

The Museu Blau, a natural history museum for the 21st century

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Introduction

According to the International Council of Museums (ICOM) statutes, a museum is "a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment." [3].

This definition reflects the evolution of the concept of what a museum is and does, and it is far removed from the original function of a natural history museum as a space where collections of items or works related to nature were preserved and exhibited. Wax anatomical models, herbaria, and animals either taxidermied in a life-like pose or alcohol- or formalin-preserved, and mineral and rock samples were exhibited in a manner not much different from the 'cabinets of curiosities,' of the Renaissance, which gathered together varied objects related to natural history, archaeology, ethnography and art. Indeed, the Botanical Institute of Barcelona is still home to the cabinet of curiosities made up of a library and the collections gathered during the 17th and 18th centuries by several generations of the Salvador family, whose members included Catalan naturalists and apothecaries (Fig. 1).

Over the last century and especially the last several decades, our notion of how to present collections and even what the contents of permanent museum exhibits should be has changed. A natural history museum is no longer a static place where visitors go only to view glass-encased specimens. Today, museums are spaces that promote interactivity, an effort that has been enormously aided and enriched by the incorporation of technology into museography. Nonetheless, a museum is defined by its collections and thereby differs from a science center.

Another feature of museums is research, which is often invisible to visitors. Beyond the exhibition spaces of natural history museums, there are laboratories where researchers work just as they do in a university laboratory or any research center. Nowadays, the trend is to allow the public to observe a museum's laboratories. A prime example is the Natural History Mu-

seum of London, which, in September 2009 opened a new building, the Cocoon, in the Museum's Darwin Centre. Now a visit to that museum includes the opportunity to see researchers at work. This public outreach effort reflects the vital role of natural history museums, botanical gardens, and herbarium collections in monitoring climate change, as studies of the evolution of biodiversity have provided important indicators thereof.

In 2007, representatives of 93 natural history institutions (including museums, research institutes, botanical gardens, and zoos) from 36 countries around the world signed "The Buffon Declaration: Natural History Institutions and the Environmental Crisis." [4] The Declaration states that science is crucial for the sustainable management of biodiversity and ecosystems and, therefore, for the survival of human life on the planet. In this context, natural history institutions make four vital contributions: (i) they are the primary repositories of the scientific samples on which our understanding of the variety of life is ultimately based (ii) through cutting-edge research, they expand our knowledge of the structure and dynamics of biodiversity in the present and the past, (iii) through partnerships, training, and capacity-building programs, they improve the world's ability to address current and future environmental challenges, and (iv) they provide a forum for direct engagement with society, which is essential to help bring about the behavioral changes on which our common future and the future of nature depend. The signatories affirmed the role of natural history institutions in serving the collective good and in linking science, policymakers, and civil society [2].



Fig. 1. Library and cabinet of the Salvador's, reproduced at the Botanical Institute of Barcelona.

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The Natural History Museum of Barcelona

This 134-year-old institution houses a patrimony of more than three million specimens. It consists of four centers located in three emblematic areas of the city. According to its mission statement:

"We generate and share knowledge with the aim of creating a society that is better informed about, more connected to and more responsible towards nature. We do this by maintaining collections that are the tangible testament of the natural heritage of Catalonia, performing research on biological and geological diversity, and creating experiences that encourage as many people as possible to explore, learn, admire, enjoy, engage in dialogue with and participate in [this heritage]."

A history of changing venues. The Museu de Ciències Naturals de Barcelona (Natural History Museum of Barcelona) is currently distributed in different venues located in three areas of the city: Ciutadella, Montjuïc, and the Forum. The first boasts the Museu Martorell and the building known as Castell dels Tres Dragons (Castle of the Three Dragons). The second is home to the Botanical Gardens and Botanical Institute, a research center operated jointly by the Spanish National Research Council (CSIC) and the Barcelona City Council. In March 2011, a new venue was added in the third area, the Museu Blau (Blue Museum), a new facility that will mainly be used for public programs (exhibitions, workshops, conferences, media resource center, etc.).

The Natural History Museum itself has its origins in the Martorell Museum of Archaeology and Natural History, inaugurated in 1882. The legacy that naturalist Francesc Martorell i Peña (1812-1878) bequeathed to the city laid the foundations for what was to become Barcelona's first public museum. That legacy consisted of Martorell's natural sciences and archaeology collections, his library, and funds to build a museum. In the following decades, the Museum's collections steadily grew, mostly benefiting from donations made by citizens. These donations were frequently acknowledged in the newspaper La Vanguardia while others were made anonymously. Wealthy businessmen, artists, and intellectuals made significant contributions as well. For example, on 18 April 1883, the newspaper announced that "renowned architect Mr. Fontseré, director of the works at the [Ciutadella] Park, has donated a white bear to the Martorell Museum." By 1900, the Museum was crammed with the many items it had received, including taxidermied animals, shells, minerals, fossils, and other specimens related to the natural sciences. It was even the recipient of more non-traditional donations such as stamps. This eclectic collection was difficult to catalogue, not to mention preserve and exhibit.

The City Council of Barcelona had developed a plan to make Ciutadella Park, where the Martorell Museum was located, a cultural space dedicated to the natural sciences. Thus, in 1906, the City Council set up the Municipal Natural Sciences Board (with the incorporation of the Provincial Government in 1917 and the *Mancomunitat de Catalunya* (Commonwealth of Cata-

Ionia, in 1920) to manage the park's facilities: the Martorell Museum, the Zoology Museum, the Zootechnical Museum, the Greenhouse and the Shade House. The Board decided to move the collections of the Martorell Museum to the nearby Castell dels Tres Dragons, which had been built to serve as a café-restaurant for the Barcelona World Fair held in 1888. This prestigious building was the work of the famous Modernist architect Lluís Doménech i Montaner. Yet, while the two buildings-the Martorell Museum and the Castell dels tres Dragons-were physically very close to each other, the move was not an easy decision for the Board because the Castell was already devoted to other activities, specifically, an exhibition on fish farming and fisheries, which had opened on its first floor in December 1912. Originally scheduled to close on 30 June 1913, the exhibit was so successful that it was extended until the end of the year. The Board had to again request use of the building and finally acquired the first floor as a natural history museum. After extensive restoration work, in 1917 the new Natural History Museum of Catalonia was inaugurated. Its aim was to exhibit samples of Catalan flora, fauna, and geology. In addition, the new museum integrated the work of naturalists linked to the recently created Catalan Institute of Natural History, which had been carrying out pioneering research focused on Catalonia.

In 1935, the Botany Department of the Natural Sciences Museum broke away to become the Botanical Institute of Barcelona. Located in Montjuïc Park, it was one of the first research centers of the Catalan Autonomous Government, established in 1931. Dr. Pius Font i Quer, who had directed the Botany Department, was appointed as the first director of the new Institute. During his tenure, he gathered all of the botany collections spread throughout Catalonia to set up the Botanical Gardens in Sots de la Foixarda, a former quarry in Montjuïc.

As part of the changes imposed on the city by the 1992 Olympic Games in Montjuïc, the City Council decided to move the historical Botanical Gardens to another area in the same park. In its new location, the Botanical Gardens were dedicated to the conservation of Mediterranean flora. One year after its 1999 inauguration, the Botanical Institute became a joint center of the Spanish Scientific Research Council (CSIC) and the city of Barcelona. In 2003, it moved to its current location, on the premises of the new Botanical Gardens, in a new building built by the CSIC.

In 2000, the Zoology Museum and the Geology Museum were combined to form the Natural History Museum. The unification continued with the inclusion of the Botanical Gardens in 2008, thereby establishing a stable working relationship with the Botanical Institute in the areas of public programs and administration. In 2011, the Museum's new headquarters was opened in the Forum area as the *Museu Blau*.

The collections. Its collections are what make the Natural History Museum special and unique. Although they date from the institution's very beginning, they have been constantly enriched over the years, thanks to research and to agreements with other institutions charged with protecting natural spaces, the Barcelona Zoo, etc.

The mineralogy and petrology collections now contain over 38,000 specimens. Of particular interest is the collection of mineralogy micromounts, comprising a basic systematic and geographical reference. The paleontology collections include some 150,000 vertebrate, invertebrate, and paleobotanical objects and thus provide an excellent overview of the paleontology of Catalonia. The zoology collections are made up of more than 1,920,000 listed items (over 1 million specimens). Of particular note for their scientific relevance are the type samples (8700 types or paratypes), the coleoptera collections (a collection of cave-dwelling beetles that is one of the finest in the world), the collection of darkling beetles, the mollusk collection, and the skeleton collections, which include species from all over the world. The Nature's Sound Archive has 83,000 recordings of natural sounds and offers a very interesting resource for consultation by specialists and by the general public.

The Botanical Garden collection contains 1500 species of living plants, with some 17,600 individual specimens. It also has a seed bank with 2500 listed items. The Documentation Center houses an extensive collection made up of 13,100 books, 1660 scientific journals titles, 3300 maps and images, and an historical archive. The Botanical Institute contains a large herbarium with about 860,000 pages of preserved specimens, as well as the Salvador Science and Plant Library, a 17th-century library, and collection of curiosities. The Institute also has a library with 9080 books and 1400 scientific journal titles, a map collection and an historical archive.

Activities. In 1993, Pere Alberch (1954–1988), a paleontologist who had worked with Stephen Jay Gould and had served as the director of the Natural History Museum in Madrid, stated that "natural history museums are at a turning point in their history. They can now play a central and critical role in the development of research leading towards the understanding, conservation and sustainable use of biodiversity. To achieve this goal, however, they must radically change their mode of operation and public image, to clearly define goals, objectives and new research strategies." [1]. The Natural History Museum of Barcelona is thus no longer an anachronistic institution, focused only on its own collections, 'a museum of itself' in Alberch's words. Instead, in addition to its exhibits, the Museum organizes numerous activities aimed at attracting the local citizenship as well as Barcelona's many visitors to the scientific world.

Even before the 2007 Buffon Declaration, the Natural History Museum of Barcelona was engaged in the activities that the Declaration considers to be crucial: lectures and debates on topics of current interest (also through the Museum's blog), guided visits for schools, retirees, and families, and research activities that allow the participation of non-scientist citizens. The Science Nest and the Association of the Friends of the Natural History Museum of Barcelona deserve special mention.

At the Science Nest, the youngest visitors (ages 6 and under), accompanied by caregivers or parents, are offered handson experiences, either creative or observational. It is the question rather than the answer that matters here because the aim of these experiences is to encourage the young child's curiosity

and desire to learn. After a session at the Science Nest, children can wander around the main exhibition rooms with their parents, caregivers, or teachers, linking the many objects on display to their Science Nest activities. The Association of the Friends of the Natural History Museum of Barcelona is a non-profit association that supports the Museum and its programs and activities. Members of the Association contribute to the Museum with their ideas, suggestions, and experiences and may even become involved in research projects. They also organize meetings, debates, and excursions to natural spaces of interest.

Research, publications and Documentation Center. Scientific research has been a major task of the Barcelona Natural History Museum since its foundation. Research at the museum is aimed at the study and interpretation of the diversity of life and the geological structures that support it, with special emphasis on Mediterranean environments. The museum is thus engaged in research based on collections and in the study of species in their natural environment, evaluating their interactions with the environment and with each other. The main lines of research carried out at the Museum are: the geological structure of Catalonia, the biostratigraphy and paleobiogeography of the Tethys Sea, biodiversity and molecular biology (malacology, entomology, and biospeleology, chordates, and molecular biology), evolutionary and behavioral ecology, and the history of the natural sciences. In addition, the Barcelona Botanical Institute conducts research on vascular plant diversity, the history of botany, palynology, and paleoecology.

The Museum publishes four scientific journals aimed at disseminating the latest findings and scientific advances: *Treballs del Museu de Geologia de Barcelona*, *Animal Diversity and Conservation*, *Arxius de Miscel·lània Zoològica*, and *Monografies del Museu de Ciències Naturals* (formerly, *Treballs del Museu de Zoologia*). In addition, the Museum publishes educational materials for schools, temporary exhibition catalogues and books related to the topics dealt with in the Museum (Fig. 2).

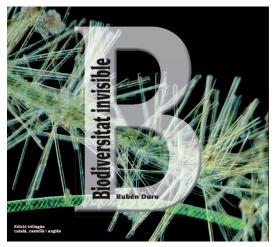


Fig. 2. Biodiversitat invisible (Invisible Biodiversity) cover, edited in Catalan, Spanish and English, by Rubén Duro. Joint publication by the Museum of Natural History of Barcelona and the Institute for Catalan Studies. Published on the occasion of the opening of the new reference exhibit at the *Museu Blau*.

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The Documentation Center comprises a wealth of bibliographic resources and a wide range of information on Earth and the life sciences, especially in the fields of geology, paleontology, mineralogy, nature, biodiversity, zoology, ethology, bioacoustics, taxidermy, and museum studies. The Center provides services in *Castell dels Tres Dragons*, in Ciutadella Park. The Library of the Botanical Institute contains large collections in all thematic areas of botany: vegetation around the world (particularly Mediterranean flora), taxonomy, applied botany, mycology, genetics, ecology, and conservation. It is essentially a research library but is open to anyone interested in botany.

In all, the Documentation Center and the Library contain more than 20,000 monographic articles, 3000 international periodical publications, 3600 maps, and several historical collections with approximately 2000 titles on naturalist topics dating from the 16th to the 19th centuries (in the Botanical Institute) and from the 17th to the 19th centuries (Documentation Center), as well as archived and photographic collections and documentation relating to the work of both institutions. The sum of these collections represents, in volume and quality, the largest documentary natural-history heritage in Catalonia. The two centers form part of the CSIC Libraries Network and the catalogue is available online at http://aleph.csic.es/ (searching by centers can be done using the advanced search option).

A new venue: the Museu Blau

The *Museu Blau* (Blue Museum) is a facility with an innovative cultural offer that is dedicated to furthering our knowledge of and investigations into the natural sciences while offering the public a leisure time experience that includes hands-on learning and rigorous debate of current environmental topics.

The *Museu Blau* building. In March 2011, the new head-quarters of the Museum were inaugurated in what was previously called the Forum. The name *Museu Blau* comes from the indigo-blue color of this emblematic building, whose shape is a 180-meter equilateral triangle, 25 meters in height. It is located at an edge of the Forum Park, in the Diagonal Mar area, near the seashore. It was designed by the Swiss architectural team of Jacques Herzog and Pierre de Meuron, on the occasion of the 2004 Forum of Cultures held in Barcelona (Fig. 3). Establishing a new space for the Natural History Museum was a challenge for the architects, but they took advantage of the characteristics of the building, transforming it as little as possible while ensuring its suitability as a museum.

They were also deeply involved in the museography and thus took care to integrate the scientific content of the exhibits with the already existing spaces. In fact, the exhibition arrangement follows the logic of the existing space and at the same time completely alters it. Interior patios, which might have been considered a hindrance, now seem to have been especially designed for the Museum. One of the two main exhibits and the one that visitors first encounter is the history and evolution of the Earth and life on our planet. The specimens are displayed such that they seem to emerge from the dark surfaces of the



Fig. 3. The Museu Blau building.

roughened walls, which resemble volcanic rocks spewing out their contents.

The facilities of the Museu Blau. The Museum occupies an area of 9000 m², distributed on three floors, but most of its facilities are now on the second floor. Visitors reach the lobby through the main stairway, where they are welcomed by a 20-m whale skeleton-originally displayed at the Castell dels Tres Dragons — dramatically suspended from the ceiling (Fig. 3). Its white bones contrast with the dark walls and ceiling of the Museu Blau, adding to the sense of a mystery that will soon be revealed. The spacious lobby is the starting point for the visit to the Museum but can also be a reason for a visit itself: it contains a media library, a bookshop, a restaurant, temporary exhibits and display cases with specimens from other natural history museums in Catalonia, and information about those museums. The 'Science Nest,' for children ages 0-6, the lecture rooms, a conference hall, and other event spaces, administration and support areas are also connected with the lobby, as is the area for the main permanent exhibits (Fig. 4).

The reference exhibition: Planet Life

The core of the Museum is its reference exhibition, which was named 'Planet Life' (*Planeta Vida*) because it is life that has made the Earth different from any other planet. The perspective offered by Planet Life is very different from standard descriptions of the evolution of the Earth and living beings that can be found in other museums. The exhibit aims to attract a wide audience, appealing to people with a broad range of interests, educational levels, and ages. It tells the tale of the joint evolution of life and the Earth, taking advantage of the vast resources offered by the Museum's collections and enhanced with up-to-date explanations using 21st-century museographic resources, including interactive screens, replicas, life-size models, graphics, and audiovisuals. Planet Life is structured around three major concepts: The Biography of the Earth, The

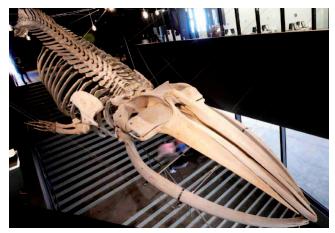


Fig. 4. Skeleton of a fin whale (*Balaenoptera physalus*) that beached in Llançà, Costa Brava in 1862. The village of Llançà and the University of Barcelona collaborated to ensure the preservation of the skeleton measuring almost 20 m in length and weighing a ton, which in 1917 was taken to the Martorell Museum. This year marks its 150th anniversary.

Earth Today, and Islands of Science (Table 1). It offers a space for exploring, discovering, and acquiring a sense of the wonder of nature (Fig. 5).

Mission statement. The Earth is clearly distinguishable from its neighbors Venus and Mars by its very special atmosphere, containing oxygen, a strong oxidizing gas, and by its emission of light, as a result of its large forest fires and luminous cities. Before we arrived at our present understanding of the history of the Earth and life, many hypotheses were put forward to try and explain the events surrounding its origin. For a long time, we humans believed that our planet was the center of the Universe. Copernicus showed that this was not so; that the Earth is just another planet of our star, the Sun. Like many other stars, the Sun is orbited by small, non-luminous bodies: the planets. Our Earth was formed some 4.5 billion years ago and is the third planet from the center of the solar system.

However, the belief persisted that Earth, from the very beginning, had been home to many different kinds of animals and plants, all of which were there to serve us and that we were 'the lords of creation.' We were also taught that Earth, as modern humans know it, was created in a very short time... only six days. Charles Darwin convinced us otherwise. He showed that the Earth was much, much older; that it took hundreds of millions of years for it to achieve its present state, including the current geography of its mountains, rivers, and oceans, the animals and plants that we know, and the presence of microbes in every conceivable environment. This view implied that the skin of our planet has undergone countless transformations and that living things have been subject to a great many changes over the course of evolution.

Finally, until quite recently, we considered the Earth to be a privileged place, where life was possible because of the special conditions of the planet, which are quite different from those on Venus and Mars, our companions in space. But the British chemist James Lovelock proved us wrong, by showing that the original conditions on Earth were very similar to those on

Table 1. Team responsible for developing the new reference exhibition 'Planet Life' at the *Museu Blau*

Manager	Anna Omedes
General coordination and museographic content	Natural History Museum of Barcelona
Concept curator	Ricard Guerrero
Scientific coordination	Mercè Piqueras
Museographic project	Herzog & de Meuron
'Biography of the Earth' curators	Carles Curto, Yael Díaz, Jaume Gallemí, and Julio Gómez Alba
'The Earth Today' curators	Carles Curto, Yael Díaz, Jaume Gallemí, Julio Gómez Alba, Ricard Guerrero, and Mercè Piqueras
'The Islands of Science' curators	Ramon Folch, Joan Carles Senar, Jordi Serrallonga, Francesc Uribe

Venus and Mars, and that the presence of life on our planet modified the initial conditions, while the Earth's physical conditions—its atmosphere, climate, and landscape—in turn affected its life forms. This is now known as the Gaia theory, or the science of Earth's physiology.

We could therefore say that we gave our planet the wrong name; it should not be called 'Planet Earth,' not even 'Planet Water' or the 'Blue Planet.' The most appropriate name for it is 'Planet Life,' since life is its principal distinctive trait. Evolution is not just the 'natural selection of organisms;' rather, it is a planetary process that has occurred, and continues to occur, as a result of the interaction between the environment and life forms. The Earth's rocks, soils, rivers, lakes, and seas, as well as its normal and extreme environments, are intimately connected with the myriad organisms that inhabit them and constitute a unique system of Gaian evolution. This system regulates the climate and the conditions that keep our planet habitable.

The Biography of the Earth. The exhibit 'Biography of the Earth' explains this uniqueness of our planet and the particular form of evolution that the Earth has undergone throughout its history. It does so by showcasing the most advanced scientific knowledge, in a clear and easy way to understand presentation, while also providing a comprehensive explanation of phenomena previously considered by completely distinct branches of science: geology, climatology, zoology, botany, microbiology, ecology. The exhibition is also unique in that it has been approached from the viewpoint of Catalonia and adjacent territories; since these are Mediterranean lands, special attention is paid to the Mare Nostrum.

A 700-m² exhibit provides a chronological overview divided in seven periods: the beginning of the Universe and the Earth (13.8–3.8 billion years ago); Archaean, first continents, the beginning of life (3.8–2.5 billion years ago); Proterozoic, new

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continents, first multicellular organisms (2.5 billion–542 million years ago); Lower Paleozoic, major mountain building, explosion of life in the oceans (542–359 million years ago); Upper Paleozoic, Pangaea supercontinent, first land plants and first vertebrates (359–251 million years ago); Mesozoic, diversification of invertebrates, and Cretaceous–Tertiary extinction event (251–65 million years ago), Cenozoic, Glacial Ages, evolution of primates, human beings, (65 million years ago to the present).

For each period, large projected images recreate life at that time, while interactive screens feature the main novelties of the geological changes and life's main 'inventions.' Rocks and fossils from the Museum's collection likewise contribute chapters to Earth's biography. Unlike many museums, which represent the history of life as if all had started in the Cambrian, some 543 million year ago, the *Museu Blau* has not overlooked the Precambrian inventions of life and the critical role that microorganisms played in the history of life. One crucial event was the evolution of the eukaryotic cell by symbiosis or symbiogenesis, a concept first introduced by the American biologist Lynn Margulis in the 1960s and now widely accepted.

The Earth Today. In this 1700-m² exhibit area, visitors discover a diverse world of fossils, animal, fungi, plants, algae, microbes, rocks and minerals. Some sections are based on the Museum's historical collections; in fact, more than 5000 such items are on display. In addition, new collections of taxonomic groups not represented in the former Museum, including fungi, algae, and microorganisms, have been prepared for this exhibit. In the case of microorganisms, the inclusion of fixed cultures was quite labor-intensive, because they are not usually contained in natural history museum collections. This is a puzzling absence, since microorganisms are not only the most abundant living beings on Earth, they are a life form essential to maintaining further life on the planet.



Fig. 5. In 'Planet Life' visitors discover a fascinating, diverse world of fossils, animals, plants, algae, fungi, microbes, rocks, and minerals. The exhibition occupies the largest area on the main floor.

Each section in the 'Earth Today' is represented by display cases specifically designed to accommodate the items they hold. In those devoted to the various organisms, the specimens are not arranged according to systematics, as is done in most museums, but based on commonalities regarding nutrition, shape, relationship with other organisms, motility, reproduction and ecology, among others. There also scale models and interactive moving screens that use animation and illustrations to present the didactic material. Through hyperlinks, visitors can pursue several additional levels of knowledge about each concept. 'More in depth' combines video in which scientists tell us about their research and the latest findings on specific topics related to that area, with display cases showing the relevant items.

Even if the museography presents the units comprising 'The Earth Today' in separate areas, the Earth itself must be understood as a whole that functions through the interaction of its components. Ecosystems are balanced; everything in them has a place and a function. All living beings live on a substrate made of rocks, minerals and water. We know their history; it is told in fossils, sometimes very well, sometimes only partially. Energy flows through the ecosystem's components, species populations interact with each other and with the abiotic components of the ecosystem. Everything functions as the various components of a large system, so that if one component fails, the whole system is disturbed.

In the Animals, Fungi, Plants and Microbes areas, 6×2.5 m panels present the classification of each group and their phylogenetic relationships with the others. Images of the species of the main groups are displayed on screens and change continuously.

Prospects for the Natural History Museum of Barcelona

The Blue Museum will soon be the main venue of the National Museum of Natural History of Catalonia. It will be responsible for defending, preserving, increasing and disseminating the natural heritage of Catalonia and awareness thereof. It aims to be a reference center on natural diversity, mainly that of the region of Catalonia and the Mediterranean area, as well as a museum recognized for its history, the value of its programs and services, its prestige, and the soundness of its criteria and opinions.

The Museum's commitment to conservation should allow it to demonstrate leadership and to serve as a role model based on its high standards and the value it places on environmental sustainability. In addition, it aspires to become a major learning resource in Catalonia, for citizens from all walks of life who share a desire to explore, learn, understand, and acquire more in-depth knowledge about our planetary home. In the coming years, the Museum will remain an integral part of the cultural, social, scientific and environmental life of Catalonia and will seek to build upon its relationships with the institutions and people who share its aims.

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