ROYAL BELGIAN INSTITUTE OF NATURAL SCIENCES

ANNUAL REPORT 2016

THE RBINS IN BRIEF

Missions

RBINS has been entrusted with four major missions:

- Scientific research into natural sciences;
- Scientific expertise at the service of the public authorities;
- Conservation and management of scientific and heritage collections;
- Dissemination of scientific knowledge in society.

Research & expertise

One out of every three people at the RBINS is a scientist. The scientific personnel includes mainly biologists, palaeontologists and geologists, but also oceanographers, anthropologists, prehistorians and archaeologists, as well as geographers, physicists, bio-engineers and mathematicians, which enables it to conduct multidisciplinary research.

Lines of Research

- Biodiversity and geodiversity;
- Biological evolution and the history of life;
- Marine and freshwater ecosystems' management;
- History of the human/environment relationship;
- Applied geology.

Service Provision

- The RBINS provides scientific expertise under Belgium's international commitments in relation to environmental protection.
- It develops tools and methods for monitoring natural land or marine environments.
- It also offers useful advice for the development of national and European policies for the protection and conservation of biotopes and biodiversity and the use of natural resources.

Collections

With their 37 million specimens conserved as Belgian heritage of universal significance, the RBINS's collections come just after London and Paris in the European classification, and belong to the top 10 largest collection in the world. They serve above all as reference and research tools and as such belong to the European 'major research infrastructure'. In this respect they are constantly being visited and studied by researchers from around the world. For several years now, the RBINS has been committed to an ambitious programme to digitize its collections and to do so has developed an open-source software, DaRWIN, which has made it possible to encode all the data on any collection of specimens, whatever their taxonomic group.

Museum

For the general public, the Natural Science Museum is the visible part of the RBINS. It has 16,000 m² of permanent galleries, temporary exhibition rooms and educational workshops, public spaces of all kind, enabling it to welcome more or less 300,000 visitors each year, approximately 30% of whom are school groups. Its Dinosaur Gallery is world famous and the largest in Europe.
It plays a leading role in the promotion and dissemination of scientific culture, both within and beyond its walls, notably through travelling exhibitions and events. The RBINS is pursuing ambitious efforts to gradually renovate the premises, to make the Museum more convivial and better adapted to people's expectations. The Museum also takes a resolute position promoting a more respectful approach to nature.

FOREWORD

The terror attacks on the 22nd March at Brussels Airport and Maelbeek metro station marked 2016 deeply, with these appalling acts of gratuitous cruelty casting a veil of sadness and incomprehension. Security became a major concern, complete with a set of measures which oppose the duty of openness that befits us as a scientific institution welcoming many visitors. As well as sadness came anger at being left alone, faced with a new situation that is likely to continue: alone in our decisions, with neither directives nor means, since despite several requests and a strong case, no additional structural budget was allotted to strengthen security for visitors and staff.

Sadness and anger, but not discouragement. Work started again, as did projects. The Museum ran special communication campaigns, put a virtual visit of the permanent halls online, launched a new participatory science project and opened a particularly attractive temporary exhibition. Thanks to all these actions, the decrease in visitor numbers was minimised. Many proposals were submitted in response to calls for research projects, and many were successful. The scientific services were assured, from storm forecasts to preparing meetings for international conventions. Behind the scenes, the digitisation of collections continued with the commissioning of two CT scanners for the non-destructive study of specimens, fossils in particular.

This continuity of action, this capacity to bounce back from difficulties, should be welcomed all the more in view of the drastic cuts imposed last year, which mobilised our strength and imaginations. Our missions remain the same. What is more, they become more complex to achieve, faced with the digital revolution, new social expectations and environmental challenges. This requires the structural establishment of new means and competences. We expect the responsible authorities to assess the challenges and needs that the federal scientific institutions are facing.

Camille Pisani,
General Director

A NEW STRATEGIC PLAN: 2016-2020

Since 2011, the RBINS' obligations have been defined within the administration contract of the Federal Public Planning Service Science Policy to which it is linked. This framework was designed for administrations and does not lend itself well to analysing key issues, formulating choices and planning initiatives in research and scientific services, which constitute our main purpose. As such, following an international peer review of our scientific activities, it became clear that we need to draw up a complementary document with a longer-term focus that would allow us to define, manage and pursue our priorities within our legal missions of research, collection management, scientific services and dissemination of knowledge.

The Institute's strategic plan was therefore initiated enthusiastically following the very positive conclusions of the peer review. It was also bound by the strict budgetary constraints imposed by the new government agreement. Such a contradiction could have clipped our wings. Instead, we responded to it with ambitiousness in our objectives but realism in our actions.

Five strategic axes are put forth: accessibility, excellence, engagement, efficiency, partnerships. As we see, they are not lacking in ambition. They were designed to apply to all of our activities: from research to welcoming visitors, managing collections to advising authorities to facilities management, quality and efficiency can be a concern.

The action plan is more concrete, with objectives on digitalising collections, scientific publications, renovating exhibition galleries, visitor satisfaction ratings, computerisation of procedures and so on. By giving substance to our wishes, describing them concretely while taking account of the available means, we also learn a lot in terms of listening, organisation and clear-sightedness.

This strategic plan was presented to the staff, the Scientific Council and to the Federal Public Planning Service. It is available online : www.naturalsciences.be/en/about-us/home. Between the lines can be found our visions of sharing and excellence, our concern about being useful, the extraordinary diversity of our aspirations. It does not define all that we do, but underlines where we find it important to make progress. And yes, some areas are vague – this is the space left to creativity.

At the end of the first year, what can we say about its implementation? Some of its actions were completed by the end of 2016. We installed new CT scanners for the digitalisation of the collections. We finalised an agreement with the Royal Museum for Central Africa to improve the distribution of our publications. Our temporary exhibition opened to the public this autumn. Thanks to initiatives linked to our EMAS certification, we have obtained a third star for ecodynamics.

However, most of our actions are longer term and are still in progress: research strategy, integrated laboratory management, renovation of permanent galleries, inventory of online collections, new oceanographic vessel, regrouping of teams on a single campus: actions like this take time, and results will not be seen until 2017 or 2018, and for some, 2020.

The strategic plan is not a straightjacket. It is reassessed and can be adapted twice a year by the Board of Directors. The changes in context and realities of the field are taken into account. Actions, and rarer, objectives, are reworked. This adds to the value of the strategic plan: it is a tool for forecasting and anticipation. To quote Eisenhower: "In preparing for battle I have always found that plans are useless, but planning is indispensable."

WALKING THE TALK:
ecology at the Institute

The Institute charts humankind's impact on the environment on such a massive scale that it's easy to overlook our own footprint.

When it comes to ecology, as an Institute of Natural Sciences, it's not enough to talk the talk. We have to walk the walk as well. This means ensuring we operate in the most environmentally-friendly way possible.

THE ECOTEAM

In 2016, our Ecoteam sprang back into action. This is a bunch of RBINS staff members with a real passion for all things green, who have voluntarily taken on the mission to ensure our Institute meets its ecological targets and are very keen to make a difference. Since its relaunch, the team has seen new members signing up as word gets around.

The European Week for Waste Reduction was an ideal opportunity for the Ecoteam to make its presence felt. On November 17th, around 100 staff arriving at the Institute found themselves in the middle of a waste workshop, with challenges on how to sort various types of waste. Those who passed the tests were rewarded with an apple – organic, of course. Another of the team's appearances was during Mobility Week in September. This time the aim was to raise awareness of different ways of getting to work. This led to an increase in visibility for cyclists literally as well as metaphorically, thanks to the flashy cycling jackets that the team handed out.

CERTIFIED GREEN

All this work contributes to the Institute's environmental management system. As part of our EMAS registration for environmental management, we are putting in place indicators for water use, waste production and electricity consumption to be able to measure the impact of initiatives like the Ecoteam. Previously we only received monthly figures on water use – in 2016 these checks increased to several times a week. Waste is also being measured more diligently – rather than recording only the cost of collection, we now record the number of containers to be able to chart waste reduction.

EMAS registration was not widely known around the RBINS. This changed in 2016 as services across the Institute began to regularly invite their colleagues working on environmental management to their meetings. This simple step sparked conversations about potential changes in ways of working to reduce the Institute's overall impact in other ways.

A successful EMAS audit in November has led the team to start looking at ways to further improve, with a particular focus on electricity. The Institute may be proud of its solar panels, but when it comes to lights left on and screens left on standby, there is certainly work to be done. Nothing the Ecoteam can't handle, of course.

2016 AT A GLANCE

01.03

The brand new taxidermy room opens, launching the restoration and preservation of specimens for the future halls of the RBINS and the Royal Museum for Central Africa.

17.03

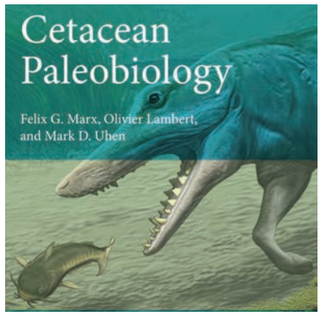
Celebrity interview: snails and their sexuality are the guest stars of Dani Klein from the group Vaya con Dios for the programme Tout le Baz'art on channels Arte and RTBF3.

22.03

Attacks in Brussels: the Museum closes suddenly. 50 children are evacuated during the day. No staff members are directly affected.

29.03

Release of the book *Cetacean Paleobiology* which presents major advances in the evolutionary history of whales and dolphins thanks to paleontological data.



01.04

The annual chance for the public to see Brussels' falcons at the cathedral via webcam brings a new addition: a second camera is installed to observe the birds nesting in Uccle.

19.05

The Gallery of Humankind is awarded second prize in the International category at the Museums and Heritage Awards 2016.

20.05

To commemorate 20 years since Belgium ratified the Convention on Biological Diversity, a debate is held for youth representatives of political parties on the theme "everyone can take action for biodiversity." Evidence is provided by the winners of the competition "1001 ideas for biodiversity" who receive their awards the same day at the RBINS.

20.06

Rudi Vervoort, Minister President of the Brussels Capital Region welcomes an unusual guest to the RBINS weighing 500kg and 210 million years old: an authentic *plateosaurus* fossil.

22.07

All summer, the RBINS presents the history of Belgian geology in three maps with the exhibition *Cartographiae* at the Royal Palace.

01.09

A monograph with contributions from two of our geologists is awarded the France HABE International Prize for its contribution to the conservation of karst.

05.09

France 3 broadcasts a documentary on one of our biologists scaling the heights of research, studying ant colonies on the peaks of the Papua New Guinea rainforests while suspended from a balloon.

27.09

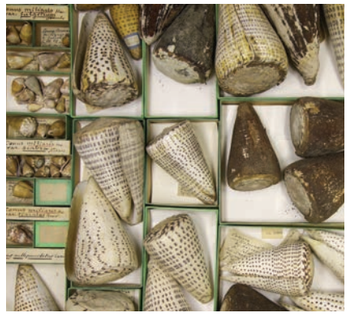
Congolese school inspectors come together with stakeholders in education and development to discuss the theme "Education meets biodiversity in DR Congo" at the RBINS.

28.09

The Geological Service receives another award: one of our colleague's publications receives the Waldemar Lindgren Award 2016 for its contribution to economic geology.

30.09

Photos of the conidae from the famous Dautzenberg collection in their original layout are made available online on demand. The Institute's Scientific Service Heritage carried out this work on the occasion of the 4th International Cone Meeting. The 50 participants had access to photos of the various types for which the Service is responsible.



03.10

Visits of the labs and collections to close the Belgian Antarctic Meteorites project: a team from the ULB, VUB and RBINS presents the project's conservation structure and first results to the scientific community. The Belgian team was also able to benefit from the feedback and expertise of international colleagues.

14.10

Recognition of our teams' expertise: our coordinator of the Biodiversity Platform is elected to the board of the International Union for Conservation of Nature.

17.10

RBINS in the spotlight on TV1: from taxidermy to the palaeontology lab, the TV programme "Iedereen beroemd" follows several of our colleagues in their work for a week.

17.10

Republishing of *Metamorphosis Insectorum Surinamensium* by Maria Sibilla Merian, originally published in 1705. The RBINS displays a rare original copy as evidence for three weeks, usually conserved among other rare works in our stock of precious books. This stock completes the collection of the Belgian Royal Library which does not cover the domain of natural sciences.

19.10

Participatory science gets a boost: Royal Flemish Academy of Belgium for Science and the Arts awards its annual prize for science communication to the RBINS' project "Stick insects in the classroom."

29.10

The Institute's work on Neogene seal fossils from the North Sea receives the Cohen Award for Student Research from the Society of Vertebrate Paleontology.

04.11

An ecological disaster is reported. Pollution linked to oil and gas development threatens the entire African Great Lakes Region. One of our researchers responds on behalf of 70 scientists from 17 countries, sounding the alarm via a letter in the journal Science. They urge governments to develop and reinforce control mechanisms and procedures.

07.11

What does the future hold for the North Sea, exploited for decades and surrounded by highly populated, industrialised countries? What research and management are needed to ensure its marine ecosystems are conserved sustainably? These are the questions asked to 190 participants at the North Sea Open Science Conference 2016 organised by the Institute's directorate for Natural Environments and the Belgian Biodiversity Platform, to work towards sustainable solutions.

15.11

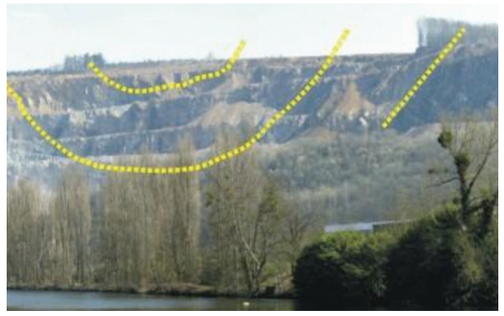
The Secretary of State for the North Sea, Philippe De Backer catches polluting vessels red handed in a flight checking sulphur content in fuels from our observation aircraft.

18.11

Scientists now have access on demand to information about the 2,977 archive documents from the Dupont collection, part of our Palaeontology Collections.

24.11

How can we restore nature, during or after mining mineral deposits and quarrying? This was the central question at the workshop Mineral Extraction versus Ecology which resulted in the publication of guidelines for the public and professionals.



01.12

A royal visit: Princess Esmerelda and the King Leopold III Fund present a documentary at the RBINS on the story of the creation of the Virunga National Park. Platform, to work towards sustainable solutions.

01.12

Resounding success for the Museum's first time participating in the Nuit Blanche: over 3,500 visitors are enthralled by a contemporary dance performance among the dinosaurs.

03.12

The exploration project "Diversity and affinities of the Tadkeshwar mine primates, India's oldest primates" receives a grant from the Leakey Foundation.

08.12

Goosebumps guaranteed at the Brussels Museum Nocturnes: an evening face-to-face with the venomous animals of the Poison exhibition, with a jazz soundtrack.

14.12

The RBINS Archaeosciences team opens its laboratory doors on the launch of a manual for sampling bioarchaeological remains. This book, a first in French, aims to improve the quality of samples carried out by archaeologists by sharing the knowhow gathered throughout the RBINS' research.

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1 RESEARCH

WHAT'S IN A NAME?

When you think about opportunities for creativity, species names might not be the first thing that comes to mind. But tell that to the taxonomist who described the only species of the trilobite genus *Han* and gave it the species name… yes, you guessed it: *solo*. You can't pick any old name, of course - every new zoological species name has to follow the rules of the International Commission of Zoological Nomenclature. **Naming species is an important and serious scientific task.** Nonetheless, it often puts taxonomists in the mood to pick a name with some meaning behind it, and the researchers at the Institute are no exception.

An unusual gift for three Belgian sisters

There are definitely advantages to having an RBINS researcher as your parent. Who else in Belgium except Alex, Bo and Yann Samyn can say they have a sea cucumber named after them? These three species in the genus *Holothuria* were described in a particularly important piece of research which showed the biodiversity of the Northern Mozambique Channel. It also meant a visit from the TV cameras for three proud daughters who were able to show specimens of *Holothuria (Metriatyla) alex* Samyn, 2016, *Holothuria (Lessonothuria) bo* Samyn, 2016 and *Holothuria (Cystipus) yann* Samyn, 2016 on the Flemish TV show Karrewiet.

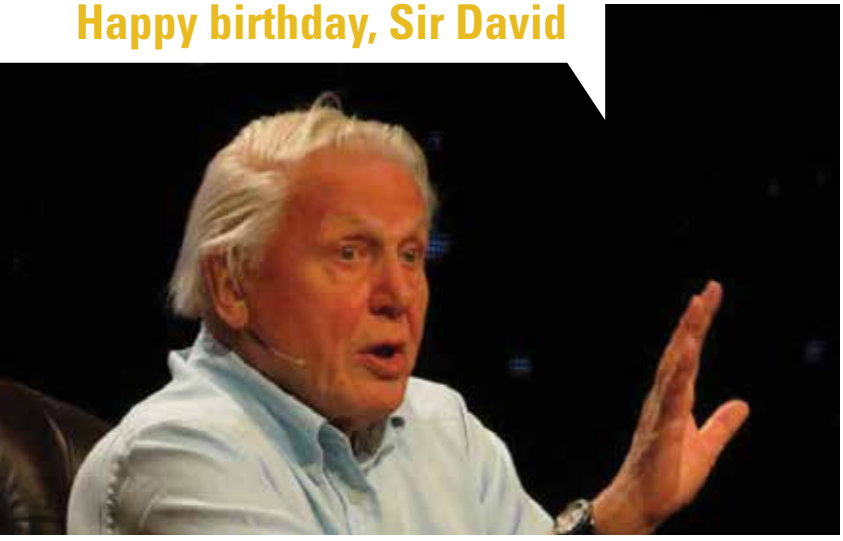
Identification: putting names to zoological faces

BopCo is a project run by the Institute in partnership with the Royal Museum for Central Africa which provides a service for anyone looking for help to identify species of policy concern. From customs officers identifying illegally traded animals, to crime investigators who need to identify insect larvae to establish the origin or time of death of corpses, our taxonomists use a combination of morphological and DNA barcoding data to help work out which species is which.

A new species for our city

The name of a place is a common choice of name for a species. But the city of Brussels is not a typical choice – after all, very few new species are discovered in Belgium these days, let alone here in our city. So when describing a new species of fly discovered at the Jean Massart Botanical Gardens in Auderghem, identified thanks to morphological and genetic studies, our researchers were only too happy to name it *Drapetis bruscellensis* Grootaert, 2016, in celebration of the capital's green spaces. It is the first time a new species of fly has been discovered in Belgium for 20 years.

Happy birthday, Sir David



The legendary BBC broadcaster and scientist Sir David Attenborough is an inspiration for many biologists across the world. When our team of Czech, Belgian and Austrian researchers discovered two new flatworm species in the waters of Africa's Lake Tanganyika, they couldn't resist naming one of them *Cichlidogyrus attenboroughi* Kmentová, Gelnar, Koblmüller & Vanhove, 2016 to honour Attenborough on his 90th birthday.

The newly discovered worms live as parasites on the gills of deep-water cichlid fish in the Lake and are proof that this ancient ecosystem harbours much more biodiversity than meets the eye. Sir David was delighted to hear the news, writing to thank the team, explaining that he was an aquarium enthusiast as a youngster and has always been fascinated by cichlids.

BIODIVERSITY: *SURPRISES IN STORE*

Ever get the feeling there's something going on that you don't know about? Our planet is home to millions of species, the vast majority of which we have not yet identified. Every piece of taxonomical research, classifying these creatures, is an opportunity for incredible discoveries – even more so in biodiversity hotspots like South East Asia and the Antarctic. And as National Focus Point for the Convention on Biodiversity, our Institute had another kind of surprise in 2016 with an award for its work.

Many legs, many species

After a heavy tropical storm in Thailand, it's not only the tourists that slowly start to creep outside again. On tree trunks, incredible millipedes can be spotted. Up to 18 cm long, these fascinating creatures come in many different species, with 35 species in the genus *Thyropygus* alone.

Or so we thought, until the results of a three-year research programme from the Institute in partnership with the University of Mahasarakham and Chulalongkorn University, both in Thailand. This study looked at biodiversity of this millipede genus by studying its anatomy alongside DNA sequence data. Nine new species were discovered, increasing the number of *Thyropygus* species in Thailand by 25%, and 15% worldwide.

A chilling discovery

The Antarctic shelf might not be the first place you'd expect to find a treasure trove of biodiversity. However, a team of researchers from the Institute produced further evidence in 2016 that for creatures well-adapted to the icy waters of the Southern Ocean, the number of species was largely underestimated. *Epimeria* is a rather handsome genus of crustaceans, many with dorsal crests reminiscent of mythological dragons.

Most species are 3 to 5 cm long and dwell on the floor of the Antarctic seas. Our researchers expected to find perhaps a handful of new species from expeditions there — what they did not expect was to discover a huge total of 29. This result effectively doubled the number of known *Epimeria* in Antarctic waters, again, thanks to morphological studies combined with DNA sequencing to uncover the secrets of the genus.

Thanks for sharing

The wealth of information discovered in this type of research is too important not to be shared. And the way it should be shared was established by the Convention on Biological Diversity in 1992. The Institute, as Belgian National Focal Point to the Convention, runs the Clearing-House Mechanism whose role is to ensure public access to information on biodiversity and on the implementation of the Convention.

In 2016, alongside the COP13 in Cancun, Mexico, the first set of prizes were awarded to countries that made the most progress in their Clearing-House Mechanism websites. Our team was delighted to receive the **Bronze Award,** in particular recognition not only of their pertinent website but also of their excellent work in supporting other countries in doing the same, hosting no fewer than 40 Clearing-House Mechanisms from countries across Africa and the Middle East.

In 2016 there were conclusions to be drawn on many levels about our understanding of the evolution of life on Earth. We learned about early mammals, thanks to one dig in India that uncovered the most primitive primate bones ever found, and a second in Northern France which revealed Europe's earliest known carnivorous mammal.
There were also unexpected discoveries about the way species made their way from continent to continent, tens of billions of years ago. Another key finding this year looked at the mechanisms behind evolution: how separate species can evolve from each other through their behaviour.

The most primitive of primates

Just because something is more recent, doesn't necessarily mean it is more advanced. This was certainly true of a set of bones belonging to a 54.5 million year old primate discovered in India. These may not be the oldest primate remains ever discovered, but they are the most primitive. The discovery of this cache of exquisitely preserved specimens marks an important chapter in the evolution of primates, mammals which include humans, apes and monkeys.

The 25 bones were discovered by an international research team, including from our Institute, in a coal mine in Vastan, Gujarat. All other primate bones found so far around the world clearly belong to one or the other of the two primate groups, called clades: *Strepsirrhini* (including lemurs and lorises) and *Haplorhini* (including tarsiers, apes and humans). But many of the Gujarat bones show features that do not clearly belong to one clade or the other.

This would mean that the small animals represent a very early stage of primate evolution. Analysis suggests that the Gujarat primates are close descendants of the common ancestor that gave rise to the two separate clades. That idea is counterintuitive, because older primate fossils exist that show more specialised features. The reason is most likely linked to the fact that they lived in India and Europe before India broke away from the ancient subcontinent of Gondwana.

A small jaw with great significance

In 2014, the most primitive carnivoraform (the oldest one known in Europe) was discovered in Belgium and described by our Institute: *Dormaalocyon latouri*. But this record was not held for long. Researchers of our Institute have now described a species which predates it.

Vassacyon prieuri from Northern France can be considered the earliest example of the *Carnivoraformes* group which now includes modern-day cats and dogs. It dates from 57 million years ago; a time when carnivorous mammals flourished on our continent after the dinosaurs became extinct.

The jawbone with three teeth on it is only three centimetres long, but palaeontologists can retrieve a lot of information out of it. It was a small meat-eating mammal of the *Vassacyon* genus and it weighed only 800 grams. From the layer in which it had been found, we are able to determine that the fossil is from the Latest Palaeocene, when the area around the Rivecourt site in Northern France was covered with tropical forests.

***Vassacyon prieuri* is named after its finder Judicaël Prieur, a French amateur palaeontologist.** The fossil was prepared by specialists of our Institute but its final destination is the Musée d'art et d'histoire Antoine Vivenel in Compiègne, close to its finding place.

India: hop on, hop off

The Vastan primate was not the only discovery which shed light last year on the way evolution was affected by India's movement. At the nearby mine of Tadkeshwar, an international team of palaeontologists and geologists dug up 54 million year old fossils from mammals, birds and reptiles.

Some of these derive from European fauna, others from primitive animals of Gondwana. This remarkable mix raises speculation that there were several land bridges connected to India, which was an island at the time and drifted towards Asia as a kind of Noah's Ark.

Palaeontologists from our Institute worked with colleagues from India and the United States to excavate fossils of over 30 types of vertebrates. These included a new species and genus of giant snake, the *Platyspondylophis tadkeshwarensis* and several vertebrates that had never been seen on Indian soil before.

54 million years ago, when these animals were alive, India was still an island in the middle of the ocean. It had detached itself from the supercontinent of Gondwana and was floating towards modern day Asia, where it would later collide and join, forming the Himalayas. The study shows that some of the animals excavated at Tadkeshwar and Vastan originated from Gondwana whereas others have a strong European kinship. This suggests there must have been temporary land bridges connected to India during the tens of million years in which the island drifted toward Asia.

Connecting behaviour and evolution

The Indian Noah's Ark is an example of how species evolve separately when natural barriers are imposed, like an island breaking away from the mainland. But research on beetles by biologists from our Institute proves that different behaviour – learned while the beetles are still larvae – can also cause populations to become isolated, which is the first step towards creating new species. How is this possible, when the two species are living in the same habitat?

Researchers from our Institute looked at the swamp beetle *Pogonus chalceus* which lives in coastal saltwater marshes in Guérande, France. One population lives in areas that regularly get flooded by the tide. The beetles don't escape at high tide, but stay underwater for a couple of hours, while capturing an air bubble under their wing cases. Underwater the beetles are protected against predators. Just ten metres away, you find the same species, but in a seasonal marsh that is flooded for a couple of months at a time each year. There, the beetles behave differently: when the water comes, they move away to escape the floods. They have longer wings than their counterparts that live on the rhythm of the tides.

Our biologists tested short-winged and long-winged beetles to see how they responded to flooding. The results showed that whether the beetles escaped was not dependent on their origin or wing length, but on whether they had been exposed to regular floods as larvae. Even long-winged beetles could "learn" to sit out the floods through this exposure. For now, the two populations are the same species, but this difference in behaviour is likely to lead to them evolving separately into two different species, side by side in the marshes.

Researchers at the Institute have more in common with detectives than we might think. Sometimes a great deal of lateral thinking is required to uncover evidence that can tell us about humankind was like in times gone by.
If you need to know about how someone lived but there's nothing recorded or documented, why not analyse the materials around them, or the food they ate? And when you enter a cave where no-one has been since Neanderthal times, it's a lot like a crime scene – you have to tread carefully…

Mass deforestation in Flanders 1000 years ago

Relatively little is known about the environment people lived in during the Middle Ages. We do know that this time last millennium, cities in the north of Belgium were expanding rapidly, and materials were needed for heating, cooking and building.

Now, research at the Institute on an archaeological layer of waste has shown that the area around the city of Ghent was completely deforested from the 10th to the 12th century. Wood and charcoal remains suggest that over 200 years, practically every usable tree was chopped down to use as construction material or fuel. We also see what happened when they ran out of trees – timber had to be imported and people used peat instead of firewood by the end of 12th century.

Uncovering the earliest underground constructions ever found

When amateur cavers squeezed down a pothole in Bruniquel in 1990, they had no idea they were probably the first modern humans ever to set foot there. A team including our researchers has been working on the Bruniquel cave and the conclusions, published in *Nature*, are both revealing and baffling. Circular structures were found deep in the cave, made from broken stalagmites, which appeared to have been used as fireplaces.

The structures were over 175,000 years old, according to uranium-thorium dating techniques. This shows early Neanderthals clearly mastered the use of fire for lighting – to carry a torch 330 metres into the cave risked plunging them into darkness. Why they went so far into the cave remains a mystery.

Lessons learned from medieval faeces

Other clues about life in medieval times came to light in 2016 thanks to research at our Institute – only this time, a little deeper digging was required, into medieval cesspits, to be precise. Cesspits are a great source of information on how people lived because they're often very well preserved beneath the ground where people have simply built over them.

Seeds and fruit in the faeces can give some idea of diet, but this research focused on an even more revealing clue: pollen. The results reveal a diet rich in cereals, peas and beans, and leafy vegetables like chervil, chard and spinach. Only the rich had cesspits, and this is evident from some of the more exotic finds - borage, capers and cloves from Indonesia and honey from southern Europe.

STRANDED!

It can be a shocking sight to spot marine wildlife washed up on the beach. But for scientists, data on strandings can provide us with a lot of information about marine mammals in particular, their population trends, problems they face, and the environment they live in. Researchers from the Institute working in Brussels and Ostend collect all stranding and sighting records in one database.

The RBINS is also part of a European intervention network dealing with the scientific research on marine mammals that are stranded or hauled up with fishing catch. The Institute also studies live marine mammals, and in particular the effects that human activities such as offshore windfarm construction can have on them. The RBINS is the competent authority in the national legislation specifically protecting all Belgian marine mammal species – a commitment we take very seriously.

Over 160 marine mammals stranded

Many people don't realise that the southern North Sea is home to a number of marine mammals. Harbour porpoises, white-beaked dolphins and common and grey seals can all be found in Belgian waters. Sometimes, species occurring in the nearby Atlantic Ocean and the northern North Sea may frequent our waters, or wander into them. In 2016, over 160 marine mammals washed ashore – mostly harbour porpoises and seals. Our scientists provide this information each year in an extensive report.

In 2016, 137 strandings of harbour porpoises were reported. The main causes of death were incidental catch in fishing nets and predation by grey seals. SEA LIFE Blankenberge took care of a record number of 39 seals, including one rare albino. We also had a remarkable sighting in the North Sea this year – two magnificent humpback whales observed near the beach at Raversijde, close to Ostend.

Rarer finds in 2016

April 2016, a startling find was made: a dead narwhal in the river Scheldt, near the sluice of Wintham (Bornem). The autopsy, carried out by scientists of the RBINS, the University of Ghent and the University of Liège, revealed that it probably died of starvation. The narwhal is an Arctic species with a distinctive tusk and has never before been observed in Belgium.

The one found in the Scheldt was a juvenile male, three metres long and 290kg in weight. Its skeleton will join the Institute's collection. Three days after the narwhal was discovered, a striped or common dolphin was found along the banks of the River Scheldt at Hemiksem – due to its decomposition, it could not be identified to species level.

October saw another unusual creature reach Belgian shores, but not a mammal: this time it was a 5 meter long basking shark that washed up on the beach of De Panne. Attempts were made to rescue the unfortunate animal, but it died on the beach. It was the first record of the stranding of this species that is rarely found in Belgian waters. A bulldozer was required to remove the remains of the animal: it turned out to weigh 670 kg.

Finally, in December, two juvenile ocean sunfish were cast on the beach. One of these was alive and was taken to SEA LIFE Blankenberge, where it perished a few months later. The ocean sunfish is the heaviest known bony fish in the world. They get stranded from time to time on our beaches, mostly around Christmas. They get into trouble in our shallow waters because of strong tidal currents, heavy surf and a decreasing water temperature.

NO INTRODUCTION NECESSARY?

"Invasive species" – even the technical term sounds like the title of a 1980s sci-fi thriller, conjuring up images of terrifying aliens destroying local natives. But the introduction of non-native species is nothing new – this has been happening deliberately for centuries, and accidentally for millennia. In 2016, the Institute published findings on examples of both types, covering locations as diverse as the Galapagos Islands, the North Sea and the Sahara. Archeological research also uncovered some hints that when it comes to reintroducing species, we might not be getting it right.

Tiny newcomers on the Galapagos Islands

The Galapagos Islands are a Mecca for biologists. Over the years, millions of people have flocked to follow in Darwin's footsteps, observing the vast number of species unique to this Ecuadorian archipelago. What they might not have realised at the time is that they were bringing with them species of ant from the mainland, which have now begun to dominate the Islands.

The extent of the impact was revealed this year in a study from an Ecuadorian PhD student at the RBINS who studied a massive 380,000 Galapagos ants. He found 53 species in total, of which no fewer than 41 turned out to be non-native and recently introduced to the Islands. Many of these new species had never been described before. This kind of introduction of non-native species is unlikely to happen these days – there are large-scale screening and quarantine programmes for people travelling from island to island.

Clawing their way across Europe

The Galapagos ants are not the only species introduced accidentally via the work of scientists themselves. Two other studies published in 2016 looked at an even more direct example – that of the African clawed frog, *Xenopus laevis*, which appears to have hopped out of the lab, quite literally.

The clawed frogs were exported worldwide from their native South Africa since the 1930s for use in labs, to produce pregnancy tests in clinics and in the pet trade. When they escape, or are released into the wild, they easily outcompete local amphibians and might even spread a deadly fungus. As such, the invasive populations in France and Portugal have been the subject of several studies by the INVAXEN research team. One key finding of the Institute's work was that these frogs came from two different lineages. DNA analysis revealed a population in France with specimens genetically related to frogs from two completely different regions of South Africa, living side by side.

The second major finding is that the invasion is not over just yet. By analysing their spread alongside models of potential climate change, researchers showed that the species is likely to continue to spread across France in the coming years. Whether it will reach Belgium remains to be seen.

Beetlemania

If you've heard of the Kerguelen Islands in the southern Indian Ocean, you're probably aware of the stunning species of seal, whale and dolphin that can be seen there. Less was known about *Merizodus soledadinus*, a species of carabid beetle which was accidentally introduced over a hundred years ago. The RBINS participated in a study of the effects of the invasion of this species, which is now one of the commonest on the island.

Up until 150 years ago, no people lived on the Kerguelen Islands. Settlers brought sheep with them, and this could have been how carabid beetles found their way to the Islands, travelling in the food for the sheep. Despite having evolved in a very different habitat, these beetles flourished on Kerguelen – in fact, invasive species often do well even with only limited adaptation to their new environment. They thrived in the damp environment, feeding on a native fly larva and spread rapidly, soon covering whole regions of the Islands.

The spread of *Merizodus soledadinus* can be tracked by looking at the current distribution. The study shows relatively little genetic variation across the species, unlike in its native habitat. It was particularly interesting to note that the beetles on the front line of the invasion are no more genetically diverse than the others, but they do tend to be stronger examples of the species.

Return of the oryx

Interfering in species distribution is not necessarily a bad thing. When a species dies out, reintroduction can be a great way of reestablishing a healthy ecosystem. In 2016, RBINS' specialist on the conservation of megafauna in the Sahara brought us good news: in Chad, twenty-five Scimitar-horned Oryx have just been shipped from Abu Dhabi meaning that after an absence of a quarter of a century, Oryx are back on Chadian soil.

The civil war which ravaged the country between 1979 and 1982 and a partial invasion by armed forces from Libya had devastating consequences for the country's Oryx which accounted for the majority of the world's population of 5,000 animals. Neighbouring Niger's Oryx are presumed to have died out in the 1980s as a result of drought and hunting. The last wild specimen, an adult male, was killed in 1989. High level political support and a strong network of partners give grounds for some optimism that the animals just released will not suffer the same fate as the others.

A fishy case of mistaken identity?

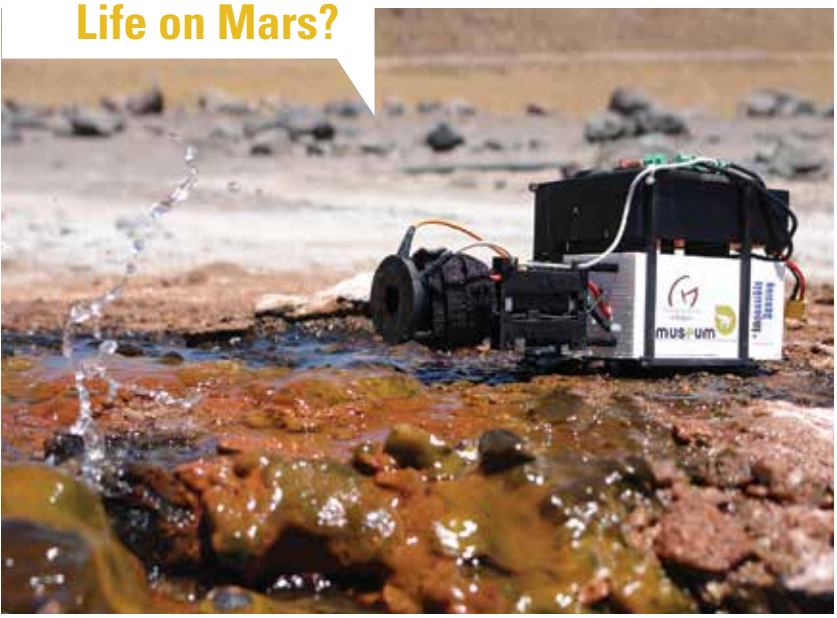
Like the oryx, the North Sea sturgeon is under threat – only for the sturgeon, it's a result of overfishing for caviar and habitat loss. Since the 1980s, policymakers and environmental organisations have been trying to reintroduce it. In 2012, dozens of members of the sturgeon species *Acipenser sturio*, from the Gironde, were released in the Nieuwe Maas, near Rotterdam and in the Waal near Nijmegen, both in the Netherlands. A similar operation was performed in the Haringvliet in 2015.

But is this the right species of sturgeon to reintroduce? Using bone fragments found at archaeological sites, researchers from the RBINS have reconstructed the occurrence of sturgeon in the North Sea over the last 7,000 years. It appears that the dominant species in our region was not *Acipenser sturio* as we had assumed – it was *A. oxyrinchus*, a species that was thought to live only off the Atlantic coast of North America.

So did we get it wrong? Not exactly. *A. sturio* was found here for thousands of years, but it was always outnumbered by *A. oxyrinchus*. On the contrary, perhaps *A. sturio* is in fact a good choice, as the climate is changing and this species thrives in warmer waters. One option could be to reintroduce both species and see which survives best.

Never before in history has technology been advancing as fast as it is today, and the RBINS is at the forefront in a number of areas thanks to the work of our researchers. New techniques allow us to take a closer look at our past and present, whether that's from a satellite 700,000 metres above the Earth, or sequencing a strand of DNA two nanometres wide.

Life on Mars?



Researchers from our Institute have developed a laser technology device called Alpheid that can detect life in extreme environments. A first test in the high deserts of Chile proved to be a success. The new 'laser ablation spectrometer' can detect minerals and bacterial traces in environments like the harsh conditions on Mars. It is possibly the smallest research-grade model in the world.

It uses a technique known as LIBS which involves shooting a very short but powerful laser pulse which blasts away a tiny fraction of the material that it hits, before measuring the light produced. The spectrometer can identify all the elements of the sample by the wavelength of the light emitted. NASA's Mars Curiosity Rover uses a similar device, but nowhere near as light as the 2kg Alpheid. It has been included in four NASA research proposals submitted by the SETI this year, and so there is a chance a future version could be sent into space.

New research vessel software making waves

The RV Belgica is the Belgian national oceanographic vessel, and is proudly managed by the RBINS. Thanks to the outcomes of a recent European project, it will be equipped with a new software system to manage its operations interoperably with other European research vessels. This covers a whole range of functions from charting the ship's location to sampling. The Eurofleets 2 project created a software platform with a core set of web services that can be planted on any research vessel. The Belgian Marine Data Centre (BMDC) within the RBINS was responsible for creating a set of terminology useful for vessel operations and writing software to log events in an oceanographical setting.

In 2016, the BMDC also gave a two-day workshop in Vigo, Spain for vessel IT technicians from across Europe to get to grips with the new system. The BMDC co-organised the workshop with Ifremer from France and the Spanish Research Council Marine Technology Unit in Vigo, Spain and was preceded by two days of successfully trialling the system at sea. What's more, all the software is open source and so scientists across Europe can download it and run it on their own vessel's network.

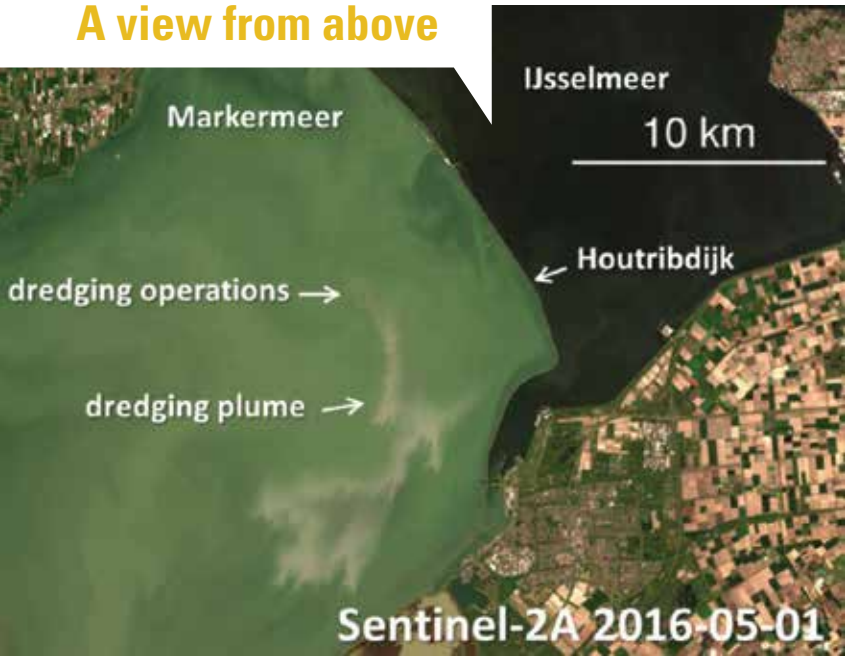
Technology on course for sea forecasting

You may associate the North Sea with cones of frites among the sand dunes. But when you look out to sea from the Belgian coast, you're looking at two of the most densely navigated fairways in the world. The busy Belgian waters are a high risk area for maritime accidents. Ships can collide or even be wrecked, people can fall overboard, there can be loss of cargo, containers and drums or accidental oil spills and chemical pollution.

To support the coast guards in preventing accidents, the RBINS' Marine Forecast Centre has been developing and operating mathematical models which can simulate the ways drifting objects and marine pollutions will move, issuing 5-day forecasts of the marine conditions in the North Sea twice a day. In 2016, researchers at our institute brought this forecasting expertise to the next level. For these developments, the Institute teamed up with consultancies and the universities of Ghent and Leuven. Together they adapted and added to existing methods, better representing estuary and coastal conditions.

The work was an assignment of the Flemish Government's Department of Mobility and Public Works. Their models can now calculate the state of the sea ten times faster than before. They can cover more complex terrains, simulate flooding and include erosion and sedimentation phenomena.

A view from above

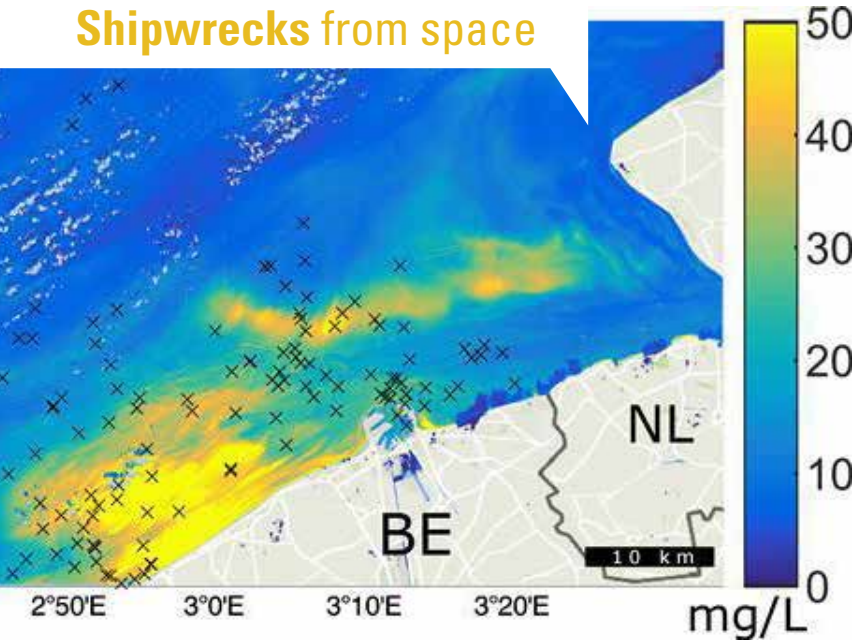


Water quality monitoring in lakes might not sound like something that would require satellite observations. And until recently, it was very difficult - traditional optical ocean colour satellite imagers were limited by their rather coarse spatial resolution and could not provide a good picture of what was going on in smaller bodies of water.

This changed with European Sentinel-2 satellite, launched recently as part of the Copernicus programme. This new sensor provides images with a spatial resolution of up to 10 metres, enabling water quality monitoring in lakes, coastal areas and even rivers. The Sentinel-2 sensor is originally designed for land applications but thanks to a new atmospheric correction procedure developed by RBINS researchers, as part of a collaborative project, this sensor can now be used for water applications. With a 25 times higher spatial resolution of optical images, it opens the doors to a range of new applications: monitoring algal blooms, sediment transport near harbours and many more.

Of course, the sky has to be clear of clouds to acquire satellite images. But even with 40 or 50 clear days per year, this is still a lot better than ship-based observations. The algorithms for the Sentinel-2 satellite were developed and improved based on data collected onsite at Lake Balaton in Hungary and validated at Markermeer in the Netherlands.

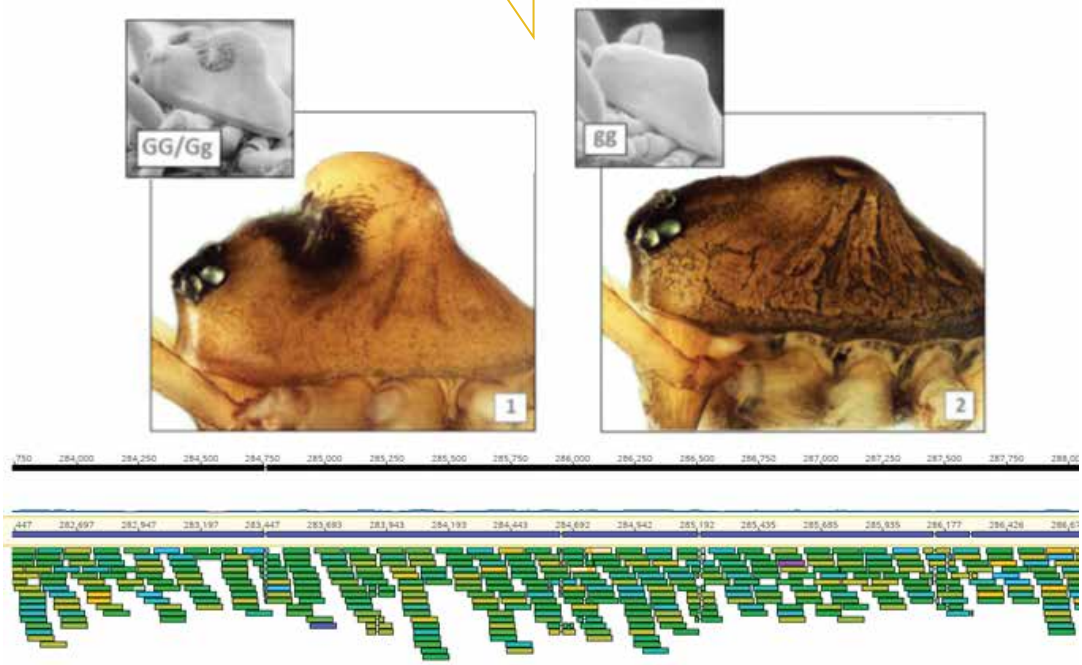
Shipwrecks from space



How do you find a shipwreck? It's estimated that there are over 3 million undiscovered wrecks on sea floors around the world. Until recently, the only way to detect them was using acoustic techniques at sea, but this method has its limitations. Now, a research team including the RBINS, the School of Environmental Sciences in Northern Ireland and the Flemish Hydrography have published a study which detects shipwrecks differently: from space, also using the Sentinel-2 sensor.

A shipwreck acts as a kind of container which slowly fills with sediment on the sea floor – fine sand, clay and organic matter. The tide stirs this sediment up to the surface, creating a kind of plume that is detectable by satellite. These plumes are the key to revealing the possible presence of shipwrecks deep beneath the surface. The technology was tested on known shipwrecks near Zeebrugge and has stirred up a great deal of interest, including from NASA.

From genetics to genomics

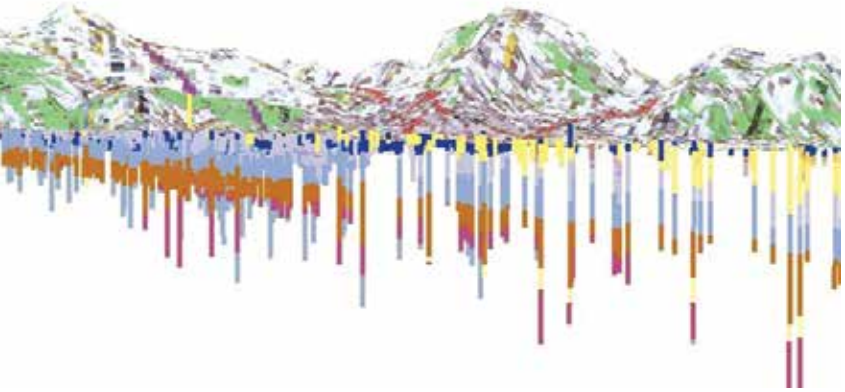


Researchers at the RBINS have been unravelling DNA codes for years. Earlier technology only allowed them to look at a very limited number of chunks at a time on any one strand of DNA. This made it difficult to draw conclusions about how genetic mechanisms lead to adaptations – with such a small number of samples, the chances of finding something relevant were very slim. But a few years ago, their work has made huge progress thanks to next-generation sequencing technology which the RBINS brought in house, allowing them to look at hundreds or even thousands of chunks of DNA at a time.

Since then, this sequencing technology has been advancing at an unprecedented rate. To keep up, researchers have now brought another new type of expertise into the RBINS that allowed them to decipher the entire genomic code of organisms. This has been successfully applied to more than 40 specimens of two carefully chosen model systems: dwarf spiders and caterpillar hunter beetles. One huge asset of this technology is that it also allows researchers to look at variation in the structure of the genome. This helps to chart evolutionary history and how genomic mechanisms bring about the diversity we see in living things around us.

The furthest underground most of us go in Brussels is when we hop on the Metro. But much further beneath our feet lies a wealth of potential. The Brussels region is very rich in terms of groundwater and when it comes to geothermics, we could be sitting on a goldmine of renewable energy.

A model that digs deep



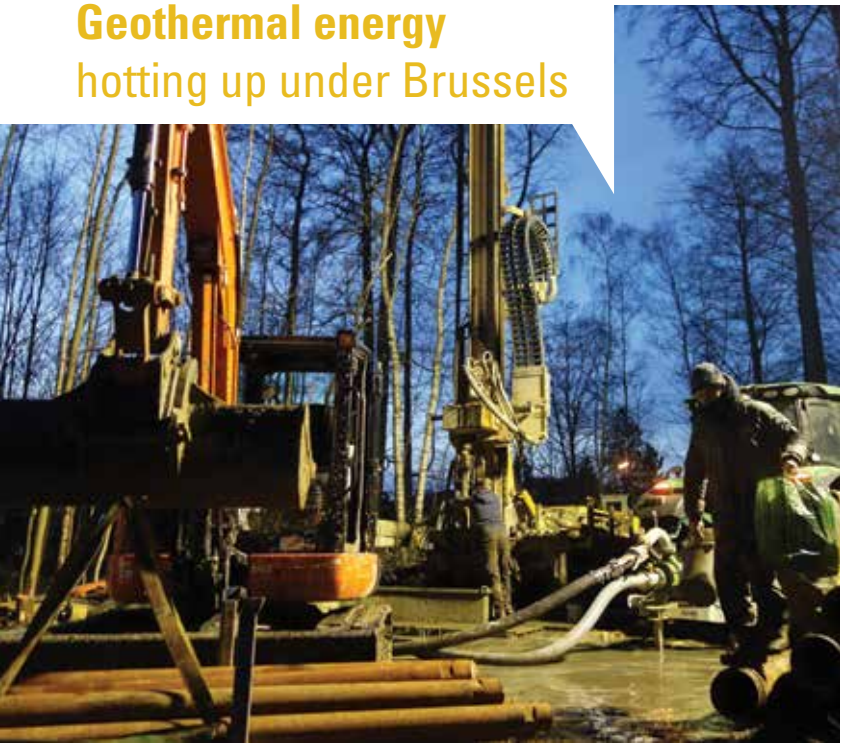
How do we work out what's going on down there? Geologists have been working for years on modelling the geological layers under Brussels as part of the Geological Survey of Belgium, which is part of the Institute.

With the Hydroland project, which came to an end in 2016, they have produced 2D and 3D geological models of the area, at a level of detail that had never before been achieved. This model leads us to some striking conclusions about the groundwater.

The information for the model comes from a range of sources – thousands of boreholes drilled into the ground, but also from observing water wells, outcrops and other tests and sources. The resulting models show the layers of the Hannut Formation, a geological formation made up of marine clay and silt, with sandy layers, and help us better understand the sources and pressure of the groundwater there. We see the direction and volumes of water that flow right under the Brussels-Capital Region.

One remarkable finding is that groundwater coming north from Wallonia under the region takes a sudden turn to the west, due to a decrease in pressure. Further research will look into it, but a likely cause for the decrease is that breweries in Flanders pump groundwater up for beer. It's something to think about next time you're at the bar.

Geothermal energy
hotting up under Brussels



The internal heat of the Earth can be used to heat houses and to generate electricity. Countries such as Italy, Iceland and Turkey have been using thermal energy for quite some time, and Greece and Germany are experimenting on a large scale. So what is Brussels waiting for?

Geologists from our Institute have been working with universities (VUB, ULB and UCL) and the Brussels environment and energy administration to map the geothermal potential in Brussels in a new project launched in 2016. They are examining the drill cores from the capital that are stored in our collections to measure the thermal conductivity at various locations in the city, as well as evaluate the presence of sources of groundwater known as aquifers. These data will be used to produce a detailed map of the geothermal potential in Brussels. The project BruGeoTherMap should be completed in 2020 and will be open access. This should help people invest in geothermal systems in projects for new constructions and renovations.

In fact, some new building projects in Brussels are already starting to be equipped with geothermal systems. The new government building of the Brussels environment and energy administration has four geothermal wells of 80 metres deep, heating the building during winter and cooling it in the summer.

2 COLLECTIONS

The beauty of a natural sciences collection is that we keep learning from it. Even specimens that have been in the collection for many years still have secrets to reveal. Particularly rich findings in 2016 came from our collection of bones discovered in the Goyet caves near Namur. Goyet is a major unique site, with exceptional human and animal remains from 14,000 to 45,000 years ago. These were discovered as long ago as 1868, by the Belgian geologist and director of our Museum Edouard Dupont, but studies of the bones are still bringing forth fresh revelations today.

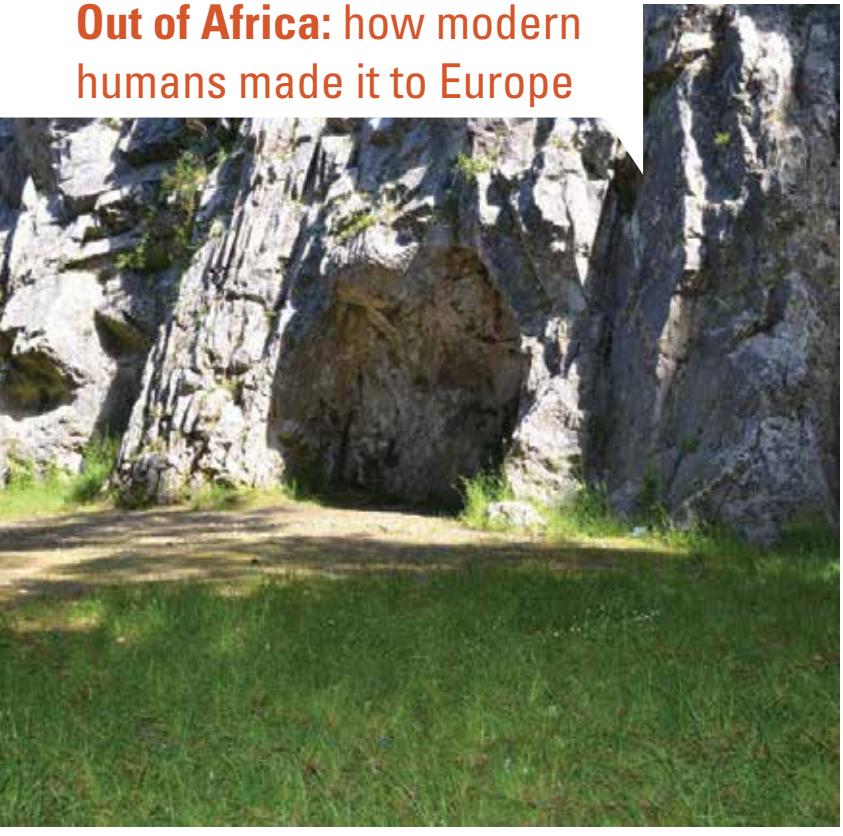
Found in Goyet: your earliest ancestor

In 2016 we learned that the Goyet collection contains modern Europeans' earliest known ancestor, in the shape of a 35,000 year old arm bone. A new study analysing the genomes of a few dozens of individuals from the Ice Age showed the humerus is linked to present-day Europeans.

Our Institute was part of an international research team analysing the nuclear DNA of 51 humans who lived between 45 000 and 7000 years ago. The earliest were the first modern humans to populate the area we now call Europe. Despite the chill of the Ice Age, they never left the area. But the study shows this first branch died out, and their genetic material cannot be found in our present-day gene pool.

But the Goyet humerus does contain genetic material we still share today – we find descendants of that group starting about 25 000 years ago in the north of Spain where they survived during the latest Glacial Maximum (between 25,000 and 19,000 years ago).

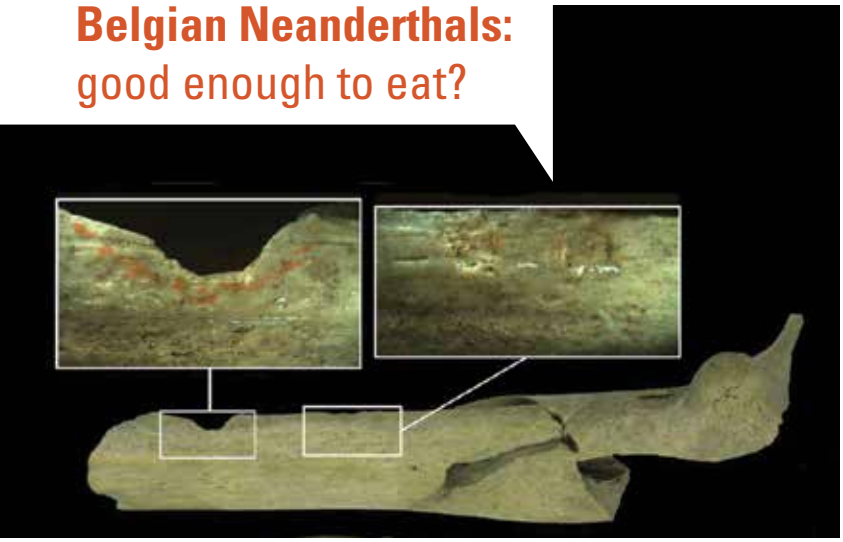
Out of Africa: how modern humans made it to Europe



The end of the Ice Age was a turbulent time for European populations in general, as a DNA analysis has shown. Evidence from Goyet shows how modern humans migrated from Africa straight to Europe, without making a detour through Asia as was previously thought.

The study unravelled the complete mitochondrial DNA of 35 prehistoric hunter-gatherers from Goyet and across Europe. The result was unexpected: two individuals from Goyet and one from France were attributed to the haplogroup M – although this genetic pattern is no longer found in today's European populations. We know however that this haplogroup is a precursor of the haplogroup N, very common in modern Asian populations. Further results show that at least some modern humans crossed from Africa directly to Europe between 50,000 and 60,000 years ago.

Belgian Neanderthals: good enough to eat?



Neanderthals were skilled butchers. Animal remains from Neanderthal times showed they knew how to skin, fillet and joint their meat. What we didn't know about Belgian Neanderthals is that there wasn't only animal meat on the menu.

An international team of researchers, two of them from our Institute, discovered traces of cannibalism on dozens of human bones from Goyet – the first time this had ever been found in Neanderthals in northern Europe. High resolution images show clear proof of the same type of butchery seen in horse and reindeer remains in Goyet. Whether Belgian Neanderthals ate human meat as part of a ritual or as a food source is not yet clear.

Goyet cave bears' diet secrets

Neanderthals were not the only ones with surprises on the menu: a 2016 study of the Goyet collection has also revealed that the cave bears there were herbivorous. Scientists made this finding by comparing isotope studies of amino acids in the bone collagen of the bears to those of other plant-eaters at the time.

These results might support the idea that this inflexible plant-only diet was part of the reason cave bears went extinct, unlike the omnivorous brown bears which occupied the niche left after their extinction.

SOURCING OUR SPECIMENS

How did the RBINS end up with 37 million specimens? We are proud to host one of the world's largest natural sciences collections. It is rich, diverse and includes many unique treasures: a major asset for researchers in our Institute and across the world. These collections have accumulated over the decades, through exploration, research, partnerships and donations, the work of both researchers and passionate amateur scientists, carefully preserved and managed for years to come. 2016 was a great year for our collections, with specimens arriving in their thousands from research expeditions and donations alike.

Peaks of insect biodiversity on Mount Wilhelm

A spectacular example of research that greatly enriched our collections this year took us to the misty treetops of Papua New Guinea. Our research project climbed Mount Wilhelm to study the immense and largely undiscovered biodiversity of the Papua New Guinean rainforest.

The dense rainforest there stretches from sea level right up to the timber line limit, making it the perfect location to examine how altitude can be taken into account when estimating biodiversity. This research was made possible thanks to many years working closely with an international team and in partnership with people from local communities, with a focus on conservation and capacity building.

Over 16 days, the research team sampled insect species at eight different elevations going up the mountain, using a range of traps, vegetation beating and insecticides, as well as surveying the plant species present. The insect samples were sent to taxonomists across the world. There are around half a million samples and will take years to analyse, but a massive 150 new species and six new taxa have already been described as part of the Our Planet Revisited project. Many of these samples will find a home in the Institute's collection to be studied further.

Swarming with donations

Aquila Dervin was a schoolteacher with a passion. When he wasn't teaching in the local Charleville-Mézières school, he was out exploring the nearby French Ardennes, collecting insects to add to his collection, carefully labeling and preserving them. He would even make little scenes using the specimens he collected to take into his classes and show the children. With the help of his son Roger, the collection soon grew to include around 40,000 specimens including an impressive set of beetles, carefully organised into taxonomic groups.

Forty years after Aquila's death, his great-grandson was keen to ensure the collection was still managed properly. Thanks to the RBINS' reputation for expertise in this area, he got in touch to donate the entire collection. For the Institute this is a very valuable addition – not only from an educational perspective, but also for research purposes, with 250 specimens already loaned out. The bee collection alone can provide precious insight into the biodiversity of the Ardennes a hundred years ago.

In 2016 the Institute received two other vast insect collections: the Keymeulen collection of over 40,000 moth specimens and the Fastre collection of over 30,000 butterflies. These specimens will all be carefully managed by our teams, opening up their wealth of potential to researchers worldwide.

A FRESH LOOK AT OUR COLLECTIONS

Not only is our collection growing, but the techniques available to study it are advancing rapidly. In terms of digitisation, we are revolutionising the ways we observe and share images of our specimens. And when it comes to genetic sequencing, we are digging deeper into the DNA of our collections than ever before.

Our collection catches some rays

Digitising our collections is a lengthy process. But in 2016 this digitisation received a massive boost thanks to two new state-of-the-art microscanners, purchased as part of the Secretary of State for Science Policy's investment plan.

The two scanners use micro-CT technology to create 3D models of the internal and external features of specimens. X-ray projections are then taken over a 360° rotation. These models provide a valuable record, allowing us to see deep inside our specimens while still keeping them intact.

Our specimens in a new light

Not all the technology we use to make images of our collection is expensive. A team from our Institute has studied how using a simple UV lamp during digitisation can open natural history collections up for new research.

Many specimens react to UV light in the form of fluorescence, to the point where it can even help taxonomists distinguish between male and female in some species. Exposure to UV light in different wavelengths, in combination with a low cost focus stacking setup, also increases the detail of the picture during digitisation. Of course, this affects the colours in the image, but those can be filtered out. In any case, the result often gives an otherworldly beauty to the specimens, enhancing colours and revealing hidden details.

Cracking the code of ancient DNA

Many of the secrets of the specimens in our collection have been lying hidden for centuries in their genetic coding. Thanks to next-generation sequencing techniques, our researchers can now unlock a whole new world of discoveries in this ancient DNA.

DNA sequencing is challenging at the best of times – determining the order of the building blocks which make up an animal or plant's genetic code. But ancient DNA is even more of a challenge. Over the years it becomes fragmented and contaminated to the point where organic material contains just a tiny fraction of the DNA we find in fresh specimens. It is only thanks to the latest sequencing techniques that we are finally starting to be able to crack some of the oldest genetic codes in our collections.

Our DNA lab at the Institute is working hard to perfect these techniques, standardising procedures and cross-checking results to ensure that the outcomes are reliable. The possibilities for further study of the collections are very promising.

Worming even more out of our collections

Another example in 2016 of fresh findings from old specimens came in the shape of a collection of worms native to Lake Baikal in Siberia. These worms are of the genus *Baikalodrilus* and are interesting from an evolutionary perspective because of a rare phenomenon: there are 21 known species present in the same habitat, all evolved from a single common ancestor.

There had been some doubt about the validity of all these species since identification is tricky. Thanks to new DNA analysis on worms we have had in our collection since the 90s, our researchers were able to confirm a number of existing and new species, proving that the *Baikalodrilus* worms are truly the Darwin's finches of Lake Baikal.

An evolutionary snail trail

How do you tell one snail species in our collection from another? Taxonomists have traditionally relied on observing specimens to see the physical differences. But some species look so similar, or exhibit so many combinations of morphological characters, that it is only by using these very advanced sequencing techniques that we can tell them apart.

Recent research into a technique known as RADseq has made it possible to distinguish between nine species of the snail *Pyramidula,* trace their evolution and even test whether hybridisation took place, where genes are shared between species.

3 PUBLIC

Our Museum looks back at millions of years of the planet's natural history. But that's not to say that we don't look to the future, too. By developing new online tools and apps we reach further than we ever could face-to-face, engaging new audiences, improving our accessibility, raising our profile and opening up new possibilities for partnerships. In 2016, the Museum took advantage of the latest technologies in particularly novel ways, from birdbox cameras to Google Cardboard.

XperiBIRD.be takes flight

When a bird nests close to a school, children are naturally curious. Will there be eggs? How many, when will they hatch, and when will the chicks spread their wings for the first time? This simple curiosity is the driving force behind a new, ground-breaking participatory science project which brings simple birdboxes together with cutting-edge technology for schools across Belgium.

Classes of schoolchildren aged 10 to 14 receive a kit containing a birdbox equipped with a Raspberry Pi nano-computer that controls a camera. Their mission: to collect scientific data on nesting behaviour of tits and other passerine birds and share these data, as well as their photos, videos, experiences and questions on the XperiBIRD.be website. **As such, XperiBIRD.be is a true citizen science project,** allowing young people to experience real natural science research, working closely with scientists at the Institute who will use the data to produce a national study.By obtaining large amounts of data about a common species like tits, we can draw interesting conclusions about how nesting is affected by a whole range of factors, including climate change. In the process, it helps develop young people's digital skills and understanding of the scientific method, in a fun way. This project was made possible thanks to a partnership between the RBINS and Google.org, the philanthropic branch of Google, and is a first in Belgium.

The first year of the project has been a big hit, with a prestigious launch event at the Institute, 200 kits distributed across the country and a particularly enthusiastic response from classes, with all eyes on the boxes as nesting season approaches. Another 400 kits will be sent out to schools and associations in the next two years, bringing in data on a massive scale to feed into this unique project.

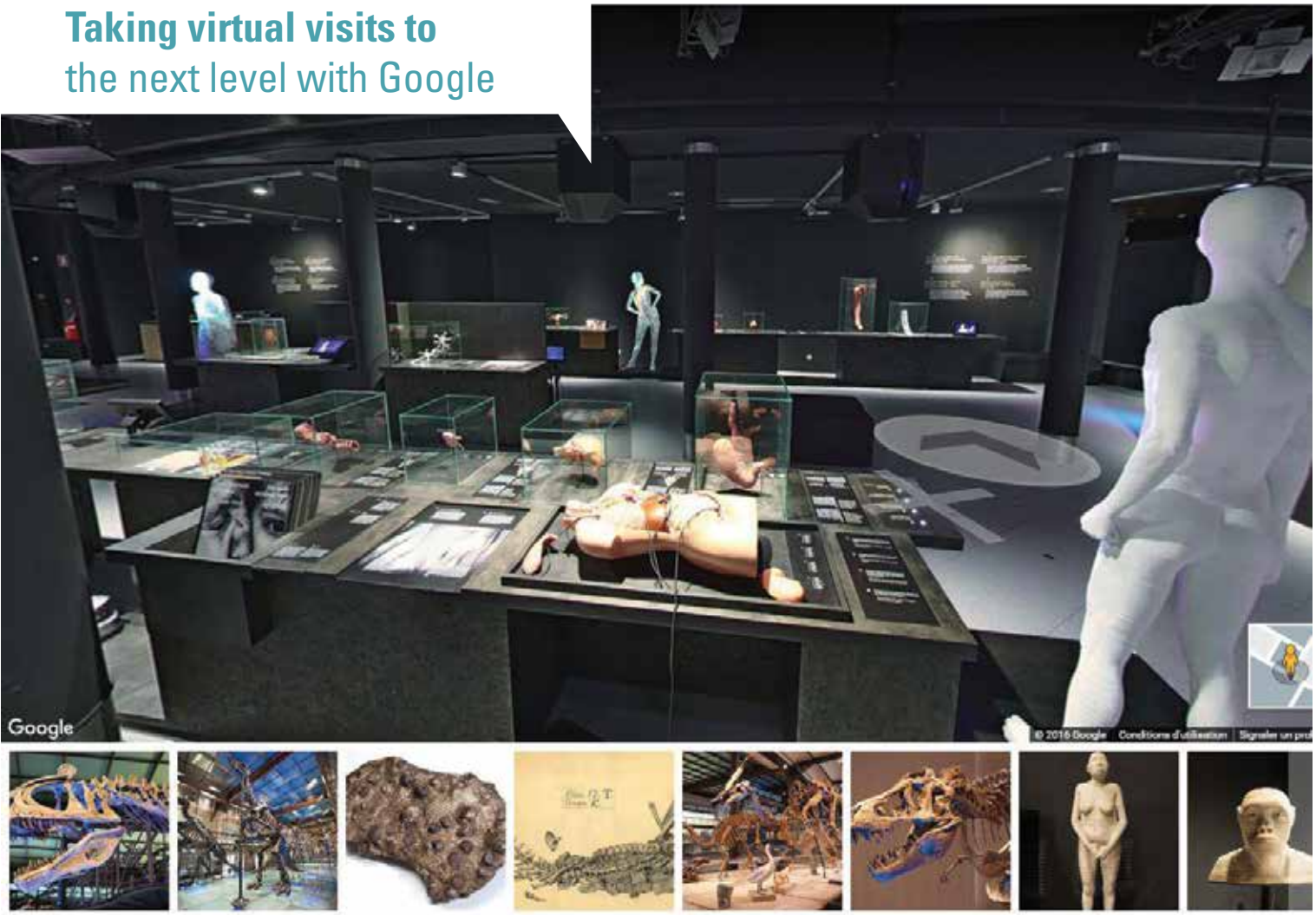
'Appy days!

Of course, all this technology doesn't only make the Museum more accessible from homes and schools – it can also bring a whole new dimension to visits inside the Museum itself. 2016 saw the launch of 'Our Natural Selection' Tour, our new guide on the free smartphone app izi.TRAVEL.

Many museums have audio guides – not many have video guides. 'Our Natural Selection' is a fun way to experience six of the Museum's top exhibits, through quirky animations and archive photos. Maybe your curiosity is piqued by the story of the Lier Mammoth. On the app you can meet Louis de Pauw, the young taxidermist that had the arduous task of reconstructing the beast, having wooden bones carved to replace the missing pieces.

Next, maybe you want to know more about the humpback whale in the entrance hall, our famous Bernissart Iguanodons, the massive mosasaur *Hainosaurus bernardi* (our "Sea Rex"), the primitive horse from Messel or Spy Man, our Belgian Neanderthal. You can just download the videos onto your smartphone or tablet thanks to the Museum's free WiFi in the entrance hall and let the app take you around in English, French or Dutch. And if you like them, you can share them – all the videos are up on YouTube to be watched wherever you like. The tour has been a hit so far, with over 16 thousand views of the content in just eight months' time, and the Iguanodon video will be featured in the upcoming Dino World exhibition which will open in summer 2017 at Brussels Expo.

Taking virtual visits to the next level with Google



With Google Street View, you can see your route to the Museum in a few easy clicks, looking around you on the way. But now, thanks to Google's Arts & Culture platform, that trip doesn't have to end at the Museum doors. Google has teamed up with our Museum, alongside over 50 others from 16 countries, to launch a new online experience, allowing people to come face to face with fascinating specimens and browse through the most spectacular collection of natural history available in one place – London's butterfly collection, Berlin's biodiversity wall and Belgium's world-famous Iguanodons, one of the greatest dinosaur discoveries of all time, all online at g.co/naturalhistory.

This meant a thorough visit to the Museum for the Google cameras. As well as a complete Street View of its permanent exhibition spaces and more than 200 specimens and archive documents, you can also visit five online exhibitions, three of which are available in eight languages. These have been specially created for the platform: Past, Present and Future: the Marvels of Evolution, The Bernissart Iguanodons, Our 250 Years of Natural Sciences, From *Sahelanthropus* to *Homo sapiens:* what did our predecessors look like? and A Short 360° Guided Tour.

The 360° Guided Tour includes a virtual reality visit of some of the Museum's highlights that can be experienced on Google Cardboard a simple, affordable virtual reality viewer, via the platform's mobile app. Teachers can also bring students on virtual Museum visits thanks to Google Expeditions. These are collections of virtual reality 360° panoramas and 3D images which bring you behind the scenes at the Institute — annotated with details, points of interest, and questions that make them easy to integrate into the school curriculum.

2016 is a year that Brussels will not forget. The March 22nd attacks left our city grieving and in shock, coming to terms with the loss of lives. As we mourned, we came together to support each other. Neighbours, strangers and Brusseleirs of all backgrounds stood side by side in solidarity. Chalk messages and candles lit up the steps of the Bourse. And life went on, the same as before and somehow not quite the same. This was the case for the staff and the visitors of the Museum, too, since the attacks, and it has not been easy. We have kept on doing what we do best, welcoming people in, continuing the important role we play in society and bringing people together around a strong programme of activities.

The impact in numbers

In general, visitor numbers had been steadily increasing over the years. Careful work promoting the Museum abroad had led to a significant rise in foreign tourists, with an overall increase of over 40% between 2014 and 2015. However, the Museum was greatly affected by the lockdown in Brussels at the end of 2015 following the Paris attacks, and after the attacks of March 22nd, this overall drop in visitor numbers inevitably continued.

Fewer visitors from foreign countries came to the Museum: only 37,500 in 2016, compared to 55,000 in 2015. French, Spanish and UK visitors went down in number by over 30%, and Italians and Dutch by as much as 50%. Similar figures can be found for museums all over Brussels and Paris – the Atomium lost over 30% of its usual visitors in summer 2016 compared to summer 2015.

Interestingly though, the RBINS' overall drop in visitor numbers did not affect visitors from Belgium. They actually increased in number in 2016. Belgian attendance managed to keep the overall total drop in visitor numbers for 2016 to 15,000, compared to the 17,500 decrease in foreign visitors. This increase in Belgian visitors is likely due to a number of reasons – in any case, it is a source of pride for the team at the Institute who have worked hard to maintain an engaging and lively programme for the Museum in particularly difficult circumstances.

A campaign with teeth

Following attacks like the one in Brussels, studies show that it takes at least six months for people to start to feel safe again. As such, the Belgian government allocated budget for activities in the city to give a boost to Brussels' institutions over the summer. This was how the Big Mouth campaign came about. In July, a photo booth appeared by the Museum exit with a playful banner inviting visitors to have their picture taken in the jaws of the T. rex with the cheeky slogan "Me, a big mouth?" to share on social media. People could also write colourful postcards to be sent to their friends and family, telling them about their trip to the Museum and offering them a discount if they wanted to come along.

The campaign met with widespread attention from the press, reinforcing our image as an organisation that visitors can count on, with a lot to offer. The strong visuals also drew attention to our collection of specimens for which we are well known, and the positive, playful message was received well. Through Big Mouth, over 8,500 visitors became ambassadors of the Museum, with thousands of photos shared across Facebook, Twitter and Snapchat.

What's your POISON?

If 2016 was the year to breathe life back into the Museum, what better way than with our first ever exhibition of live animals? Poison dart frogs, tarantulas, scorpions, rattlesnakes and a mighty Gila monster are among the dozens of poisonous animals crawling, slithering and swimming their way around the exhibition's 24 spectacular terrariums.

It's no surprise that many of Poison's inhabitants can do some serious damage with their venom, whether it is delivered as a bite, a sting or through simple contact. A bite from the beautiful king cobra, for example, can deliver up to 500mg of poison, potentially fatal for humans. As such, the fridge is well stocked with antidotes and an experienced animal handler, Guillem, oversees the exhibition from the confines of a special lab in the centre of the gallery. Visitors are welcome to look on through the large window as the animals are handled, fed and bred. Since the exhibition opened, a number of poisonous babies have been born in Brussels, including a litter of tiny black widow spiders.
What might be more surprising is what the exhibition has to say about the functions of poison, which go far beyond their use as a weapon. Poison is often a means of self-defence, and we also meet animals like the milk snake that disguise themselves as poisonous, mimicking the colouring of the coral snake and confusing would-be predators. We understand from the exhibition that poison is a precious resource for venomous animals, and not something they are likely to use except in cases of real need. What's more, many of these animals' poisons have medical applications that can save lives. Drugs derived from the gila monster's poisonous saliva can help diabetics control their glucose levels, for example.

The exhibition, along with the workshops and nocturnes which accompanied it, attracted a great deal of attention in the press. As a result, *POISON* was often sold out during weekends and holidays. From Brussels, the exhibition will move next to Naturalis in the Netherlands where Guillem will continue the adventure.

The WoW effect continued

Our previous temporary exhibition WoW went from strength to strength in 2016, closing its doors at the end of August after over ten months and over 100,000 visitors. Despite the effects of the lockdown and attacks, visitors continued to be drawn to WoW's gravity-defying displays of taxidermy. The universal appeal of the exhibition and its immersive nature allowed the Brussels public to step into another world for just a moment, and its Instagram-friendly visuals certainly helped spread the word on social media too.

The oldest of the Masters

100 masters in 100 days: this was the challenge set by Brussels museums over the summer. And five of the Brussels 100 were to be found within our walls. To raise the profile of the highlights of our permanent collections, we invited visitors to discover this selection of the RBINS' prized pieces: the Iguanodons of Bernissart, the lunar rock, sea lilies, the extinct Tasmanian tiger and finally our "Sea-rex", one of the largest mosasaurs known to date. Treasure hunts and guided tours accompanied the campaign, which met with a great deal of success across Brussels, at a time when it was particularly crucial to put across a positive image of the city.

The education team at the Museum is constantly coming up with new activities to add to our varied programme, for visitors of all ages – from pre-school, through primary and secondary and beyond. 2016 offered something new to all these groups, covering topics from taxonomy to earthquakes.

Workshops for the littlest and the not-so-little

How can you get to grips with science at the age of two? The Museum rose to the challenge this year, launching a brand new set of workshops for toddlers known as the Tout-Petits Ateliers. Kids aged 18 to 36 months can come along with a parent for an hour-long workshop. There, they can listen to birdsong and touch fur, feathers and scales, guided through the session by our workshop leader and her puppet friends. Our education team now produces a new themed workshop every month, from the aquatic world to animals of the savannah. The focus is on inspiring these future scientists with the wonders of the natural world.

Meanwhile at the other end of the age spectrum, our Coffee Workshops sprang up as a new highlight in the Museum calendar in 2016. These sessions are a chance for adults to get together in an informal setting while exploring a hot topic in natural sciences. Be a part of experiments to see how the human eye works, try out Stone Age tools or chat with one of our researchers over unseen fossils from our collection, all the while with a coffee in hand and maybe even a biscuit or two.

A fresh approach to classification

Another challenging topic for teachers is the classification of living things, and this begins even earlier: in primary schools. There is a lack of resources to support teachers in the classroom, and many are uneasy about where to start.

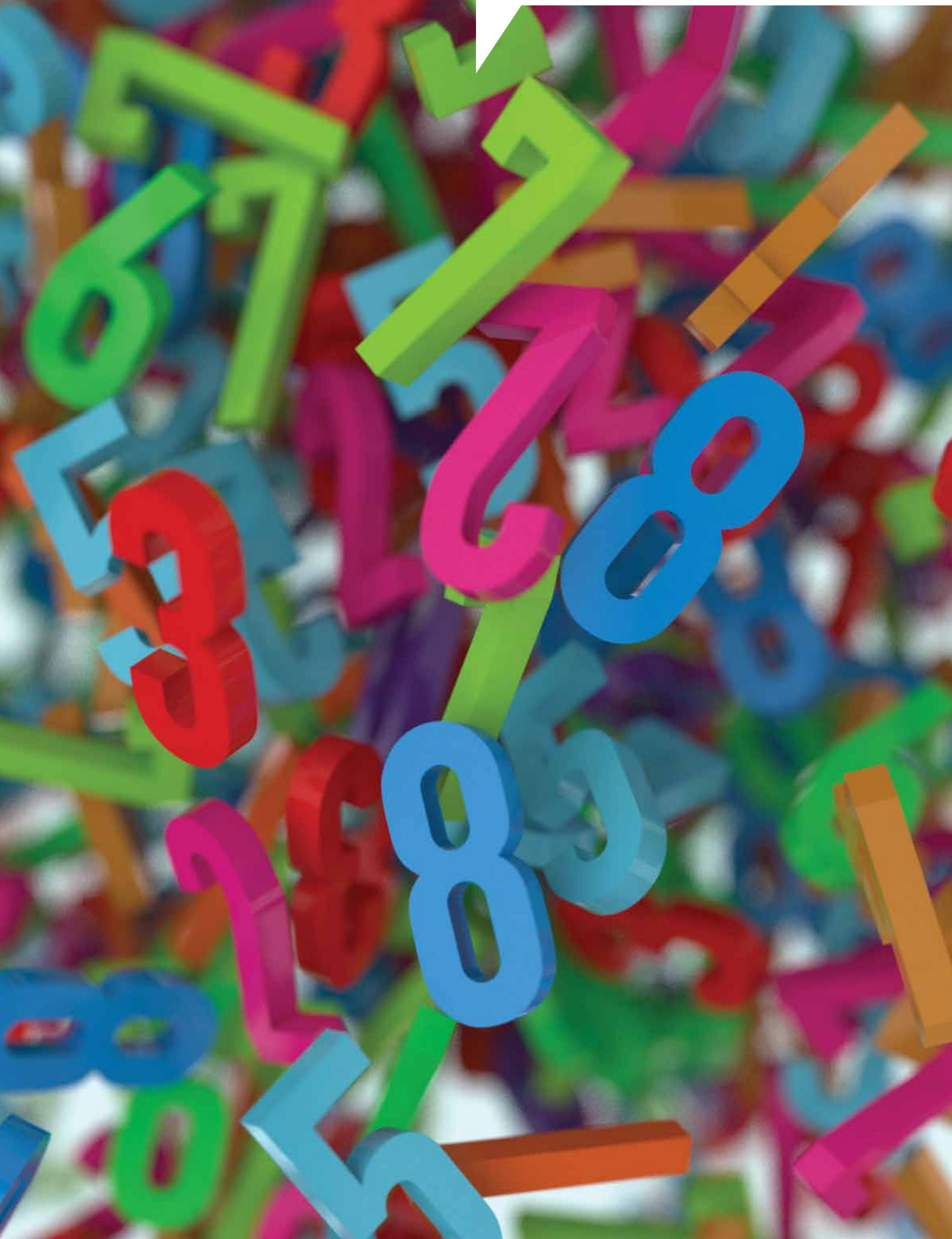
The Museum launched a solution in 2016: Classific'Action, our education team's new outreach workshop for primary school students. No need to book the bus to the Museum for this one: we bring the Museum to schools for free. This workshop blows open old preconceptions about classification, ditching concepts like "reptile" and "invertebrate" which are actually terms for sorting, not taxonomy. Our adaptable, participatory workshop scenarios tackle classification in a way that fits an evolutionary approach and begin from the same kind of observations our own taxonomists make in the Institute. A full educational kit accompanies the activities. We'll be busy touring the Brussels-Capital region for two academic years.

Unraveling evolution in schools

Evolution is a complex subject to approach with high school students, and even more so in communities where religious education tells another story of how life on Earth began. GO! Is one of the main educational networks in Flanders and when they contacted the Museum for support on how evolution is taught in Brussels schools, our team worked closely with them on a set of training courses.

The first course was launched in 2016 including a guided tour of the Museum and a set of participatory workshops for two groups of over 15 teachers from the Brussels region. Teachers got a chance to discover the educational material the Museum produces which can support them in the classroom, including our evolution board game. Lively discussions focused on how to ensure religious beliefs are no obstacle to engaging students in understanding the mechanisms behind evolution by focusing on scientific evidence. Future courses are already planned to ensure this significant impact continues.

4 FIGURES



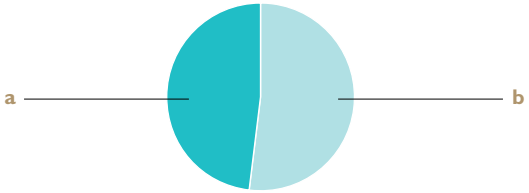
The turnover figures give the impression that 2016 was a disastrous year, with a balance of minus €2.376m. This negative figure gives a distorted picture and needs to be clarified.
Two factors help to explain this figure. Firstly, at the end of 2015, a total of €1.2m additional funds were allocated. This includes an exceptional grant to purchase two microscanners for the digitisation of certain specimens from the Institute's collections. It also covers additional resources made available following the terrorist threat. This helped to secure public spaces in the Institute as one of the federal scientific institutions that works with the public. Secondly, there was a delay in invoicing the operating costs of the Belgica research vessel. Operating expenses for the year 2015 amounting to €1.3m were invoiced and paid in 2016. Excluding payments relating to 2015, the total balance for the year 2016 is just in the positive at €134k.

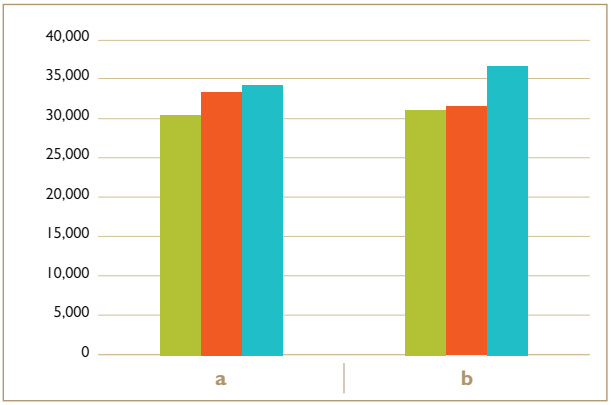
In terms of revenue, we see a continued decline in funding from Belspo provided via staff budget and the general grant, due to current cuts. The sharp rise in the Museum's income is almost entirely due to subsidies from Beliris for the renovation of the Institute's monastery wing, which will host the new permanent exhibition on biodiversity and ecology. Income from scientific research remains stable from 2015 to 2016, thanks to project subsidies from Belspo.
These two sources of income are directly linked to the two major activities of the Institute: the Museum and our scientific research and services. Alongside this, the Institute also generates a number of smaller miscellaneous streams of revenue, such as income related to running the staff restaurant and royalties from copyrights.

Looking at expenses, we see an increase in staff costs paid by our own revenue. This can be attributed to recruitment planned in the past but was postponed due to a recruitment freeze. It is a constant challenge for the Institute to find the means of maintaining human capital. The increase in expenses for the operation of the aircraft and vessel can be explained by the aforementioned remark regarding the 2015 operating costs of the Belgica research vessel which were billed and paid in 2016.

INCOME AND EXPENSES (IN €k)

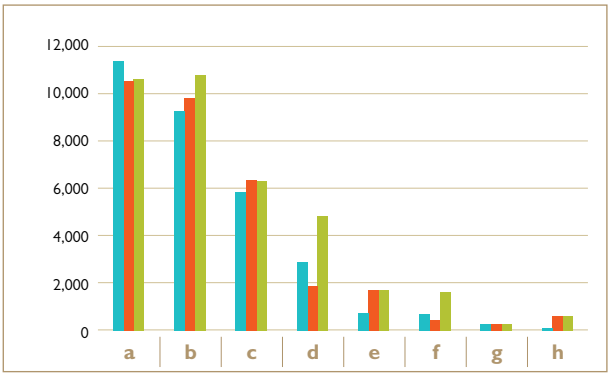
	2014	2015	2016
a Income	30,452	33,360	34,257
b Expenses	31,080	31,484	36,633
Balance	**-628**	**1,876**	**-2,376**

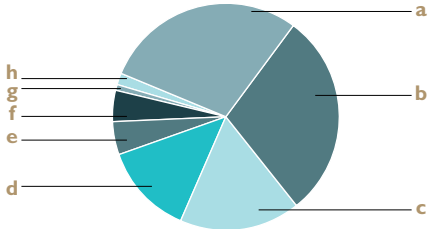




SOURCES OF EXPENSES (IN €k)

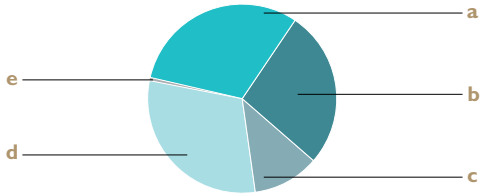
	2014	2015	2016
a Staff budget	11,321	10,487	10,596
b Staff expenses financed from own income	9,231	9,765	10,766
c Ordinary operational expenses	5,834	6,335	6,274
d Operation flight equipment/vessel	2,875	1,869	4,806
e Investment in the Museum	739	1,702	1,717
f Equipment	685	448	1,601
g Library and collections	288	253	278
h Transfers to research partners	107	625	595
Total	**31,080**	**31,484**	**36,633**

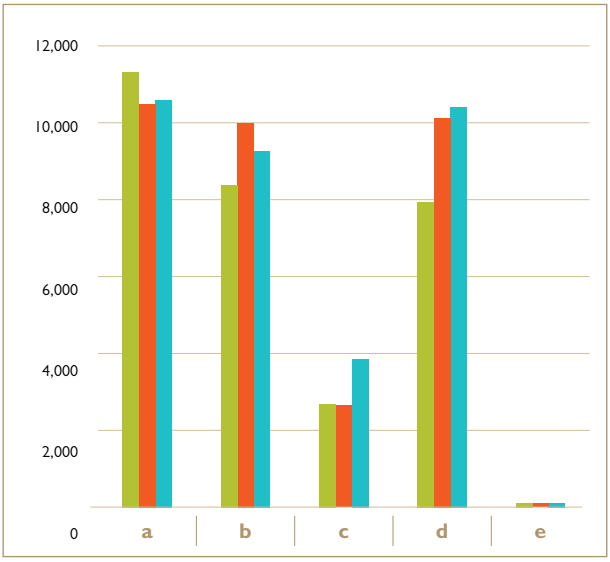




SOURCES OF INCOME (IN €k)

	2014	2015	2016
a Staff budget	11,321	10,487	10,596
b General grant	8,376	10,000	9,275
c Museum's own income	2,691	2,651	3,865
d Research's own income	7,941	10,123	10,400
e Various own income	123	99	121
Total	**30,452**	**33,360**	**34,257**



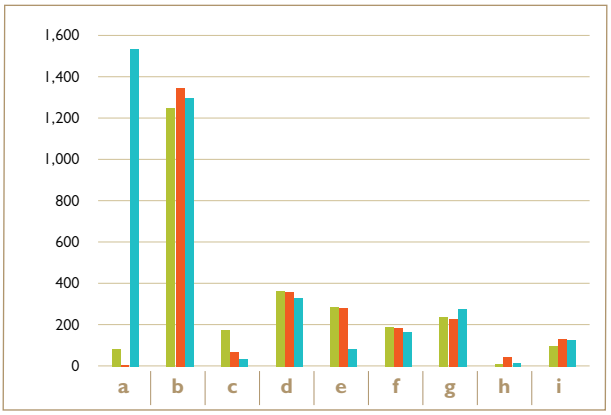


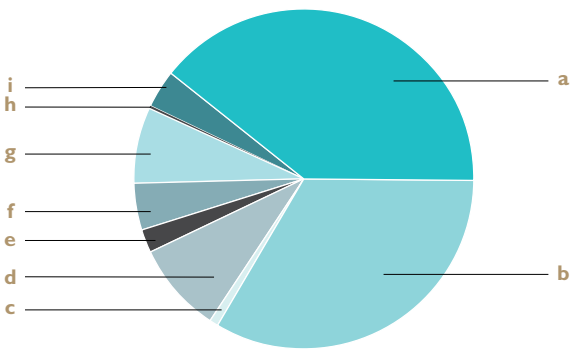
BREAKDOWN OF MUSEUM INCOME (IN €k)

Regarding the Museum incomes, the large increase is due to the major renovation subsidies for the new permanent exhibition on biodiversity and ecology in the Institute's monastery wing. It goes without saying that the 2016 terrorist attacks had an impact on revenue from ticket sales, the Museum shop and the educational activities. There were also less income from donations and grants.

However, this was partially compensated by a positive result in revenue from events. As such, even without taking into account the renovation subsidies, the result is comparable to the previous year: €2,338m in 2016 compared to €2,643m in 2015.

	2014	2015	2016
a Museum renovation grant	82	8	1,527
b Ticket sales	1,247	1,340	1,292
c Exhibition hire and sales	175	68	35
d Shop	362	358	332
e Donations - sponsorship - grants	286	283	86
f Educational Service	189	186	166
g Events	236	227	279
h Cafeteria concession	14	48	18
i User Observatory (all federal Museums)	100	133	130
Total	**2,691**	**2,651**	**3,865**





BREAKDOWN OF RESEARCH INCOME (IN €k)

Income from scientific research shows a rise in revenues from Belspo project subsidies. This increase can be explained by the receipt of significant advances for a number of larger projects. This clearly has an impact on future billing, so it remains to be seen what the result will be in 2017. It should be noted that only 2015, and not 2014, is representative for comparison. A change in the billing system of 2014 meant the income figures were much lower than usual.

Revenue from federal agencies other than Belspo continues to rise in line with 2014. 2015 also saw an extraordinary bonus in the shape of a double payment of €1.2m under the development cooperation program. Belspo therefore remains the leading funder among the federal agencies.

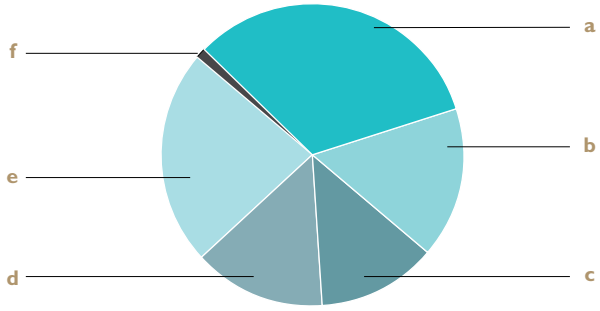
Income from the European Commission remains stable: the cycles of reimbursement for these European projects are very specific and as such, the amount of income is not a reliable indicator of the level of activity. As the Institute has a coordinating role, it manages the total budget of all partners involved in the project on behalf of the European Commission.

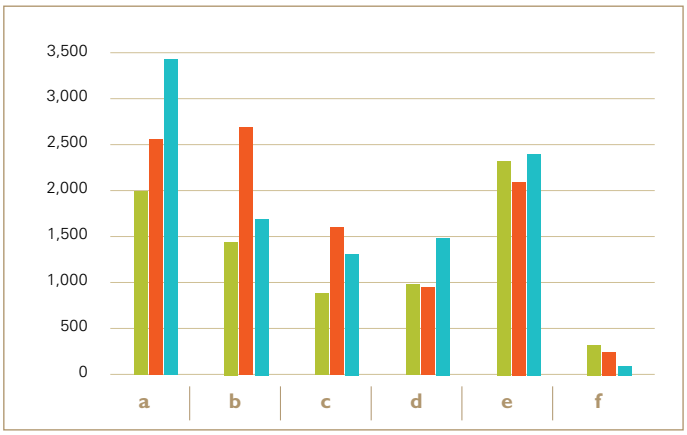
Contributions for scientific research from the federated entities are mainly linked to archaeological sciences and North Sea monitoring. A sharp rise of 56% can be seen in comparison with the previous two years.

Private sector income remains stable. This is primarily revenue generated by monitoring the impact of human activities in the North Sea, such as sand and gravel extraction and concessions for offshore wind farms. Due to the delay in establishing new concessions, a sharp drop in revenues is expected for the years 2017 and 2018. From 2019 onwards, revenues will pick up again. This category also includes all kinds of smaller sources of income that are linked to the Institute's scientific activities, such as laboratory analyses, organisation of seminars and sale of geographic maps.

Foreign sources of funding continue to decline. This may be an effect of austerity measures at European level.

	Projects financed by	2014	2015	2016
a	BELSPO	1,990	2,552	3,419
b	Federal administrations (excl. BELSPO)	1,440	2,682	1,694
c	European Commission	884	1,601	1,313
d	Belgian federated entities	983	948	1,483
e	Private sector	2,319	2,091	2,392
f	International Institutions	325	249	99
	Total	**7,941**	**10,123**	**10,400**





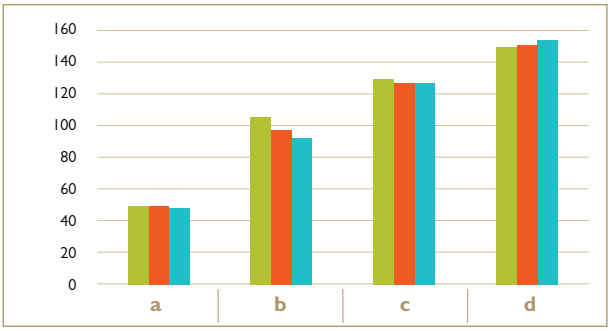
STAFF

The workforce has declined in line with government demand since 2014. Among statutory staff, the decline is noticeable among statutory non-scientific (support) staff. The statutory staff is impacted by the direct consequences of the drastic cuts.

In general, statutory staff members that leave are only replaced exceptionally, which particularly weakens support functions that have to ensure permanent duties. Temporary solutions are sought through contractual staff.

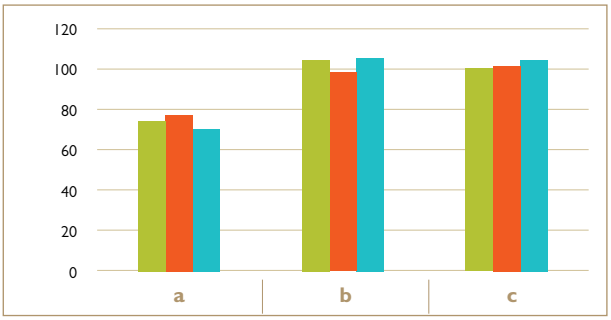
STAFF BREAKDOWN

	2014	2015	**2016**
a Statutory scientists	49	49	48
b Statutory non-scientists	105	97	92
c Contractual scientists	129	126	126
d Contractual non-scientists	149	150	153
Total	**432**	**422**	**419**



SOURCES OF FINANCING FOR CONTRACTUAL STAFF

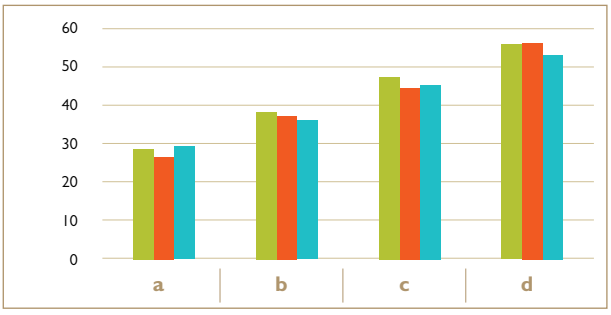
	2014	2015	**2016**
a Staff budget	74	77	70
b Grant and ordinary income	104	98	105
c External projects	100	101	104
Total	**278**	**276**	**279**



PERCENTAGE OF FEMALE STAFF

After a significant increase until 2012, particularly among statutory staff, the proportion of female staff shows a slight decreasing trend. The overall balance remains, however, within the average.

	2014	2015	**2016**
a Statutory scientists	28,6%	26,5%	29,2%
b Statutory non-scientists	38,1%	37,1%	35,9%
c Contractual scientists	47,2%	44,4%	45,2%
d Contractual non-scientists	55,7%	56,0%	52,9%
Total	**45,4%**	**44,8%**	**44,2%**

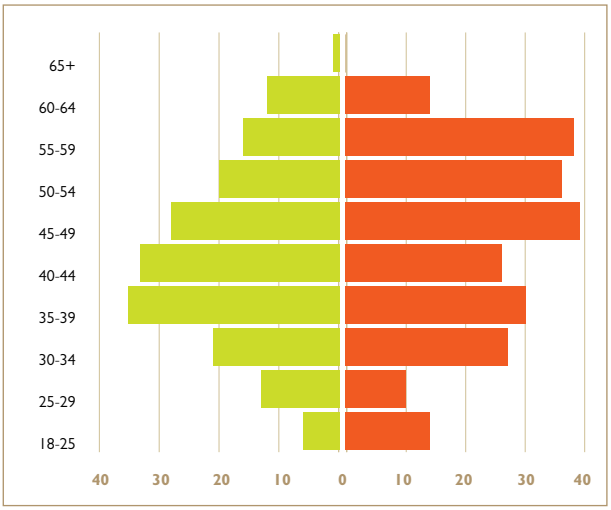


AGE PYRAMID

The average age of employees is 42 for women and 44 for men, in line with the previous year. Just over 19% of the workforce consists of employees aged over 55. The magnitude of these figures demonstrates the importance of developing a real knowledge transfer strategy.

Due to the strong influx of women over the past 10 years, men and women are more or less equally represented in the 18-44 age range. However, men account for two thirds of employees aged 45 and over.

	Women	Men
65 +	1	0
60-64	12	14
55-59	16	38
50-54	20	36
45-49	28	39
40-44	33	26
35-39	35	30
30-34	21	27
26-29	13	10
18-25	6	14
Average age	**42**	**44**



STAFF BREAKDOWN BY LINGUISTIC ROLE

	FR	NL	For.	Ost.
a Statutory scientists	22	26	0	0
b Contractual scientists	53	63	4	6
c Statutory non-scientists	41	44	0	7
d Contractual non-scientists	75	68	3	7
Total	**191**	**201**	**7**	**20**

As in 2015, we are close to linguistic parity. Dutch speakers constitute the majority of scientific employees (54% of the workforce; 57% in 2015) and statutory employees (52.5% compared to 51.5% in 2015).

Note that Ostend staff is not included in the calculation of language balance.

ABSENTEEISM AND WORK ACCIDENTS

	2014	2015	**2016**
Absenteeism RBINS (%)	4.50	5.20	4.87
Absenteeism federal level (%)	5.71	5.98	n/a
Work accidents RBINS (frequency)	13.65	6.83	16.96
Work accidents R&D (frequency)	2.54	2.22	n/a
Work accidents Museums (frequency)	7.02	15.39	n/a
Work accidents RBINS (number)	10	5	14
Accidents RBINS on the way to work (number)	9	15	6

The figures for absenteeism dropped slightly compared with financial year 2015 from 5.2% to 4.87%. This is a good result compared to the total number of absentees at federal public level overall.

The number of accidents at work, however, has increased, due to activities related to relocation work, whereas the number of accidents during the commute to and from work fell sharply from 15 to 6.

In 2016, the total number of publications remains relatively stable compared to 2015.

The number of scientific publications is back at 2014 level, with the same proportion of high-level publications with impact factor (36%).

OD Natural Environments remains the main author of expert reports and OD Earth and History of Life still leads for popular science. However, the number of expert reports continues to fall steeply.

Popular science works have also been on the decrease for several years (by 50% since 2015). Several causes could be attributed, such as the lack of recognition of these works in researchers' evaluations, or the increasingly widespread use of digital and social media which is not recorded here.

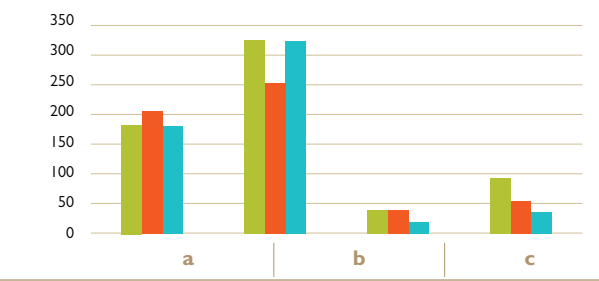
In terms of scientific publications with an impact factor, OD Earth (28% of the Institute's total researchers) is now the leading author (49% of publications, compared with 25% in 2015).
Next is OD Natural Environment (42% of researchers) with 29% of publications, at the same level as 2015.

OD Taxonomy and Phylogeny, which is limited in size (13% of researchers), nevertheless produced 23% of these publications.

In 2016, 20% of publications of the year were available via Open Access compared to 25% in 2015 and just 15% in 2014.

PUBLICATIONS

	2014	2015	**2016**
a Publications with IF	182	205	180
b Other scientific publications	323	252	321
c Popular works	40	39	20
d Expert reports	93	54	36
Total	**638**	**550**	**557**



BREAKDOWN OF PUBLICATIONS

	Scientific publications				Popular works	Expert reports	Total
Operational Directorates	Total	*of which journals with IF*	*of which others*	*of which Open Access*			
Taxonomy and Phylogeny	183	*41*	*142*	*31*	2	2	**187**
Natural Environment	114	*52*	*103*	*32*	6	35	**155**
Earth and History of Life	238	*88*	*150*	*30*	14	13	**265**
Scientific Service Heritage	25	*12*	*14*	*7*	1	0	**26**
Total RBINS*	**501**	***180***	***321***	***96***	**20**	**36**	**557**

* Due to the cooperation among ODs and services, the sum of the parts may be greater than the total.

SCIENTIFIC PROJECTS WITH EXTERNAL FUNDING

The Institute ran 135 scientific projects in 2016, either alone or in cooperation with other partners. This is the lowest number since 2008, and 24% fewer than in 2015. The decline is visible in all ODs except for OD Public and OD Taxonomy and Phylogeny which remains around the same number. However, the overall budget remains close to that of 2015 at €10m.

Within the Institute, the Operational Directorate Natural Environments works on very current environmental issues. This OD manages the largest number of research and expertise contracts: 56% of the total. Like the other ODs, it is affected by the reduction in number of contracts. Nevertheless, a global amount of 2016 is comparable to the amount of 2015.

	Projects with external funding
General Direction	3
OD Public	3
OD Taxonomy and Phylogeny	24
OD Natural Environment	74
OD Earth and History of Life	27
Scientific Service Heritage	4
Total	**135**

BREAKDOWN OF CURRENT PROJECTS ACCORDING TO SOURCE OF FINANCING

The Institute's research is mainly funded by the federal government, then by the private sector, federated entities and the European Commission. The private sector mostly funds expertise studies, mainly in the framework of North Sea monitoring such as wind farms.

	2014	2015	**2016**	**2016**
	Number	**Number**	**Number**	**Amount (in €)**
Belgian Science Policy Office	65	65	57	3,419
Federal funding from other sources	10	11	11	1,611
National Lottery	4	3	2	83
Federated Entities	23	23	22	1,426
Universities	1	2	2	57
European Commission	35	32	23	1,313
International Institutions	12	13	10	99
Private sector	8	8	8	2,392
Total	**158**	**157**	**135**	**10,400**

SUPERVISION OF STUDENTS

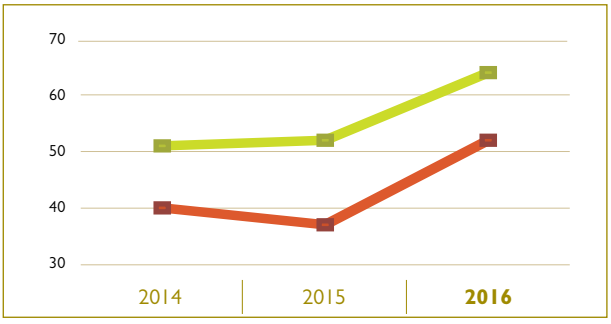
Supervision of students, doctoral and masters students is up from 2015 (up by 16%) but has not yet returned to 2013 levels (139 students).

Numbers of both doctoral and masters students are increasing (up by 23% and 41% respectively), reversing the trend of 2014 and 2015.

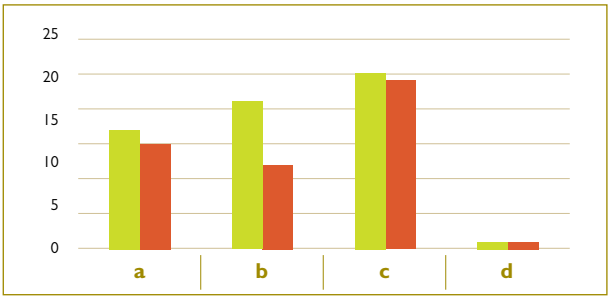
The OD Natural Environment, which only supervised two students in 2015, now achieves figures close to the other research ODs. With 42% (compared with 49% in 2015), OD Earth and History of Life still supervises the most students.

It is worth noting that we have only included dissertations that are supervised, wholly or jointly, by one of the Institute's employees.

CHANGE IN SUPERVISION OF STUDENTS			
	2014	2015	**2016**
PhD	51	52	64
Master	40	37	52
Total	**91**	**89**	**116**



BREAKDOWN OF THE SUPERVISION OF STUDENTS				
		PhD	Master	**Total**
a	OD Taxonomy and Phylogeny	17	15	32
b	OD Natural Environment	21	12	33
c	OD Earth and History of Life	25	24	49
d	Scientific Service Heritage	1	1	2
	Total 2016	**64**	**52**	**116**



LIBRARY

The library continues its back-cataloguing work. The growth in number of titles in the catalogue remains steady but with a confirmation in 2016 of the drop in new acquisitions that we saw in 2015.

We see progress in the consultations of online journals, alongside a drop in the number of journals lent internally, showing evolution in use of the library's resources.

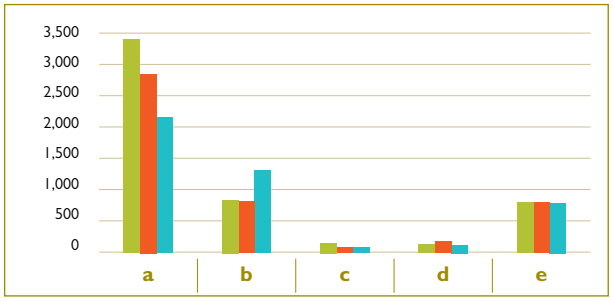
In general, readers come for a single specific search. The increase in consultations in the reading room is attributable to the presence of diligent readers conducting in-depth research requiring several consultations and the fact that books are held for people in the reading room.

ACQUISITIONS

	2014	2015	**2016**
Books and journals	+8,665	+7,097	**+6,034**
Electronic journals	+204	+152	**+134**
Back-cataloguing	+5,448	+7,148	**+5,917**

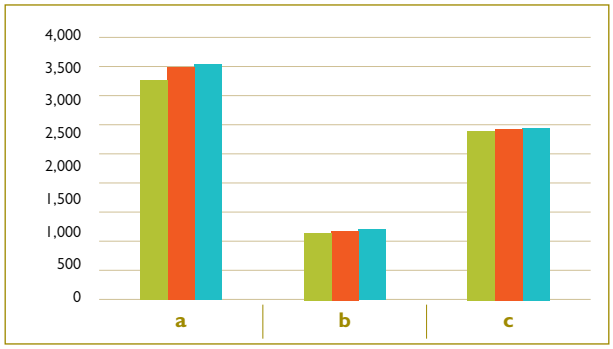
LOANS

	2014	2015	**2016**
a Internal loan of documents	3,419	2,869	**2,168**
b On-site consultation by external visitors	850	832	**1,328**
Inter-library loans			
c *Sent documents*	161	90	**94**
d *Received documents*	138	192	**131**
e International exchanges	815	809	**802**



TYPES OF CONSULTED ELECTRONIC DOCUMENTS

	2014	2015	**2016**
a Periodicals	3,748	3,972	4,023
b Abstracts	1,152	1,189	1,208
c Complete text	2,891	2,916	2,933
Total consultation sessions	**8,681**	**8,747**	**8,852**

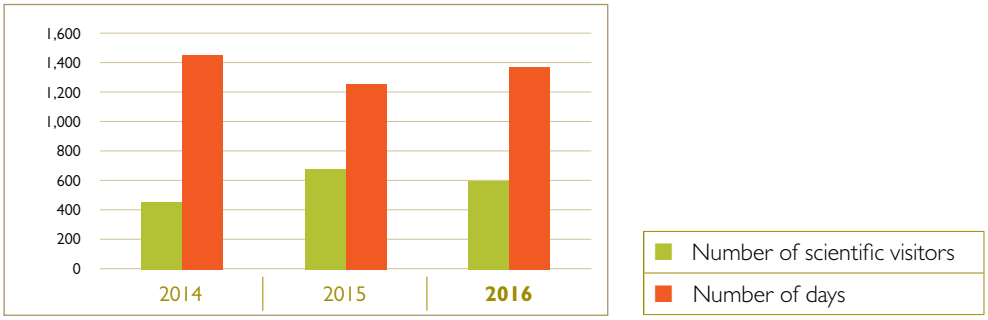


SCIENTIFIC VALORISATION

After two years of steep increase in 2014 and 2015, the number of scientists visiting the collections fell slightly by 13%. However, the number of visit days increased by 9%. The visits are fewer but longer than in 2015: from 1.84 to 2.3 days.

The spectacular enrichment of the collections is due to two large entomological donations totalling over 207,000 specimens.
The number of loans is also on the increase.

	Number of visiting scientists / Number of days	Additions to the collections	Number of loans			
			external	internal	exhibition	Total
Vertebrates	58/135	81	17	20	4	41
Invertebrates	73/140	383	10	43	7	60
Entomology	216/695	207,454	139	0	1	140
Palaeontology	48/157	16	2	9	2	13
Anthropology and Prehistory	29/124	0	5	1	1	7
Geology	169/110	1,870	93	26	6	125
Total	**593/1361**	**209,804**	**266**	**99**	**21**	**386**



DIGITISATION OF THE COLLECTIONS

The number of encoded specimens is down compared to 2015. However, 2015 was notable for over 30,000 geological data imported. This figure also hides an increase in manual encoding.

2016 was also the year of the first encodings in the Virtual Collection.

ENCODING IN THE DaRWIN DATABASE				
	Recording of types	New species	Recording of non-types	Total new records in DaRWIN
Growth 2014	523	15,668	2,537	16,191
Growth 2015	708	45,676	1,453	43,491
Growth 2016	2,182	15,364	2,815	17,546

ENCODING PER DEPARTMENT*	Encoding in DaRWIN			Virtual collection	Total
	2014	2015	**2016**	**2016**	**2016**
Vertebrates	6,384	7,537	5,400	40	5,440
Invertebrates	12,384	14,109	21,309	497	21,806
Entomology	1,795	958	1,982	812	2,794
Palaeontology	7	21	1,031	142	1,173
Geology	373	33,081	2,816	100	2,916
Anthropology and History	0	0	0	2	2
Total	**20,943**	**55,706**	**34,554**	**1,593**	**36,147**

* Including new records and updates

MUSEUM

In 2016, the Museum welcomed 284,865 visitors, a drop of 5.05% compared with 2015. This decrease can clearly be attributed to the attacks in March and the resulting security climate.

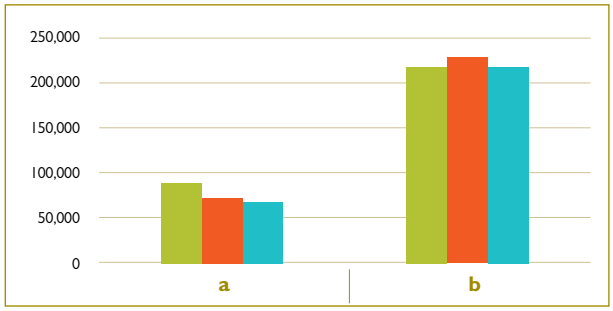
The lack of visitors primarily results in 55,000 fewer visits to the permanent halls. However, the year's two temporary exhibitions, WoW and Poison attracted many more visitors than in 2015: over 114,000 in total. This helped to cushion the effect of the terrorist attacks. WoW brought in 73,384 visitors over 8 months; and Poison 40,839 in less than 3 months!

A closer analysis reveals that two categories of visitors were particularly affected: groups, mainly from schools, who now only make up 24% of our total visitors against 29% in the previous years; and foreign tourists whose share of the total visits fell to 13.5% after a peak of over 18% in 2015.

The two travelling exhibitions co-produced by the Institute also continued to tour abroad: Senses was presented in Naturalis (Leiden, NL) and Baby Animals started at Museon (The Hague, NL) and is now on show at Cité des Sciences (Paris, Fr).

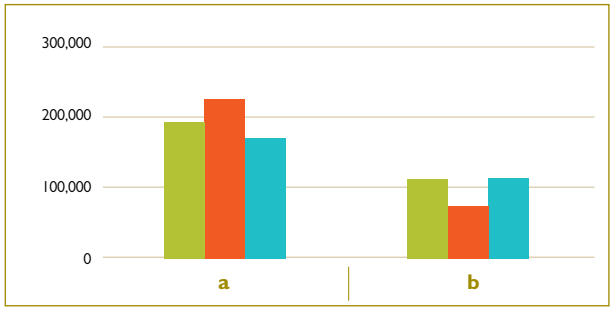
MUSEUM ATTENDANCE

	2014	2015	**2016**
a Visitors in groups	88,846	72,529	67,956
b Individuals and families	216,932	227,482	216,909
Total	**305,778**	**300,011**	**284,865**



BREAKDOWN OF MUSEUM ATTENDANCE

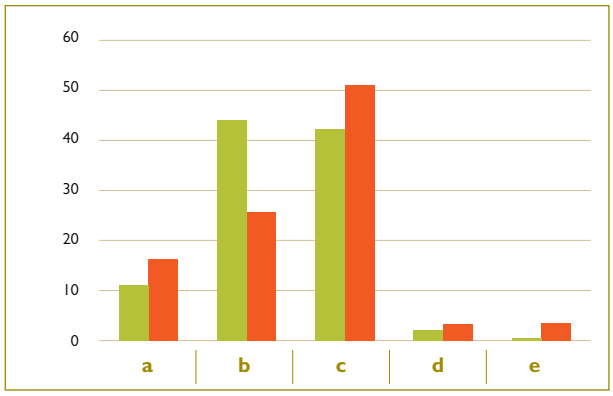
		2014	2015	**2016**
a	Permanent galleries	193,602	225,853	170,642
b	Temporary exhibitions (on-site)	112,178	74,158	114,223
	Total Museum	**305,780**	**300,011**	**284,865**
c	Temporary exhibitions (off-site)	414,816	482,272	n/a



BREAKDOWN OF VISITORS BY AGE GROUP (%)

The breakdown of visitors by age group is largely very similar to the spread of previous years. A slight trend is visible in a decrease in average age of visitors to the temporary exhibition. This is very likely to be due to the themes of the 2016 exhibitions, with an animal focus which appeals to younger visitors.

		Permanent	Temporary	**Total**
a	Small children (0-5 years)	11.17	16.31	**13.23**
b	Young people (6-17 years)	44.06	25.72	**36.71**
c	Adults (18-59 years)	42.25	51.05	**45.78**
d	Senior citizens (60+)	2.10	3.35	**2.60**
e	Not known	0.42	3.57	**1.68**



REDUCED AND FREE ADMISSION

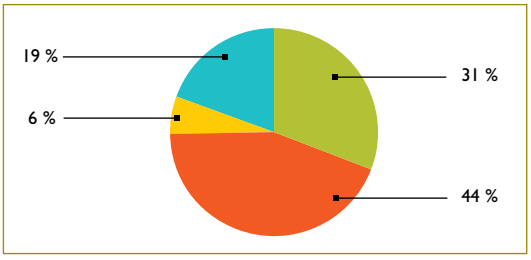
The number of free entries remains stable (and high compared to figures received from other Belgian and foreign museums) at around 25.6%. Half of free entries (around 12% of total entries) are children under 6 years old. Almost 6% of visitors make use of free entries on the first Wednesday of each month.

The remaining 7% are mainly teachers and group leaders, with some additional ICOM cardholders, press cardholders and people with vouchers for free entry linked to marketing campaigns.

31% of visitors paid full price; a similar figure to that of 2015.

Most visits are at reduced rate, since this includes group visits and all reasons for reductions (senior citizens, students etc) as well as all initiatives taken by the Institute, alone or with partners (SNCB, Brussels Card etc) to attract as many visitors as possible to the Museum.

	Number	Percentage
Full admission	88,123	31
Reduced admission	124,881	44
Free admission on 1st Weds of month	17,055	6
Other free admission	54,806	19
Total	**284,865**	**100%**



SHOP VISITORS

MuseumShop turnover is down 5%. The number of customers fell even more sharply, by 11.3%. This was compensated in part by an increase in the average spend per customer: €16.42, from €15.33 in 2015. This is linked to the drop in the number of school groups whose spending power is more limited.

The shop still suffers from its unfavourable location in the middle of the Museum.

	2014	2015	**2016**
Museum visitors	305,780	300,011	284,865
Shop customers	23,889	23,176	20,556
Rapport customer/visitor	7,81%	7,73%	7,22%
Expenditure/customer	14,86	15,33	16,42
Expenditure/visitor	1,16	1,18	1,18

THE INSTITUTE IN THE MEDIA

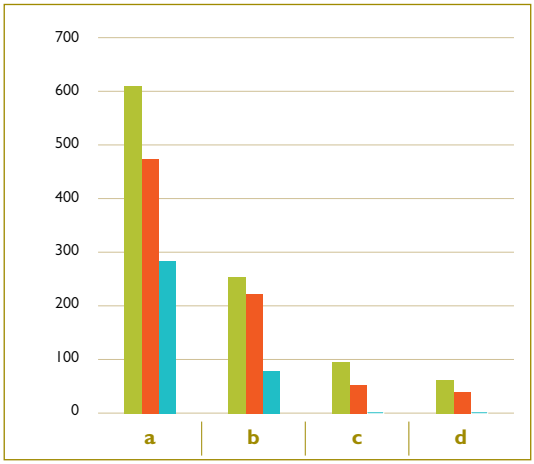
The visibility of the Institute in the printed press is much greater than in 2015, with a 44% increase. Combining all media formats, there are 1,513 references to our activities across the year, compared to 1,051 in 2015. The number of articles has risen by 30% in French and 54% in Dutch.

The number of articles on the Institute's scientific activities went up considerably, by 59% in French and 57% in Dutch. They are now clearly greater in number than articles on Museum exhibitions and activities (53.62% in French and 65% in Dutch compared to 43.62% and 44.24% respectively in 2015).

The particularly significant increase in international media can be explained by improvements in our international press monitoring activities. We are mentioned 285 times in the printed press in countries including the US, France, Spain and Germany. Most of these articles are on scientific subjects (palaeontology, entomology, human evolution and so on).

In 2016, we were mentioned four times a day on average by traditional media (printed press, radio and television), up from three times a day in 2015.

	FR	NL	Others*
Printed press			
Articles Museum	235	140	16
Articles Institute	326	309	266
Articles on temporary exhibitions	47	23	2
a Total printed press	**608**	**472**	**284**
b *of which interviews RBINS employees*	*254*	*222*	*79*
Radio and TV			
c Total Radio and TV	**96**	**52**	**1**
d *of which interviews RBINS employees*	*62*	*40*	*1*
Total general	**704**	**524**	**285**



* international press and press in English

ACTIVITIES ORGANISED BY THE EDUCATIONAL SERVICE

The Educational Service's activities attracted 49,885 visitors. Compared with 2015, there was a drop of 12%. Over the last four years, after a record peak in 2013, this figure has dropped by 20%. This decrease closely follows the drop in the Museum's visitor numbers overall. A series of factors can also be mentioned: the attacks in Brussels, after those in Paris, had a very clear impact on school visits, which lead the requests for activities; the themes of the two exhibitions in 2016 were not closely linked to the school curriculum; and school trips are harder to organise due to the budget caps imposed on schools.

Lastly, the Educational Service's workforce was severely depleted (temporarily) which meant activities had to be limited, as can be seen in the number of activities and holiday activities organised.

	2014	2015	**2016**
Number of participants	60,060	56,556	**49,885**
of which groups (indoor + outdoor)	*53,529*	*49,473*	**44,372**
of which individuals	*6,531*	*7,083*	**5,513**
Number of sessions organised	2,874	2,681	**2,447**
Average number of participants per activity	20.9	21.1	**20.4**

PROPORTION OF VISITORS IN ACCOMPANIED VISITS ON-SITE (%)

Just under half of group visitors requests accompaniment from our Educational Service. This average rate of accompaniment makes up just 12% of Museum visitors overall.

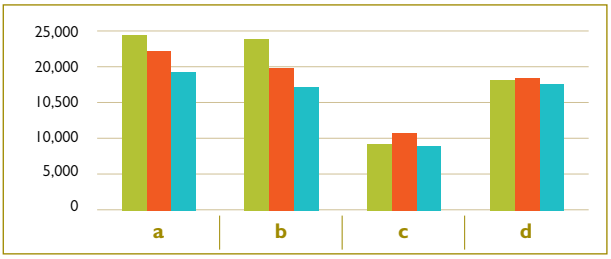
	2014	2015	**2016**
In relation to the total number of museum visitors	14.9	14.0	**12.6**
In relation to group visitors	46.0	49.7	**46.1**

BREAKDOWN OF VISITORS PER ACTIVITY

All types of activity decreased between 2015 and 2016, but in varying proportions. Traditional activities for groups (guided tours and workshops) lost just over 13% of their audience.

Activities for individuals (mainly the PaleoLABs and summer activities) lost 17%. Finally, activities outside our walls (XperiLAB and BNEC) were down only 5%.

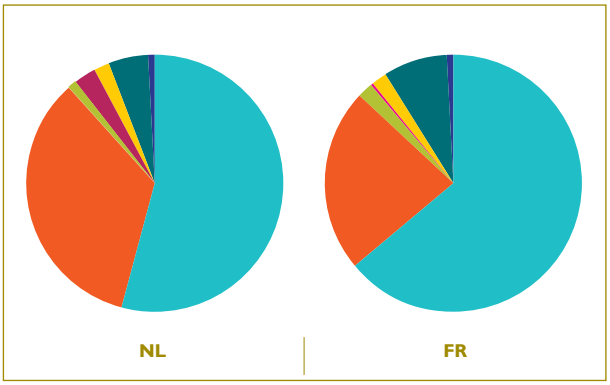
	2014	2015	**2016**
a Guided tours	19,332	17,604	15,264
b Workshops	18,933	15,692	13,584
c Other activities	7,364	8,599	7,108
d Off-site activities	14,431	14,661	13,929
Total	**60,060**	**56,556**	**49,885**



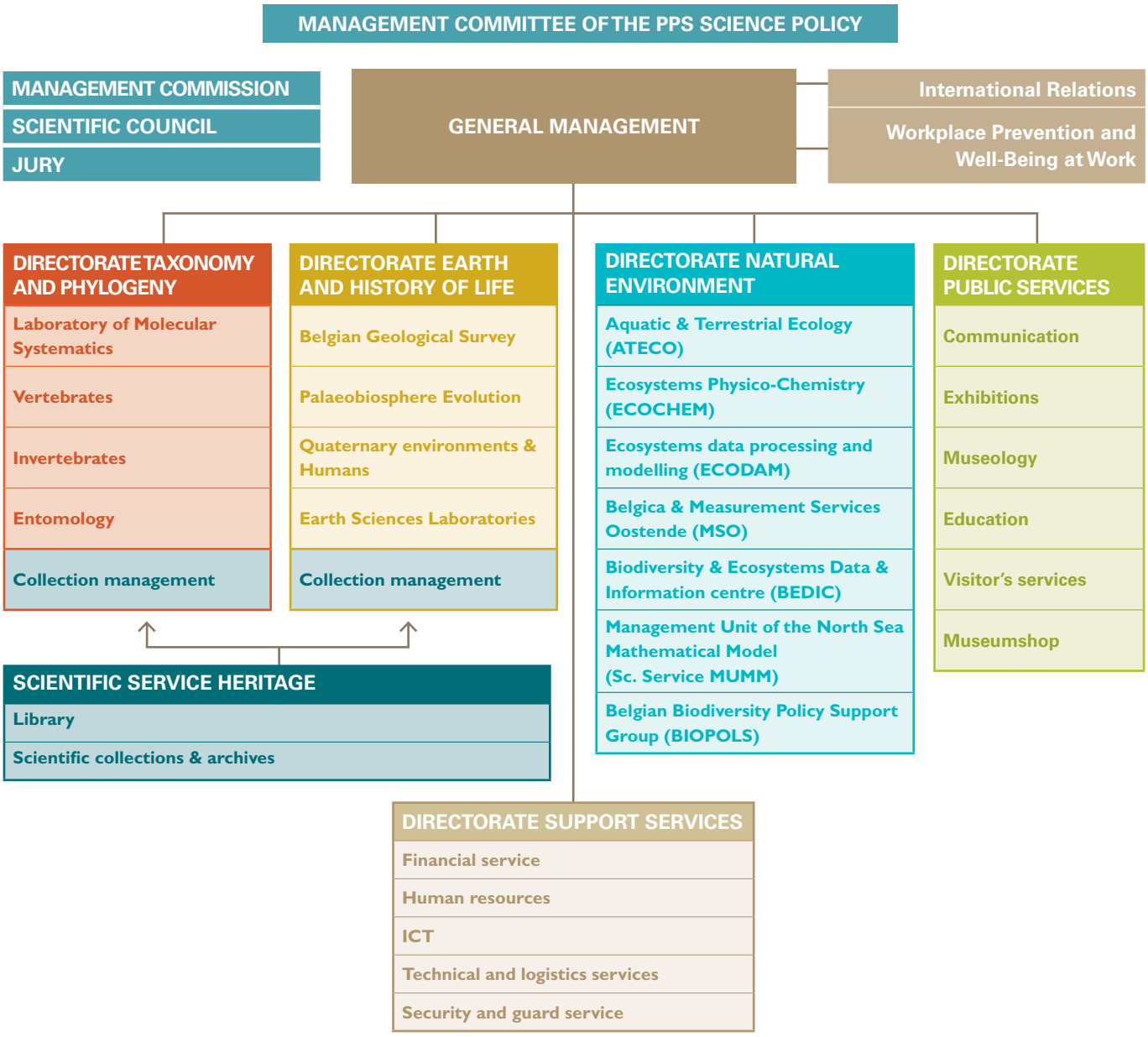
PROFILE OF PARTICIPANTS IN GUIDED TOURS AND IN WORKSHOPS (%)

The audience of the Educational Service is still mainly made up of nursery schools and primary schools. The proportions of each level of education remain similar to the previous year, even if it is important to note that the percentage of secondary school classes has stopped decreasing on the French-speaking side and even increased on the Dutch-speaking side. Activities for adults represent between 5 and 8%, depending on the language.

	NL	FR
Nursery & primary school	54.2	64.4
Secondary school	34.15	23.08
Higher education	1.15	1.86
General education	2.98	0.36
Youth groups	1.8	2
Groups of adults	5.16	8.12
Individuals and families	0.56	0.18
Total	**100**	**100**



ORGANISATION



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The RBINS is a State service.
It is managed by **three independent entities:**

The Scientific Council offers advice on issues of a scientific nature that have an impact on the accomplishment of the tasks of the Institute.

The Management Commission is responsible for the financial and practical management of the RBINS. It is the same body for the RBINS and the Royal Museum for Central Africa.

The General Director is responsible for the day-to-day Institute's management. He is assisted by **the Management Board.**

Moreover **the Jury** for recruitment and promotion is responsible for recruiting the permanent scientific employees and monitoring their carreers.

The Institute's General Director is also a full member of the Management Committee of the Belgian Science Policy Office.

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All of RBINS activities are described in the 2016 detailed report (FR/NL).
This report is available on CD ROM and can be obtained
on request from direction@naturalsciences.be.

museum

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