Biodiversitätsmuseum Göttingen

The storyline

Trogonoptera brookiana trogon Vollenhoven, 1860
Zoological Collection / University of Göttingen

Biodiversitätsmuseum Göttingen

Concept and storyline
Presented by Georg-August-Universität Göttingen
and Kunstraum GfK mbH – vivid exhibitions

Cicinnurus regius (Linnaeus, 1758)
Zoological Collection / University of Göttingen

«This is the assembly of life that took a billion years to evolve. It has eaten the storms – folded them into its genes – and created the world that created us. It holds the world steady. We should preserve every scrap of biodiversity as priceless while we learn to use it and come to understand what it means to humanity.»

— Edward O. Wilson

Cicinnurus regius (Linnaeus, 1758)
Zoological Collection / University of Göttingen

Content

1

«When you realize the value of all life,
you dwell less on what is past and concentrate
more on the preservation of the future.»

— Dian Fossey

The task

Biodiversity

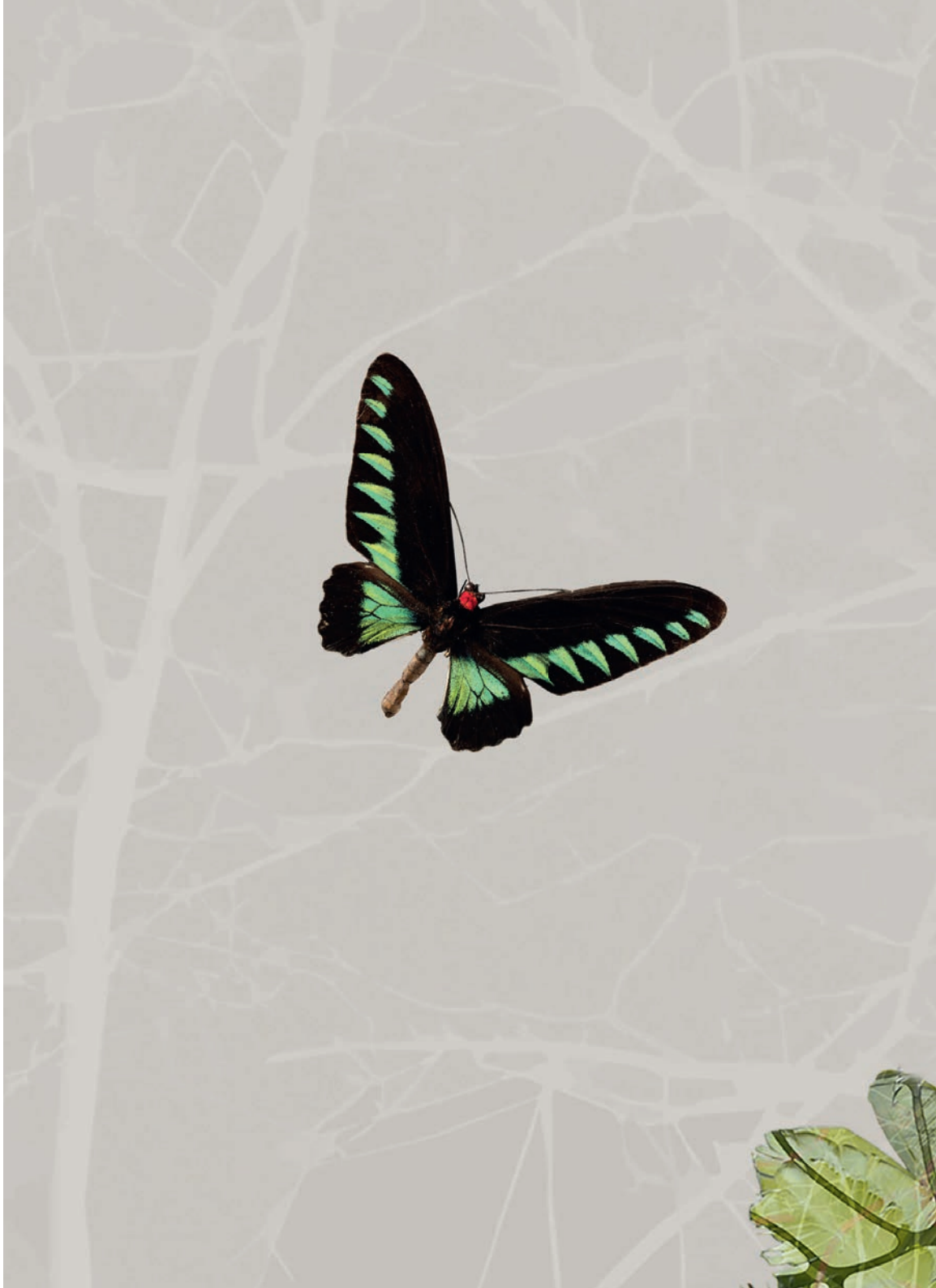
The variety of life on Earth, in all its forms and all its interactions. Humans and human cultural diversity are part of biodiversity.

Threats to biodiversity

«Two global environmental problems, biodiversity loss and climate change, are the preeminent environmental issues of this millenium. Biodiversity loss, the extinction of millions of species, is a very real consequence of increasing human use of the planet. Climate change due to greenhouse gas emissions threatens to alter the composition of the atmosphere and the living conditions on the surface of the planet for both people and all other species.»

— Thomas E. Lovejoy and Lee Hannah

→ **Without biodiversity, there is no future for humanity.**



What is biodiversity?

Why should we preserve and conserve it?

What is the value of biodiversity?

The aim

«We are at a critical moment for the Earth's biodiversity, as a direct result of human pressure. Overcoming this challenge will call for improvements in our knowledge of the mechanisms producing and sustaining biological diversity and predict how ecosystems will respond to man-made global change. The science of biodiversity aims to be inclusive and interdisciplinary, combining knowledge of natural history, evolutionary biology, genetics, ecology, and the social sciences.»

— Rafael Zardoya

Göttingen, the city that creates knowledge, is intimately linked with its university and with more than forty Nobel Prize winners. Currently, researchers from many excellent departments are working in the broad field of biodiversity and sustainability research on the Göttingen Campus. In the Museum of Biodiversity, we will introduce the research from these groups to present what biodiversity is, how it evolved and its interactions within ecosystems. We, as humans, totally depend on this biodiversity and are part of it. However, because of our impact, biodiversity is in crisis. We will show the significant impact of human activity on the planet's biodiversity. Understanding that biodiversity matters to us and what that means for our future is the key to start acting to stop this crisis.

DPZ Deutsches Primatenzentrum Leibniz-Institut für Primatenforschung

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

EFForTS

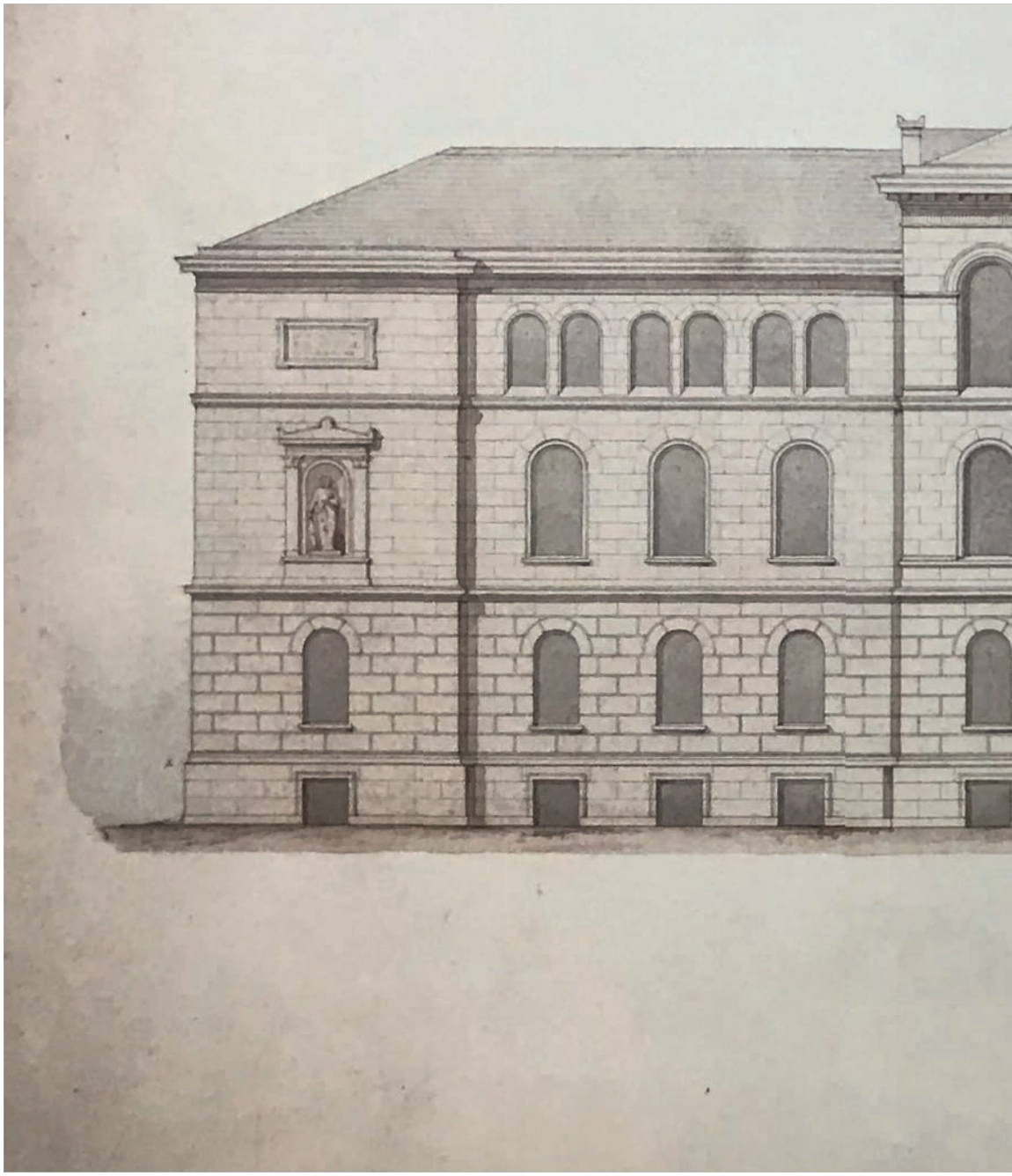
Göttingen Campus

Macaca assamensis (McClelland, 1840)
Kittisak Srithorn / Deutsches Primatenzentrum GmbH

The museum

Zoologisches Museum becomes Biodiversity Museum.

The zoological collection (Zoologische Sammlung) of the Georg-August-Universität Göttingen has a long tradition and was originally part of the Königliches Academisches Museum, which had been founded in 1773. In 1878 the zoological collection moved together with the geological and mineralogical collections to the newly built Naturhistorisches Museum at the Berliner Straße.
However, during the last century, the exhibition area of the zoological collection slowly got reduced while research departments moved into the building. Meanwhile, the value of museums and museum collections got rediscovered. The building at the Berliner Straße is currently being renovated and, in the meantime, the zoological collection has moved to other temporary locations in and around Göttingen.
In 2023 a new museum will be hosted at the second floor of the former Naturhistorisches Museum building. The first floor and part of the ground floor will be occupied by the "Forum Wissen", which will open in 2021. This storyline lays the groundwork for a new exhibition which will focus on biodiversity.



Building of the former Naturhistorisches Museum at the Berliner Straße

VORDERANSICHT.

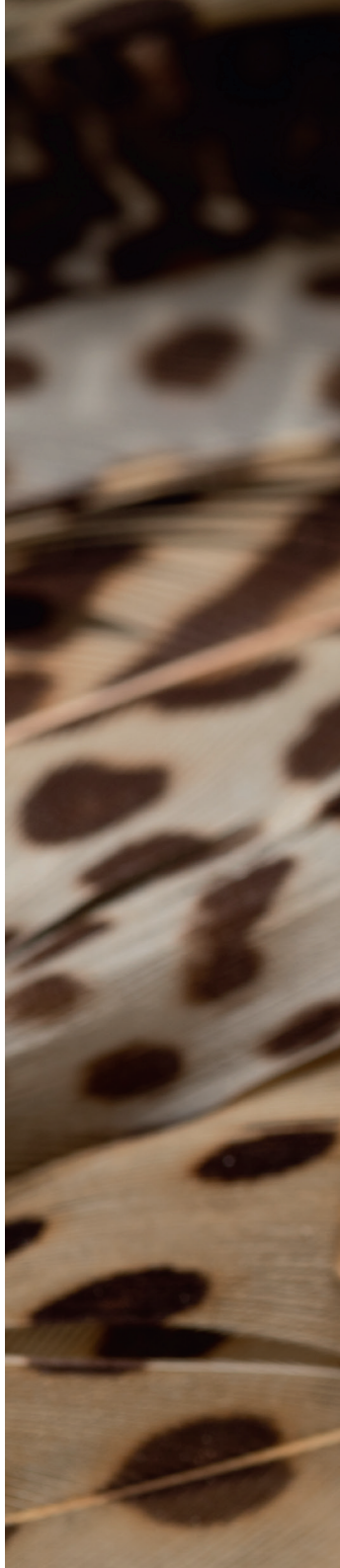
NATURHISTORISCHES MUSEUM FUER GOETTINGEN.

The purposes

Promoting and supporting a scientific culture in the society – this is the overall aim of the museum. By kindling enthusiasm for the natural world and its exploration, we strive to make science from the university accessible to the general public.

Science – this is the message – is not happening in an ivory tower, and its findings have relevance for our lives. Starting from there, we want to equip people to become active players within their communities. Beyond individual visitors, we envision the museum as a nexus between different communities. As it belongs to the university, it has a naturally strong connection with the scientific community. It aims to become a meeting point for different scientific groups and also offer expertise about scientific outreach to scientists.

The museum will also continue to be part of the museum community, participate in platforms and networks and work closely with Forum Wissen in the same building. One further aim is to build strong connections locally and reach out to the citizens of Göttingen. The idea is to create a space for art, thinking and recreation, thus promoting a culture of science in the city. Complementing the exhibition, the museum will reach out to schools, students and also other visitors. We will look beyond the "usual suspects" who visit museums regularly and develop programs that address minority groups or people with handicaps.
The exhibition itself has different didactic purposes: it will be a window into current research, but also an intellectual and emotional journey through the wonders of the natural world. It hopes to inspire curiosity, creativity and – ideally – commitment.



Argusianus argus (Linnaeus, 1766)
Zoological Collection / University of Göttingen

The subjects

Biodiversity basics and how to act

The exhibition has three main subjects: biodiversity and evolution, biodiversity and ecosystems, and biodiversity and human impact.

The visitors learn about them in 6 chapters that are framed by a prologue and an epilogue. Biodiversity and evolution is the main focus in chapter 2 and 3, chapter 1 and 4 have an emphasis on ecosystems, while chapter 5 and 6 are dedicated to the human impact on biodiversity. Like in real life, the different themes are closely intertwined, that is why the content is not rigidly presented in three blocks. Instead the visitors go on a quest, finding riddles that have been solved and other, unsolved ones, on the way. They also meet the professional explorers, e.g. scientists whose research is presented.

*Pinguinus impennis (*Linnaeus, 1758)
Zoological Collection / University of Göttingen

Biodiversity and ecosystems

What are the interactions in biodiversity?
How does it change?

Biodiversity and human impact

How are human influences changing biodiversity?
How can we protect and conserve?

Target groups

Visitors are protagonists

The Biodiversity museum aims to empower citizens with scientific knowledge to become active members in their communities.

Our potential visitors are different kinds of people, in a wide range of ages, motivated by different feelings. Some of them will come just looking for entertainment, others will seek, in addition, an intellectual challenge. Those who are curious, or disruptive, those who want to help and improve what surrounds them, experts, creative minds, or simply those who are bored or don't know what else to do in a rainy day.

All of you are welcome. This is your Museum! Citizens participate at many different levels in their communities. We are the main engine that moves society and also the main ingredient of every societal movement. However, citizens often don't feel they (can) participate in science. Science is usually seen as a combination of different unconnected parcels of expertise, difficult to understand, poorly connected to our daily lives. This museum offers the opportunity to fill these gaps, to understand the different sections, and to participate finding connections. Every chapter is designed as a new experience. Going from one room into another provides a gradual increase of interconnected concepts and feelings.

The overall experience aims to be as inclusive as possible, attending different needs and expectations. It needs to be carefully designed and structured in different layers, physically and intellectually accessible. This ranges from seats for elderly visitors and furniture that is accessible for wheelchair users to creative stations that keep small children busy and interactions that can be used by groups of teenagers. The experience includes tailored group activities like rallies, creative tasks or role games. The information, interactions and experience opportunities are organized in a way to take into account the different levels of interests but also the accessibility for adults and children.

Target groups: schools, families, experts, students, etc.

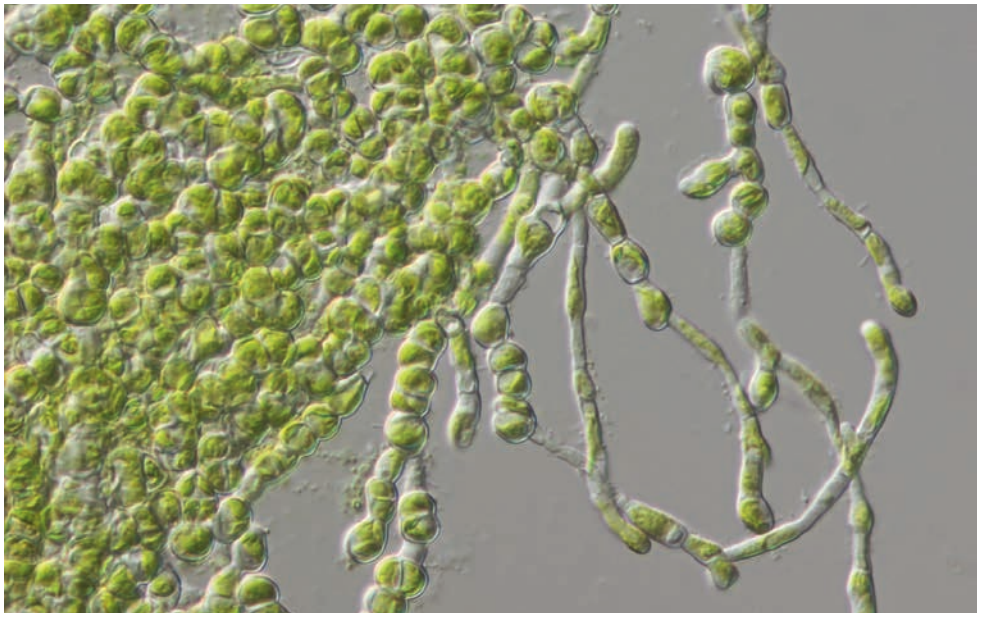
The collections

Knowledge and beauty

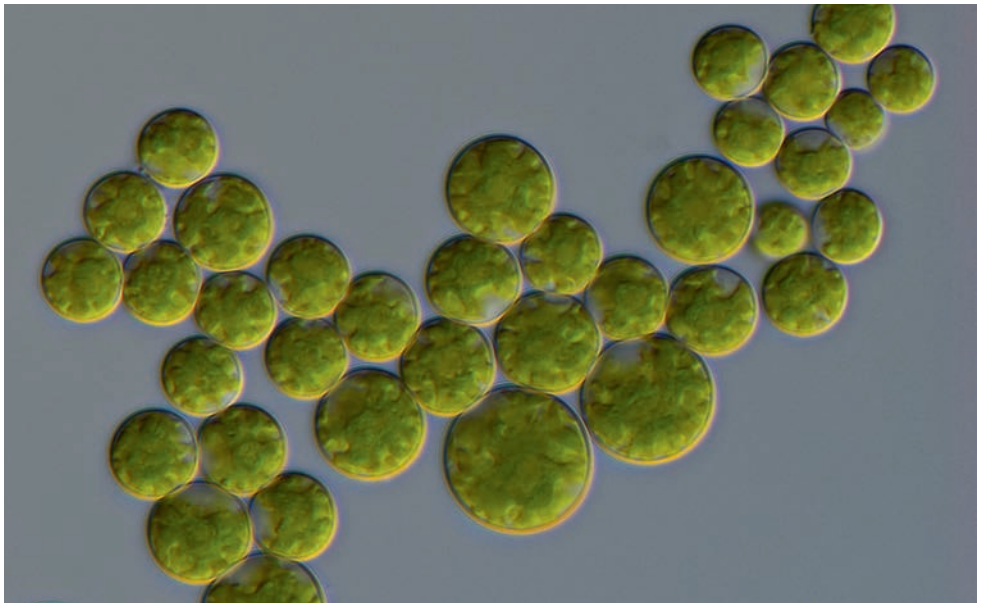
The Georg-August-Universität is home to a number of botanical and zoological collections that cover a wide range of topics.

The zoological collections alone contain more than 100,000 objects ranging from flatworms over extinct birds to the complete skeleton of a sperm whale. Many of these specimens have a cultural and historical value as well as a scientific one. The new museum will present the collections and put them into the context of biodiversity research. In each chapter, we will showcase some key exhibits from the university collections, carefully chosen to illustrate and underpin the storyline. The presentation of the exhibits will stress different aspects, depending on the chapter of the story. Sometimes it will show the beauty of nature, sometimes it will focus on a specific detail like a single bone that proves a connection between two related species.

Culture Collection of Algae (SAG) of the University of Göttingen



Halofilum ramosum Darienko & Pröschold, 2017



Asterochloris gaertneri Skaloud & Peksa, 2015 (photos by T. Darienko)

Coracias garrulus Linnaeus, 1758

Arestorides argus (Linnaeus, 1758)

Ovibos moschatus (Zimmermann, 1780) (photo by C. Fischer)

Communication & didactics

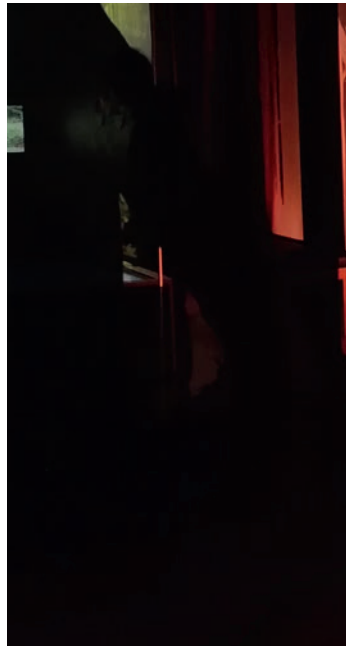
For the heart and the mind

In addition to exhibits, the exhibition will use several different ways of communicating with the visitors: printed text, multimedia installations, hands-ons, analogies, simulations and stations for creativity and participation. Different learning competencies will be stimulated.

Thinking – conceptual competencies: Minds on!
The exhibition will have to do a bit of explaining, and this can happen in many different ways that educate and entertain: There will be text, infographics and videos, but also real specimens and analogies for certain processes in nature.

Making – procedural competencies: Hands on!
Hands-ons are a great way of conveying information. These can be simple, like puzzles, quizzes or smelling stations, but also more complex like a scientific simulation or a role game with several characters.

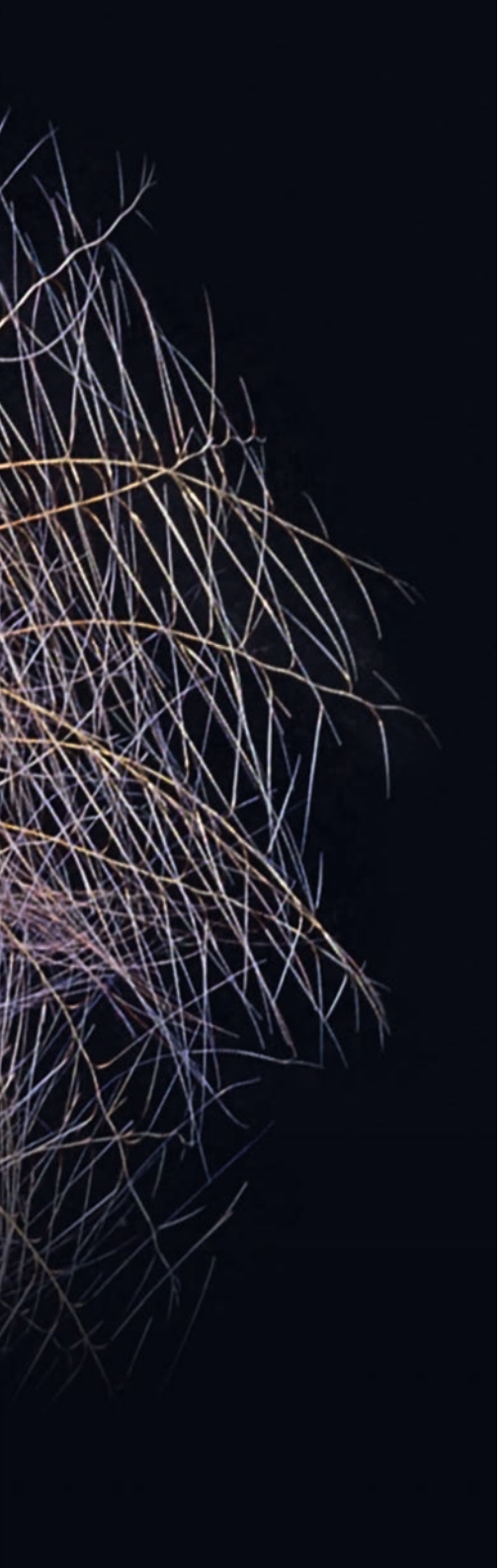
Feeling – attitudinal competencies: Hearts on!
A good exhibition is one that appeals to the visitors' emotions. Most of all we want the visitors to marvel at the sheer diversity and beauty of nature, and that is what the first chapters are showing. But we will also talk about loss (in the form of extinction) and show how the loss has been accelerated through human impact. On the other hand, we will show how scientists develop their research in biodiversity and work towards preserving it. Possible ways to develop citizen science projects and to engage in nature conservation will be as well presented. This will be a motivation for the public to get active in the current challenge of conserving biodiversity.



Thinking: Minds on!

Making: Hands on!

Feeling: Hearts on!



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«We have become, by the power of a glorious evolutionary accident called intelligence, the stewards of life's continuity on earth. We did not ask for this role, but we cannot abjure it. We may not be suited to it, but here we are.»

— Stephen Jay Gould

The concept

Knowledge gaps & how to fill them

Biodiversity studies are a relatively new discipline, and few people outside academia have a full understanding of what "biodiversity" exactly is and how it is different from the term "Artenvielfalt" (diversity of species), which is more common in Germany.

While the basics of evolutionary theory and ecology are taught in school, most people don't have a comprehensive grasp of the complex relationships and thus struggle with it on a practical level. This is painfully evident every time a building project gets stopped because of a rare species that is deemed "unimportant" by the general public while environmentalists try hard to explain the urgency.

This lack of understanding isn't entirely surprising – some mechanisms that lie at the heart of the loss of biodiversity are not intuitive. Some misconceptions regarding evolution are still quite common in the general public, like the idea that evolution has a clear direction and always moves from simple to complex.
It is therefore of utmost importance for the exhibition to explain the basics of biodiversity studies in an entertaining and understandable way so that visitors gain the insight needed to understand their own role and the urgency. There is also good news: Most people and especially children love nature and a good story, they will marvel at the beauty and the twists and turns of evolutionary science, soaking up the knowledge in passing.

*Paradisaea rudolphi (*Finsch & A. B. Meyer, 1885)
Zoological Collection / University of Göttingen

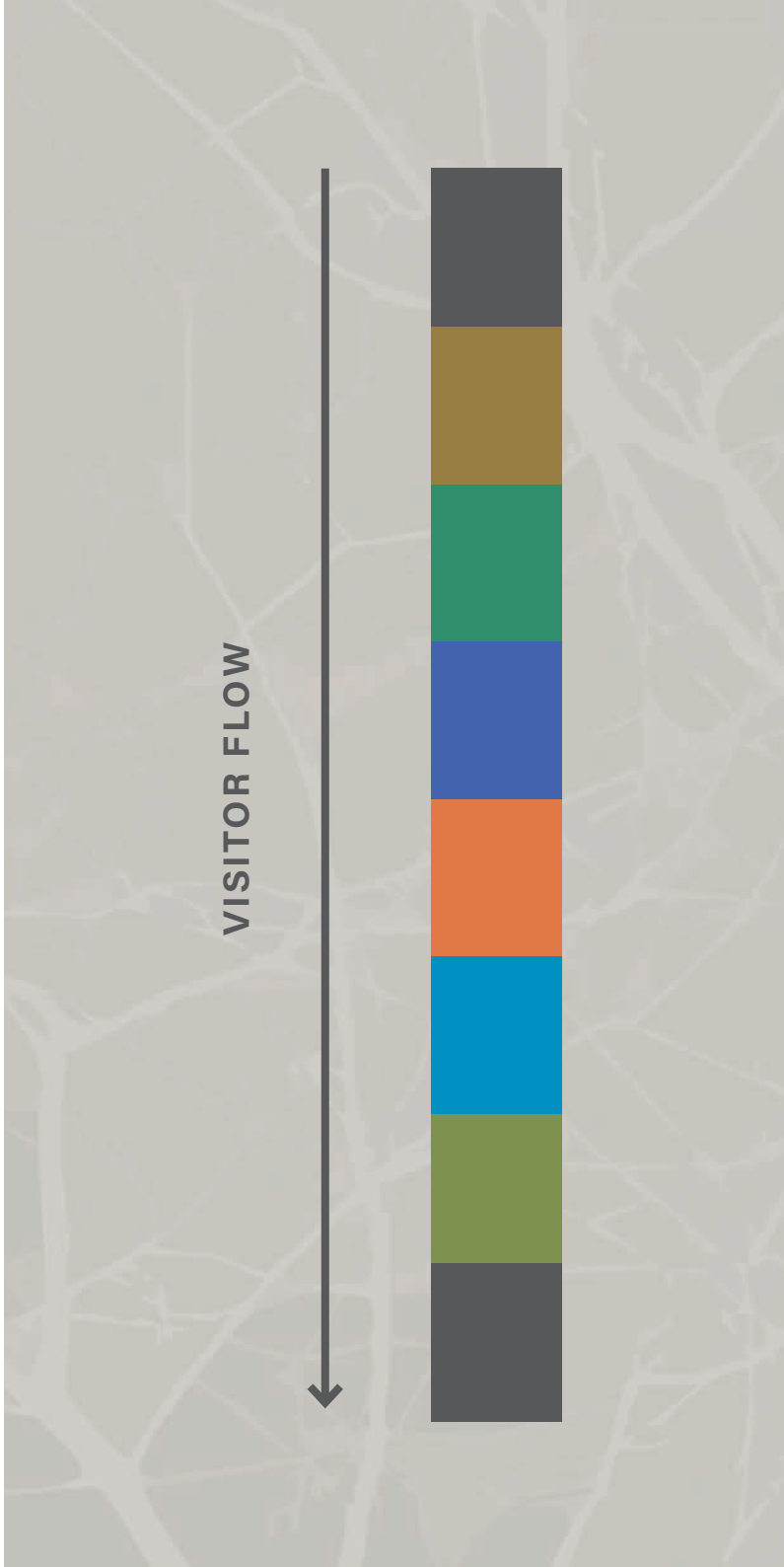
«WITHOUT BIODIVERSITY, THERE IS NO FUTURE FOR HUMANITY»

— David Macdonald

The dramaturgy

The exhibition of the Biodiversity Museum will have a fixed circuit that tells the story in different chapters, starting with basic information and ending with complex interactions.

The exhibition can be imagined like a beautiful pop-up book – each time a page is turned, a new marvel pops up, and new, exciting information is imparted.
Each chapter has a visual "connector" that leads the way to the next chapter and that connects them in an unexpected way. These connectors are physically activated by the visitors, as a metaphor of the experience of learning by acting.



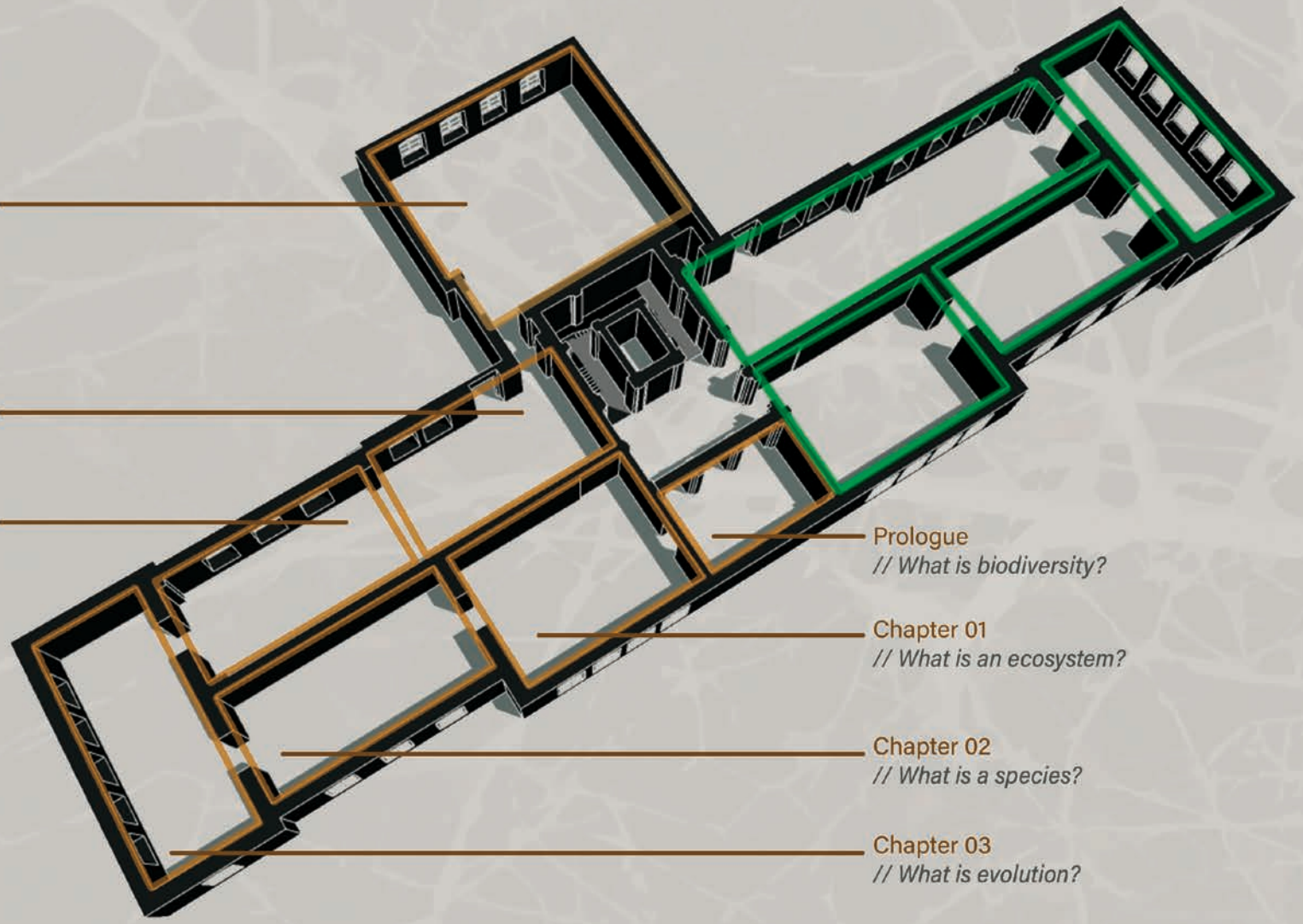
AREAS AND SUBJECTS	SCENOGRAPHY	CONNECTORS
PROLOGUE What is biodiversity (and why is it important)?	Three pillars of biodiversity	
CHAPTER 1 What is an ecosystem?	A rock with lichen in a barren environment	Moth
CHAPTER 2 What is a species?	Mobile with many different insects	Bat
CHAPTER 3 What is evolution?	Transition between terrestrial and marine environment	Starfish
CHAPTER 4 Why does biodiversity matter?	Jungle on an Indonesian island	Bird
CHAPTER 5 Human impact	A palm oil plantation in Indonesia and a corn monoculture in Germany	Bee
CHAPTER 6 Finding biodiversity in your surroundings	Diorama of Göttingen	
EPILOGUE What can I do?	The tree of wishes and commitments	

Spatial organization

The Biodiversity Museum will occupy most of the second floor of the former building of the Naturhistorisches Museum in the Berliner Straße. It is an impressive historical building in the center of Göttingen and with its location next to the main train station it is well connected to public transport.

The second floor consists of a suite of adjacent rooms. This layout is the inspiration for the spatial organization in chapters. Visitors will follow the course through the different spaces, with each room representing a different perspective on biodiversity, each with a different scenography and atmosphere.
One wing will host the exhibition; the other wing is reserved for labs and interactive areas for groups.

Internship rooms and
life science student laboratory



Epilogue
What can I do?
&
Chapter 06
// Finding biodiversity in your surroundings

Chapter 05
// Human impact

Chapter 04
// Why does biodiversity matter?

Prologue
// What is biodiversity?

Chapter 01
// What is an ecosystem?

Chapter 02
// What is a species?

Chapter 03
// What is evolution?

The scenography

The museum is located in a flight of rooms, so each chapter has its own room, and the visitors walk from room to room.

Even though each chapter and thus each room has the same basic structure – an impressive installation in the middle surrounded by interactions and "window elements" – they all look completely different and surprising when the visitors enter them. Each is a new, exciting world that asks and answers new questions. Thus, the visitors feel they are on an exciting expedition through the wonders of biodiversity.

The focus of the room – the crystal – is an atmospheric, and, at the same time artistic 3D depiction of what the chapter is about, the topic condensed in a visually stunning nutshell. The crystal contains, for instance, recreations of an ecosystem with objects from the collections, artistic and conceptual representations of the topic, as well as opportunities to interact with its content. Around the crystal, several media stations, interactions and also specimens in different platforms are grouped in concentric rings. On the outer periphery there is another element: the "windows" – physical windows that open to the world of scientists' work (further explanations in following pages).

Scenography of chapter 1

Scenography of chapter 2

Scenography of chapter 3

Scenography of chapter 4

Organizing the information

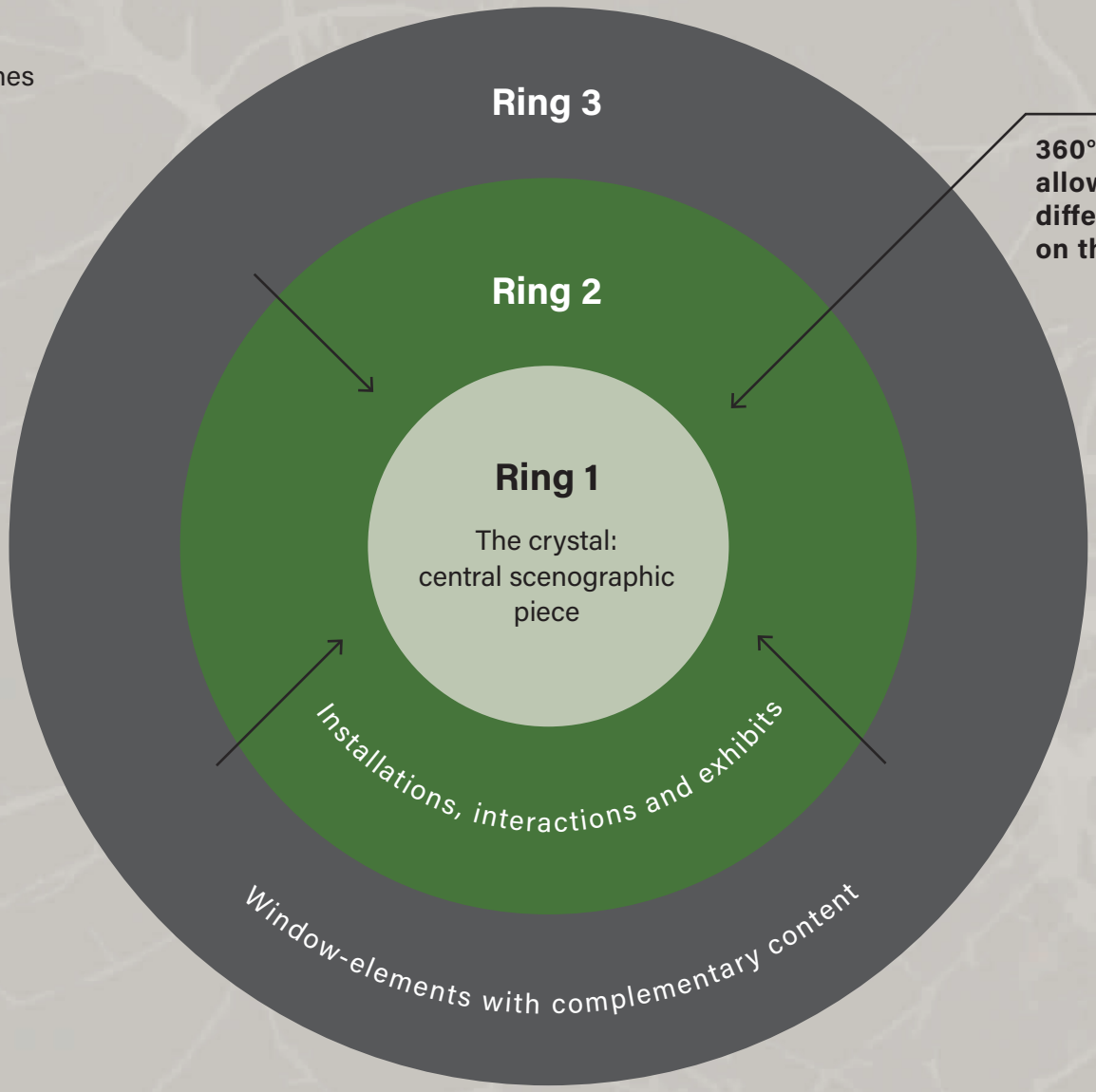
Rings of knowledge and experience

Since the visitors are very diverse, we have to make sure that all of them will be addressed by different media & levels of information, called "rings of knowledge".

Every room has at least three different rings of knowledge in a concentrical order and level of information. The first one and the basic information is in the center, and the last one and additional information in the outer ring.
In the first ring (in the center of the room), as the basic layer of information, there is a vivid scenography "the crystal" that is complemented by headlines and quotes. It sets the mood and the topic of each chapter. Inside this first level ring, basic questions need to be asked and answered, for example, in the "Lichen Room", "What is an ecosystem?" is the central question. The answer will be given in the crystal in relatively simple terms, using the lichen and the rock as an example. Similarly, basic questions regarding the main topics are answered in each room in the corresponding first level of understanding. Thus, a visitor could hurry through the exhibition with little attention and still absorb what it is about.
Beyond that basic understanding, each visitor should be able to gather more information and experiences. To achieve this, there are further "rings of knowledge". For instance, in the "Lichen room", inside the second ring, more in-depth information about both lichens and ecosystems is given, and people can look at different lichens under a microscope. In this second ring, interactive stations, panels and objects will be used as didactic resources.
Finally, on the third level, we have the walls of the room, where the "windows" are located. These "windows" are used as if they were real and they can be opened by visitors. The windows connect the visitors with places outside the building and the exhibition. For instance, the scientific laboratories where different researchers from the University of Göttingen are working. We can see what they do and interact with them. For this, we will use audiovisuals and interactive stations, among other resources.

Chapter / room

Scenography, big headlines
and open-sound



Rings of knowledge for each chapter/room

The windows

Beyond the exhibition

The so-called windows are elements in every room that give an in-depth view of a particular subject.

They are physical windows (that resemble the real windows of the building), of which some can be opened by the visitors in order to "look outside", that is to say beyond the exhibition. It can be a look into another spatial dimension, another world region or a different time period. It is also a closer look into science and at scientists. The scientists who are presented are sometimes the members of the Advisory Council, sometimes the pioneers of biodiversity research, among them many women.

Real windows of the „Naturhistorisches Museum" building

Example 1:
A window into a laboratory, explaining a research project

Example 2:
A window into the ocean,
showing a marine research project

Example 3:
A window into the jungle,
showing biologists working in the field

Example 4:
A window into the
hidden biodiversity in a city

The sense of wonder

Very few people visit an exhibition alone. It is therefore important that different groups can enjoy it together in a way that makes it a collective experience rather than a solitary one.

In families with kids, parents and/or grandparents usually take the role of guiders for the smaller children, while older children or teenagers often act as a kind of "digital guide" for other family members. Thus, the textual information needs to be attractive and friendly, and the exhibits and interactions need to be playful and accessible enough for children and adults to enjoy.
There is also a special place for small children, the "Tiny Explorers" area, in each chapter. The "Tiny Explorers" is a playful interaction that they can use autonomously. In addition to that, there will be a recurrent game of "I spy" where children and parents can try to spot a detail in the room, like a plant or an animal.
For school classes we will develop a pen-and-paper game or even a digital rally that engages them so they cannot pretend to be bored.

In addition to all of this, other didactic resources, like cell phone applications, will be available and shared with the rest of the exhibitions in the building, like the „Forum Wissen".
For all people – old and young, with or without disabilities – it improves the visitors' experience to activate different senses.


DIE REISE
DES FRIEDENS

Scientific content

In addition to the directorship and the curatorship, the museum's Advisory Council is a panel of twelve scientists researching and teaching at the Georg-August-Universität Göttingen.

Within this group, there are specialists for animal biodiversity and evolution, plant and animal ecology, agriculture and forest ecology, to name a few. They have accompanied the development of this concept with their advice and input, and they will continue to support the project during the realization phase. In every chapter, one or two scientists' work will be showcased, so that the visitors get an insight into genuine science.

Direction and curation

Prof. Dr. Christoph Bleidorn
Faculty of Biology & Psychology

Dr. Maria Teresa Aguado Molina
Faculty of Biology & Psychology

Prof. Dr. Julia Fischer
Faculty of Biology & Psychology

Prof. Dr. Alexander Knohl
Faculty of Forest Sciences & Forest Ecology

Prof. Dr. Holger Kreft
Faculty of Forest Sciences & Forest Ecology

Dr. Simone Pfeiffer
Centre of Biodiversity & Sustainable Land Use (CBL)

Prof. Dr. Christoph Leuschner
Faculty of Biology & Psychology

Prof. Dr. Matin Qaim
Faculty of Agricultural Sciences

Prof. Dr. Catrin Westphal
Faculty of Agricultural Sciences

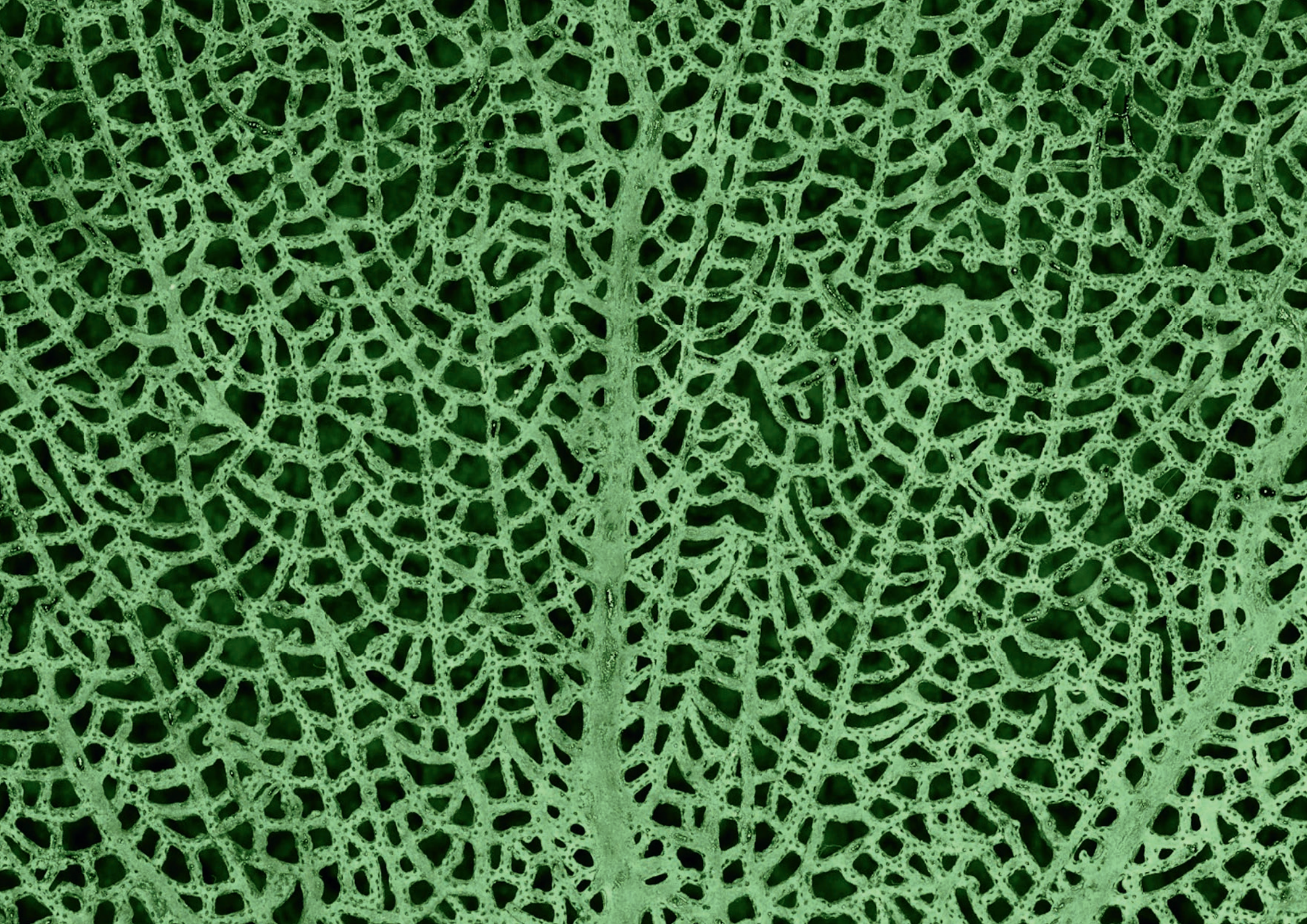
Prof. Dr. Stefan Scheu
Faculty of Biology & Psychology

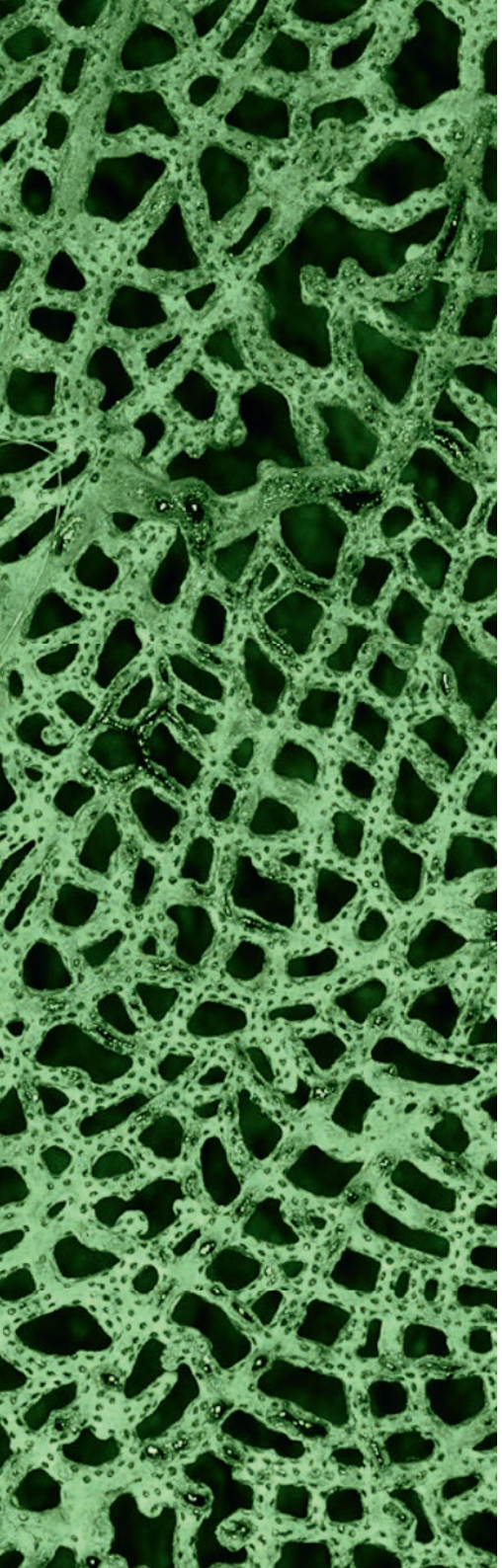
Prof. Dr. Hermann Behling
Faculty of Biology & Psychology

Dr. Maike Lorenz
Faculty of Biology & Psychology

Dr. Sven Bradler
Faculty of Biology & Psychology

Prof. Dr. Thomas Friedl
Faculty of Biology & Psychology





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«In its broadest sense, biodiversity could mean all of life on Earth, and everything that is diverse about life – ecosystems, species, genes.»

— Georgina Mace

Walk through the exhibition

The prologue: What is biodiversity?

The Prologue introduces the subject of the exhibition and provides the visitors with a definition. It also gives a first glimpse into the diversity of nature.

It is set in a dark room in which the three pillars of biodiversity stand out: 1. Diversity within species (genotypes and phenotypes), 2. Diversity of species, 3. Diversity of ecosystems. When the visitors approach them, they can hear quiet voices asking questions like "Why do we need biodiversity? Why is it important to understand biodiversity? What value does it have?" Additionally, some monitors show videos of other visitors answering these questions just before they entered the exhibition. At the end of the exhibition, these same questions will be asked, so visitors could notice if their knowledge and opinion about biodiversity and preservation policies have changed.

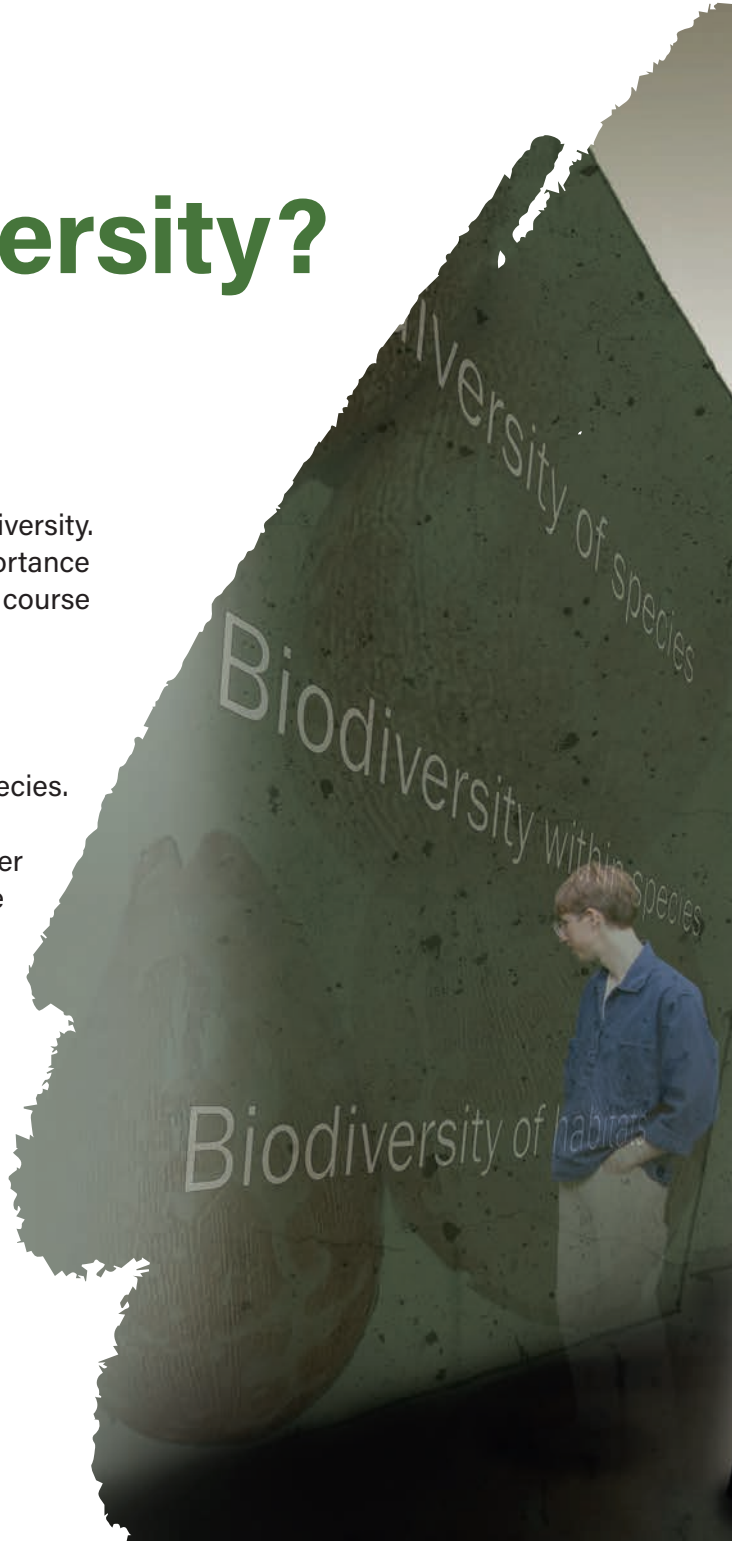
Each of the three transparent pillars shows one aspect of biodiversity: One has a variety of ecosystems, another a variety of species and the last one shows a species with many different individuals (and genotypes).

Topics:

- Provide and illustrate the definition of biodiversity.
- Ask fundamental questions about the importance of biodiversity that will be answered in the course of the exhibition.

Key specimens:

- **First pillar (diversity of species):** Wet specimens to show the diversity of species.
- **Second pillar (diversity within species):** Genotypes and phenotypes. A large number of shells of the same species that show the variety of patterns and colors.
- **Third pillar (diversity of ecosystems):** Model that shows different ecosystems, like a rainforest, a desert or an




„What is
biodiversity?“

3. Walk through the exhibition

Photo by T. Friedl

What is an ecosystem?

«From Everest's peak to the floor of the Mariana Trench, creatures of one kind or another inhabit virtually every square inch of the planetary surface.»

— Edward O. Wilson

Chapter 1

Scenography & subjects

In this chapter, the exhibition lays the foundation for the understanding of evolutionary biology by showing how life and the environment interact.

The room might be surprising for visitors who expect diversity: It is dark and mostly empty, with a group of rocks as the center piece. The walls are covered with reproductions of lichens, and there are genuine lichens growing on the rocks. It is a barren landscape, seemingly hostile to life. But, as the visitors learn, the lichen-covered rock is one of the smallest ecosystems imaginable.

The crystal: key specimens

Lichen and lichen-eating moth
(for example tiger moth species of the genus *Coscinia*).

The crystal: a rock with macrolichen (Photo by T. Friedl)

The lichen-eating moth larva

Topics & interactions

Ring 1: interactive stations
- Interactive station: Definition of ecosystem
- Interactive station: Ecological niche
- Interactive station: Symbiosis

Ring 2: interactive station
A station where you can look at lichens under a microscope. For students there can be an extra task where they have to identify different lichen groups.

Ring 3: window element
Only about 150 years ago scientists realized that lichen is composed of different organisms: fungi and algae.

Tiny Explorers:
A lichen puzzle with lego-type blocks where they can put together different forms and build a 3D lichen.

RING 1: INTERACTION
Definition of symbiosis

RING 2: INTERACTION
Microscope station

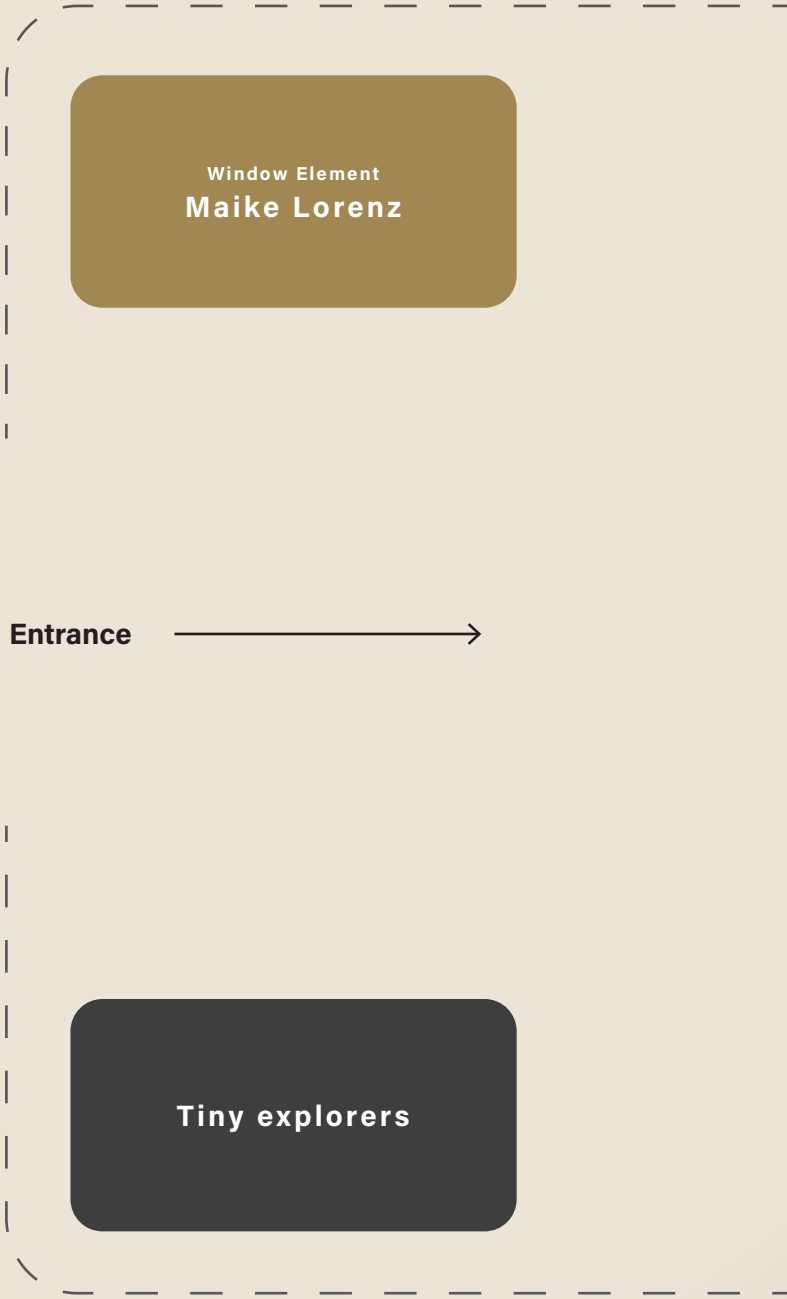
RING 3: WINDOW-ELEMENT
Movies/Algae collection/research

TINY EXPLORERS
Lichen puzzle

Spatial organisation

Dr. Maike Lorenz
Curator of the Culture Collection of Algae at the Department of Experimental Phycology and Culture Collection of Algae at the University of Göttingen (EPSAG) and Senior Lecturer since 1999. Her expertise lies primarily in the isolation, identification, cultivation and cryopreservation of micro and macroalgae, and their possible biotechnological applications.

Prof. Dr. Thomas Friedl
Professor and head of the Department of Experimental Phycology and Director of the Culture Collection of Algae (SAG) since 1999. His main research areas are systematics, molecular phylogeny, biodiversity and biogeography of terrestrial and freshwater algae, algae in complex microbial networks and the potentials of algal biodiversity as sustainable resources.



Ring 3

Ring 2

Ring 1

Crystal

Ecological niche
(interactive station)

Definition of ecosystem
(interactive station)

Symbiosis
(interactive station)

Magnification of lichen (interactive station)

Window Element
Thomas Friedl

Connector:
Moth

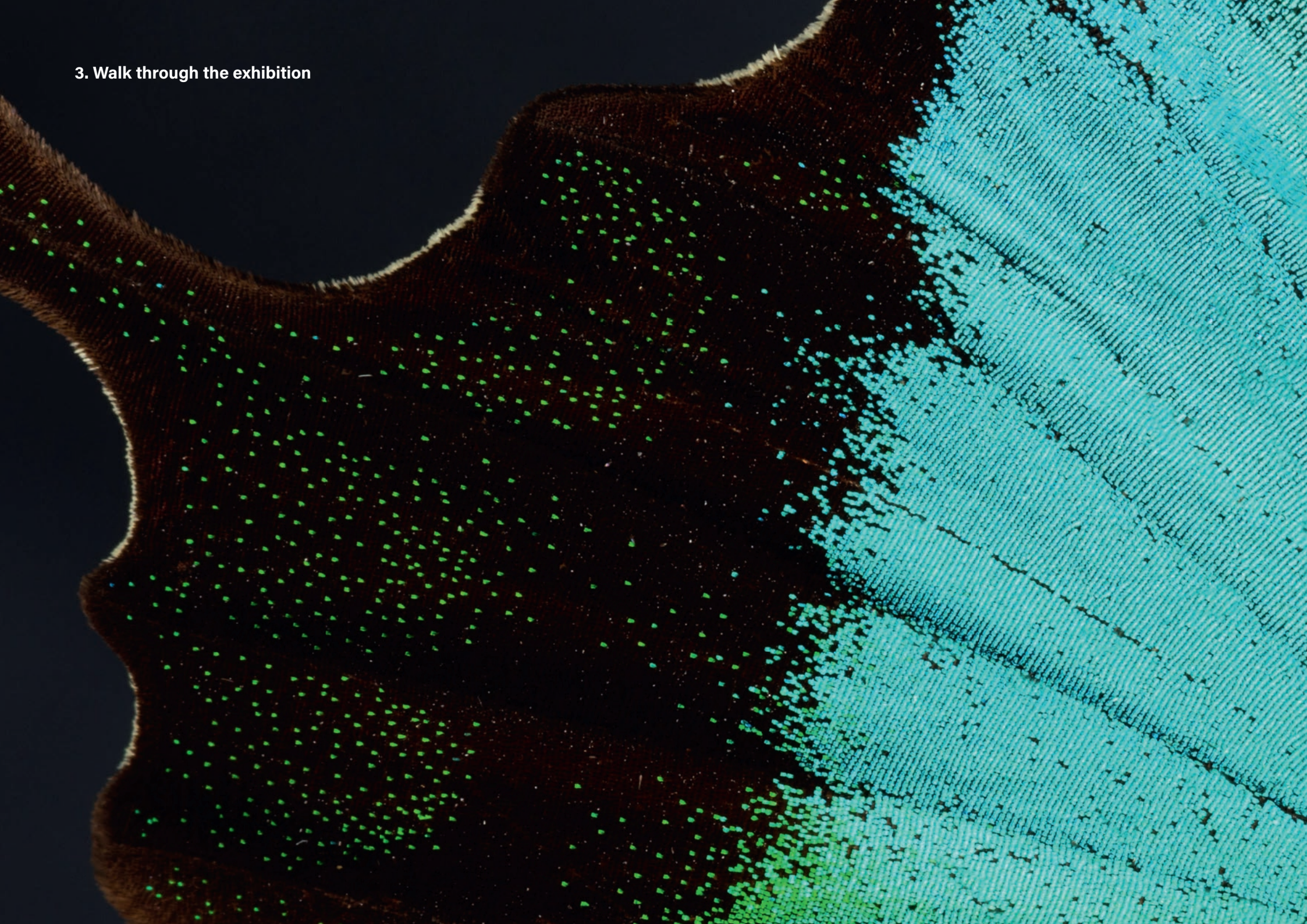
→ Exit

The connector

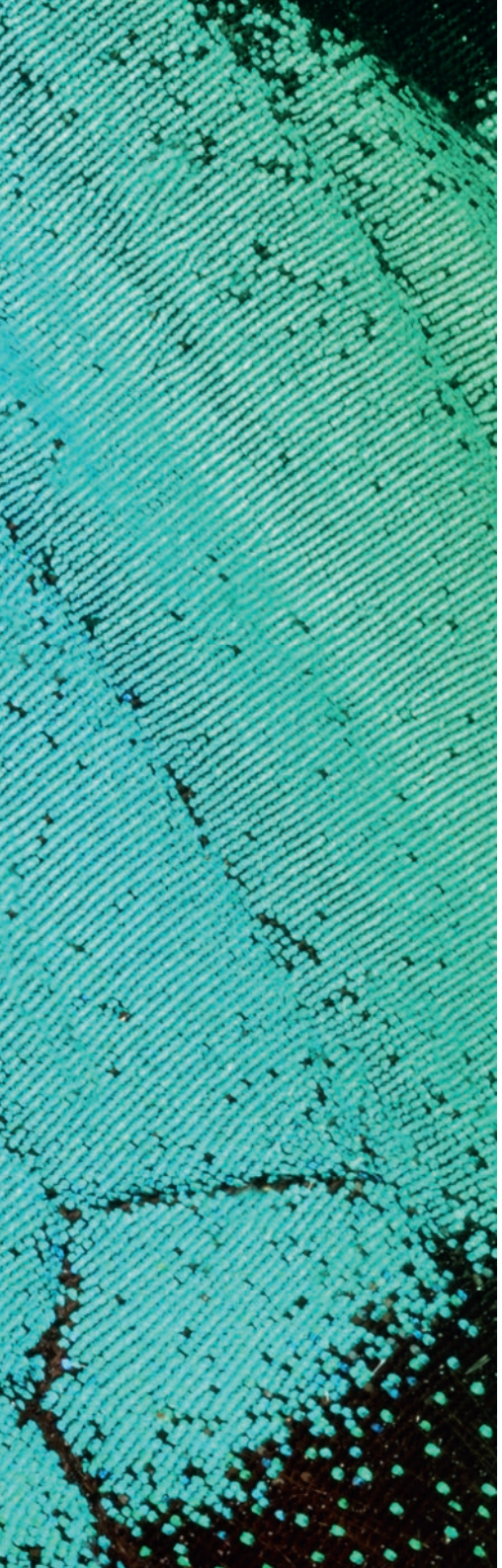
While lichens can live on a rock, they can also be part of a larger ecosystem.

Some caterpillars (lichen moths) feed specifically on lichens. Here, one of these species – *Coscinia* – is introduced, its metamorphosis as well as the moth flies are shown. Then, the visitors follow the moth to the next room.

Coscinia sp.



3. Walk through the exhibition



What is a species?

«Insects are the most speciose animal group on Earth and represent 70% of all species – therefore they are a central part of all ecosystems. Most of the existing insect species haven't even been discovered yet and lack a name.»

— Teja Tscharntke

Chapter 2

Scenography & subjects

This chapter explains what a species is, how they evolve and how they are studied and systematized by scientists.

After following the butterfly from the dark lichen room, the visitors are now entering a room that shows an abundance of colors, patterns and forms. The crystal is an installation consisting of a mobile of insect silhouettes joined in different clusters that represent the evolutionary lineages of insects. The walls are covered with enlarged reproductions of wing patterns, carapaces, jewelled compound eyes and feelers. There are many cases with hundreds of different specimens – bees and wasps, butterflies, dragonflies, and beetles.

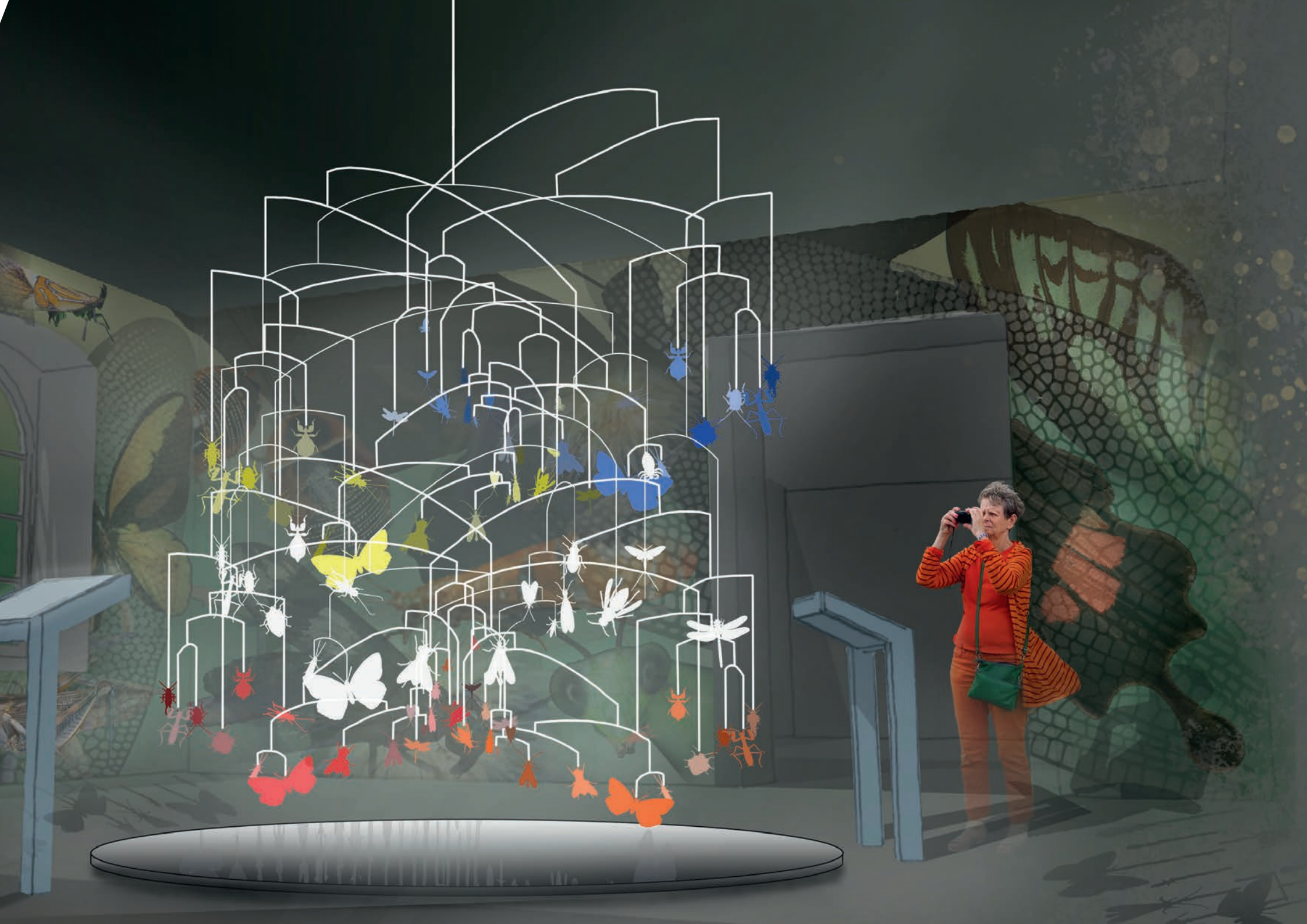
In this room, visitors learn about the concept of species and many related topics, using the most numerous taxon in animals. They can marvel at the variety, but also compare species from different groups and habitats and start to understand the complexity of evolution.

The crystal:
Mobile with key specimens representing insect evolution.
Different insects, lots of them!

Ornithoptera croesus lydius (Felder & Felder, 1865)
Zoological Collection / University of Göttingen

Troides hippolytus hippolytus (Cramer, 1775)
Zoological Collection / University of Göttingen

Crystal: Mobile with insects



Topics & interactions

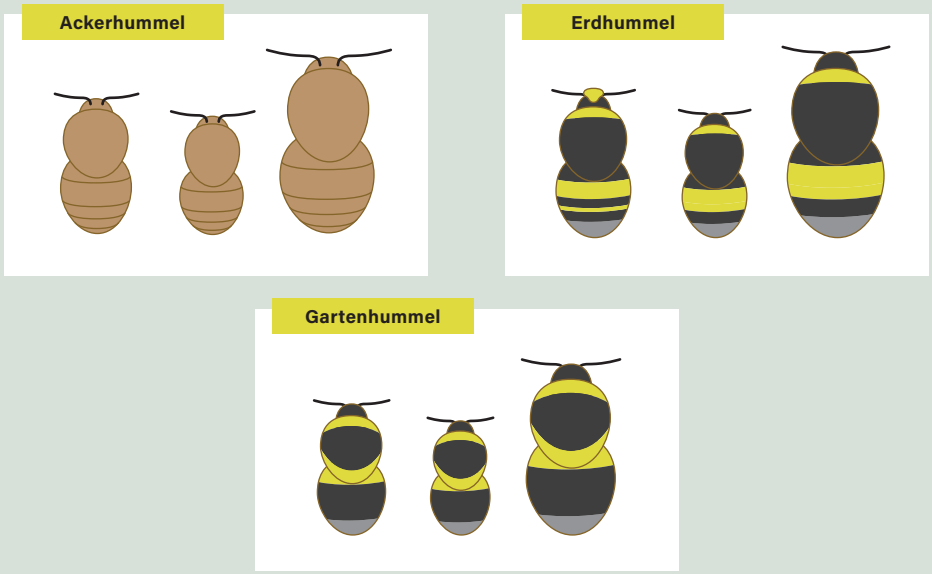
Ring 1: interactive stations
- Definition of species
- How many species exist and how many do we know?
- Insects – the most numerous group of animals

Ring 2: interactive stations
- Definition of evolution (including variation)
- How does genetic diversity arise? (Mutation, recombination, gene flow, hybridization)
- Visitors can classify bumblebees by their color patterns with the help of a simple app, so as to understand how classification works in principle.

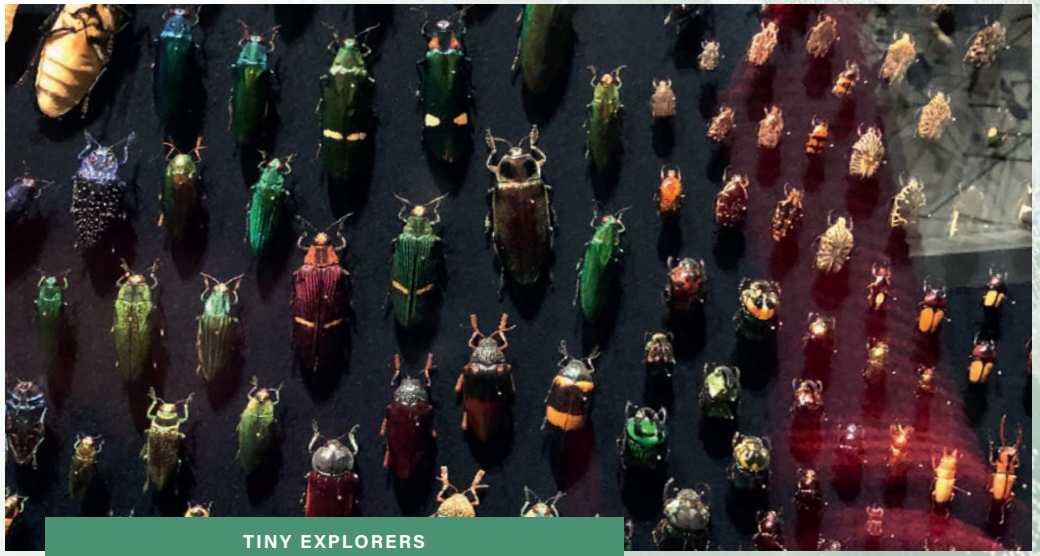
Ring 3: window elements
- Natural selection and genetic drift
- Systematics I – Why is it so important to name and systematize?

Tiny Explorers:
- An “I spy” game where they have to find certain insects in the showcases.
- A “make your own insect” game where they can either use puzzle pieces or draw a new insect.

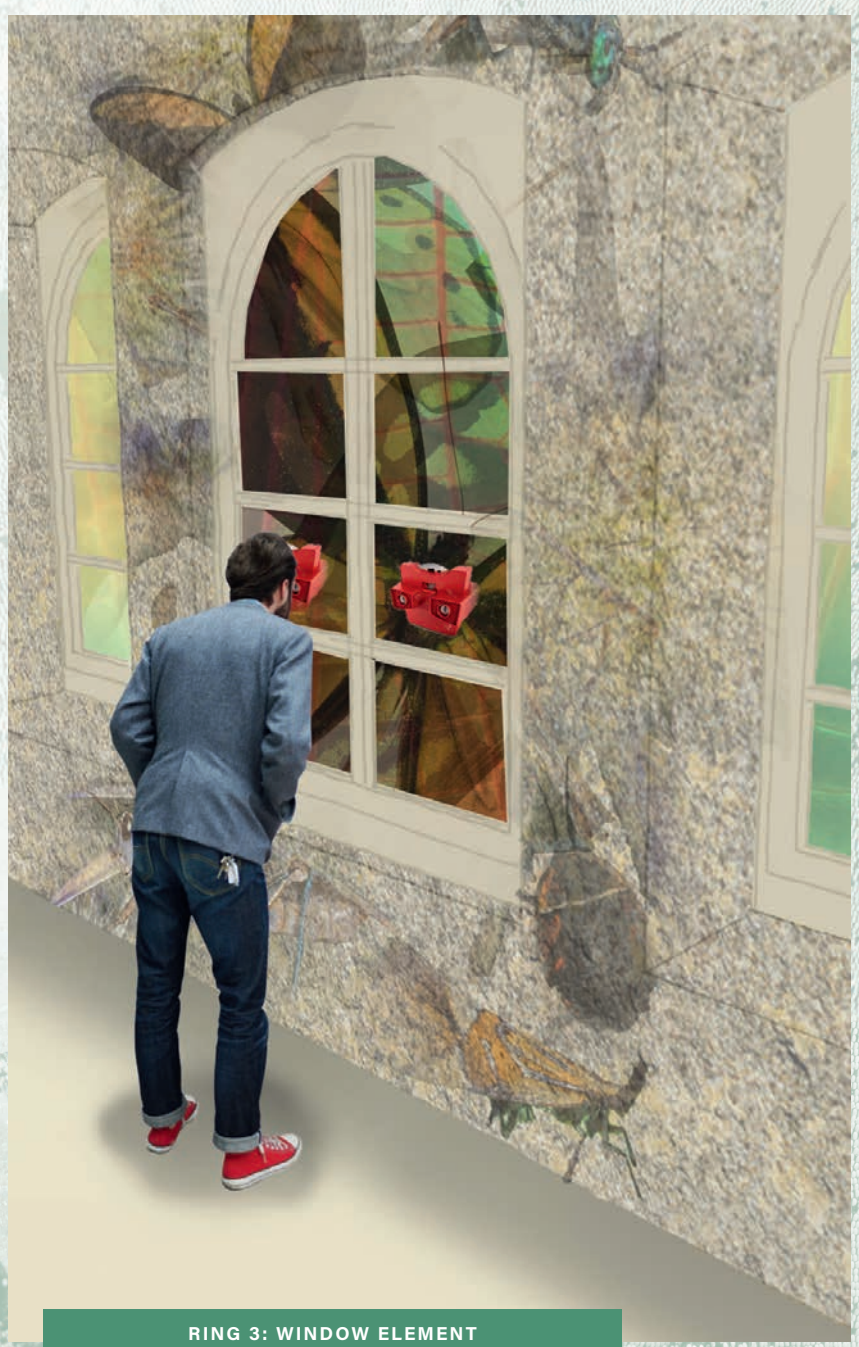
RING 1: INTERACTION
Definition of species



RING 2: INTERACTION
Identifying insects



TINY EXPLORERS
"I spy" game

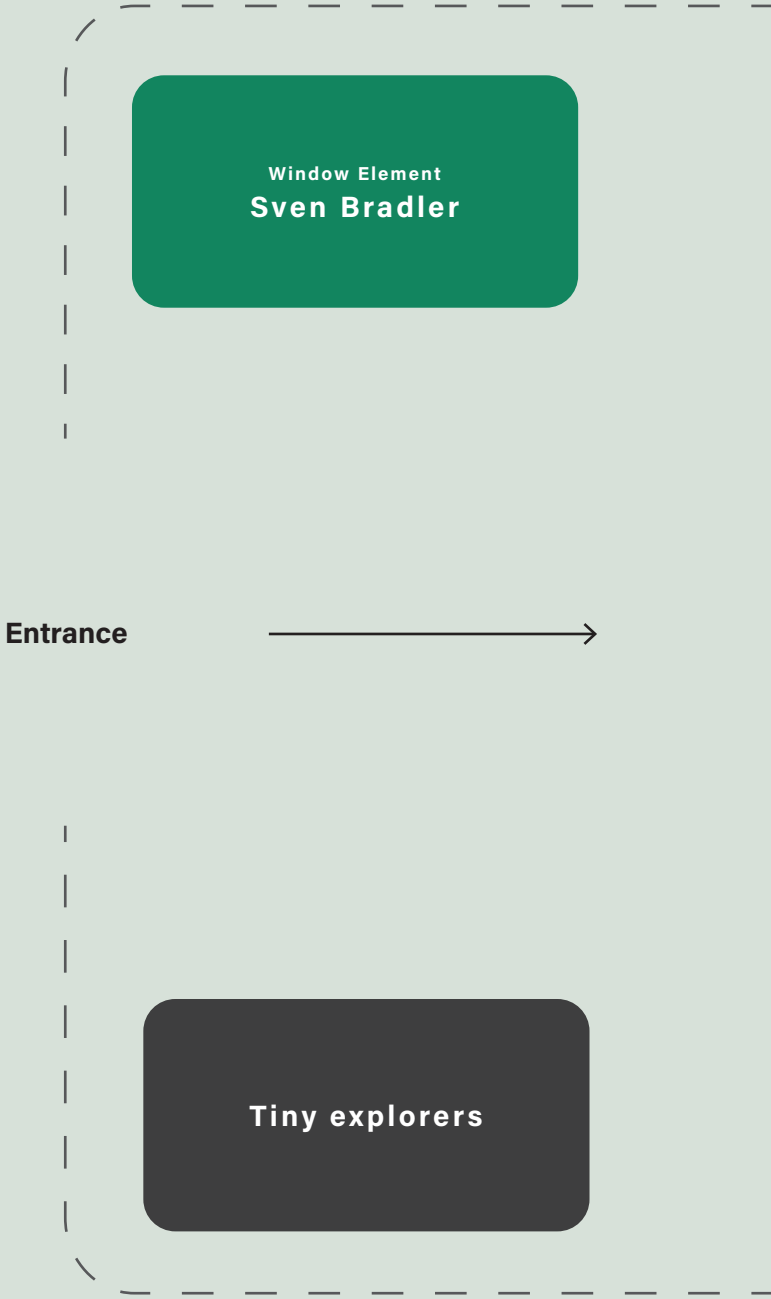


RING 3: WINDOW ELEMENT
Natural selection and genetic drift

Spatial organisation

Dr. Sven Bradler
Research Assistant and Senior Lecturer at the Department of Animal Evolution and Biodiversity at the J.F. Blumenbach Institute. His research focuses on the study of macroevolutionary patterns of taxonomic diversity, morphological disparity and biogeographic distribution in a phylogenetic framework.

Prof. Dr. Catrin Westphal
DFG Heisenberg Professor for Functional Agrobiodiversity since 2018. Her research focuses on the development and exploration of novel ecological intensification practices that sustain and promote productivity, agrobiodiversity and its multiple functions within agricultural systems.

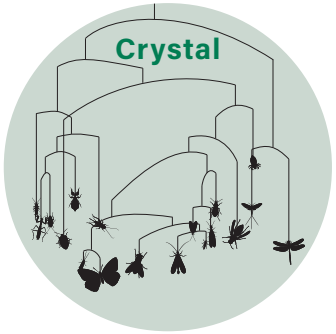


Ring 3

Ring 2

Ring 1

Crystal



Definition of species
(interactive station)

How many species exist? How many do we know?
(interactive station)

Insects:
the most numerous group of animals
(interactive station)

Definition of Evolution (interactive station) | How does genetic diversity arise? (interactive station)

Window Element
Catrin Westphal

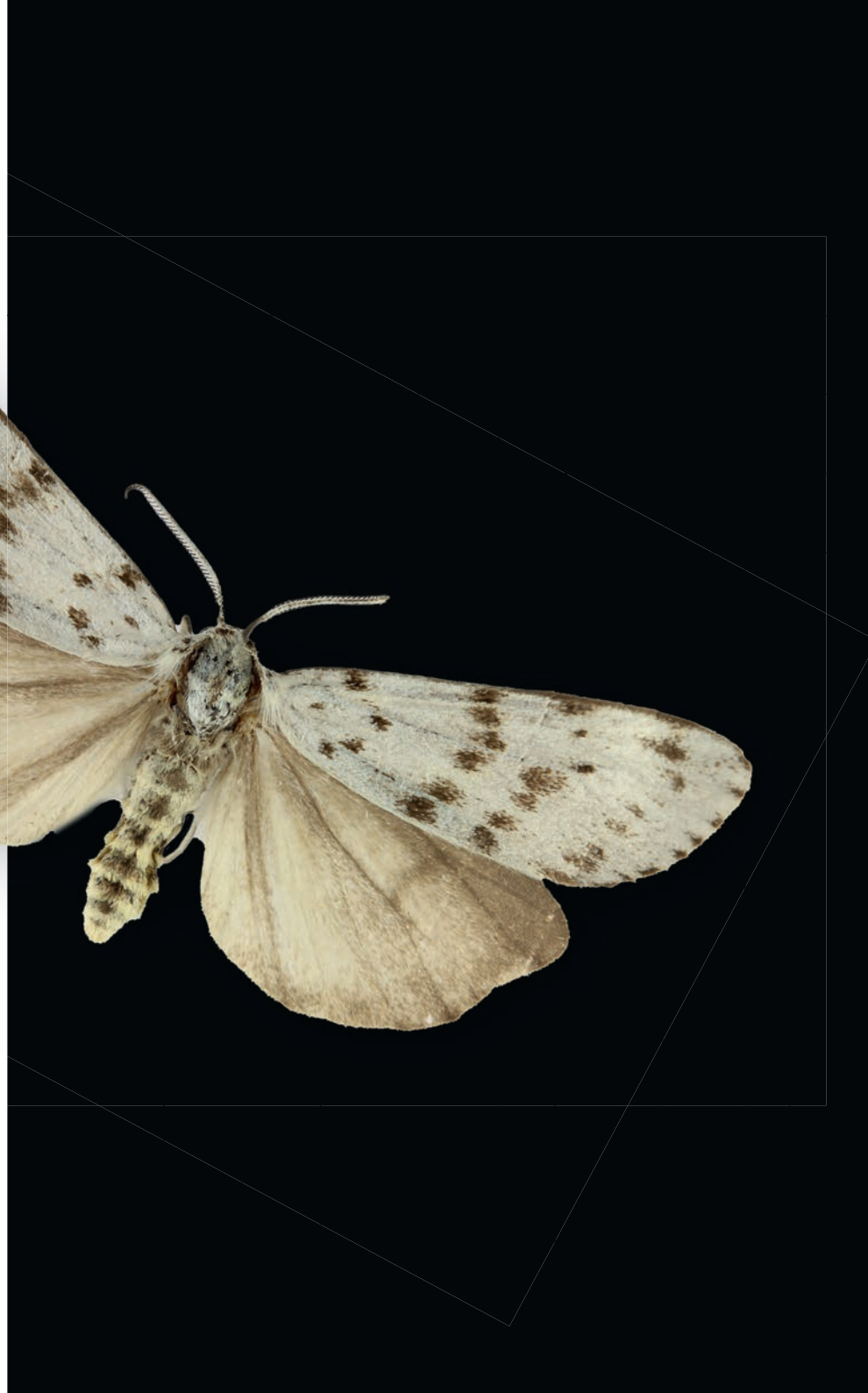
Connector:
Bat

→ Exit

The connector

Insects are of course just one part of the story, and they provide nourishment for many other animals.

At the end of the room, the visitors come across a moth that looks similar to the one that led them there (the lichen moth). The moth is eaten by a bat (mammal), which flies away, followed by the visitors who are already curious how the bat will feature in the next room ...



Coscinia Hübner, 1819
Rhinolophus hipposideros (Bechstein, 1800)
Zoological Collection / University of Göttingen

3. Walk through the exhibition

What is evolution?

«Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.»

— Charles Darwin

Chapter 3

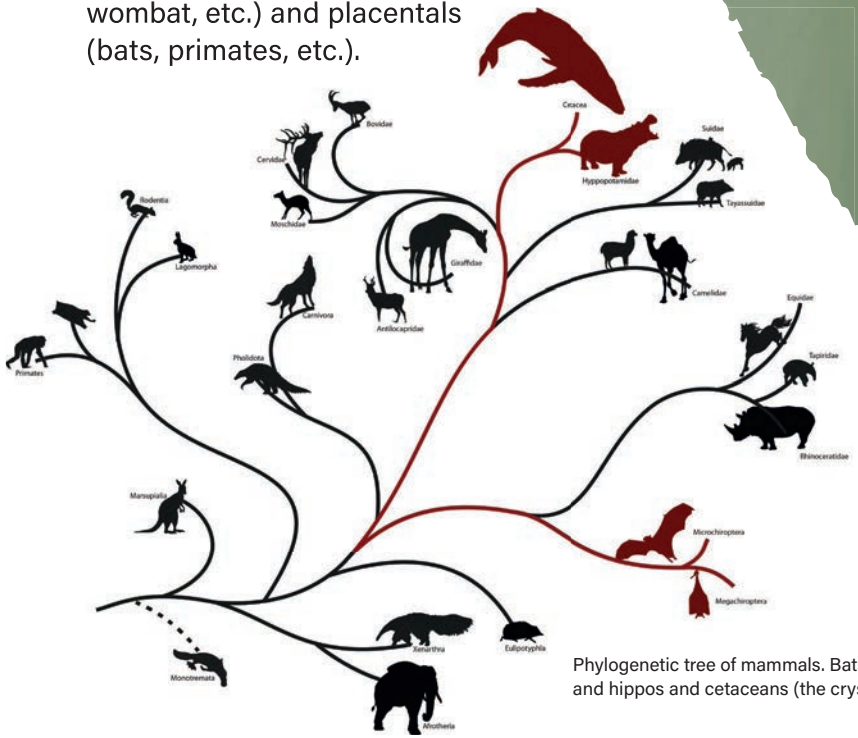
Scenography & subjects

When visitors enter chapter 3, they notice the bat brought them into the world of mammals, where we (primates) belong. They find themselves in an atmospheric room whose scenography has a transition from land on the side of the entrance to an ocean floor at the far end.

The crystal consists of an installation of three different skeletons: a hippo, a beluga whale (which is a cetacean, and a fossil (e.g., *Pakicetus*) that represents one related extinct animal that lived in the past who help us to reconstruct the terrestrial ancestor of the current cetaceans. The visitors learn quickly that this room is all about mammals and their evolution and that hippos and whales share a common ancestor. What the crystal shows is that the ancestors of today's aquatic cetaceans were terrestrial and that the hippo is the current related closest group – one riddle that evolutionary biologists managed to solve. We also provide a context to the magnificent 17 m long sperm whale skeleton from the Zoological Collection that will be shown in a different part of the building.
Around the crystal, there are different interactions that explain how evolution is driven by natural selection and extinction, among other mechanisms.

The crystal: key specimens

- Specimens that show the evolution of Mammalia.
- Skeletons and dermoplastic: Mammal groups and evolution: monotremes (platypus, echidna, etc.), marsupials (kangaroo, wallaby, wombat, etc.) and placentals (bats, primates, etc.).



Phylogenetic tree of mammals. Bats (the connector) and hippos and cetaceans (the crystal) in red.

Topics & interactions

Ring 1: interactive stations

- Systematics II: Phylogenetics; the tree of life (e.g. evolution of mammals)
- Evolution from terrestrial to marine ecosystems (in mammals, e.g. the whale (cetaceans) evolution)
- Whale carcass as an ecosystem

Tiny Explorers

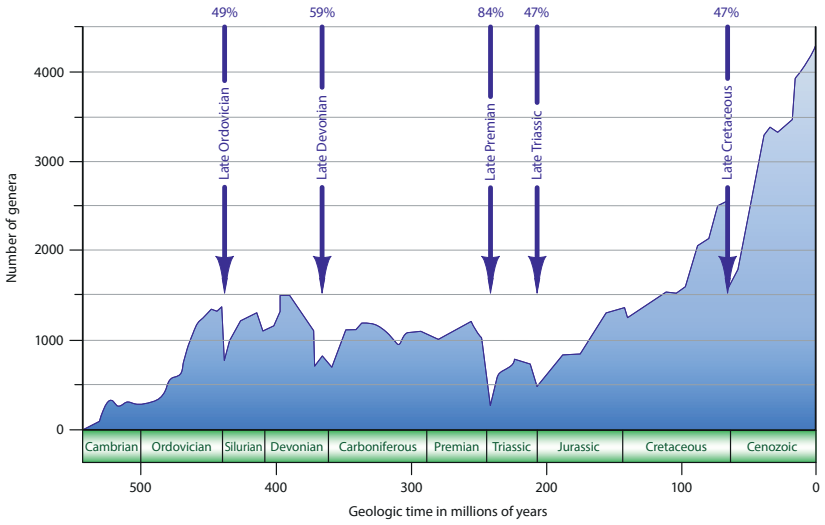
The childs are asked to lie on their belly and either move their legs sideways like a fish or up and down like a whale. They will find that they are "whales" – or rather, that whales aren't built like fish.

Ring 2: interactive station

- Diversification vs. extinction (diversification events and mass extinctions through periods of geologic time)
- Are we on the verge of the 6th mass extinction? The Anthropocene
- Different skeleton puzzles: Visitors have to guess from the skull what kind of animal it belongs to, visitors have to put together parts of a skeleton, find a missing or a "wrong" bone.

Ring 3: window elements

- How science found that hippos and cetaceans were closely related.
- The importance of Darwin's theory
- Sand and interstitial fauna: The "unknown" Phyla: Loricifera and Gnathostomulida



Big five mass extinction events since the Cambrium with assumed percentage of extinction of known genera (figure modified after Reitner, 2011).

RING 1: INTERACTION
Systematics II: Phylogenetics

RING 2: INTERACTION
Skeleton puzzles (photo by C. Fischer)

RING 3: WINDOW ELEMENT
Marine environment (photo by A. Nygren)

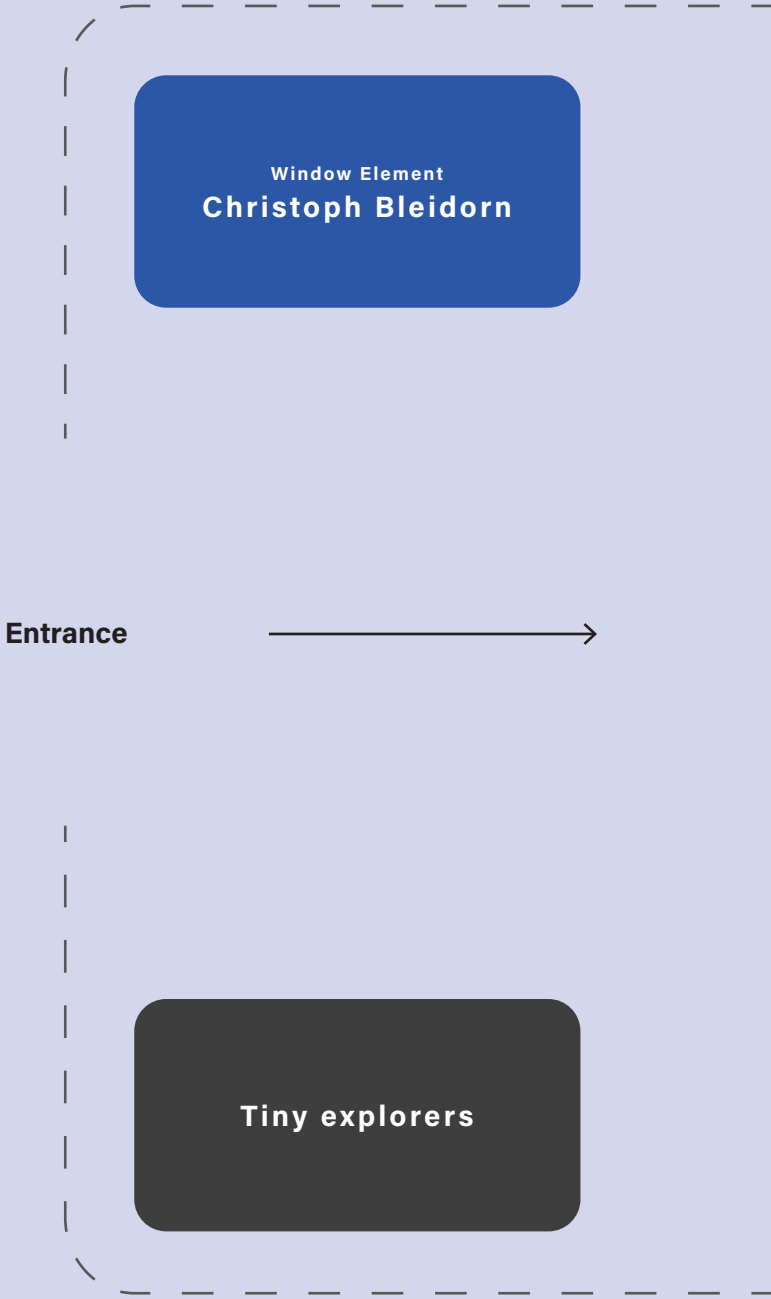
TINY EXPLORERS
Can you move like a whale?

Spatial organisation

Prof. Dr. Christoph Bleidorn
Professor and head of the department for Animal Evolution and Biodiversity, J.F. Blumenbach Institute, since 2017. Director of the Zoological Museum of the University since 2018. His research interests include the phylogeny and evolution of annelids, evolution of symbiotic relationships between insects and bacteria, as well as the inventory of the local bee fauna.

Dr. Maria Teresa Aguado Molina
Curator of the Zoological Collection and the Biodiversity Museum and Senior Lecturer at the J.F. Blumenbach Institute since 2019. Her research interests are the biodiversity of marine invertebrates, their evolution, phylogenetic relationships, developmental patterns and adaptations to extreme habitats like the deep-sea.

Prof. Dr. Julia Fischer
Professor for Primate Cognition and head of the Cognitive Ethology Laboratory, German Primate Center and J.F. Blumenbach Institute since 2004. Her main research interests are primate cognition, communication, social behavior, and evolution of language.



Ring 3:
Curtain / Room separation between terrestial and maritime ecosystem

Window Element
M. Teresa Aguado Molina

Connector: Starfish → Exit

Window Element
Julia Fischer

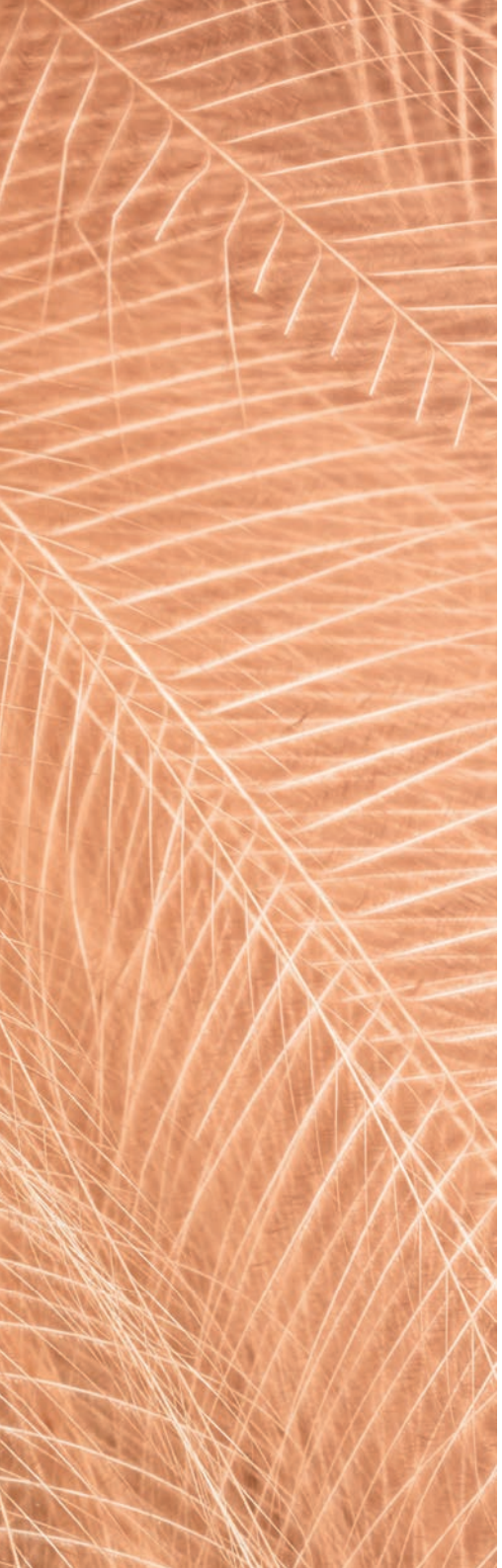
The connector

When the visitors have crossed the room and walked past the crystal they find themselves on the ocean floor.

There is a projection of a whale carcass that is being eaten by different organisms, among them starfishes. One of the starfishes crawls across the floor; it dies and is washed up on the shore in the next room.

Phocoena phocoena (Linnaeus, 1758)
Crossaster papposus (Linnaeus, 1767)
Zoological Collection / University of Göttingen

3. Walk through the exhibition



Why does biodiversity matter?

«Biological diversity [...] is the key to the maintenance of the world as we know it. Life in a local site struck down by a passing storm springs back quickly because enough diversity still exists.»

— Edward O. Wilson

Chapter 4

Scenography & subjects

After being made familiar with the basic concepts of evolutionary science, the visitors arrive in the middle of a complex environment.

Chapter 4 is set in an island of Indonesia. The starfish is stranded on the beach, from which we get into the jungle, which is full of different shapes, smells and sounds; plants play a large role in this space. The two main concepts in this chapter are resilience and fragility. The visitors learn that ecosystems with a high biodiversity are more resilient than ecosystems with a low number of species. But each ecosystem also has a certain degree of fragility. For example, on an island, the introduction of a new predator can change the whole system and lead to the extinction of entire species.

The crystal: key specimens

The tropical rainforest in Indonesia.

The crystal: The Indonesian jungle. Jambi, Sumatra (photo by K. Rembold)

Paradisaea minor Shaw, 1809
Zoological Collection / University of Göttingen

Loris tardigradus (Linnaeus, 1758)
Zoological Collection / University of Göttingen

Goura cristata (Pallas, 1764)
Zoological Collection / University of Göttingen

Topics & interactions

Ring 1: interactive station

- Biodiversity hot spots
- Biodiversity and ecosystem functions (connection with „why do we want to preserve biodiversity?“)
- Feedback loops (for example the interdependent populations of a predator and its prey)

Ring 2: interactive station

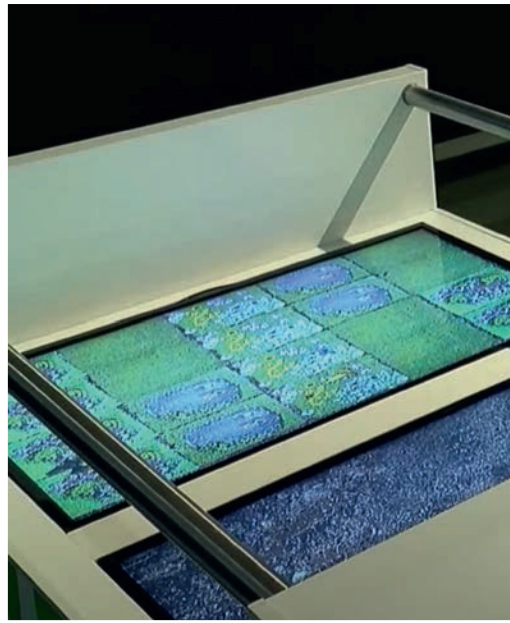
- Endemism and species richness in islands (global diversity of island flora)
- Resilience in ecosystems and fragility of island ecosystems
- The orchestra of biodiversity: Visitors can listen to an orchestra playing. They can then “delete” the instruments one by one. How does the music change? When does it get unrecognizable?
- A simulation where visitors can build ecosystems with many or few species and then see what happens in case of a disturbance or change in the environment.

Ring 3: window elements

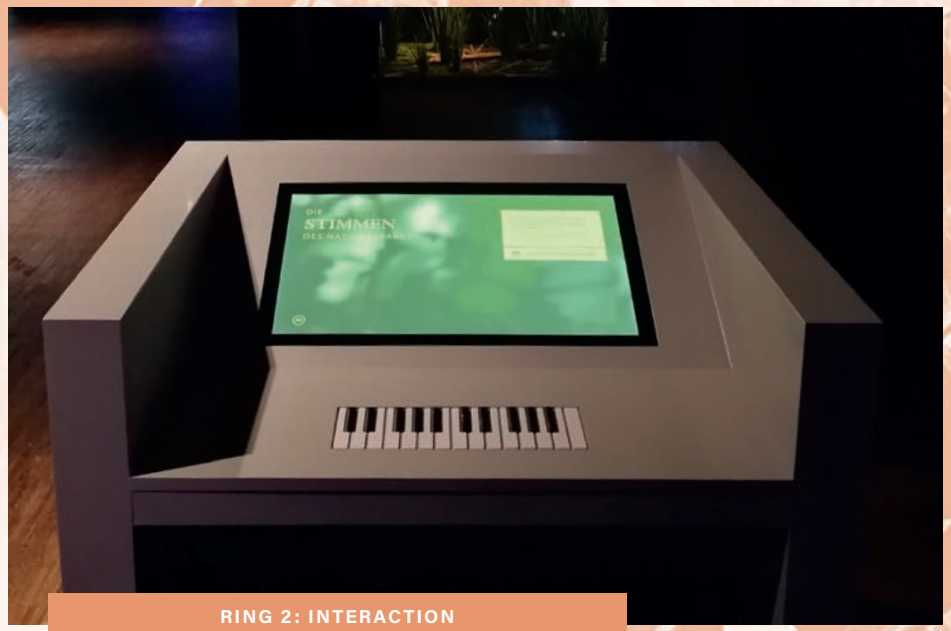
- Humboldt (who also studied at the Georg-August-University) and his ideas
- Island Biogeography (e.g., species-area relationships, Wilson, Mc Arthur and Simberloff)

Tiny Explorers

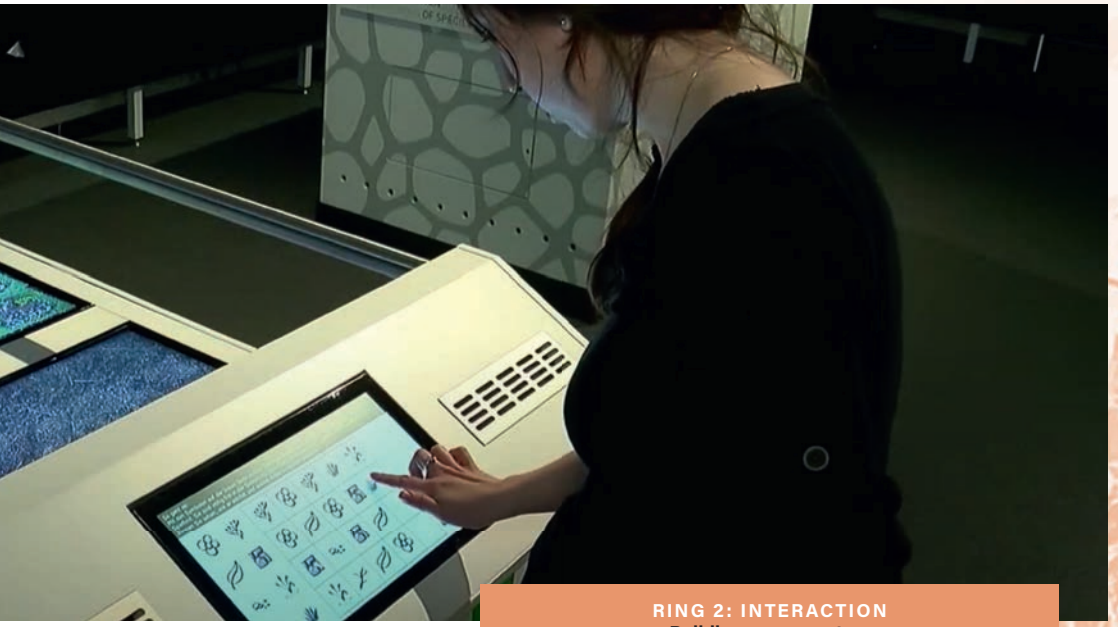
- A “bandolino puzzle” where children can pair bird beaks and food or insect proboscis and different flowers
- A “Wimmelbild” that visitors can color
- A haptic station where visitors can feel different kinds of leaves or bark



RING 1: INTERACTION
Biodiversity hot spots



RING 2: INTERACTION
Hearing biodiversity



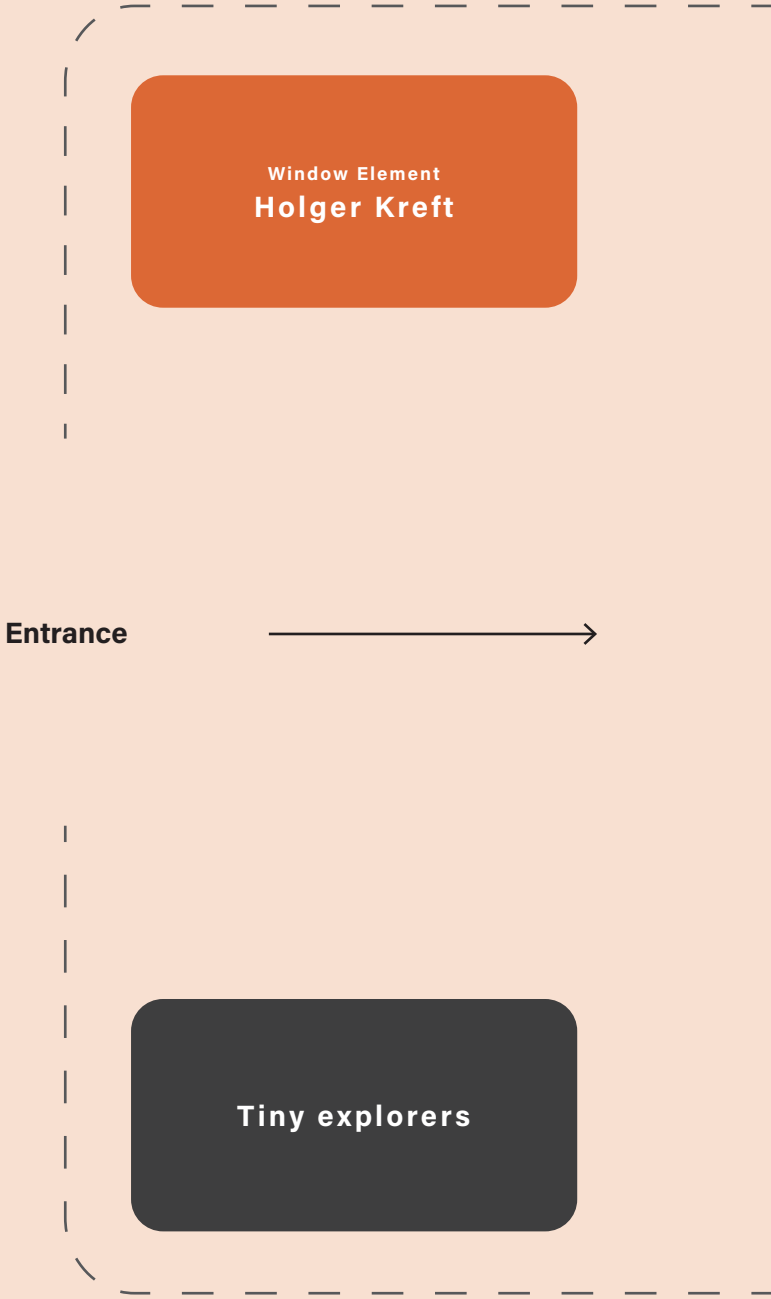
RING 2: INTERACTION
Building an ecosystem

TINY EXPLORERS
Bandolino puzzle

Spatial organisation

Prof. Dr. Holger Kreft
Professor and head of the Department Biodiversity, Macroecology & Biogeography since 2015. He researches ecological and biogeographic patterns in order to document and understand general trends in the spatial distribution of biodiversity.

Prof. Dr. Hermann Behling
Professor of Botany and head of the Department of Palynology and Climate Dynamics at the Albrecht-von-Haller Institute of Plant Sciences since October 2005. His major research interests are terrestrial and marine Palynology, Palaeoecology, Biodiversity Dynamics, Palaeoclimatology, Pollination, Fire History and Human Settlement History.



Ring 3

Ring 2

Ring 1

Crystal

Biodiversity hot spots
(interactive station)

Biodiversity & ecosystem functions
(interactive station)

Feedback loops
(interactive station)

Endemism and species richness in islands | Resilience in ecosystems and fragility of island ecosystems

Window Element
Hermann Behling

Connector: Bird → Exit

The connector

In Indonesia, large areas of tropical rainforest are burned down to make room for palm oil plantations.

The connector to the next room is a tropical bird that lives in the rainforest. It flies through a (projected) curtain of fire. Fire is one of the ways to transform a rainforest ecosystem into an empty area ready for monocultures. The visitors “walk through the fire” to get to the next room. The bird is still alive on the other side, but what happened to all the other species in the rainforest?

Paradisaea minor Shaw, 1809
Zoological Collection / University of Göttingen

3. Walk through the exhibition

Human impact

«The Holocene has ended. The Garden of Eden is no more. We have changed the world so much that scientists say we are in a new geological age: the Anthropocene, the age of humans.»

— David Attenborough

Chapter 5

Scenography & subjects

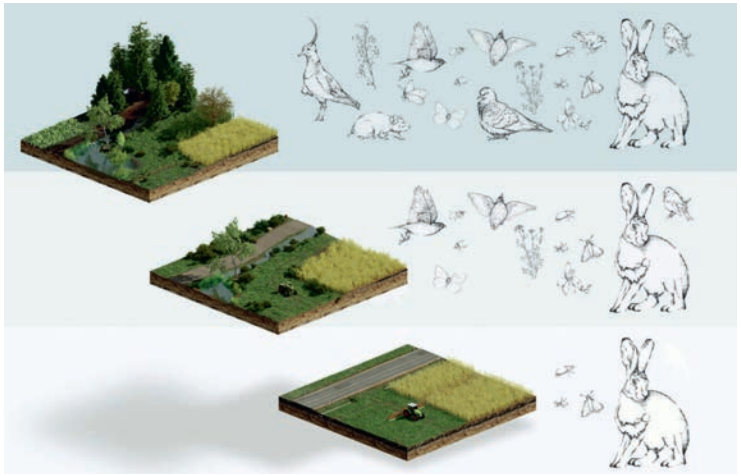
Today, changes made by humans have a great impact on the environment and on biodiversity. Many researchers go so far to talk about a new geological epoch, the Anthropocene, as the impact of humans on the climate and the environment is unprecedented.

In this chapter, the visitors encounter the impact of monoculture on ecosystems in different countries and the consequences and conflicts arising. The space is divided into two areas: One part is set in a palm oil plantation in Indonesia (as the result of the transformation of the rainforest), the other in a corn monoculture in Germany. The two halves mirror each other, but are separated by a "wall of produce", e.g. palm oil containers and sacks of corn.

- Environmental heterogeneity as a universal driver of species richness across taxa, biomes and spatial scales
- The loss of Biodiversity and intact ecosystems through human impact
- Differences in the complexity of natural habitats
- Numerous conflicts (e.g. space and resources) and trade-offs (many voices and viewpoints)
- Complex problems often require complex solutions

The crystal: key specimens

The burning down of tropical rainforest for palm oil plantations drives the loss of biodiversity. The German primordial forest, however, has been cut down hundreds of years ago and much of the land has been planted with monocultures for decades. The loss of biodiversity is similar, as are the conflicts around it. Chapter 5 aims at making the visitors think about the parallels and realize that the ecosystems close to home may also need to be considered. They also get an understanding of the complexity of the problem.



Transformation of a landscape, German National Academy of Sciences Leopoldina

Topics & interactions

Ring 1: interactive stations

Indonesia – five different protagonists with movies: A table with a model (drone view) of a palm oil plantation in the middle. Visitors can sit down at the table and "meet" different people who talk about what the plantation means for their work or life. They can be a farmer or a worker who profits from the palm oil, an environmental activist who fights against the loss of the rainforest, a scientist or a local politician. The different views and conflicts are discussed and solutions are suggested where possible.

Germany – roleplay game: A table with the model of a cornfield in the middle. The visitors can sit down and play a role game. The characters are similar to the ones at the other table (a farmer, an activist, a scientist, a consumer ...), but the setting is in Germany. Playing the game, the visitors will find that the conflicts are somewhat similar, and that creative solutions are needed to resolve them.

Tiny Explorers

A multimedia station where visitors can build an area with many small or few big habitats. The result shows how many species are attracted.

Ring 2: interactive stations

Indonesia:

- A multimedia station that shows how species abundance and species diversity change with the different environments
- Animation color metaphor

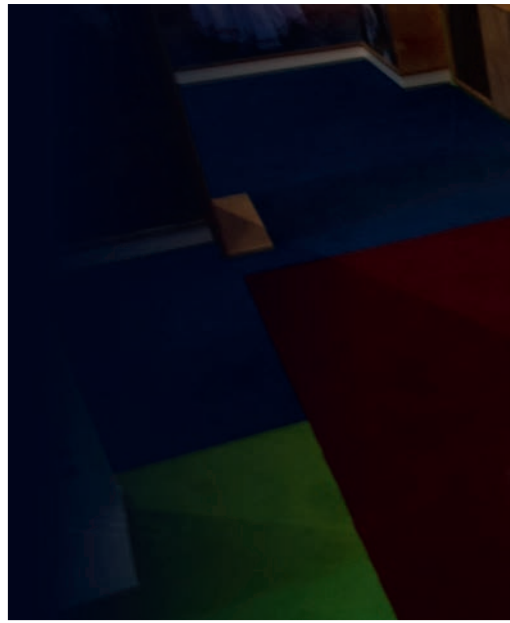
Germany:

- Global consequences of human impact on biodiversity loss (e.g., human lifestyle in Western societies)
- Insect Armageddon (loss of biodiversity linked to loss of habitats)

Ring 3: window elements

- Show how species richness and species abundance change with the transformation of the ecosystem into a monoculture.
- Open the window and visit an oil palm plantation.
- Open the window and visit a corn plantation.
- Audio recording - measuring biodiversity
- Monocultures in Germany

Harvest of oil palm bunches,
Jambi, Indonesia (photo by S. Eckelmann)



RING 1: MOVIES
Indonesia: protagonists

RING 2: INTERACTION
Diversity change with different environments

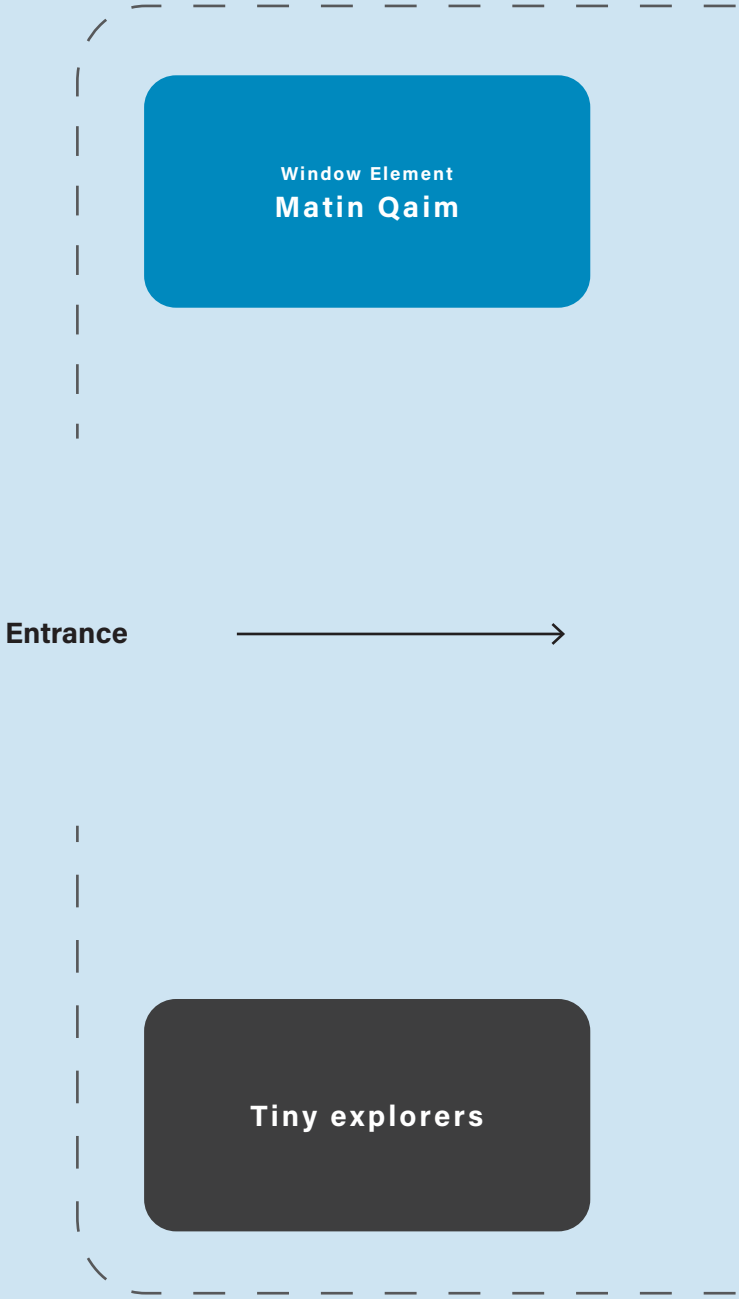
RING 1: INTERACTION
Germany: roleplay game

TINY EXPLORERS
Multimedia station

Spatial organisation

Prof. Dr. Matin Qaim
Professor of International Food Economics and Rural Development at the Department of Agricultural Economics and Rural Development since 2007. His main research areas include sustainable food systems and food security, sustainable land use, and effects of technical and institutional innovations in the small farm sector.

Prof. Dr. Stefan Scheu
Professor and the head of the Department of Animal Ecology, J.F. Blumenbach Institute, since 2008. His research focuses on the structure and functioning of soil animal communities and interrelationships between the below- and aboveground systems.



Ring 3

Loss of Habitats leads to biodiversity loss
–
Impact of human

INDONESIA

Ring 2

Ring 1

Protagonist 1
Martin Qaim

Crystal

Protagonist 5
Researcher
from Indonesia

Protagonist 2
Farmer

Protagonist 3

Protagonist 4

Heterogenic habitats (interactive station) | Animation color metaphor

GERMANY

Ring 2

Ring 1

Protagonist 1
Consumer

Crystal

Protagonist 5
Researcher
from Germany

Protagonist 2
Farmer

Protagonist 3

Protagonist 4

Global consequences of human impact on biodiversity loss | Insect Armageddon

Window Element
Stefan Scheu

Connector:
Bee

→ **Exit**

The connector

There has been a great loss of insects lately, some of it due to the use of insecticides and land-use change.

Like other insects, bees struggle to find enough resources in a landscape dominated by monocultures and intensive agriculture. At the end of the room, a single bee is looking for flowers among all the corn plants, it then flies away to the next room where it finds a more favourable environment.

Osmia aurulenta (Panzer, 1799)
(photo by C. Venne)

3. Walk through the exhibition

Finding biodiversity in your surroundings

«At the same time, almost every second person believes that the loss of biodiversity in Germany "is not a big problem". Most participants believe that the extinction is happening in the developing world. When asked whether they wanted to create spaces in their gardens for rare plants and animals, most people checked the box "I'd rather not". »

— Artenschwund im Kopf, GEO 3/10

Chapter 6

Scenography & subjects

In the last chapter, visitors have returned from their explorations of different exotic ecosystems. Now they are back home in Göttingen, ready to find biodiversity in their surroundings.

These include nature reserves like the Harz National Park and the Grünes Band that have a high biodiversity. It also showcases regional success stories of species that have returned, after being much scarcer in former times, like the wolf, the lynx or the crane.
The chapter is set in a cemetery in the center of Göttingen. Even though it is in the middle of a city, it looks more diverse and more natural than the monocultures in the last chapter – there are trees, birds and insects, even a fox. Here, the visitors learn that a city can have a much greater biodiversity than the countryside – a surprising fact for most people. They also learn to look for biodiversity in their close surroundings and to nurture it whenever possible.

The crystal: key specimens

Show regional success stories of species that have returned: the wolf, the lynx, the crane, etc.

Göttingen

Harz National Park

Garbage containers

Botanical Garden

Graveyard

Green roofs

Topics & interactions

Ring 1: interactive station

- Wild animals in the city areas
- Different types of insects in different gardens
- Misconception about city ecosystems
- Green network
- Cemetery

Ring 2: interactive station

- Migration of animals from other habitats to the city (fox, wild boar, woodpigeon)
- Adaptation of animals to urban ecosystems (city pigeons, blackbirds, sparrows, etc.)
- Interaction that shows how species richness and species abundance change during the transformation of a complex ecosystem into others simpler, like monocultures

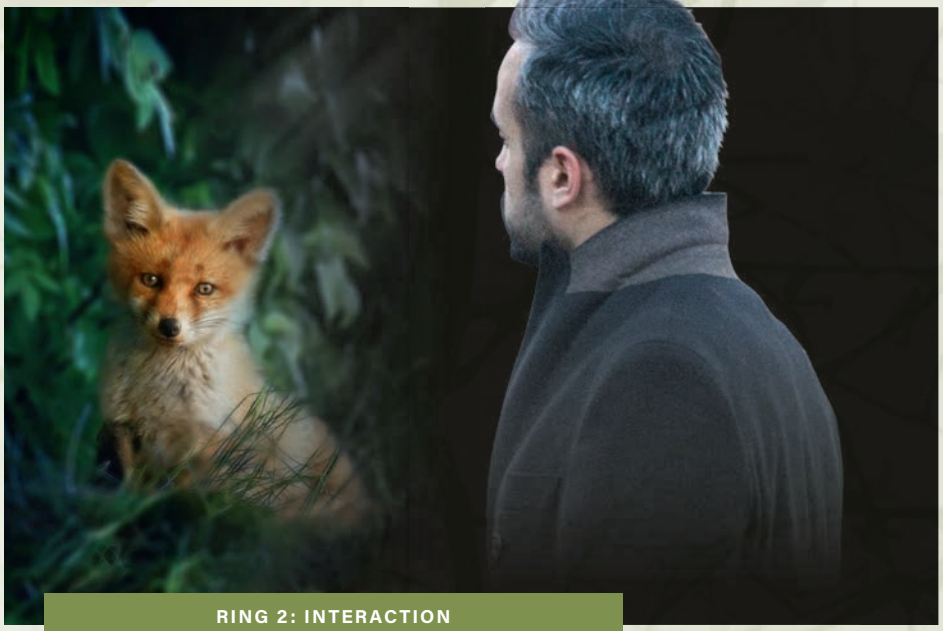
Ring 3: window elements

- Grünes Band – the former inner German border that is now “the longest nature reserve” in Germany (1300 km)
- National park interview with a ranger
- Naturpark Solling-Vogler
- Urban planning projects

Tiny Explorers:

A simple quiz where kids can guess which animals live in the city and in the countryside. An interactive station that shows why some flowers are favoured by beetles, some by butterflies and some by bees.

RING 1: INTERACTION
Wild animals in the city areas



RING 2: INTERACTION
Introduction of species

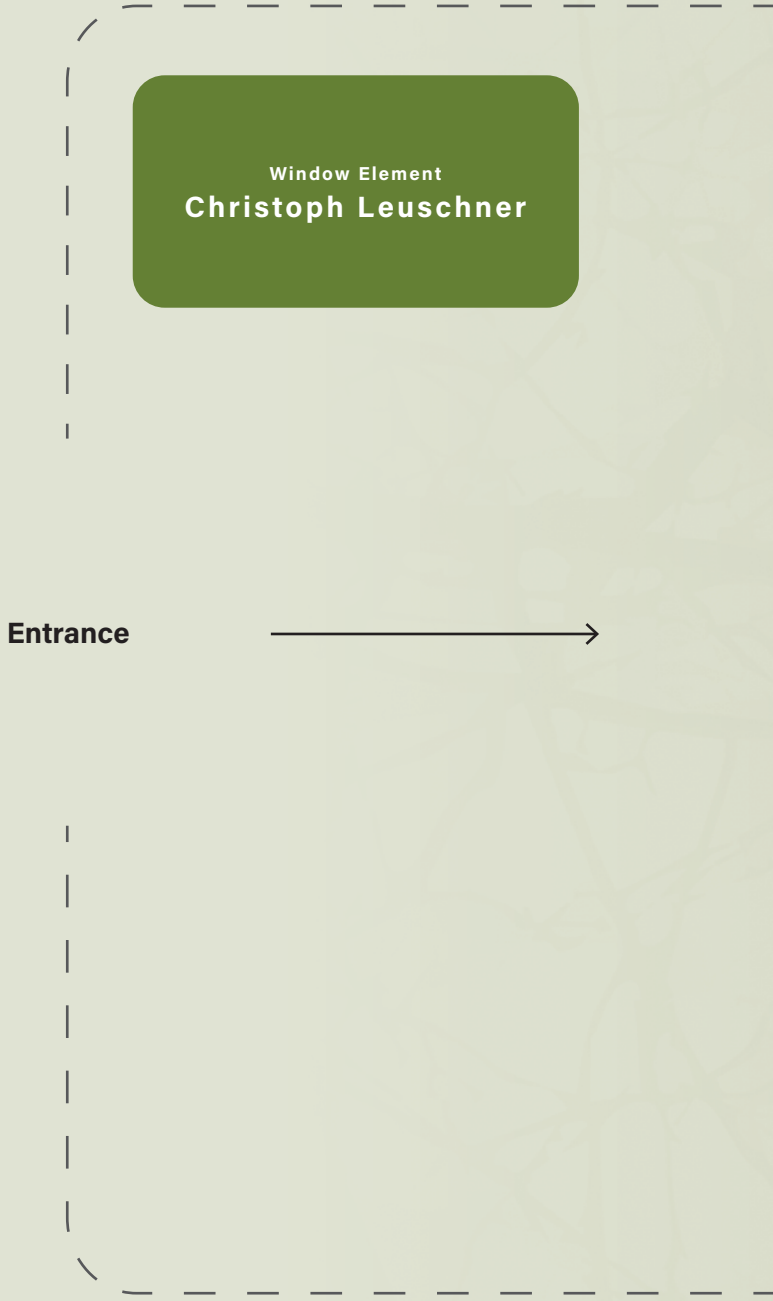
RING 3: WINDOW ELEMENT
National park interview with ranger

TINY EXPLORERS
Quiz

Spatial organisation

Prof. Dr. Christoph Leuschner
Professor of Plant Ecology, at the Albrecht-von-Haller Institute for Plant Sciences, Department of Plant Ecology and Ecosystems Research since 2000. His research interests are Ecophysiology of temperate and tropical trees, Ecology of tree root systems, Forest dynamics research, Climate change effects on temperate and tropical forests, Biodiversity and ecosystem function in forests and Conservation of biodiversity in agroecosystems.

Prof. Dr. Alexander Knohl
Professor and head of the Department Bioclimatology at the Büsgen-Institute since October 2009. His research interests are Biosphere-atmosphere interaction, carbon and water cycle in terrestrial ecosystems, micrometeorology and eddy covariance measurements, and process-based ecosystem modeling.



Ring 3:

Window Element
Alexander Knohl

Connector: Question → Exit

Tiny explorers

3. Walk through the exhibition

What can I do?

«Then there might be an answer to the question I am asked most frequently about the diversity of life: if enough species are extinguished, will the ecosystem collapse, and will the extinction of most other species follow soon afterward? The only answer anyone can give is: possibly. By the time we find out, however, it might be too late. One planet, one experiment.»

— Edward O. Wilson

The epilogue

The epilogue: What can I do?

Now that visitors have heard so much about biodiversity, it is time to act! In the epilogue, more information can be found about people who preserve biodiversity and about projects that are being developed right now.

Visitors can also find out about their own ecological footprint and about things they can do. Finally, they can write a commitment or something they are doing on a piece of paper and attach it to the "tree of wishes and commitments" for other visitors to read.

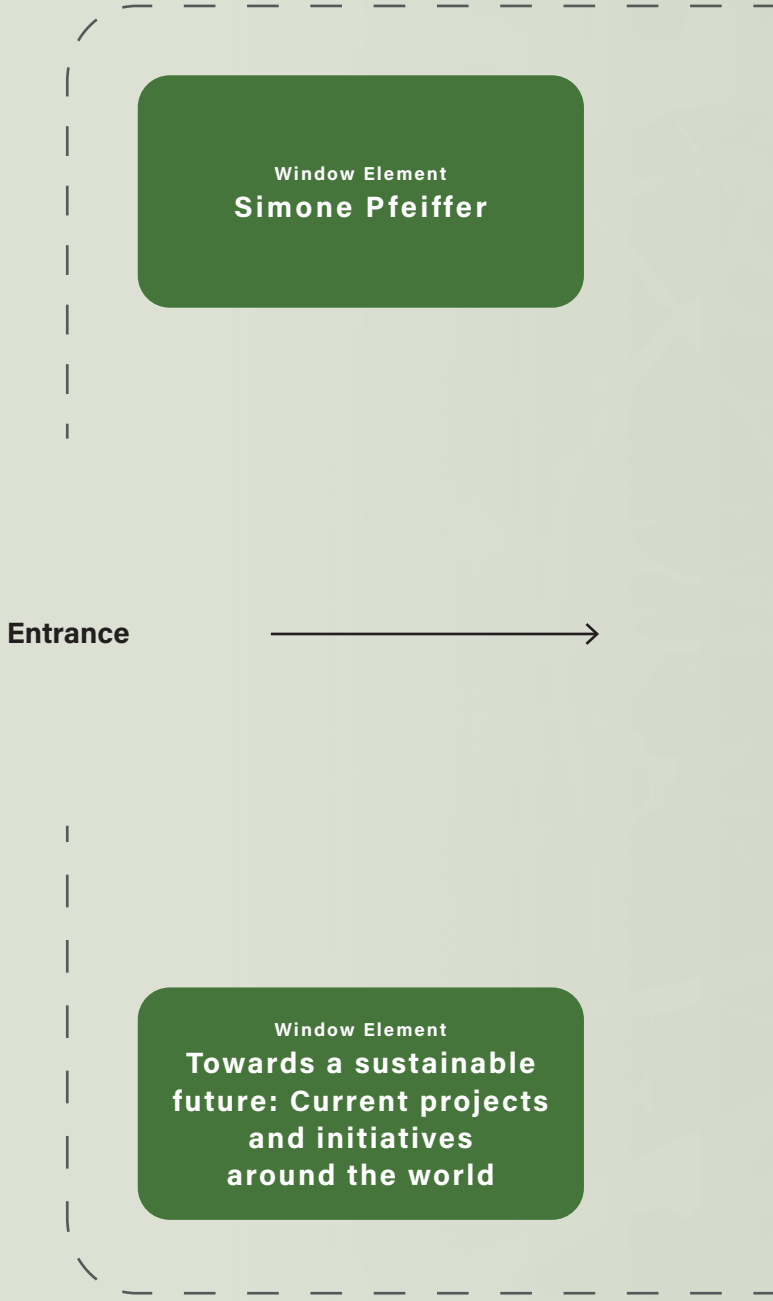
After a journey through the different chapters, visitors are hopefully able to answer the same questions they were asked in the beginning with more complex answers. As well, visitors are hopefully more conscious about the current environmental problems and the loss of biodiversity. There will be monitors showing the answers of previous visitors.
In addition to these questions, there will be others, in this case more related to what we can do in our daily life to contribute to a more sustainable future.

The crystal:
Tree of wishes and commitments.

Topics:
- How can we learn more about biodiversity (example: „Flora incognita")?
- How can we contribute to expand the knowledge about our local animal and plant diversity (example: citizen science project "Stunde der Gartenvögel")?
- What can we do in our daily life to preserve biodiversity, both globally and locally at home?
- Where can we use our influence as citizens?

Spatial organisation

Dr. Simone Pfeiffer
Scientific coordinator for tropical and subtropical agricultural and forestry sciences at CBL since 2013. Her work focuses on the proposal preparation and administration of interdisciplinary collaborative projects in research and teaching, alumni work and event management.



Ring 3:

Ring 2

Ring 1

Crystal

Tree of wishes / commitments

Infobox 1 | Infobox 2 | Infobox 3 | Infobox 4

Tiny explorers

Exit

4

«It doesn't much matter whether people care or don't care. What matters is that people change the world.»

— Elizabeth Kolbert

Troides hypolitus hypolitus (Cramer, 1775)
Zoological Collection / University of Göttingen

The team

Team of the Biodiversity Museum at the University of Göttingen

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Collection management and didactics

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Asterochloris gaertneri Skaloud & Peksa, 2015
Culture Collection of Algae (SAG) / University of Göttingen

«Nature can be conserved, restored and used sustainably while other global societal goals are simultaneously met through urgent and concerted efforts fostering transformative change.»

— IPBES global assessment report on biodiversity and ecosystem services

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