adequate conditions to give shelter to live, take a fundamental role.

As an important fact, the most recent research has found that many of the compounds that are fundamental for life are present in comets, interplanetary dust particles, and in meteorites.

They remember the phrase "a lucky chain of accidents" because we find ourselves in front of it when we see life.

Figure 126.

Meteor Allende. UNIVERSUM.

IV

Little pieces of heaven

"Moving from words to deeds, a decisive step to obtain results"

Aldebarán Martínez

Little pieces of heaven

What is a meteor?

Let's start by mentioning that certainly, meteorites have been present in the history of humanity causing amazement, fear, or admiration for those who had the opportunity to observe them, but also played an important role in the manufacture of high-value instruments for those who arrived. to possess them, like the emperor of China, the dagger found in the tomb of Pharaoh Tutankhamun (from a meteorite of the group of iron meteorites called octahedrite) which possibly came to Egypt from King Tushratta of Mitanni to objects of common use such as harpoons made by the Inuit and even more peaceful uses such as plows made in Mexico.

Figure 127.

Meteor in UNIVERSUM.

It is certainly a bit elusive to obtain data on meteorites due to the destruction of the libraries and codices that referred to them, however, one of the first mentions that it is possible to identify is by Anaxagoras, who attributed the prediction (considering that the most adequate translation would be the observation), of a meteorite in Aegospotami, in 467 before the common era.

Figure 128.

Meteor in UNIVERSUM.

In the new Spain (today Mexico), in 1792 the work of collecting samples that include meteorites by the Royal Mining Seminar began. In 1803 Friedrich Wilhelm Heinrich Alexander Von Humboldt devoted special attention to the study of the Zacatecas, Charcas, Chupaderos, and Toluca meteorites.

In 1794, Ernst Florens Friedrich Chladni publishes an essay entitled "On the origin of the iron masses found in Pallas and other similar ones, and on some natural phenomena related to them", managing to provide consistent arguments about the cosmic origin of the balls of iron. falling fire. This last sentence allows us to measure the fascination, fear, and curiosity that meteors arouse, including other denominations such as fireballs, shooting stars, older witches, aerolites, iron and fireballs, emperor souls, etc.

However, when the object that falls to Earth survives, it changes its name, and the term meteorite is published in 1848, by John Craig, who described it as(Craig, 1848, p. 57)“solid substance or body that falls from the upper regions of the atmosphere”

Figure 129.

Meteor Chupaderos I. PM.

That said, we can conceptualize meteorites as; solid material that comes from an environment outside the limits of the body where it was recovered. That is to say, in the case of the Earth, we refer to all the objects that come from space, a condition similar to the objects recovered from the moon and soon from other planets and celestial bodies.

Figure 130.

Meteor Chupaderos II and Morito. PM.

We are going to dedicate a special space to the impact of the Chicxulub meteorite.

First of all, it is important to mention the force of the impact, to have a mental image, the first nuclear bomb launched in Hiroshima had a force of 14 kilotons, it is estimated that the impact of the meteorite in Tunguska was 12 megatons (note, as far as we know there were no remnants of the impact), the largest bomb launched by humans to date, the Zar bomb had a force of 50 megatons, compared to Zar, the Chicxulub impact is estimated to have been two million times higher, that is, 400 Zettajulio.

Figure 131.

Meteor Chupaderos I. PM.

How do distinguish them?

Recalling the phrase, knowing to recognize, it will be of great help to have access to fully identified meteorites, in Mexico City, there is an open-air museum that allows visitors to see them at any time and at any time, we are referring to the meteorites found in the Mining Palace.

Originally there were five meteorites in the lobby of the Mining Palace, these being Morito, Zacatecas, Chupaderos I, Chupaderos II, and Adargas (Concepción), the latter is currently in the Astronomy Institute of Ciudad Universitaria.

Figure 132.

Meteor Chupaderos I. PM.

Chupaderos Meteorites I.
It was located near the old town of Huejuquilla, in Chihuahua. It is among the ten largest meteorites in the world, weighing 14,114 kilos. Made up mostly of kamacite, taenite, and phosphates.

Chupaderos II

Located near the old town of Huejuquilla, in Chihuahua. Weighing 6,676 kilos, it is mostly made up of kamacite, taenite, and phosphates.

Figure 133.

Meteor Chupaderos II. PM.

Figure 134.

Meteor Zacatecas. PM.

Zacatecas.

Located west of Zacatecas, weighing 780 kilos, it is made up mostly of kamacite, taenite, silicate, and graphite.

Figure 135.

Meteor Morito. PM.

Morito.

Also called San Gregorio, weighing 10,100 kilos, it was recovered in El Morito, Allende Chihuahua, and is made up mostly of kamacite, taenite, and troilite.

Morito has an inscription that says "Only God with his power, this iron will undo because in the world there will be no one who can do it".

Figure 136.

The detail in meteor Chupaderos I. PM.

Figure 137.

Meteor Morito. PM.

Figure 138.

Meteor Chupaderos I. PM.

Figure 139.

Meteor Chupaderos I. PM.

Visiting these huge meteorites, you will be able to have a first-hand clear view of the characteristics of meteorites, however, specimens of this size are scarce and, certainly, there are many more types of meteorites, to learn more about them, You can go to the Universe room in the Universum museum, in Ciudad Universitaria, or to the UNAM geology museum, in Santa María la Rivera. However, are there some steps that could support us to know if we are in the presence of a meteorite, or should we wait to ask an expert? The answer is that some basic ideas are very helpful, for this, consider the following suggestions:

If someone wants to sell you or offers you a meteorite, it is a first alert to think that it is necessary to immediately request the guidance of an expert, however, if we are the ones who find a rock of interest, we can consider the following:

Figure 140.

Meteorito Chupaderos II. PM.

Scenario one:

a) It is heavier than other rocks;
b) Carefully sand one edge, and see if the inside is similar in color to stainless steel;
c) Has bubbles on the surface or inside.

Figure 141.

Detail of a meteor. PM.

Scenario two:

a) It is not heavier than other rocks;
b) It has a dark crust on the outside;
c) When applying hydrogen peroxide it does not bubble;
d) Inside it is clear or ferrous and white dots or metallic sheens are observed.

Figure 142.

Detail of a meteor. PM.

Figure 143.

Detail of a meteor. PM.

Scenario three:

We witnessed its fall and when we arrived we were able to identify the fragments inside the respective craters.

Figure 144.

D The detail in a meteor in Canadá.

Naturally, this third scenario is unlikely but not impossible.

It is important to remember that due to their entry into the Earth, meteorites present an entry crust that is devoid of sharp edges and it is possible to identify a dark entry crust.

As a final note, the ideas given to recognize a meteorite only fit the most frequently found, however, we are convinced that there must be a large number of these wonderful objects that we simply have not been able to identify, waiting for us to advance in our knowledge so that we can identify them and with them, be able to study them in depth.

Possible carriers of life?

Finally, it is possible to imagine a scenario where life on Earth is surely linked to the elements that formed us and all of them come from the cosmos of which we are a part, in such a way that, whether life began on this Earth or may have been brought in one or many of the meteorites that have arrived, we are part of a cosmos and without a doubt, the elements that allowed the development of the magnificent treasure of life as we know it had their origins beyond our beautiful blue protective layer.

Figure 145.

Lunar rock brought by Neil Armstrong, mission Apolo 11. UNIVERSUM.

Figure 146.

Lunar rock brought by Neil Armstrong, mission Apolo 11. UNIVERSUM.

Figure 147.

Lunar Rocks, brought by Neil Armstrong, mission Apolo 11, and Apolo 17. UNIVERSUM.

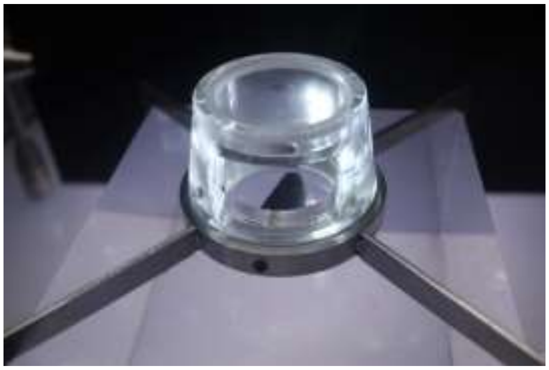

Figure 148.

Lunar rock brings by Apolo 17 mission. UNIVERSUM.

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