

31. März 2020

**Stellungnahme zum
Museum für Naturkunde -
Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der
Humboldt-Universität zu Berlin (MfN)**

Inhaltsverzeichnis

1. Beurteilung und Empfehlungen	2
2. Zur Stellungnahme des MfN.....	4
3. Förderempfehlung	4

Anlage A: Darstellung

Anlage B: Bewertungsbericht

Anlage C: Stellungnahme der Einrichtung zum Bewertungsbericht

Vorbemerkung

Die Einrichtungen der Forschung und der wissenschaftlichen Infrastruktur, die sich in der Leibniz-Gemeinschaft zusammengeschlossen haben, werden von Bund und Ländern wegen ihrer überregionalen Bedeutung und eines gesamtstaatlichen wissenschaftspolitischen Interesses gemeinsam gefördert. Turnusmäßig, spätestens alle sieben Jahre, überprüfen Bund und Länder, ob die Voraussetzungen für die gemeinsame Förderung einer Leibniz-Einrichtung noch erfüllt sind.¹

Die wesentliche Grundlage für die Überprüfung in der Gemeinsamen Wissenschaftskonferenz ist regelmäßig eine unabhängige Evaluierung durch den Senat der Leibniz-Gemeinschaft. Die Stellungnahmen des Senats bereitet der Senatsausschuss Evaluierung vor. Für die Bewertung einer Einrichtung setzt der Ausschuss Bewertungsgruppen mit unabhängigen, fachlich einschlägigen Sachverständigen ein.

Vor diesem Hintergrund besuchte eine Bewertungsgruppe am 2. und 3. September 2019 das MfN in Berlin. Ihr stand eine vom MfN erstellte Evaluierungsunterlage zur Verfügung. Die wesentlichen Aussagen dieser Unterlage sind in der Darstellung (Anlage A dieser Stellungnahme) zusammengefasst. Die Bewertungsgruppe erstellte im Anschluss an den Besuch den Bewertungsbericht (Anlage B). Das MfN nahm dazu Stellung (Anlage C). Der Senat der Leibniz-Gemeinschaft verabschiedete am 25. März 2020 auf dieser Grundlage die vorliegende Stellungnahme. Der Senat dankt den Mitgliedern der Bewertungsgruppe und des Senatsausschusses Evaluierung für ihre Arbeit.

1. Beurteilung und Empfehlungen

Der Senat schließt sich den Beurteilungen und Empfehlungen der Bewertungsgruppe an. Das „Museum für Naturkunde – Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin“ (MfN) hat die **Aufgabe**, naturkundliche Objekte zur Entstehungs- und Entwicklungsgeschichte der Erde sowie ihrer biologischen Vielfalt zu sammeln und zu erschließen. Es betreibt eigene Forschung, ermöglicht Forschung an den Sammlungen und transferiert Wissen über seine Schausammlung und über Ausstellungen. Das MfN berät außerdem auch politische Entscheidungsträger dazu, wie biologische Vielfalt geschützt werden kann.

Seit der letzten Evaluierung hat sich das Museum außerordentlich dynamisch entwickelt. Ausgangspunkt dafür war, die Arbeiten in vier neue wissenschaftliche Programme zu gliedern und auf diese Weise Aufgaben im Bereich der Digitalisierung und des Wissenstransfers deutlich stärker mit den Forschungs- und Sammlungsaufgaben des Museums zu verbinden sowie nach außen sichtbarer zu machen. Außerdem wurden die Arbeiten zur „Biodiversitätsentdeckung“ im Rahmen eines neuen Zentrums am Forschungsmuseum ausgebaut, für das Bund und Länder dauerhaft zusätzliche Mittel bereitstellen. Es erfolgte eine

¹ Ausführungsvereinbarung zum GWK-Abkommen über die gemeinsame Förderung der Mitgliedseinrichtungen der Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e. V.

klare Zuordnung der Infrastrukturen des Museums zu den Forschungsbereichen. Die musealen und wissenstransferierenden Tätigkeiten wurden erheblich ausgebaut und modernisiert.

Mit der 30 Millionen Objekte umfassenden **Sammlung** stellt das Museum eine global außerordentlich bedeutsame wissenschaftliche Infrastruktur bereit. Es erzielt sehr gute **Forschungsleistungen**. Die Arbeiten, die zu einem weit überwiegenden Teil auf die Sammlungsbestände zurückgreifen, sind wissenschaftlich hoch aktuell und umfassen auch Beiträge zur besseren inhaltlichen und technologischen Erschließung der Sammlungen. Die Leistungen im Bereich des **Wissenstransfers** sind herausragend. Die Besuchszahlen im Museum stiegen im jährlichen Schnitt von 475.000 (2009-2011) auf 730.000 (2016-2018). Insgesamt werden die sieben Arbeitseinheiten des MfN dreimal als „sehr gut bis exzellent“, dreimal als „sehr gut“ und einmal als „gut“ eingeschätzt.

Das MfN erhält eine institutionelle Förderung für seine musealen Aufgaben vom Land Berlin (3,7 Mio. €/2018) und für die Aufgaben als Leibniz-Einrichtung von Bund und Ländern (13,1 Mio. €/2018). Die Ausstattung für die gesamtstaatlich geförderten Aufgaben ist für das derzeitige Aufgabenspektrum auskömmlich. Die **Drittmittel** entwickelten sich außergewöhnlich positiv und tragen mittlerweile nahezu ein Drittel zum Budget bei. Es wird begrüßt, dass Bund und Sitzland erhebliche Mittel zur Sanierung des vom MfN genutzten **Gebäudekomplexes** bereitstellten und wesentliche Verbesserungen gegenüber der 2012 festgehaltenen, partiell desolaten Situation erreicht wurden.

In den kommenden Jahren möchte sich das Museum weiter modernisieren. Dafür wurden hervorragende Grundlagen gelegt, u. a. mit einer zehnjährigen Sonderfinanzierung durch Bund und Sitzland in Höhe von insgesamt 660 Mio. €. Diese Mittel werden es ermöglichen, die Gebäude weiter zu ertüchtigen, die Digitalisierung der Sammlungsbestände erheblich voranzutreiben und einen gemeinsam mit der Humboldt-Universität zu Berlin geplanten Wissenschaftscampus zu realisieren. Als Teil seiner **strategischen Arbeitsplanung** möchte das MfN darüber hinaus ein „Knowledge Lab for Nature“ aufbauen, um den seit der letzten Evaluierung deutlich fortentwickelten Bereich der Interaktionen von Wissenschaft, Museum und Gesellschaft zu stärken. Der Senat befürwortet die Idee. Die vorgelegten Planungen für einen ausgesprochen hohen zusätzlichen Stellenbedarf haben jedoch nicht überzeugt. Sollte der Beirat einer deutlich präzisierten Darlegung zustimmen, kann ein Antrag für zusätzliche Mittel der Bund-Länder-Förderung weiterverfolgt werden.

Das MfN ist ausgezeichnet in die Berliner Forschungslandschaft integriert und arbeitet eng mit Berliner Universitäten und wissenschaftlichen Einrichtungen zusammen. Es ist derzeit über sechs **gemeinsame Berufungen** mit der Humboldt-Universität und eine mit der Freien Universität Berlin verbunden. Zwei weitere Verfahren werden momentan durchgeführt. Der Senat begrüßt, dass das MfN das Instrument der gemeinsamen Berufung deutlich stärker als in der Vergangenheit nutzt, um seine Verbindungen zu Universitäten zu vertiefen. Zukünftig muss das Museum jedoch sicherstellen, dies regelmäßig mit neuen Rekrutierungen von außen zu verbinden.

Das MfN arbeitet eng mit zahlreichen Einrichtungen der **Leibniz-Gemeinschaft** zusammen. Im nationalen und internationalen Raum ist es ausgezeichnet vernetzt und an einer

Vielzahl von Initiativen, Netzwerken und Konsortien beteiligt, teilweise in führender Rolle. Unter anderem brachte es sich federführend in die Konzeption der beiden Forschungsinfrastrukturen DCOLL und DiSSCo² sowie deren Aufnahme auf nationale bzw. europäische Roadmaps ein. Im Bereich *Citizen Science* nahm das Museum auf europäischer Ebene in den vergangenen Jahren eine ausgesprochen aktive und führende Rolle ein.

Das MfN verfügt über gut ausgestaltete Rahmenbedingungen zur Förderung des wissenschaftlichen Nachwuchses. In der **Förderung der Chancengleichheit** ist das MfN sehr engagiert, so dass der Anteil von Wissenschaftlerinnen in den letzten Jahren weiter stieg, insbesondere auch auf Ebene der Leitung der sechzehn Abteilungen und Forschungsprogramme, wo Frauen und Männer nun in nahezu gleicher Zahl tätig sind. Es fällt jedoch auf, dass unter den Senior Scientists der Anteil der Wissenschaftlerinnen derzeit sehr niedrig ist, so dass Verbesserungen notwendig sind.

Das MfN wird von Generaldirektor und Geschäftsführer ausgezeichnet geleitet. Das Museum hat überzeugende Management- und **Controllinginstrumente** implementiert. Wie geplant sollte das Museum die Wirkung (impact) seiner Aktivitäten in die Gesellschaft hinein ebenfalls erfassen und dazu geeignete Indikatoren entwickeln. Der Wissenschaftliche Beirat begleitete die Entwicklung des Museums konstruktiv und mit sehr hohem Engagement.

Das MfN hat sich in den vergangenen Jahren mit bemerkenswerter Geschwindigkeit und in sehr überzeugenden Schritten zu einem weltweit sichtbaren Forschungsmuseum entwickelt. Es partizipiert mit großem, öffentlich stark wahrgenommenem Engagement am Diskurs zum Verlust der globalen Biodiversität. Die Erfüllung der damit verbundenen Aufgaben in einem eng aufeinander bezogenen Dreiklang von Sammlungsentwicklung, Forschung und Wissenstransfer ist an einer Hochschule nicht möglich. Eine Eingliederung in eine Hochschule wird daher nicht empfohlen. Das MfN erfüllt die Anforderungen, die an eine Einrichtung von überregionaler Bedeutung und gesamtstaatlichem wissenschaftspolitischen Interesse zu stellen sind.

2. Zur Stellungnahme des MfN

Der Senat begrüßt, dass das MfN beabsichtigt, die Empfehlungen und Hinweise aus dem Bewertungsbericht bei seiner weiteren Arbeit zu berücksichtigen.

3. Förderempfehlung

Der Senat der Leibniz-Gemeinschaft empfiehlt Bund und Ländern, das MfN als Einrichtung der Forschung und der wissenschaftlichen Infrastruktur auf der Grundlage der Ausführungsvereinbarung WGL weiter zu fördern.

² DCOLL – „Deutsche naturwissenschaftliche Sammlungen als integrierte Forschungsinfrastruktur“
DiSSCo – „Distributed System of Scientific Collections“.

Annex A: Status report

Museum für Naturkunde - Leibniz Institute for Research on Evolution and Biodiversity at Humboldt-Universität zu Berlin (MfN)

Contents

1. Key data, structure and tasks	A-2
2. Overall concept, activities and results	A-3
3. Changes and planning	A-5
4. Controlling and quality management	A-8
5. Human Resources	A-11
6. Cooperation and environment.....	A-14
7. Subdivisions of MfN	A-16
8. Handling of recommendations from the previous evaluation.....	A-25

Appendices:

Appendix 1: Organisational chart	A-27
Appendix 2: Publications.....	A-28
Appendix 3: Revenue and Expenditure	A-29
Appendix 4: Staff.....	A-30

1. Key data, structure and tasks

Key data

Year established:	1810 (as part of today's Humboldt-University, at current site since 1889)
Admission to joint funding by Federal and <i>Länder</i> Governments:	2009
Admission to the Leibniz Association:	2009
Last statement by the Leibniz Senate:	2013
Legal form:	Independent trust under public law
Responsible department at <i>Land</i> level:	Chancellery of city state of Berlin (<i>Senatskanzlei</i>)
Responsible department at Federal level:	Federal Ministry of Education and Research (BMBF)

Total budget (2018)

€17.6 Mio institutional funding (thereof € 13.1 m in accordance with AV-WGL)
 €5.4 Mio revenue from project grants
 €2.9 Mio revenue from services

Number of staff (2018)

329 individuals in total, of which
 124 scientific staff
 67 infrastructural service staff
 44 Directorate & central administrative units (cf. appendix 4)

Mission and tasks

Statutory mission: *“The purpose of the trust is to carry out research in the fields of history, diversity and evolution of the animate and inanimate nature, the consequences of human activities and climate change on the natural as well as in the fields of conservation and protection of biodiversity, ecosystems and their fossil heritage. This includes research in the field of history of science. Coupled with these research objectives is the task of collecting objects of natural history, and protecting them, caring for them and documenting them, as well as publishing the results of research and making the collections accessible through permanent and temporary exhibitions and through other public education programmes.”¹*

¹ *Naturkundemuseum Act*, article 1, section 2.

MfN's mission is implemented within four Scientific Programmes (currently consisting of eleven departments), which are allocated to two Science Themes (cf. organisational chart/appendix 1 and chapter 7).

2. Overall concept, activities and results

The *Museum für Naturkunde* (MfN) Berlin, as a research museum of the Leibniz Association, is engaged in research, infrastructure development and knowledge transfer. It sees itself as an integrated research museum with its staff working together across the Museum and as teams in programmes and projects, often intersecting the three parts of the Museum's work.

- (1) Question driven research spans across various disciplines and methodologies in natural, social sciences, the humanities and information technology, encompassing as different projects as model-based basic research into the beginnings of Earth and the solar system, evolution, biodiversity and taxonomy, heritage science, research on science data structures or multidisciplinary socio-political inquiries into the Museum's scientific and political history.
- (2) The Museum's collection is maintained and constantly developed into a global scientific infrastructure, with this also taking current and future research needs into consideration and including the development of standards and methodologies.
- (3) While applying tried and tested approaches in science communication and public engagement with science, the MfN also experiments with new or different formats of communication, citizen science, co-production, participatory sciences and dialogue, all as part of the Museum's knowledge transfer activities.

According to the MfN, all these activities help the Museum to gain new insights into its science, its collections, how to integrate itself even better into the national, European and international science landscape and to develop its role as a pace maker and change agent in the democratic knowledge society.

Results

Research

In the period 2016-2018, Museum staff published a total number of 652 peer-reviewed journal articles, 575 of which are part of the SCIE², thereof four papers in *Nature*, 15 in journals of the Nature Publishing Group, three papers in journals belonging to the *Science* Group, and two papers in the *Proceedings of the National Academy of Sciences of the United States of America* (PNAS). 38 % of its publications have been published in open access journals (predominantly gold standard; also hybrid and free access). Furthermore, with 25 popular science publications/books it contributed to the transfer of its results to a broader audience in science and society.

² SCIE = Science Citation Index Expanded, formerly ISI.

Museum taxonomists discover, describe and name on average 100 species a year, among them, since 2012, a new wasp species, a new family of frogs, a tailed arachnid and a new amphipod species. In partnership with amateur taxonomists e.g. a new giant amphibian species from the late Triassic in Northern Germany was described. On average, the Museum publishes five to six taxonomic monographs annually.

During 2016-2018, the Museum's staff gave 749 scientific presentations and presented 142 posters, 57 % in Germany, 22 % within the EU, and 21 % worldwide.

In the same time period, the MfN organised over 400 scientific events, among them the first "Global Summit of Research Museums" and the two-day international workshop "Politics of Natural History – How to Decolonize the Natural History Museum?", both in 2018.

The Museum's staff are board members or chairs of international professional associations. Throughout the evaluation period, they contributed to over 30 journals in editorial roles.

Infrastructure

With some 30 million objects, as the MfN points out, the collection of the Museum is one of the world's oldest and largest natural history collections, attracting over 1.700 scientific guest from 50 countries during 2016-2018, who spent a total of 6.590 days in the collection. In the same period of time, nearly 85.000 objects were sent as scientific loans to colleagues from all over the world. Just above 1.500 objects were loaned for exhibits in partner organisations. According to the Museum, 65 % of third party funded projects and 76 % of doctoral researchers are linked to the collection.

The Museum hosts several laboratories with its staff also contributing to their technological development. In 2016-2018, more than 11.500 user days were registered, 14 % were external users. Also, MfN has established a central database and management system to register its collection objects. By the end of 2018, a total of 1.37 million records were registered.

The MfN houses one of nine data hubs within the German Federation for Biological Data (GFBio), and is also a member of the German network within the Global Biodiversity Information Facility (GBIF-D). Within these frameworks, the MfN provides scientific data and media to international specialist platforms, such as GBIF, GeoCAsE (Geosciences Collection Access Service), the Global Genome Biodiversity Network, and NSB (Neptune Sandbox Berlin). In total, the Museum has published 3.5 million datasets via aggregators.

In 2018, the Museum became a Digital Object Identifier/DOI-allocating agent. In the first months, 37 DOIs were allocated for data publication, a number that the MfN expects to increase in the coming years.

Knowledge Transfer

As part of its mission the Museum aims to communicate with a wide range of stakeholders and target groups: with the general public, its local community, the scientific community,

the Berlin (scientific) community, as well as policy makers, NGOs, the start-up scene, business and other private actors. In 2018, the Museum both launched its new logo and brand “Für Natur” (For Nature) and adopted Knowledge Transfer Guidelines.

In 2016-2018, on average, the Museum attracted almost 730.000 visitors annually (475.000 in 2009-2011). Next to its permanent exhibition it curated 28 temporary exhibitions, e.g. *Tristan – Berlin bares teeth*, macaw/ARA or ARTEFACTS.

In the same time period, on average 93.000 participants per year attended educational and public engagement with science programmes offered by the Museum (53.000 in 2009-2011), ranging from special topic tours to evening events to adult education and citizen science. The Museum offered approx. 3.500 different programme items annually.

With an average of 488 radio and 141 TV appearances per year, Museum and its staff often appear in the news. In addition, an average of 4.400 news pieces in print and another 3.050 online were published 2016-2018. The MfN started collaboration with the Berlin daily newspaper *Der Tagesspiegel* featuring one collection item every single day in an on-going campaign. Also, the MfN is using social media to communicate with various groups. In 2018, it had 7.114 followers on Twitter (1.661 retweets), 4.418 Instagram followers and 20.517 followers on Facebook (1.445 shares).

The Museum engages in policy advice at various levels, from the chairmanship of advisory boards to the European Commission to informal administrative assistance to public offices and workshops at the International Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

3. Changes and planning

Development since the previous evaluation

Since the last evaluation in 2012 the Museum had a strategic focus on becoming an integrated research museum, building synergies between science, collection development and public engagement with science. To align the institution with its mission, the Museum underwent an intense bottom-up process and developed its Strategy 2020 – an eight-year programme with the aim to focus and strengthen its research around specific questions, develop its infrastructure as a global scientific infrastructure, experimenting with public engagement and aiming to bring science and society more closely together, and to renew its policies and procedures (*Strukturziele*).

As part of this process, a new structure was implemented and a new leadership team appointed in 2014, after approval by the trustees and following an amendment of the Museum’s by-laws. The MfN points out that the new organisational structure changed the Museum substantially, integrating the previous six cross-cutting topics into now four Science Programmes with clear leadership and financial responsibilities. Also, the Museum’s infrastructure was streamlined and allocated to specific Science Programmes, to be managed there.

Between 2012 and 2017, all internal rules, guidelines and regulations were examined, adapted and changed, and new instruments and procedures have been adopted. The MfN

points out that the entire Museum staff has been involved in the overhaul of procedures and processes. Moreover, in 2017 a branding and marketing process led to a further focussing of its message: *Für Natur*, also the new Museum logo in the handwriting of Alexander von Humboldt.

Following the advice of the last evaluation, the Museum has strengthened its activities in public engagement with science: the Programme “Museum and Society” was newly established in 2014 (cf. chapter 7.4). With digitisation reshaping all aspects of a research museum, the MfN decided to establish the Science Programme “Digital World and Information Sciences” (cf. chapter 7.3). Since 2014, this Programme combines scientific, information-scientific and technological aspects.

In 2018, the Museum received additional joint funding (*Sondertatbestand*) in order to strengthen the Museum’s taxonomic research and to develop new efficient methods for biodiversity discovery. The “Centre for Integrative Biodiversity Discovery” was formally opened in July 2018 (cf. chapter 7.2 Science Programme “Collection Development and Biodiversity Research”). In the meantime, the first five research positions have been filled and the newly established chair in Integrative Biodiversity Discovery (joint appointment with HU, cf. chapter 5) is currently recruited. Further major milestones are the inclusion of the Museum led DCOLL programme in the German Roadmap for Research Infrastructures and being part of the Berlin bid in the nation-wide Excellence Initiative.

Strategic work planning for the coming years

Having become an integrated museum, the MfN is now aiming to develop into an open and integrated research museum. It is preparing to develop the collection into a modern information and research infrastructure freely accessible to researchers worldwide: From being a collection *of* the world and the past the Museum aims at becoming an institution *for* the world and mankind’s future.

With the Zukunftsplan – the Museum’s development until 2030 – the MfN presented its future agenda to meet its scientific cultural and social responsibilities. The Plan has four parts:

- (1) re-building the still war-torn estate,
- (2) developing and digitising the collection,
- (3) strengthening the public offer, with new permanent exhibitions and community space and
- (4) developing a science campus with local and (inter-)national partners.

In November 2018, the MfN was informed of a decision of the budgetary committee of the German *Bundestag* pledging an investment of €660 million through state and federal governments to realise the Museum’s *Zukunftsplan* with the next 10 years.

Planning for additional funds deriving from institutional funding

According to the MfN, the *Zukunftsplan* makes appropriate provision for the building programme and the collection development, but does not stretch to a permanent uplift of institutional funding to hire staff to develop and deliver the vision. The Museum therefore

intends to apply for additional institutional funding (extraordinary item of expenditure; *Sondertatbestand*) to develop a “Knowledge Lab for Nature” as a new public engagement infrastructure and an intellectual scientific framework for the Museum and its infrastructures on the theme of Nature knowledge in the 21st century.

In detail, three themes are envisaged: 1) the social science-oriented research area Public Science, 2) the humanities-oriented research area History of Science & Museum Studies and 3) the information science-oriented research area Digital Knowledge Management. The three associated professorships and teams will be anchored in the Science Theme “Nature and Society” (cf. appendix 1) and are intended to establish novel research foci, developing new competencies in researching for an open science agenda, but also training and promotion of young scientists in the field of open knowledge research and open science. All three professorships will draw on the Knowledge Lab for Nature infrastructure.

In detail, the planning include the following measures:

(1) Public Science: At the interface between biodiversity research, politics and society, the professorship will investigate discourses about human-nature relationships. Focusing on questions of science and society through a sociological lens, questions will be asked about how societies generate social knowledge about nature, and how they might best do this in the contemporary context in which socio-natural environments bear multiple and competing pressures.

1 x professorship (W3); 1 x senior scientist (E14), 3 x scientists (E13); 5 x doctoral researchers (E13); 1 x secretariat (E6)

(2) History of Science & Museum Studies: With this professorship, a space for historical reflection concerning the Museum, its collections and its scientific history is to be established, creating a new and – according to MfN – unique research field in the area of museum and archive studies, and the history of science.

1 x professorship (W3); 4 x scientists (E13); 5 x doctoral researchers (E13); 1 x secretariat (E6)

(3) Digital Knowledge Management: The professorship seeks to break new ground in the field of digital, participatory knowledge generation for the bio- and geosciences and will investigate which tools, framework conditions and working methodologies are required for open knowledge management.

1 x professorship (W3); 1 x senior scientist (E14), 3 x scientists (E13); 3 x doctoral researchers (E13); 2 x technicians (E11); 1 x secretariat (E6)

(4) Shared infrastructure: The laboratory will be equipped to conduct experiments with digital, participative and open forms of knowledge generation and transfer – in relation to bio- and geosciences. With this, MfN aims to create a physical and a virtual space where Museum visitors, people, citizen scientists and other actors (co-)produce data and knowledge. They will be supported by online tools as well as professional workspaces and manuals and have access to collection databases, biodiversity information, and archival material.

1 x head (E14); 3 x scientists (E13); 2 x librarians (E11); 3 x project & innovation manager (E13); 3 x technical assistance (E9); 1 x assistance (E6)

„Extraordinary item of expenditure“: summary of funds planning

	2022	2023	2024	Permanently
Own funds + additional funds = „extraordinary item of expenditure“	€2.482 Mio	€4.382 Mio	€4.367 Mio	€4.367 Mio
Own funds from existing funding by institution (at least 3 % of core budget)	€0.472 Mio	€0.479 Mio	€0.487 Mio	€0.494 Mio
Additional funds of institutional funding	€2.010 Mio	€3.903 Mio	€3.880 Mio	€3.824 Mio

4. Controlling and quality management

Facilities, equipment and funding

Funding

In 2018, the Museum's institutional funding amounted to € 17.6 million, with € 13.1 million coming from institutional funding according to AV-WGL and € 3.7 million from the *Land* Berlin.

Revenue for project grants amounted to € 5.4 million (corresponding to 21 % of the MfN's overall budget in 2018), most of the funds coming from Federal and *Länder* governments (51 %), the DFG (31 %), and foundations (7 %). Also, the MfN generated revenue from services in the amount of € 2.9 million (e.g. revenues from commissioned work, from the exploitation of intellectual property rights and museum tickets).

The MfN points out that the annual increase of the Museum's institutional funding through the German *Pakt für Forschung und Innovation* (1.3 to 2.3 % annually) is outpaced by pay rises and building maintenance costs. Furthermore, with plans to develop the Museum into a science campus (cf. chapter 3), expenses for building management are expected to rise in the foreseeable future. These parameters, as the MfN points out, signal a medium-term need to adjust institutional funding accordingly – also to come in-line with the benchmarks for similar German/European infrastructure organisations.

Buildings and construction

In 2012, it had been stated that there was a strong need to restore the MfN's still war-damaged building complex. After a first rebuilding phase (2007-2010), which resulted in the reconstruction of the Museum's East Wing and the opening of an extensive scientific wet collection, the Museum started a second restoration phase in 2012, which will become functional in 2019. Next to the improvement of storage conditions for the dry collection, the enhancement of logistics for collection management and the economising on energy and operation costs, a particular focus was put on climatic preservation requirements of the collection. The measures included both renovation and new construction.

Altogether, as the MfN highlights, a total investment of €60 million has been granted by the Federal government and the state parliament since 2009 to improve the building situation. In total, it facilitated to modernise 38 % of the MfN's main building.

Research infrastructure

The collection is the core research infrastructure of the museum, including physical and digital sub-collections, library and archive. The physical part comprises 30 million objects ranging from zoology, palaeontology to mineralogy and geology with 10 % of all type specimens worldwide being part of the collection.

The collection is developed according to the Museum's collection strategy. Next to the ongoing assessment of the collection using international standards (e.g. in the framework of SYNTHESYS and a customised version of the Smithsonian assessment) and the further professionalisation of the collection management through the development of staff competencies. Profiles for collection managers as well as a scientific heads of collection have been developed and positions appointed. A digitisation strategy (2014) and concepts developed as part of the national infrastructure roadmap application DCOLL provide further strategic framework. In total 67 staff (2018), from technician to scientists, are looking after the collections from collection care, preservation, digitisation, service to users to strategic planning and research. As the Museum points out, the collection is the basis for and driver of most of its research areas, with biodiversity and evolutionary studies leading the way, as well as data management, outreach and public engagement activities. In the coming years, as the MfN highlights, staff structures will be developed further along the lines of centralisation and specialisation including new competencies such as data curation and public services.

The Museum's library holds 374.000 objects, including rare books, going back to the 16th century, historical maps and special collections. Correspondences between scientists all over the world as bequests, images and manuscripts are administered by the archive.

The MfN hosts a research laboratory infrastructure, ranging from geochemical and micro-analytical facilities to isotope laboratories, collection care laboratories, a bioacoustics laboratory, an in-house computer cluster to the Museum's 3D lab or a DNA-laboratory. Its equipment is mainly used to support Museum projects. Specific agreements for joint lab use exist within both national centres and networks such as BeGenDiv (Berlin Center for Genomics in Biodiversity Research) and Geo.X (Research Network for Geosciences in Berlin and Potsdam) as well as international collection infrastructure projects. As the MfN points out, major investments since the last evaluation in 2012 helped to further develop and improve its laboratory facilities, e.g. the temperature control system of the integrated zoological laboratory (2014), the chemical and micro-analytical facilities (2016) and the establishment of additional lab space for ancient/old DNA-analysis.

The MfN's research information technology infrastructure supports both central IT services as well as the digital transformation and the ongoing digitisation of the collection. It updates, secures and expands data storage and ensures long-term access to digitised objects. At present, the MfN operates five storage controllers with a total capacity of 1.5 Peta

Byte. A strategy for long-term archiving of the Museum's data is currently under development.

The Museum houses a research data management infrastructure, which has been extended and further developed since 2012. Its main task is the evaluation, development and implementation of software components for the management/long-term availability of the Museum's data. Components are: collection databases, a media repository, a research data repository for data publication with its own DOI allocation, a publications database, databases of library holding and journal licences as well as web-based information platforms.

Organisational and operational structure

The Museum is led by the Director General and the Managing Director (Directorate), supported by a management team. Currently, the Museum's activities are assigned to two Science Themes, comprising two Science Programmes each. Work is conducted in eleven departments.

The Board of Trustees, as the MfN's supervisory board, oversees all significant scientific, programmatic and economic matters of the trust. The Board is in particular responsible for enacting and amending the by-laws, approval of the budget and the annual financial statement, the appointment of the Director General and the members of the Scientific Advisory Board. It consists of up to eleven members, among them a member of the Berlin Senate responsible for research (as chairperson), a representative of the Federal Ministry responsible for the promotion of scientific research (as vice chair), the president of the Humboldt-Universität zu Berlin and up to eight other people according to the by-laws.

The Scientific Advisory Board (SAB) advises the Museum's Directorate and the Board of Trustees on scientific, programmatic and significant structural issues. It develops proposals and recommendations on the research fields of the Museum and its programmatic planning. It issues a statement on the Director General's Annual Report and the programme budget. In 2018, the SAB had seven members (with the by-laws, since 2013, allowing for ten) reflecting the main tasks and activities of the Museum. Members of the SAB are appointed by the Board of Trustees in consultation with the Director General for a term of four years; they may be reappointed once.

Operational structure

The Museum's Directorate, together with the heads of the Science Programmes, implement the Museum's vision and mission, setting long-term goals or short-term tasks in the programme budget, the Museum's yearly strategic plan. Department heads are given full responsibility for the direction of their research and how to attain goals. The leadership of each Science Programme and the Directorate discuss the performance of the previous year, financial forecast and strategic goals in regular meetings and annual appraisal meetings.

The Lenkungskreis was implemented by the Directorate as an internal advisory body, consisting of the Science Programmes' leadership, the Directorate, the staff council, public relations, and experts on overarching topics, such as on open science. It meets every other

week to discuss topics relevant to the entire Museum and related to the overarching strategic direction. There are various committees or subject-specific working groups in order to discuss and decide on specific issues, e.g. on the development of quality assurance, collection acquisition, animal welfare, change management (Change Management Board (2012-2016)) or the new branding of the Museum (Nature Team, 2016-2018).

Quality Management

The MfN implemented a broad range of quality control measures to monitor its activities in research, infrastructure and transfer. Since 2010 scientific staff members elect a central Ombudsperson. Based on the recommendation of the Leibniz Association and the German Research Foundation (DFG) the Museum in 2016 approved its own guideline to maintain “good scientific practice”. The Museum’s publication strategy reflects the various disciplines and target groups of the Museum’s work. In 2018, the MfN developed an open access policy that seeks to encourage staff to publish in open access formats and offers support through various measures to promote the visibility and the re-use of results.

The Museum has established policies, procedures and guidelines concerning its laboratories (with respect to data acquisition, documentation and storage), the management, development, accessibility and conservation of its collection, visitor profile surveys (educational programmes, temporary exhibitions, events, public relations) as well as internal procedures and regulation for research integrity and control.

Quality management by advisory boards and supervisory board

The Scientific Advisory Board convenes twice a year to discuss the Museum’s development and give their expert opinion on scientific, programmatic and significant structural topics. As mandated by the Leibniz Association, it audits the MfN at least once between two external evaluations, most recently at the beginning of 2018.

The MfN points out that since 2012 the Board of Trustees has taken important decisions that have enabled its further strategic development. Among the most significant of these are the adoption of new by-laws in 2013, which define the new organisational structure of the Museum; the continuation of the structural upgrading of the Museum; the adoption of the *Zukunftsplan*; the support for the extraordinary item of expenditure (*Sondertatbestand*) for the “Centre of Integrative Biodiversity Discovery” (cf. chapter 3).

5. Human Resources

Management

The MfN considers joint appointments with universities as a strategic instrument anchoring the Museum’s science and expertise in academia. Currently, seven joint appointments exist.

Humboldt-Universität zu Berlin:

- Professor for Systematic Zoology (C3, 1994)
- Professor for Palaeozoology (W3, 2010)

- Professor for Biodiversity and Public Science (W3, 2012)
- Professor for Palaeobiology and Evolution (W3, 2017; (W2, 2013))
- Professor for Development and Evolution (W3, 2017)
- Junior Professor for European Ethnology and Socio-cultural Anthropology (2017)

Freie Universität Berlin:

- Professor for Impact and Planetary Physics (W3, 2017)

In 2019, a call was issued for a joint professorship for Impact and Meteorite Research (W3, FU, to be installed by 2020). Also, a job advertisement for a professorship for Integrative Biodiversity Discovery (W3, HU, as part of the Centre for Integrative Biodiversity Discovery) was published in early 2019.

Beyond this, the Institute of Biology of the Humboldt-Universität zu Berlin is currently recruiting a W2/W3 professor for botany in cooperation with the Museum. Here, the Museum is planning to fill two positions in palaeobotany. According to the MfN, further strategic joint appointments are envisaged, such as a new professorship for palaeoecology with Potsdam University and the three professorships as part of the plans for a “Knowledge Lab for Nature” (cf. chapter 3).

Scientific leadership positions at the Museum are filled through international recruitment or via strategic promotion of highly qualified candidates. Based on Leibniz standards, the MfN developed its own Museum specific standard for joint appointments. The SAB is involved in the entire process and, together with the Board of Trustees, has to confirm any final decision. The Museum published interview guidelines and, from 2019 onwards, a recruitment management system will be available. The staff council, the Equal Opportunity Officer and the Representative for Persons with Special Needs are formally included in recruitment processes.

Since the last evaluation, 68 staff have been promoted to a higher pay scale, and for 32 staff contracts were changed from temporary to permanent (altogether amounting to 30 % of the Museum’s overall staff). The Museum points out that the programme budget postulates a maximum of 50 % of staff budget to be used for permanent contracts, a percentage the MfN considers low for an infrastructure organisation and its given permanent tasks.

Postdoctoral staff

The Museum supports the academic development of postdoctoral researchers. They come from various countries, often funded by highly competitive programmes. Since 2012 the Museum has attracted 20 Humboldt Research Fellows and Awardees. It also hosted one Emmy-Noether-Group and one Sofia Kovalevskaja Awardee, as well as one Marie Skłodowska-Curie-Action Award recipient, one DFG Heisenberg-fellow and an ERC Starting Grant recipient.

In the last evaluation it was stated that the traditional role of *Kustos* (researching curator) required clarification considering the demands of a modern research infrastructure. Only

a close connection between research and collections will ensure future relevance. Following recommendations, the Museum engaged in a comprehensive process to clarify roles and responsibilities of collection management. In an externally facilitated process, involving all scientists working in the collection, expectations and future challenges were discussed and translated into requirements and tasks. Since 2018, the new profiles assign responsibility for the strategic planning and development of a sub-collection to a scientific head of collection, who conducts collection-based research and leads a team of collection management staff. In line with this new arrangement, several new positions (for both modern integrative taxonomists and more collection-oriented staff) have been hired as part of the new Centre of Integrative Biodiversity Discovery since November 2018 (see 7.2).

According to the MfN, postdocs pursue a variety of career paths in a broad range of academic and non-academic fields after their time at the Museum, e.g. accepting permanent positions as lead scientists/directors at Natural History Museums, being awarded prestigious fellowships and awards, joining non-governmental organisations or starting up their own businesses.

Doctoral Candidates

Following recommendations of the evaluation in 2012 and the Scientific Advisory Board, the Museum developed Guidelines for Structured Graduate Support (*strukturierte Graduiertenförderung*) which were formally established in 2017. A part-time coordinator was assigned to ensure its implementation and development. The common guidelines set uniform standards for all doctoral students and their supervisors and include a structured supervision scheme. Participation in the Museum's programme became mandatory for all doctoral students starting from January 2018 onwards, but is also open for all other students who started at an earlier date. To this end, the MfN's Directorate granted €23.4k in 2018 for the organisation of workshops and career development opportunities.

Between 2016 and 2018, more than 50 doctoral researchers worked at the Museum in any given year (Ø 52.3 persons, on average 60 % female researchers and 40 % international students). In addition, staff supervised 12 external PhD candidates on average annually. About half of the students were employed by the Museum, while the other half was holding scholarships, had contracts with partner organisations or secured other funding.

Altogether, 38 doctoral degrees were completed successfully at the MfN in the period 2016-2018. According to the MfN, about half of the Museum's doctoral researchers continue their careers in other research institutions, while the other half put their expertise into practice working for business enterprises or start-ups, join public administration offices or non-governmental organisations, typically with a focus on biodiversity or conservation, in about equal numbers.

Non-scientific staff

The Museum offers certified vocational training in event management and office administration; between 2016 and 2018, two trainees were working at the MfN at any one time. The Museum aims to increase this number to strengthen its staff in the long-term.

In collaboration with partners, the MfN established a competency matrix for technical staff at European level, allowing technical staff to acquire comparable skills to increase job mobility and advancement, and was also part of a training-on-the-job project with European collaborating museums.

The Museum provides apprenticeship programmes (*Volontariat*) and internships. Each year, up to nine volunteers complete the Voluntary Ecological Year (FÖJ). Finally, the MfN coordinates a steadily increasing number of volunteers in its collections and engages with the non-profit Friends and Supporters of the Museum.

Equal opportunities and work-life balance

As of 31.12.2018, the proportion of women in “Research and scientific services” was 44%. In terms of individual scientific status groups, the proportion of women among doctoral researchers directly employed by the Museum was 68% (about 60 % in the entire group including scholarship holders, see above), those in non-executive scientific positions 53 %, senior scientists 14 % and heads of departments/Science Programmes 44 % (cf. annex 4).

As of the same date, all four Science Programmes were led by women, and 3 out of 12 heads of department were female.

As a public foundation of the state of Berlin under public law, the Museum applies the Berlin state equality law. It has an Equal Opportunity Officer who was released from 50 % of her work assignment and as of April 2017 received further support by an elected team of five staff.

The MfN is a certified institution of the *audit berufundfamilie* (audit workandfamily; re-audition in 2018) and has on its own account implemented measures to reconcile work and family as well as a family-conscious and life-phase oriented personnel policy. Among other measures, the Museum offers a flexi-time agreement and schedules meetings within core working hours. It is about to introduce Museum Guidelines for the Promotion of Women in order to create an atmosphere in which gender equality is understood as part of leadership responsibility and its working culture.

6. Cooperation and environment

The Museum cooperates with Humboldt-Universität zu Berlin (HU) and Freie Universität Berlin (FU), e.g. in the framework of joint professorial appointments (cf. chapter 5), the training and promotion of doctoral students, curriculum development, and academic teaching as well as joint scientific endeavours. Furthermore, Museum’s scientists contribute to specialist programmes offered at, for example, the University of Arts (UdK), Technische Universität Berlin (TU) and HTW Berlin University of Applied Sciences.

During 2016-2018, the MfN had been partnering with over 30 universities in six structured programmes funded by the DFG, , i.e. three priority programmes (SPP), two research units (FORs) and one cluster of excellence (EXC). The Museum was also part of a successful

(announcement in 2019) application of the Berlin University Alliance within the Excellence Strategy of the German Government, supporting the HU to deliver a Public Engagement with science programme for Berlin.

The MfN is represented in 14 groups or networks of Leibniz Association, e.g. in the Leibniz Biodiversity Network and in the Leibniz Research Alliance Open Science. Moreover, it participated in the development of programmatic agendas, such as the Leibniz Commitment to European Open Science Cloud (EOSC), the Leibniz PhD agreement, and the open access monitoring. The Director General functions as Leibniz Association representative for Citizen Science.

Since 2019, after having spearheaded the conceptual development and writing, the Museum has been chairing the DCOLL initiative³, which unites seven partner institutions including four Leibniz institutes, to become part of the German national roadmap for research infrastructures. It aims to mobilise, structure, interlink and make openly available data hidden in natural science collections in Germany. The MfN also is involved in the Berlin-Brandenburg Institute for Biodiversity Research (BBIB) and the Berlin Center for Genomics in Biodiversity Research (BeGenDiv).

The MfN established formalised cooperation with over 360 partners worldwide, among them 313 European partner institutions. According to the MfN, to open the Museum, it seeks out partners with access to new audiences, while institutions with a complementary skillset are regular research-focussed partners. As the MfN points out, the range of cooperation is as wide as it is diverse: from industry cooperation to test and further develop state-of-the-art technology (e.g. XYLON International) to large consortia tackling the digitisation of natural history collections (e.g. CETAF – Consortium of European Taxonomic Facilities, DINA – Digital Information systems for NATural history data, DiSSCo – Distributed System of Scientific Collections) to pooling intellectual and infrastructural resources for research (e.g. Geo.X – Research Network for Geosciences in Berlin and Potsdam, Charité University Hospital Berlin), to focused partnerships with neighbouring city districts (e.g. Neighbouring Management Councils in Berlin-Wedding).

Institution's status in the specialist environment

In line with its vision of a museum that is embedded in society and a critical driver of science-society dialogue, the Museum leadership is engaged in an international mobilisation to create a common agenda for research museums in general, and natural history museums in particular. The Museum is, e.g., a founding member of the informal G12 – regular, two per year, strategic meetings of the directors of the twelve largest natural history museums in the northern hemisphere.

The MfN points out that, it has supported a rethinking of the role and potential of research museums within the Leibniz Research Alliance resulting in a *Leibniz Aktionsplan* (Action Plan for Leibniz Research Museums) that aims at rethinking museums as places of dia-

³ DCOLL = *Deutsche Naturwissenschaftliche Sammlungen als integrierte Forschungsinfrastruktur* (German Natural Sciences Collections as an Integrated Research Infrastructure)

logue and participation. Within the Aktionsplan, the MfN hosted the world's first transdisciplinary Global Summit of Research Museums, bringing together over 200 representatives of 109 leading research museums from 24 countries.

With regard to size (collection and staff), scientific/public mandate and general research fields, the MfN refers to the Belgian Institute of Natural Sciences (Brussels) and the Naturalis Biodiversity Center (Leiden) as comparable institutions.

7. Subdivisions of MfN

Science Programme "Evolution and Geoprocesses"

The programme analyses the patterns and processes that have shaped the evolution of the solar system, planet Earth and Life on it – mapping the Earth's evolution from cosmic dust to eco-systems and their inhabitants down to genomes.

In the previous evaluation, the geo- and biosciences at the Museum were organised in four of the then six cross-cutting science programmes. Following a strategic review, taxonomic research became more closely associated with the Science Programme "Collection Development and Biodiversity Discovery" (see below) whilst hypothesis driven research was organised into four departments within the Programme "Evolution and Geoprocesses". This strategic reorganisation, as the MfN points out, redefined research foci based on longstanding strengths and further supports the interchange and natural ties between the four departments and with other Science Programmes.

In a modern approach, the departments are not oriented along classic systematic or disciplinary delineations, but rather are grouped around research foci on cosmic collisions and meteorites, biodiversity dynamics, *bauplan* evolution and micro-evolutionary mechanisms.

In the coming years, the Science Programme aims to continue developing the research concepts of the individual units and strengthen connections and interdependencies between major fields of research. This requires continuous capacity building (technological and methodological) and staff development. Also, building on collection and expertise, the programme envisages conceptual, theoretical and experimental research focusing on the emergence and early evolution of life on Earth (and the solar system) bridging the Programme's established research foci.

As the departments of this Science Programme have mostly remained stable since the last evaluation, they form individual evaluation units.

Department "Impact and Meteorite Research"

[12.7 FTE, thereof 5.6 FTE Research and scientific services, 2.5 FTE Doctoral candidates, and 4.6 FTE Service staff]

The department investigates processes involved in the collision of cosmic material ranging from the formation of the solar system, the subsequent evolution of Earth and other planets to present day meteorite falls and potentially hazardous future impacts. Its main goals are:

- (1) to constrain the compositional requirements and the impact-related thermal and dynamic conditions for planets and moon formation and subsequent evolution,
- (2) to improve the quantitative understanding of the physicochemical processes during hypervelocity impacts,
- (3) to gain a better understanding of the genesis of impacts- and shock wave induced specific modifications in rocks and mineral phases, and
- (4) to study the (environmental) consequences of impacts on biosphere, atmosphere, and lithosphere in Earth's history and future.

These objectives are addressed by an interdisciplinary approach combining field- and collection-based material studies, experimental setups and numerical modelling. According to the MfN, the department's predominant focus lies in conducting research, while also engaging in infrastructure and transfer work

Select examples of research, infrastructure or transfer work of the department include:

- The first quantitative, systematic approach to constrain the impact genesis of Apollo specimen by numerical modelling;
- The discovery of new minerals and quantification of shock metamorphism in meteorites based on the Museum's collection and modelling skills;
- A new understanding of impact-generated rock types by nature and experiment producing new insights into the complexity of impact-induced release of climate active gases;
- The development of simulation-components for the open source software iSALE, co-hosted and maintained by the Museum and used by researchers worldwide;
- The organisation of the international ESA workshop 2018 (HERA mission), the METSOC 2016 conference, and the associated exhibitions on the ROSETTA mission.

In 2016-2018 department staff accounted for 76 publications altogether, 66 of which were published in 23 different peer-reviewed journals. It published six articles in other journals, and three individual contributions to edited volumes.

The revenue from project grants totalled €1.3 million (Ø €445k p.a.), with almost €1 million spent from DFG, €140k from EU-grants, €100k from Federal and *Länder* governments as well as €55k from industry. 8 doctoral and 7 academic degrees were completed.

Department "Diversity Dynamics"

[14.1 FTE, thereof 9.2 FTE Research and scientific services, 3.0 FTE Doctoral candidates, 1.2 FTE Service staff, and 0.7 FTE Student assistants]

The department investigates drivers, processes as well as ecological and evolutionary consequences of diversity change. Research covers changes on different spatial and temporal scales, thereby integrating ecological, zoological and palaeontological expertise. The department particularly focuses on the importance of biotic and abiotic drivers of biodiversity changes, from species to community level. Research comprises living and fossil species, including protists, as well as various invertebrate and vertebrate groups. According

to the MfN, the department's predominant focus lies in conducting research, while also engaging in infrastructure and transfer work.

Select examples of research, infrastructure or transfer work of the department include:

- Based on diversity partitioning among within-habitat, between-habitat, and overall diversity of marine invertebrates during the Phanerozoic, the department revealed that diversification occurs in successive phases of progressing levels of biotic interactions.
- Warming-induced reduction in the body size of marine invertebrates, body size change thus being a precursor of biodiversity change and serving as an early warning signal of imminent extinctions.
- Traits were used to build a fossil-based model calculating the extinction risk of amphibians – these results were evaluated against the IUCN Red List criteria and allow assessing Data Deficient species concerning extinction risks.
- Studies revealed new patterns of taxonomic diversity, morphological diversity and biogeographical distribution of early tetrapods across the end-Permian mass extinction.

In 2016-2018, department staff accounted for 173 publications altogether, 160 of which were published in 92 different peer-reviewed journals. It published eight articles in other journals, three individual contributions to edited volumes, and one monograph.

The revenue from project grants totalled approx. €1 million (Ø €350k p.a.), with almost €850k spent from DFG, €110k from Federal and *Länder* governments, and €102k from industry. 11 doctoral and 21 academic degrees were completed.

Department “Evolutionary Morphology”

[31.6 FTE, thereof 12.4 FTE Research and scientific services, 4.3 FTE Doctoral candidates, 13.1 FTE Service staff, and 1.4 FTE Student assistants]

The department's research focuses on the evolution of body plans and organ systems, integrating information from both past and present, in order to generate a broad understanding of phenotypic evolution of life on Earth and the underlying processes. A wide array of different analytical methods and experimental set-ups are applied, including 3D-imaging, phylogenetic comparative methods, quantitative and qualitative morphological analyses, and conceptual and technical approaches from evolutionary developmental biology. Characteristic for its research is the emphasis on non-model organisms, including such diverse organisms as marine invertebrates, plants, dinosaurs, and early tetrapods. According to the MfN, the department's predominant focus lies in conducting research, while also engaging in infrastructure and transfer work

Select examples of research, infrastructure or transfer work of the department include:

- The description of unique patterns of developmental and evolutionary processes in limb development and regeneration of early tetrapods and modern amphibians.

- A combination of high-resolution microscopy, immunohistochemistry and synchrotron tomography disproved previous hypotheses about brittle stars' usage of skeletal elements as 'lenses' for light transmission.
- UV-imaging techniques enabled the documentation of pneumatisation in the skeleton of the famous Berlin specimen of *Archaeopteryx*, indicating a metabolism similar to modern birds.
- Integration of extant and fossil data combining X-ray computed tomography gave new insights into the origin of modern spiders, showing that some early evolutionary lineages unexpectedly survived until the Late Mesozoic.
- Development of new technological standards for computed tomography focusing on natural history collections, especially with respect to visualising soft-tissue.

In 2016-2018, department staff accounted for 199 publications altogether, 175 of which were published in 84 different peer-reviewed journals. 11 articles were published in other journals. It made 8 individual contributions to edited volumes and published one monograph.

The revenue from project grants totalled €1.8 million (Ø €600k p.a.), with almost €1.3 million spent from DFG, €188k from Federal and *Länder* governments, €104k from the EU, and €44k from industry. 9 doctoral and 10 academic degrees were completed.

Department "Microevolution"

[9.9 FTE, thereof 6.1 FTE Research and scientific services, 3.2 FTE Service staff, and 0.6 FTE Student assistants]

The department studies the process of speciation as the basis of the evolution of biological diversity, particularly using molecular genetics and genomic approaches. Its main goals are to understand how populations diverge, adapt to the environment and evolve hybridisation barriers that could lead to speciation. Thus, the department's focus is on evolutionary mechanisms that act within populations and species or among closely related species. A wider range of organisms beyond the classical genetic model species are studied, including invertebrates as well as vertebrates. Research projects are assigned to three major research fields:

- First, studies in phylogeography characterise genetic variation in a spatial context.
- Second, speciation research focuses on the evolution of effective hybridisation barriers.
- Third, functional genomics allow a better understanding of the speciation process at the genetic level by using novel genomic techniques.

According to the MfN, the department's predominant focus lies in conducting research, while also engaging in infrastructure and transfer work.

Select examples of research, infrastructure or transfer work of the department include:

- The investigation of evolutionary histories of closely related bat species revealed unexpectedly high cryptic diversity, providing evidence for new species.

- The identification of promising new candidate genes for evolutionary important traits involved in adaptation and speciation.
- Using DNA extracted from historic specimen in the MfN's collection allowed the reconstruction of Pleistocene population dynamics.
- The establishment of a new research group investigating the role of acoustic communication in speciation, using Museum facilities and infrastructures, including the animal sound archive and cold archive.
- Collaboration in Berlin-Potsdam area and modern laboratory and bioinformatics infrastructures were established at the Museum and allow genomic studies in both evolutionary biology and biodiversity research.

In 2016-2018, department staff accounted for 50 publications altogether, 48 of which were published in 38 different peer-reviewed journals. In addition, one article in other journals and one individual contribution to edited volumes were published.

The revenue from project grants totalled €820k (Ø €270k p.a.), with almost €690k spent from DFG, €75k from the Leibniz competitive procedure, €45k from Federal and *Länder* governments, and €5k from industry. 8 doctoral degrees were completed.

Science Programme “Collection Development & Biodiversity Discovery”

[50.7 FTE, thereof 19.0 FTE Research and scientific services, 0.5 FTE Doctoral candidates, 29.0 FTE Service staff, and 2.2 FTE Student assistants]

The two main objectives of the Science Programme are (1) the transformation of the current and future collection of the MfN into a global, open and integrated research infrastructure, and (2) the development and application of efficient methods for discovering, describing and understanding global biodiversity. It consists of the departments “Biodiversity Discovery” and “Collection Development”.

The Science Programme combines three different but related aspects that in the previous evaluation in 2012 were evaluated separately: collection, collection development and care as well as taxonomy. According to the Museum, bringing them together in 2014 was not just a strategic decision, but a next step on the way to an integrated research museum. In the Science Programme, the 30 million objects provide the infrastructure embedded in and developed through research programmes directly based on these objects. Conservation science was introduced as new research field to the Museum. A “Centre for Integrative Biodiversity Discovery” was established in 2018 based on the award of a permanent grant-in-aid-uplift (Sondertatbestand). Supported and driven by technological and methodological advances especially in molecular taxonomy, visualisation techniques and biodiversity informatics, it will turn taxonomy into a multidisciplinary collection-based science of biodiversity discovery at the Museum. A new centre of collections is building up a knowledge pool and ensures knowledge transfer to the community and beyond. . According to the MfN, the Science Programme's predominant focus lies in infrastructure development, while also engaging in research and transfer work.

Select examples of research, infrastructure or transfer work of the Science Programme include:

- The co-development of concepts and plans to develop natural history collections as an integrated global research infrastructure on the national level. (DCOLL)
- Introducing and implementing a new, data-based collection stewardship leading to improvements in collection management, e.g. the establishments of standards, in-house policies for biocides, integrated pest management, disaster preparedness etc.
- Analysing deterioration processes and developing methods to ensure long-term preservation of historical objects, e.g. of microscopic slides and mammal skins.
- Enhancing the scientific value of collection objects through collection-focused research, in-depth digitisation and publication in open data portals.
- Leading collaborative large-scale biodiversity discovery projects including the development and application of novel integrated specimen and data workflows.
- Establishing the Centre for Integrative Biodiversity Discovery
- Conducting training and capacity building for collaborative state-of-the-art biodiversity research in megadiverse Southeast Asia

In 2016-2018, Programme staff accounted for 256 publications altogether, 175 of which were published in 77 different peer-reviewed journals. Furthermore, 36 articles in other journals, 19 individual contributions in edited volumes, one monograph, and three editorships of edited volumes were published.

The revenue from project grants totalled €2.6 million (Ø €860k p.a.), with €350k spent from DFG, almost €1.8 million from Federal and *Länder* governments, and €137k both from the EU and industry. 2 doctoral and 5 academic degrees were completed.

According to the MfN, the funding perspective provided by the *Zukunftsplan* (cf. chapter 3) will shape the future of the whole Science Programme as this will offer the opportunity (1) to implement quality standards in collection care & preservation, (2) to deliver a step change and digital turn in collection development and management, and (3) to improve access and information quality through user driven and in depth collection development. Furthermore, the “Centre for Integrative Biodiversity Discovery” will become fully operational in 2020 providing for innovative and fast high-quality exploration of global diversity, with this also establishing links between taxonomic research and applied fields such as health or material science, food, agriculture and conservation with the aim to strengthen the sustainable use of biodiversity and foster a sustainable bioeconomy.

Science Programme “Digital World and Information Science”

[35.1 FTE, thereof 11.7 FTE Research and scientific services, 0.8 FTE Doctoral candidates, 17.9 FTE Service staff, and 4.8 FTE Student assistants]

The Science Programme “Digital World and Information Science” was established in 2014 in order to combine and consolidate efforts in the area of biodiversity informatics and research data management, which were previously distributed across other science programmes and were mostly conducted by individual third party projects or as part of research projects. Specific recommendations from the evaluation report 2012 that helped

shaping the programme include (1) the requested improvement of the general IT services in terms technology and staff, (2) support of the digital cataloguing of the scientific collections, and (3) provision of access to the collection data. It aims at:

- analysing, designing and testing of new ideas/workflows for long-term management of the Museum’s data to enable the development of solutions for management of national and international geo- and biodiversity research data.
- the development of processes and methods for capturing, networking, storing and accessing data.
- the design and implementation of interfaces to technical as well as social information networks.

The Programme comprises two departments: The department “Science Data Management” addresses the integration of the Museum’s heterogeneous data in professional and sustainable systems based on an interoperable data infrastructure. The data management infrastructure, the library and information services are maintained as research infrastructure units in this department. The “Biodiversity Informatics” department focuses on the application of informatics analysis methods and information technology based on biodiversity data, environmental factors, geological events and the interconnection with other data. The animal sound archive is developed as a global, digital research infrastructure in this department.

The programme is now entering consolidation moving from serving mostly as a support function towards developing a research programme with a scope extending beyond the primary needs of research and collections. According to the MfN, the Science Programme’s predominant focus lies in infrastructure development, while also engaging in research and transfer work.

Select examples of research, infrastructure or transfer work of the Science Programme include:

- The implementation of research data management structures accompanied by the development of in-house software components, methods for data publication and standardised exchange formats.
- The transfer of the Museum’s Animal Sound Archive from an analogue tape collection to a fully digital collection.
- The development of algorithms for acoustic and visual pattern recognition using machine learning technologies based on neural networks and deep learning integrated into environmental education applications.
- The development of the smartphone app *Naturblick* to engage young adults with urban nature.
- The establishment of ‘Mediasphere for Nature’, a media application lab bridging the gap between research and economy.

In 2016-2018, Programme staff accounted for 31 publications altogether, 20 of which were published in 14 different peer-reviewed journals. It published five articles in other journals and made three individual contributions to edited volumes.

The revenue from project grants totalled €3.1 million (Ø €1 million p.a.), with €680k spent from DFG, €2 million from Federal and *Länder* governments, and €370k from the EU. Three academic degrees were completed.

In the coming years the Science Programme aims to intensify its efforts in two main target research areas 1) in order to develop into a competence centre for Research Data Management at/for Natural History Institutions, and 2) applications of pattern recognition algorithms in biodiversity research. Furthermore, the programme seeks to improve and build mechanisms and structures, such as media application lab infrastructures, allowing for Open Innovation in partnership with industry at the Museum.

Science Programme “Museum & Society”

[44.4 FTE, thereof 22.6 FTE Research and scientific services, 17.2 FTE Service staff, and 4.5 FTE Student assistants]

The Science Programme delivers public engagement with science through exhibitions, educational activities and structured, young adult focussed programmes, including citizen science. It explores the relationship between humans and nature and aims to place this debate in the minds of the public, politics, economy, science or other cultural institutions.

The Programme evolved out of the former Science Programme “Science Communication and Science History”, which has been gradually expanded since 2014. In addition, strategic co-operations were consolidated and a junior professorship with focus on the socio-political contextualisation and challenges of natural history collections, their knowledge practice and infrastructures was appointed. According to the MfN, the Science Programme’s predominant focus lies in knowledge transfer development, while also engaging in research and infrastructure work.

The Programme currently comprises three departments: With the Museum opening up to society in a more holistic way, the “Education and Exhibition” programmes were merged in the correspondent department. The department “Science and Society” focuses on the inquiry into and the development of methodologies that provide the framework for knowledge transfer and capacity building in the area of biodiversity science, citizen science and science policy. The former humanities department PAN (Perspectives on Nature), dedicated to the history of natural sciences, the history of the Museum as well as cultural and artistic programmes, has evolved into the department “Humanities of Nature”, which combines historical research, includes the *Historische Arbeitsstelle* (historical collection of images and documents) and the newly established Science & Technology Studies group.

Select examples of research, infrastructure or transfer work of the Science Programme include:

- The Museum attracted exceptional numbers of visitors to its permanent and temporary exhibitions, educational and adult audience focussed events, as well as integrating these strands around specific topics. It conducted successful experiments with stakeholder dialogues.
- The department was involved in creating/establishing the *European Citizen Science Association*, and has been developing into an internationally recognised centre for strategy, policy, thinking about and practising citizen science.
- In biodiversity policy the programme is embedded in various science policy networks such as NeFo (*Netzwerk-Forum zur Biodiversitätsforschung Deutschland*) or IPBES (*Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*) contributing to the understanding and development of global and national biodiversity governance.
- Research into the potential of transfer in museums and practical projects on transfer culminating in the Museum's transfer guidelines.
- Developing and strengthening research on the provenance of objects resulted in an international conference and the timely book *Dinosaurierfragmente* (2018).

In 2016-2018, Programme staff accounted for 87 publications altogether, 30 of which were published in 19 different peer-reviewed journals. It published 6 articles in other journals and accounted for 29 individual contributions to edited volumes as well as three monographs.

The revenue from project grants totalled almost €3.8 million (Ø €1.25 million p.a.), with approx. €2 million spent from Federal and *Länder* governments, approx. €1 million from foundations, €500k from the EU, and €175k from DFG. 6 academic degrees were completed.

In the coming years one of the main goals of the Programme will be the opening of the Museum physically, scientifically and digitally. It is to experiment and reflect on different forms and formats exploring what “openness” means, for whom, and how opening of information and for participation will help the Museum to reach its targets. The Museum wants to strengthen the Programme with two professorships (for public science and museum studies [see also STB]), closely linked to a modern knowledge lab curating digital and material information, which will be part of a “School of Public Engagement and Open Science” and also linked to teaching and other forms of knowledge transfer. Beyond this, it aims to investigate educational aspects of learning in museums and evaluate the results of ongoing activities as well as from previous projects. It will further strengthen its resolve to stimulate and support public debates in the fields of science and nature. Also, it will analyse how the impact of opening the Museum can be described and scientifically evaluated, developing a method for identifying and adjusting transfer indicators.

8. Handling of recommendations from the previous evaluation

General concept

1. *“MfN’s organisational form appropriately underpins internal cooperation at the museum. Care is taken to ensure that there is an on-going interaction between the museum’s research, collection and educational tasks and personnel. Attention should continue to be paid to this interaction in the future as well.”*

According to the MfN, the integration of infrastructure, knowledge transfer and research was further advanced since 2012 as well as was the strengthening of cross-departmental teams. In addition, bi-monthly all-staff meetings and weekly lecture series aim at strengthening internal cooperation (cf. chapter 2 and 4).

2. *“At German research museums scientific curators are responsible for scientific care for the collections (maintenance, development and management) and research based on these collections. In recent years the research side has been emphasized more with the positive effect that many curators now publish very well and acquire competitive grants. However, collection development and care are equally important responsibilities of a curator; collection development and care are recognised as scientific work. Activities in these fields should be supported and acknowledged appropriately. The MfN’s new leadership has realised this and has already taken measures. Firstly, in the new science programme “Collection Development” (SP5) an appropriate framework is being created for merging the organisation of collection development and research. It can already be seen that this leads to synergies that generate knowledge (see the evaluation of this new SP below). Secondly, human resources development is being triggered according to the dual functions of curatorial work (research and collection care). For this purpose, a very appropriate and transparent framework has been created: the Curatorial Policies and Guidelines (see 6. Quality assurance). In the coming years, one important task will be to implement this framework whilst taking account of the special features of individual collections and the existing staffing situation. It is necessary to achieve an appropriate balance between promoting research ideas of the staff and securing a high level of collection care. MfN’s new leadership has fully understood this and is dealing with these issues rigorously.”*

As the MfN points out, it has delivered and implemented profiles for the dual tasks of scientific care of and research based on the collection (cf. chapter 3).

3. *“There are still grave building defects and equipment deficits which have a negative impact on science and research at the museum. Some of the collections are not appropriately housed. There is a very serious need for action in this respect.”*

Since 2009, a total sum of €60 million was available to reduce building defects culminating in the completion of a second building phase in 2019. Moreover, the German *Bundestag* and the Berlin Senate announced prospective founding of the *Zukunftsplan* with €660 million to re-build the entire Museum between 2019 and 2028 (cf. chapter 2 and 3).

4. *“In order to provide sufficient staff for laboratories and IT services six additional technical positions in laboratories and three additional positions in IT will have to be created. The funding bodies should provide the museum with the requisite additional funding.”*

According to the MfN, this recommendation was implemented.

Science Programmes

5. *“Public engagement with science is a field that is not well developed in Germany. Berlin is considered a highly suitable scientific environment for this field. Thus, SP 6 is strongly recommended to use collaborations to recruit additional expertise.”*

With the establishment of the Science Programme “Museum & Society”, various activities in public engagement of science have been merged and developed further (cf. chapter 7).

Staff development and promotion of junior researchers

6. *“It is urgently recommended to increase the proportion of women at scientific leadership level and to align these efforts with the DFG’s cascade model which the Leibniz Association also employs.”*

The MfN points out that all Science Programmes are currently led by women. As of 31.12.2018, the proportion of women in “Research and scientific services” was 44.4 % while the proportion of women leading departments/Science Programmes was 43.8 % (cf. chapter 5).

As of 31.12.2011, 37 % of staff in “Research and scientific services” was female, the proportion of women in leading positions was 19.2 %.

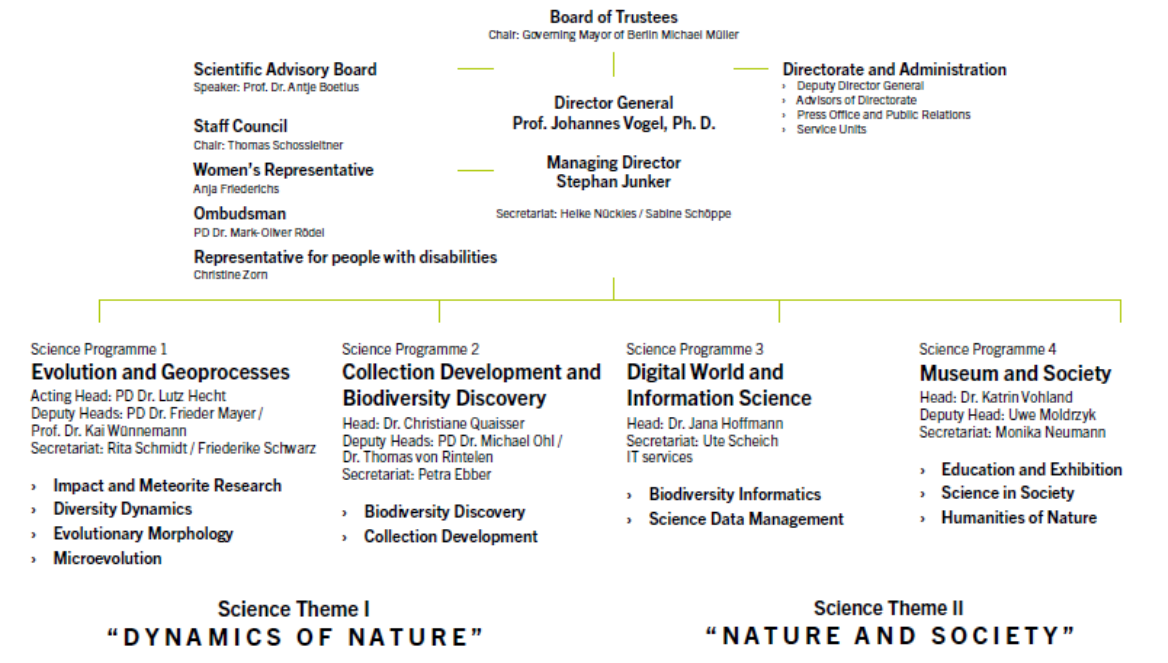
7. *“It is welcomed that the museum has drawn up Guidelines for Writing a Doctoral Thesis and is in the process of developing a structured doctoral programme. These efforts should be given high priority in order to install a structured doctoral programme soon.”*

The MfN has developed Guidelines for Structured Graduate Support, which were formally introduced in January 2017 (cf. chapter 5).

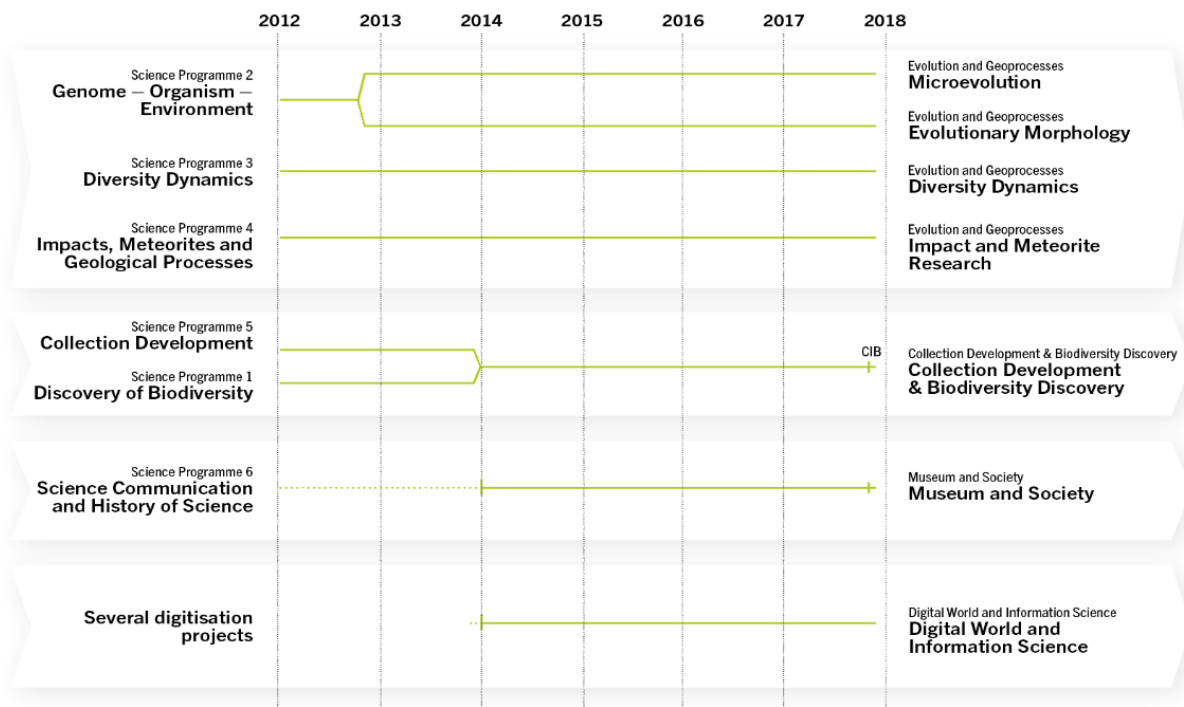
Appendix 1

Organisational Chart

Museum für Naturkunde Berlin –
Leibniz-Institut für Evolutions- und Biodiversitätsforschung



Change in Museum science and programme since 2012



Appendix 2

Publications and patents

	Period		
	2016	2017	2018
Total number of publications	307	261	282
Monographs	1	2	3
Individual contributions to edited volumes	32	8	26
Articles in peer-reviewed journals	220	218	214
Articles in other journals	36	25	11
Working and discussion papers	1	–	–
Editorship of edited volumes	4	1	6
Expert review	–	1	15
Popular science publication	12	6	7

Industrial property rights ¹⁾	2016	2017	2018
Patents (granted / applied)	–	–	–
Other industrial property rights (granted / applied)	–	–	1
Exploitation rights / licences (number)	–	2	–

¹ Concerning financial expenditures for revenues from patents, other industrial property rights and licences see Appendix 3.

Appendix 3 Revenue and Expenditure

Revenue		2016			2017			2018 ¹⁾		
		k€	% ²⁾	% ³⁾	k€	% ²⁾	% ³⁾	k€	% ²⁾	% ³⁾
Total revenue (sum of I., II. and III.; excluding DFG fees)		31.057,3			34.141,4			33.448,1		
I.	Revenue (sum of I.1.; I.2., and I.3.)	25.259,7	100 %		25.440,6	100 %		25.888,4	100 %	
1.	<u>Institutional Funding (excluding construction projects and acquisition of property)</u>	16.952,0	67 %		17.211,0	68 %		17.634,0	68 %	
1.1	Institutional funding (excluding construction projects and acquisition of property) by Federal and <i>Länder</i> governments according to AV-WGL	12.728,0			12.946,0			13.894,0		
1.2	Institutional funding (excluding construction projects and acquisition of property) not received in accordance with AV-WGL	4.224,0			4.265,0			3.740,0		
2.	<u>Revenue from project grants</u>	4.682,0	19 %	100 %	5.537,0	22 %	100 %	5.387,0	21 %	100 %
2.1	DFG	1.969,0		42 %	1.948,0		35 %	1.678,0		31 %
2.2	Leibniz Association (competitive procedure)	151,0		3 %	57,0		1 %	91,0		2 %
2.3	Federal, <i>Länder</i> governments	1.595,0		34 %	2.170,0		39 %	2.725,0		51 %
2.4	EU	375,0		8 %	391,0		7 %	262,0		5 %
2.5	Industry	171,0		4 %	181,0		3 %	76,0		1 %
2.6	Foundations	368,0		8 %	526,0		9 %	393,0		7 %
2.7	other sponsors	53,0		1 %	264,0		5 %	162,0		3 %
3.	<u>Revenue from services</u>	3.625,7	14 %		2.692,6	11 %		2.867,4	11 %	
3.1	Revenue from commissioned work	17,7			18,2			46,0		
3.2	Revenue from publications	5,6			6,5			27,1		
3.3	Revenue from exploitation of intellectual property for which the institution holds industrial property rights (patents, utility models, etc.)	68,4			–			70,2		
3.4	Revenue from exploitation of intellectual property without industrial property rights	–			–			–		
3.5	museum tickets	3.534,0			2.667,9			2.724,1		
II.	Miscellaneous revenue (e. g. membership fees, donations, rental income, funds drawn from reserves)	1.030,6			1.792,8			2.642,7		
III.	Revenue for construction projects (institutional funding by Federal and <i>Länder</i> governments, EU structural funds, etc.)	4.767,0			6.908,0			4.917,0		

Expenditures		k€	k€	k€
Expenditures (excluding DFG fees)		27.092,8	30.335,9	30.985,5
1.	Personnel	13.792,5	14.206,4	15.216,6
2.	Material expenses	8.122,5	8.718,2	10.873,6
2.1	<i>Proportion of these expenditures used for registering industrial property rights (patents, utility models, etc.)</i>	20,1	20,2	20,7
3.	Equipment investments	818,4	520,0	338,2
4.	Construction projects, acquisition of property	4.359,4	6.891,3	4.557,1
DFG fees (if paid for the institution - 2.5 % of revenue from institutional funding)		308,4	312,5	227,5

¹ Preliminary data: yes.

² Figures I.1, I.2 and I.3 add up to 100 %. The information requested here is thus the percentage of “institutional funding (excluding construction projects and acquisition of property)” in relation to “Revenue from project grants” and “Revenues from Services”.

³ Figures I.2.1 to I.2.7 add up to 100 %. The information requested here is thus the percentage of the various resources of “Revenue from project grants”.

Appendix 4

Staff

(Basic financing and third-party funding / proportion of women (as of: 31 December 2018))

	Full-time equivalents		Employees		Female employees		foreigners
	Total	on third-party funding	Total	on temporary contracts	Total	on temporary contracts	Total
	Number	Percent	Number	Percent	Number	Percent	Number
Research and scientific services	106,3	45,5	124	54,8	55	69,1	25
1 st level (scientific director)	1,0	0,0	1	0,0	0	0,0	0
2 nd level (heads of Science Programmes)	4,0	0,0	4	0,0	4	0,0	0
3 rd level (heads of departments)	11,5	8,3	12	8,3	3	33,3	1
Senior Scientists (E13Ü/E14/E15/A13/A14/A15/professors in non-executive positions)	28,8	0,0	29	0,0	4	0,0	2
Scientists in non-executive positions (A13, E13, or equivalent)	49,9	72,9	59	81,4	31	77,4	16
Doctoral candidates (E13, E13/2 or equi.)	11,1	100,0	19	100,0	13	100,0	6
Service positions	63,5	1,4	67				
Laboratory (E9 to E12, upper-mid-level service)	20,9	4,2	24				
Laboratory (E5 to E8, mid-level service)	21,0	0,0	21				
Animal care (E5 to E8, mid-level service)	2,0	0,0	2				
Workshops (E5 to E8, mid-level service)	6,0	0,0	6				
Library (E9 to E12, upper-mid-level service)	0,8	0,0	1				
Library (E5 to E8, mid-level service)	1,0	0,0	1				
Information technology - IT (E9 to E12, upper-mid-level service)	6,8	0,0	7				
Technical (large equipment, service) (E5 to E8, mid-level service)	5,0	0,0	5				
Administration	71,6	11,5	81				
Head of administration	1,0	0,0	1				
Staff positions (from E13, senior service)	3,0	0,0	3				
Staff positions (E9 to E12, upper-mid-level service)	31,1	23,5	36				
Staff positions (E5-E8, infrastructure)	9,2	0,0	11				
Internal administration (financial administration, personnel, etc.) (from E13, senior service)	1,0	0,0	1				
Internal administration (service units, directorate) (E9 to E12, upper-mid-level service)	14,5	6,3	16				
Internal administration (service units, directorate) (E5 to E8, mid-level service)	5,8	0,0	7				
Cashiers & service (E1 to E4)	6,0	0,0	6				
Student assistants	15,3	56,4	55		39		5
Trainees	2,0	0,0	2				
Scholarship recipients at the institution			29		17		19
Doctoral candidates			13		9		5
Post-doctoral researchers			16		8		14

Annex B: Evaluation Report

Museum für Naturkunde - Leibniz Institute for Research on Evolution and Biodiversity at Humboldt-Universität zu Berlin (MfN)

Contents

1. Summary and main recommendations	B-2
2. Overall concept, activities and results	B-4
3. Changes and planning	B-6
4. Controlling and quality management	B-9
5. Human Resources	B-11
6. Cooperation and environment.....	B-13
7. Subdivisions of MfN	B-14
8. Handling of recommendations of the last external evaluation.....	B-20

Appendix:

Members of Review Board

1. Summary and main recommendations

The Museum für Naturkunde – Leibniz Institute for Research on Evolution and Biodiversity at Humboldt-Universität zu Berlin (MfN) is one of the eight research museums in the Leibniz Association.

MfN was admitted to joint funding by the Federal and *Länder* Governments in 2009. In 2011, a new Director General and a new Managing Director both assumed their positions at the museum. In the context of the 2012 evaluation, they sketched out plans for developing MfN into an integrated research museum, pursuing research infrastructure development, innovative basic research and knowledge transfer in line with the principles contained in the “White Paper on the Research Museums in the Leibniz Association”. The museum stated its mission and the structural goals derived from it in its “Strategy 2020”. It then embarked on the organisational development and transformation phase with a strong sense of purpose. MfN has developed exceptionally dynamically.

These developments were based on setting an important strategic, staffing and structural course which was wisely implemented by the leadership of the museum by gaining the full participation and engagement of the staff at MfN. Overall, these processes were tackled very convincingly and created the foundations for MfN to develop from a traditional natural history museum into an integrated research museum covering the three dimensions listed in the White Paper (see above). In general, MfN made clear progress in terms of strategy and content as well as enhancing performance. Also, MfN is successful in promoting junior researchers and equal opportunities for men and women. With its many activities and initiatives in recent years, it has become a globally visible role model for its kind of institution.

The exploration, care and development of the 30 million objects in the collection is conducted at a high level of expertise. The museum thus provides a unique research infrastructure which is now in-line with the top institutions worldwide. Research activities draw largely on the collections and the results are published very effectively. Also, third-party funding is developing very positively. The museum’s knowledge transfer and communication activities involving various stakeholder groups are outstanding. In particular, MfN has managed to increase the number of visitors from an average of 475,000 (2009-2011) to an average of 730,000 (2016-2018) per year. The museum’s seven research units (Science Programmes and departments) are rated as “very good to excellent” and “very good” in three cases each, and “good” in one.

In the coming years, the museum wants to open up even further and become more connected worldwide. It has already laid excellent foundations for doing so, not least thanks to special funding from the Federation and the *Land* Berlin: As a result, MfN will have EUR 660 m at its disposal during the next ten years to upgrade buildings, extend digitisation of museum stocks and develop a science campus together with Humboldt-Universität zu Berlin. Moreover, as part of its strategic work planning, MfN wants to create a “Knowledge Lab for Nature” in order to further reinforce public engagement with science. In principle, plans for this measure are endorsed (see Recommendation 3 in the following).

Special consideration should be given to the following main recommendations in the evaluation report (highlighted in **bold face** in the text):

Changes and planning (chapter 3)

1. It is positive that, for some time now, MfN has increasingly drawn on state-of-the-art methods of biodiversity discovery. The museum should resolutely continue to pursue this path. It should both expand its expertise in evolutionary and computational genomics and increase staffing levels in bioinformatics. Irrespective of this, there will always be a clear need for 'classical' taxonomic and collection management expertise at MfN in the future. This specialist knowledge must therefore be retained and expanded.
2. In recent years, the museum has increasingly dedicated itself to reflecting the effectiveness of its own transfer activities which also entails re-envisioning 'transfer' as an area for research. In this context, questions relating to societal benefits and the impact of activities and initiatives play an important role. The MfN pays attention to Open Science principles and has started to implement them. Open outputs of the MfN research activities will increase the societal impact yet further. The initial work is very promising. As planned, MfN should expand these activities significantly and extend them by developing appropriate indicators for recording and measuring the museum's impact. In doing so, the specific characteristics of the Science Programmes should also be taken into account. The museum is extremely well positioned to drive these activities among museums generally and internationally, too.
3. As part of its strategic work planning, MfN would like to create a "Knowledge Lab for Nature" by building an overarching infrastructure and establishing three new professorships in Public Science, History of Science & Museum Studies, and Digital Knowledge Management. To finance these measures, MfN envisages permanently utilising its own means as well as additional funding from the Federation and the Länder of approx. EUR 4.4 m (small strategic item of expenditure; see Status Report, p. A-6–8).

The plans are convincing with regards to content and correspond very well with current activities as well as the museum's strategic thinking. They promise high additional value in areas that are important and seminal to MfN. The additional staffing requirements totalling approx. 50 positions, however, were not justified convincingly, both relating to numbers as well as tasks. Also, the numbers presented during the evaluation visit were even higher than in the evaluation documents. MfN should now provide comprehensive justification for all staffing requirements. If the Scientific Advisory Board assesses this positively, a small strategic item of expenditure could be envisaged.

Controlling and quality management (chapter 4)

4. It is positive that MfN has already made provisions for further investments in infrastructure and developed relevant plans. It is recommended that a systematic approach is used in describing the current and future infrastructure, for which initiatives of other museums, archives and libraries may provide role-models. Furthermore, interoperability issues should receive greater attention. In the course of further development, MfN should, moreover, consider outsourcing parts of its IT and science data management

infrastructures to external partners or operating them jointly. In the framework of collaborations, MfN already opens its infrastructures to its partners; this aspect should be promoted and intensified.

Human resources (chapter 5)

5. It is positive that MfN is utilising the joint appointment tool to a considerably greater extent than in the past. In the future, however, MfN must make sure to also attract individuals from outside the museum.

2. Overall concept, activities and results

The Museum für Naturkunde – Leibniz Institute for Research on Evolution and Biodiversity at Humboldt-Universität zu Berlin (MfN) is one of the eight research museums in the Leibniz Association. According to its statutes, the museum acts as a natural history research institution as well as a collection, documentation and service centre for natural history and the history of science. It engages in public education in the fields of evolution, the development of the Earth and its biodiversity, and advises on issues relating to the study and protection of biodiversity, ecosystems and their fossil heritage. Another of MfN's duties is to act as a social and cultural forum for academic dialogue (Statutes, §2).

As an integrated research museum, MfN conducts its statutory business in accordance with the structural principles contained in the "White Paper on Research Museums in the Leibniz Association" (2012). In the four Science Programmes, the museum carries out differently weighted research infrastructure, research and knowledge transfer activities which it pursues very convincingly.

Research infrastructure/collections

The foundations for MfN's activities are the approximately 30 million objects in the collection. In exploring, maintaining and developing the collection, the museum performs core tasks of the highest relevance. It provides a unique research infrastructure which easily takes its place alongside the most important natural history collections in the world. Work is conducted with great dedication and at a high level of expertise. The museum stocks are well utilised both by external visitors on the spot and through loans for exhibitions and research projects, for example. They are also used in the context of third-party funded projects and constitute the basis for, amongst others, a raft of taxonomic activities and the description of numerous new species every year. The work related to this on recording and observing biodiversity is very good and also contributes significantly to capacity building in biodiversity-rich regions studied, for example in Southeast Asia.

It is welcomed that in recent years the collections have been made increasingly accessible for scientists and interested citizens alike through modern technologies whilst the digital data have been made available in repositories and databases. In this context, MfN has made remarkable progress, but with about 10 percent of objects digitised, has only just begun. Apart from its own databases that are maintained inhouse, it also participates in numerous, relevant networks which allow it to gain international visibility as well as recognition for its collections (see Chapter 6).

Research

Overall, museum staff produce very good research results in the broad variety of disciplines represented at MfN (see Chapter 7). The activities, which largely draw on museum stocks, are topical and appropriate. Apart from this, they comprise research and development to improve the accessibility of the collections, both in terms of content and technology, as well as work relating to knowledge transfer and visitor participation. In the relevant specialist communities, MfN is thus very visible and actively contributes to the respective discussions and discourse.

The publication record is rated as very good. In recent years, it has been enhanced with a large proportion being published in peer-reviewed journals. Museum scientists have also managed to publish articles in outstanding journals like *Nature* and *PNAS* as well as in other journals belonging to the *Nature* and *Science* group. It is welcomed that the museum's publication strategy not only seeks to publish results at the highest possible level – providing collection-based scientific results of especial novelty and high impact to the international community – but also includes taxonomic monographs as well as other knowledge transfer formats to communicate the knowledge generated by the museum, including non-scientific contexts. MfN's strategy also involves communicating the results of the more social science-oriented areas. This is welcomed and should be strengthened even further. Also, in the future, cooperation between the Science Programmes and Departments, which is already clearly visible, should be reflected in even more joint publications that further bridge traditional 'gaps' between working groups devoted to different groups of organisms or methodical approaches.

Transfer

Knowledge transfer and communication activities involving various stakeholder groups are outstanding. In this area, MfN has developed into an extremely active driving force in the ranks of the major natural history museums worldwide and takes a leading role within Germany.

In the last few years, the museum has managed to launch innovative programmes for visitors and participants alike that are both highly visible and relevant. Its success is impressive. Visitor numbers have almost doubled and, at an average of 730,000 visitors per year (2016-2018), are at a very high level. This also has been due to MfN's many activities in the field of educational work, including specific programmes for families, school classes and migrants. Offers have been greatly expanded in recent years so that the number of participants has increased significantly. This reflects just how attractive the diverse, targeted portfolio has become. In particular, the museum has achieved an increase in groups of people who are often difficult to reach, such as adolescent and young adult visitors. It should utilise its experience in this field to specifically address socially and financially disadvantaged groups of people. Part of its success is due to excellently-curated exhibitions such as *Tristan – Berlin bares Teeth* and the *ARA* exhibition in which the museum invited visitors to address issues relating to sustainable environmental protection and the loss of species diversity.

MfN is very dedicated in the field of Citizen Science with this drawing on lay expertise and communicating the work of the museum to the broader public. Activities like the project to collect, analyse and store micrometeorites that started in mid-2019 are highly innovative (see also Chapter 7, Science Programme “Museum & Society”). These activities are supported well by the museum’s public relations staff.

MfN is very actively involved in political consultancy and visibly contributes its expertise to the relevant committees. In addition to dedicated scientific meetings, it organises a host of events, including the first Global Summit of Research Museums in 2018, and has increasingly established itself as a platform for dialogue within the museum community over the last few years.

3. Changes and planning

Development since the previous evaluation

MfN was admitted to joint funding by the Federal and *Länder* Governments in 2009. In 2011, a new Director General and a new Managing Director both assumed their positions at the museum. In the context of the 2012 evaluation, they sketched out plans for developing MfN into an integrated research museum, pursuing research infrastructure development, research and knowledge transfer in line with the principles contained in the “White Paper on the Research Museums in the Leibniz Association”. The museum then embarked on the resulting organisational development and transformation phase with a strong sense of purpose. The process of change that has taken place since then is remarkable. MfN has developed exceptionally dynamically in the last few years.

These developments were based on setting an important strategic, staffing and structural course which was wisely implemented by the leadership of the museum by gaining the participation and engagement of the staff at MfN. In the context of its “Strategy 2020”, which was passed in 2013, the museum recorded its mission and the structural goals derived from it for its development as an integrated research museum. Subsequently, MfN’s statutes were adapted and the fundamental guidelines governing the museum’s activities were developed further.

The matrix that existed in 2012 comprising three Departments and six cross-cutting Science Programmes was dissolved in dialogue with the museum staff and the units gradually focussed in what are now four convincing, question-driven Science Programmes. In addition to making three formerly independent Science Programmes into research departments and amalgamating them into a new Science Programme, “Evolution and Geoprocesses”, in 2014, two formerly separate, strongly collection-focused Science Programmes were integrated into one new Science Programme, “Collection Development & Biodiversity Discovery”. Thanks to additional funding provided by the Federal and *Länder* Governments in 2018, it was possible to expand biodiversity discovery by creating a centre of the same name. Furthermore, Science Communication was developed further into the Science Programme “Museum and Society”. Various digitisation activities were pooled and extended in a fourth Science Programme, “Digital World and Information Science”.

MfN's responsibilities in collection, research and transfer have been dovetailed on the strength of additional Federal and *Länder* funding that was made available under the Action Plan I for Leibniz Research Museums (2017-2019). A revision of the role and duties of curators at the intersection of collection management and collection research, as had been recommended in 2012, optimally supported this. These developments were accompanied by personnel restructuring and the appointment of new leadership personnel involving both joint procedures with the universities and fixed-term appointments to head the newly established Science Programmes. Moreover, the museum's infrastructures have been reorganised and structurally assigned to the four Science Programmes. It was especially innovative to bundle service functions (e. g. collections management, IT maintenance and development, exhibitions) into research units of equal status with the biodiversity research-based units. This structure promotes innovations, e. g. in collections digitisation, app development, outreach and impact, and also dissolves the traditional hierarchy of scientific groups versus service groups sometime perceived of lower status. Inspired by Alexander von Humboldt, the brand "for nature" was introduced in 2016/17 as part of a branding and marketing process.

All in all, the underlying processes were conducted very convincingly and formed the basis for MfN to develop from a traditional natural history museum into an integrated research museum with its trio of responsibilities. Overall, MfN made clear progress in terms of strategy and content as well as enhancing performance (see above). With its many activities and initiatives in recent years, it has become a leading institution and a globally visible role model.

Strategic work planning for the coming years

In the coming years, the museum wants to open up even further and increase connections worldwide. It has already laid very convincing foundations for doing so. In particular, MfN envisages expanding the two Science Programmes "Digital World and Information Science" and "Museum and Society" which were established in recent years and have since developed very well since then, also due to the successful acquisition of third-party funds (see below). The individual strands of development must now be reflected and further substantiated in the museum's new mid-term strategy which is already foreseen as a follow-up to the "Strategy 2020". In order to continue developing the characteristic elements of a research museum in a consistent way, MfN should keep a careful eye on the balance between the individual Science Programmes.

It is positive that, for some time now, MfN has increasingly drawn on state-of-the-art methods of biodiversity discovery. The museum should resolutely continue to pursue this path. It should both expand its expertise in evolutionary and computational genomics and increase staffing levels in bioinformatics. Irrespective of this, there will always be a clear need for 'classical' taxonomic and collection management expertise at MfN in the future. This specialist knowledge must therefore be retained and expanded.

In recent years, the museum has increasingly dedicated itself to reflecting the effectiveness of its own transfer activities which also entails re-envisioning 'transfer' as

an area for research. In this context, questions relating to societal benefits and the impact of activities and initiatives play an important role. The MfN pays attention to Open Science principles and has started to implement them. Open outputs of the MfN research activities will increase the societal impact yet further. The initial work is very promising. As planned, MfN should expand these activities significantly and extend them by developing appropriate indicators for recording and measuring the museum's impact. In doing so, the specific characteristics of the Science Programmes should also be taken into account. The museum is extremely well positioned to drive these activities among museums generally and internationally, too (see also the extraordinary item of expenditure and Chapter 7, Science Programme "Museum & Society").

One of the key elements of development in the coming years is the *Zukunftspan* – a master plan that includes comprehensive upgrading and refurbishment of MfN's buildings and facilities, some parts of which are still in need of renovation, as well as the redesign of the site to become a globally visible science campus together with Humboldt-Universität zu Berlin. It also includes accelerating the digital accessibility and delivery of the museum's collections. Following resolutions by the German Bundestag's Committee on Budgets and the Berlin Senate in autumn 2018 and autumn 2019 respectively, MfN will receive funding amounting to EUR 660 m in the coming ten years for this purpose. Such exceptional financial efforts on the part of the funders are greatly welcomed. They open up outstanding prospects for MfN's future development. The funders should take early account of the resulting need to maintain the redesigned buildings.

Planning for additional funds deriving from institutional funding

As part of its strategic work planning, MfN would like to create a "Knowledge Lab for Nature" by building an overarching infrastructure and establishing three new professorships in Public Science, History of Science & Museum Studies, and Digital Knowledge Management. The aim is to enhance understanding of knowledge transfer in the digital age. The two Science Programmes "Digital World and Information Science" and "Museum and Society" whose activities, in the past, essentially had to rely on third-party funding, provide a strong foundation for this initiative. Also, by establishing this knowledge laboratory MfN aims to further integrate the infrastructures created in the *Zukunftspan* into the work of the museum. **To finance these measures, MfN envisages permanently utilising its own means as well as additional funding from the Federation and the *Länder* of approx. EUR 4.4 m (as a small strategic item of expenditure; see Status Report, p. A-6–8).** The plans are convincing with regards to content and correspond very well with current activities as well as the museum's strategic thinking. They promise high additional value in areas that are important and seminal to MfN. The additional staffing requirements totalling approx. 50 positions, however, were not justified convincingly, both relating to numbers as well as tasks. Also, the numbers presented during the evaluation visit were even higher than in the evaluation documents. MfN should now provide comprehensive justification for all staffing requirements. If the Scientific Advisory Board assesses this positively, a small strategic item of expenditure could be envisaged.

4. Controlling and quality management

Facilities, equipment and funding

The provision of institutional funding is sufficient to allow MfN to fulfil its current portfolio of activities. It also receives funding from the Land Berlin for museum purposes. In the context of an extraordinary item of expenditure, the Federal and *Land* Governments provided additional funds in 2018 to establish the “Centre for Integrative Biodiversity Discovery” which will lead to a permanent increase in institutional funding amounting to approx. EUR 2.1 m from 2021. In the period 2017-2019, the Federation and the *Land* Berlin have provided further additional funding of EUR 2 m in the framework of special financing under the Action Plan for Leibniz Research Museums.

Third-party income has developed very positively since the last evaluation, increasing from approx. EUR 4.2 m in 2011 to almost EUR 8.3 m in 2018¹. The proportion of MfN’s overall budget covered by third-party funding increased from 21 percent to 32 percent in the same period; when related exclusively to the funding provided in the framework of AV-WGL institutional funding from 29 percent to a remarkable 37 percent. Successful acquisitions from the Federal and *Länder* Governments as well as the DFG particularly contributed to this pleasing development. Funding was also raised from the EU and foundations. Thus, MfN has a well-balanced third-party portfolio.

The state of the building complex used by MfN was strongly criticised at the last evaluation. Since then, improvements have been made. It is welcomed that since 2009, the Federation and the *Land* Berlin have provided extensive funding of approx. EUR 60 m for necessary building and restoration work. It is much to the credit of the leadership and MfN staff that the business of exhibitions, transfer and research continued unabated during construction work. It is positive that thanks to the special funding that has been approved by the Federation and the *Land* Berlin it will be possible in the coming years to implement the *Zukunftsplan* and carry out substantial improvements to the structural conditions during a third construction phase (see Chapter 3).

Infrastructures

With its comprehensive collections of some 30 million objects, MfN provides a key infrastructure of global relevance. The corresponding work and activities are excellent (see above and Chapter 7). The collection and digitisation strategies constitute a convincing basis for sustainable development.

It is welcomed that, in recent years, extensive replacements and new procurements have led to improvements in laboratory infrastructure. Moreover, MfN draws on consortia for technical infrastructures and cooperates with partners in industry in order to drive its research and development. There are further needs for replacements in the Science Programme “Evolution and Geoprocesses” which should be met quickly.

In accordance with recommendations, the IT infrastructure, which was criticised as poor at the last evaluation, has been improved, both with regard to software and hardware as well as, e. g., catalogues and applied standards. Furthermore, the additional IT positions

¹ Including project grants, revenue from services and museum tickets (cf. Status report, Appendix 3, p. A-29).

advocated in 2012 have been established and filled. Further improvements came about during the establishment of the Science Programme, “Digital World and Information Science” and the “Centre for Integrative Biodiversity Research”, which were both cause for substantial investments. Important improvements have also been made in recent years to the research data infrastructure. In this context, issues relating to data security and data back-up have also been solved convincingly. Aspects of open access as well as open science and open infrastructure play a very important role and have been convincingly developed and incorporated in the last few years.

It is positive that MfN has already made provisions for further investments in infrastructure and developed relevant plans. It is recommended that a systematic approach is used in describing the current and future infrastructure, for which initiatives of other museums, archives and libraries may provide role-models. Furthermore, interoperability issues should receive greater attention. In the course of further development, MfN should, moreover, consider outsourcing parts of its IT and science data management infrastructures to external partners or operating them jointly. In the framework of collaborations, MfN already opens its infrastructures to its partners; this aspect should be promoted and intensified.

Organisational and operational structure

MfN’s activities are conducted in departments which are combined in four Science Programmes (see Chapter 7). Two Science Programmes respectively are assigned to one of the two Sciences Themes. Work structuring is transparent and the museum’s concomitant administrative, organisational and scientific structure is appropriate. The management and controlling tools MfN employs are convincing.

Quality Management

The measures in place contribute well to MfN’s quality management of research work, infrastructures and knowledge transfer activities. The existing guidelines and directives have been revisited in recent years and updated in line with the objectives stated in the “Strategy 2020”.

MfN has an elected ombudsperson and, since 2016, a deputy to this function as well. Good scientific practice is safeguarded in a directive of the same name which reflects DFG and Leibniz Association standards. The museum uses standardised procedures for handling research data and metadata. Quality management issues are also a constituent part of the collection directives and procedures. Furthermore, in recent years, MfN has extended user surveys and usage research.

Quality management by the Scientific Advisory Board

In the framework of its statutory mission, the Scientific Advisory Board engages constructively in developing MfN and has demonstrated great dedication in supporting the organisational, staffing and structural processes of change that have taken place in recent years.

As a result of a recent change in the statutes, the Board now comprises up to ten members (2012: a maximum of seven) which means the broad spectrum of specialist disciplines at

the museum can now be represented better. MfN should more strongly utilise the opportunities this creates. In the future, membership of the Board should not exceed the maximum period foreseen in the statutes. As requested by the Senate, the audit should be conducted halfway in between external evaluations.

5. Human Resources

Management

The Director General and Managing Director carry out the leadership and control functions with remarkable dedication. They have managed to actively involve staff in driving and elaborating the necessary processes of change. Hierarchies are flat and facilitate fast communication between everyone involved. The management is also very open and supportive in the way it conducts its business. It responds positively to the needs of MfN staff and integrates them in its plans for continuing to develop the museum. During the site visit by the Review Board, MfN staff proved to be highly motivated and satisfied.

It is positive that the *Land* Berlin abolished the binding staffing plan, as it had already indicated at the last evaluation. This allows the museum considerably greater and well-utilised flexibility in staffing matters.

MfN uses the tool of joint appointments to recruit managerial staff and reinforce networking with the two Berlin universities (Humboldt University zu Berlin and Freie Universität Berlin) involved. Since 2012, four further procedures have been conducted, currently resulting in seven joint appointments. Two appointment procedures are ongoing. It is positive that the museum has announced additional strategic appointments for the future. Closer linkages with the universities in the region have also been achieved by appointing individual members of staff to extraordinary professorships. **It is positive that MfN is utilising the joint appointment tool to a considerably greater extent than in the past. In the future, however, MfN must make sure to also attract individuals from outside the museum.**

The head of each of the four Science Programmes is taken on by a researcher for a fixed period, opening up welcome career options. These positions should continue to be used to temporarily entrust scientific staff with managerial responsibilities.

Postdoctoral staff and curators

The general conditions at MfN for promoting junior researchers are good. The tools provided for this purpose are convincing and contribute to career development. The museum also regularly manages to attract researchers with highly competitive, prestigious fellowships.

During the last evaluation it was established that the role of curators between performing collection management and collection-based research needed to be clarified. The current structure introduced in 2018, whereby a scientific head is responsible for the care and development of a sub-collection, conducts independent research and heads a team of people involved in collection management, is convincing (see Chapter 7).

Doctoral candidates

MfN is a highly sought-after location for doctoral candidates. In the period from 2016 to 2018, on average more than 50 doctoral candidates worked at the museum each year. In the same period, 38 doctorates were successfully completed, more than doubling the number registered at the previous evaluation. Also, MfN staff supervised numerous candidates externally. The total number of supervised candidates thus achieved is remarkable. Particularly, MfN managed to attract young female researchers who accounted, on average, for two-thirds of the doctoral candidates. It is positive that MfN envisages additional doctoral positions, amongst others in the framework of the “Centre for Integrative Biodiversity Discovery” and/or possibly the “Knowledge Lab for Nature”. Overall, also from an international point of view MfN has become an outstanding institution for doctoral studies in evolution and biodiversity research.

As recommended, MfN has continued to develop the structured promotion of post-graduates. In order to support them, the position of a coordinator has been established. Thus, since 2017, the museum can boast unified in-house standards that, after a transition phase, are valid for all the doctoral candidates supervised as well as their supervisors. Within this framework, the museum offers specially tailored workshops and courses to develop academic careers. It is positive that part of the requisite funding is also provided by the Directorate.

Non-scientific staff

MfN trains staff in event management and office administration. On the reporting date of 31.12.2018, two trainees were employed at the museum. Plans to increase these efforts in the future are welcomed. The museum also offers unpaid traineeships and work experience opportunities and cooperates with a constantly increasing number of volunteers.

Equal opportunities and work-life balance

The tools for promoting equal opportunities at MfN are well structured. The issues this involves are pursued in a committed and systematic fashion which has led to a growth in the proportion of women employed in research and scientific services since the previous evaluation – not least due to the targeted promotion of young female researchers. MfN has been particularly successful in increasing numbers at the level of heads of department and Science Programmes: out of 16 leadership positions, seven are currently held by female researchers (44%). At the time of the last evaluation, only one woman was employed at this level (2011: 19%). The plans to institute the promotion of women as an integral aspect of management and work culture at the museum to a greater extent are welcomed as the proportion of female researchers on temporary contracts is still higher than the equivalent proportion of male researchers.

MfN holds a certificate issued by the *audit berufundfamilie*; in 2018, re-auditing was conducted. The measures to combine work and family life and the staffing policy derived from them are convincing and are described by MfN staff as helpful and purposeful.

6. Cooperation and environment

MfN is excellently integrated in the Berlin university landscape and cooperates closely with Berlin universities and research institutions.

The museum's major partner is Humboldt-Universität zu Berlin whereby the two institutions enjoy a long common history and are connected by six joint appointments. Since 2012, the Director General has held a professorship in Biodiversity and Public Science at HU. Since the last evaluation, three new professorships have been established and filled for the first time.

Both partners work together closely and highly productively. Apart from broadly-based participation in academic teaching and the training of junior researchers, MfN is also involved in a cluster of excellence to which the museum contributes its expertise in Citizen Science and Public Engagement with Science. It is positive that both partners envisage expanding their collaborations, e.g. through a further joint appointment procedure that is currently ongoing as well as the campus development initiated under the *Zukunftsplan*.

MfN cooperates, moreover, with other Berlin universities, including Freie Universität Berlin, with which the museum concluded a cooperation agreement in 2015 and completed the first joint appointment in 2017. The procedure governing a second joint appointment is approaching completion.

It is welcomed that in its role as a research museum, MfN participates in various DFG-funded structural programmes such as collaborative research centres, research groups and one cluster of excellence, and that it contributes its expertise both in general and in the framework of individual projects. MfN is also involved in interdisciplinary centres, including the Berlin Center for Genomics in Biodiversity Research (BeGenDiv) and the Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB). Long-term collaborations also exist with Charité Universitätsmedizin Berlin, amongst others in the field of CT-based bone analysis and the storage of tissue samples.

MfN is an active partner in various networks, initiatives, alliances and working groups within the Leibniz Association. Of particular relevance are its collaboration and coordination with the seven other research museums in the association. MfN has adopted a leading role in this context. This was also based on the Action Plan for Leibniz Research Museums, which provided a framework and funding for joint strategic actions, e. g. in the fields of digitisation, educational research, historical authenticity, provenance research as well as research on issues of conservation and restoration. Furthermore, there are close connections between the three natural history museums of the Leibniz Association leading to pursuing common goals, e. g. in the context of the establishment of research infrastructures such as DCOLL (see below). The Director General's engagement as the Leibniz Association's representative for Citizen Science is welcomed.

MfN also carries out important work in connection with developing digital research infrastructures. Together with seven partner institutions, including four Leibniz Institutes, it played the leading role in drawing up the concept for the German Natural Sciences Collections as an Integrated Research Infrastructure (DCOLL) as well as in an application for the infrastructure to be listed on the national roadmap. The aim is to continue digitising stocks

and extend the exploration, exploitation and digital availability of natural history collections. The project is extremely important and opens up diverse opportunities to enhance the networking of the institutions involved and their collections even further. At the European level, efforts to link national infrastructures more effectively resulted in DiSSCo (Distributed System of Scientific Collections) being listed on the ESFRI Roadmap in 2018. That is a huge achievement.

All in all, MfN is excellently connected and involved in a large number of initiatives, networks, alliances and consortia. These activities range from cooperation with local education partners and involvement in extensive EU projects (e.g. EU BON and EU SYNTHESIS) through to the initiation and implementation of internationally oriented activities such as the Global Summit of Research Museums. The museum adopted a leading role in parts of these activities. MfN thus generates remarkable visibility for itself and enjoys wide recognition for its engagement.

7. Subdivisions of MfN

Science Programme “Evolution and Geoprocesses”

Department “Impact and Meteorite Research”

[12.7 FTE, thereof 5.6 FTE Research and scientific services, 2.5 FTE Doctoral candidates, and 4.6 FTE Service staff]

The department investigates the collision of cosmic material with planetary surfaces. The aim is to study planetary collision history, especially that of the Earth. In this context, questions about the formation of the solar system, the genesis of the Earth and other planets as well as present-day meteorite impacts are also investigated using analytical, experimental and model-based methods.

The research questions addressed are of exceptionally high scientific interest and have produced remarkable results. The projects, which are strongly collection-based, form a very coherent research programme. Apart from studies of early archaeological impact deposits (e.g. in Africa), the group is very successful in exploring the role of impacts within the so-called “late accretion phase”. This work is optimally complemented by simulation studies for which MfN developed its own, now globally utilised, numerical model. All in all, thanks to its activities and expertise, the department is highly respected and is outstandingly visible in the field, both nationally and internationally. In order to exploit the full potential of work even better within MfN as well, cooperation with other groups at the museum should be reinforced. Good docking points exist, for example, in the thematic context of the evolution and origins of life.

In May 2017, the head of department, who has led the group since 2010, was appointed to a W3 professorship in Impact and Planetary Physics at FU Berlin in the context of a joint appointment procedure. Currently, the partners are conducting a further joint appointment procedure for a professorship in Impact and Meteorite Research (W3). This prospective addition to the group is very promising. According to MfN, the position has already been offered to the person who headed the shortlist.

The department utilises remarkable technical facilities which, however, in some cases are in need of overhaul and will have to be modernised in the coming years. This is essential if the high level of work that has constantly been achieved over many years is to be maintained and raised further. The department has a truly high-quality publication record. Third-party income has reached an impressive level whereby significant funding was acquired, in particular, from the DFG. By organising an Annual Meeting of the Meteoritical Society (2016) and an international workshop for the European Space Agency (2018), the group recently took on important, highly visible activities for the specialist community.

All in all, the Department “Impact and Meteorite Research” is rated as “very good to excellent”.

Department “Diversity Dynamics”

[14.1 FTE, thereof 9.2 FTE Research and scientific services, 3.0 FTE Doctoral candidates, 1.2 FTE Service staff, and 0.7 FTE Student assistants]

The department investigates the drivers, processes as well as the ecological and evolutionary consequences of changes in diversity. In particular, it addresses the significance of biotic and abiotic factors for current and historical geological changes in biodiversity, from species to community level.

The way the projects are addressed is convincing. Account is taken not only of the various spatial and temporal scales, but also of different terrestrial and marine ecosystems. The broadly-based studies range, amongst others, from investigating changes in diversity and disparity during the end-Permian mass extinction, via diversification processes in geological time, and the analysis and comparison of spatial biodiversity dynamics through to examining reductions in body size as a precursor to a decline in biodiversity. In this context, questions pertaining to recent global climate change play an important contemporary role. In its studies, the group utilises a large variety of data types and sources that are of great relevance, for example, to model-based research approaches. However, they only draw on the in-house collections to a lesser extent. In the future, the group should make greater use of this potential for its own research questions.

The department amalgamates broadly-based methodological and technological knowhow, including in particular the use of stable isotopes to date change processes and extensive statistical analyses. There is a culture of close and intensive exchange both in the department and within the Science Programme. This should make it possible to become a stronger presence in the museum’s public outreach than has been the case so far. Work has been very well published in the relevant journals. Third-party income, especially from the DFG, is high.

All in all, the Department “Diversity Dynamics” is rated as “very good”.

Department “Evolutionary Morphology”

[31.6 FTE, thereof 12.4 FTE Research and scientific services, 4.3 FTE Doctoral candidates, 13.1 FTE Service staff, and 1.4 FTE Student assistants]

The largest department of the Science Program focusses on questions regarding the evolution of body plans and organ systems as well as other characteristic complexes in the plant and animal kingdom. Both intrinsic and extrinsic processes are elucidated.

The research questions addressed are relevant and produce highly visible results in the field of evolutionary developmental biology, functional morphology, comparative anatomy and phylogeny. The group employs a broad spectrum of the most diverse methodological approaches and can rely on remarkable technical facilities, including high-resolution imaging equipment (e.g. a 3D scanner, high-resolution microscopy and X-ray tomography). The visualisations this facilitates – in addition to the very well utilised museum collections – form the essential basis of work and allow new insights into evolutionary processes.

Overall, this approach leads to extremely productive interactions between museum stocks and technology which have been reflected in the development of technological standards for computer tomography-based approaches in natural history collections. The data are also intensively used by other groups at MfN.

The department emerged from what was previously Science Programme 2 “Genome – Organism – Environment” in 2013. Results have been very well published, including in highly respected journals. With its third-party income, which includes, in particular, extensive DFG funding, the group is very well positioned.

All in all, the Department “Evolutionary Morphology” is rated as “very good”.

Department “Microevolution”

[9.9 FTE, thereof 6.1 FTE Research and scientific services, 3.2 FTE Service staff, and 0.6 FTE Student assistants]

The department has its focus on the process of speciation as the basis for the evolution of biological diversity. It is the smallest department of the Science Program and was extracted from the former Science Programme 2 “Genome – Organism – Environment” in 2013. Efforts concentrate on investigating evolutionary mechanisms that act within populations and species or amongst flocks of closely related species. In this context, the group particularly focusses on issues relating to behavioural biology and evolutionary ecology.

For its investigations the department makes impressive use of the museum stocks, including MfN’s extensive animal sound archive, to study, for example, the role of acoustic communication in speciation processes (e.g. in Orthoptera and bats). In doing so, the group has successfully adopted an interesting, little researched area which has also led to the recruitment of an ERC Starting Grant Fellow. Moreover, historical samples have been convincingly utilised for DNA-based testing.

The group addresses a broad spectrum of themes ranging from various phylogeographic analyses (e.g. on species interactions) via speciation to molecular genetic/genomic and model-based activities. It is, however, too small to pursue all these topics at the same intensity and depth. Hence, it is strongly recommended to either focus its activities or draw on the potential that lies in the recommended reinforcement of bioinformatics/evolutionary genomics (see Chapter 3).

The publication record is good. Third-party income reaches a very good level. The group is well connected and maintains diverse linkages within the Berlin area, especially to the Berlin Center for Genomics in Biodiversity Research (BeGenDiv), in which it participates in modern laboratory facilities.

All in all, the Department “Microevolution” is rated as “good”.

Science Programme “Collection Development & Biodiversity Discovery”

[50.7 FTE, thereof 19.0 FTE Research and scientific services, 0.5 FTE Doctoral candidates, 29.0 FTE Service staff, and 2.2 FTE Student assistants]

The Science Programme addresses the ongoing transformation of MfN’s collections into a global, open and integrated research infrastructure as well as the development and application of efficient methods for discovering and describing global biodiversity based on museum collections. It thus carries out service and infrastructure tasks, in particular. The Science Programme was newly established in 2014 by amalgamating the former independent Science Programmes “Collection Development” and “Discovery of Biodiversity”. It has since developed very well.

One of the programme’s main responsibilities is to maintain, make available and continue developing MfN’s extensive and, in many cases, unique collections. The duties this entails are conducted in a highly dedicated fashion. This has partly been achieved by more precisely defining the role and responsibilities of curators who are active in collection management and collection-based research (see Chapter 5). In order to continue this work successfully, independent taxonomic expertise must be retained at MfN and continue generating relevant publications, which are expected to have long-term value rather than high short-term impact. Activities have been optimally complemented by collection-related historical research work on selected objects.

Furthermore, the programme pools the museum’s activities in the field of digitising stocks. The work this involves is conducted very convincingly and has generated notable results in recent years, amongst others in the digitisation of type specimens and 3D digitisation. The procedures and approaches that have been developed in accordance with international standards are innovative, very well structured and open to the global specialist community. A particular feature of the programme is that it not only delivers data but also feeds its technological knowledge into the international scientific discourse via appropriate publications. In this field, the programme plays an extremely active and leading role in developing the infrastructures required in this area of science.

The programme is very well connected at national and especially international levels. Amongst others, it spearheaded the conception and application for DCOLL as well as being involved in the establishment of the European equivalent DiSSCo (see Chapter 6). Moreover, it has participated and still does in numerous, large-scale projects on biodiversity discovery, in some cases in a leading role.

In 2018, the foundations were laid for the “Centre for Integrative Biodiversity Discovery” for which the Federal and *Länder* Governments have provided additional institutional

funding. The aim is to develop concepts and methods to improve the recording and research of biodiversity. This should also lead to further exploration of MfN's huge collections. Having recruited individual members of staff, the position of head is currently being filled as a joint appointment with HU Berlin; it is envisaged that the newly appointed individual will assume the position at the museum in the coming year. The relevant processes should be completed as quickly as possible so that the centre can embark on its promising activities. With regard to the museum's *Zukunftsplan*, the programme's potential for innovative work and further performance enhancement is also very great.

The programme's publication record is very good. Publications are targeted and embrace both papers in refereed journals as well as handouts, for example on handling contaminated collection objects, and expert reviews evaluating species included in the IUCN Red List. Third-party income is remarkably high. The programme has been very successful, particularly in acquiring funding from the Federation and the *Länder*. Funding has also been acquired from the DFG, EU and industry.

All in all, the Science Programme "Collection Development & Biodiversity Research" is rated as "very good to excellent".

Science Programme "Digital World and Information Science"

[35.1 FTE, thereof 11.7 FTE Research and scientific services, 0.8 FTE Doctoral candidates, 17.9 FTE Service staff, and 4.8 FTE Student assistants]

The Science Programme pools MfN's activities in biodiversity informatics and science data management. It is also responsible for maintaining the museum's IT. It thus largely carries out service and infrastructure tasks. The programme was created in 2014 by bundling various activities that were previously distributed amongst other programmes. In doing so, recommendations from the last evaluation were implemented, amongst others, concerning staffing and technical improvements in IT services as well as the digital cataloguing of the collections.

Overall, the programme fulfils its remit very well and provides indispensable services for MfN. Activities range from implementing MfN-wide science data management, developing software components, digital (online) tools and workflows through to introducing standardised procedures for publishing data or data exchange. In the context of the strong drive towards open access in recent years, the programme draws on the common international standards (FAIR principles). The animal sound archive, for example, has been completely digitised and thus opened up to both researchers and the public (e.g. via the *Naturblick* app developed by the museum). The programme's service and infrastructure activities are complemented by independent methodological and experimental research work. The algorithms which have been developed to recognise visual and acoustic patterns, for instance, have won awards in past years.

The programme cooperates closely with other MfN groups. Currently, it still responds to the needs of these groups. The potential exists to drive developments at MfN more independently. The Science Programme is very well connected and involved in national and international collaborations as well as a raft of consortia. It is welcomed that the workflows and tools developed in-house are made available to external partners. This approach

should continue to be expanded in the future. The programme is also recommended to systematically develop existing infrastructures and to look towards paying greater attention to interoperability than it has so far. In this context, MfN should consider the possibility of outsourcing the hardware required for its infrastructure offers or operating it in the framework of consortia.

By establishing the application laboratory, Mediasphere for Nature, the programme introduced a new format for developing knowledge-based innovations in cooperation with SMEs as well as the media and creative industries. The relevant activities in the field of Open Science/Museum & Society are very well complemented by questions dealing with the production, provision, sharing and use of (digital) knowledge, and the groups of people involved in these processes. These approaches and the methodological knowledge thus acquired are ground-breaking and should be reinforced and pursued, especially in the framework of collaborations.

It is welcomed that the Science Programme makes its technological and infrastructure results available to the public by means of publications. The programme is encouraged to continue pursuing this path. Third-party income is consistently high and has been used, for example, to build the multimedia application laboratory (EFRE funding) as well as for continuing to develop the infrastructures provided in the framework of the German Federation for Biological Data (GFBio Phase II and III). If research activities are reinforced, there is potential for further increases.

All in all, the Science Programme “Digital World and Information Science” is rated as “very good”.

Science Programme “Museum & Society”

[44.4 FTE, thereof 22.6 FTE Research and scientific services, 17.2 FTE Service staff, and 4.5 FTE Student assistants]

This programme pools MfN’s activities in the field of exhibitions, visitor and educational programmes, citizen science and public engagement with science and research. It evolved from the former programme “Science Communication und Science History” in 2014 and has developed impressively since then.

The programme’s main remit lies in drafting, promoting and conducting activities in the field of public engagement with science and there is significant potential to turn these activities into areas of research that the programme can further capitalise on in the future. Relations between museums, science and society are important research topics in their own right and the MfN is in a very good position to become a leader in this field. The work is undertaken with great dedication and has led to a wealth of very good, in some cases excellent, results. The staff hold remarkable specialist knowledge and their activities are complemented by strongly interdisciplinary research work. These activities are interesting and cover a broad spectrum of topics ranging from questions about the collections’ colonial heritage and provenance, works in the fields of social sciences, e. g. sociology of science and cultural anthropology, studies on collection, research and networking practices through to stakeholder and visitor surveys as well as contributions to the design of

international biodiversity policy; examples include the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). The initiatives launched by the museum to involve citizens are remarkable; the *Experimentierfeld*, for example, which is intended as an area for exchange and participation in science, is an innovative infrastructure developed by the programme. With its numerous activities the Science Program makes MfN a source of inspiration for the German museum landscape.

Overall, the programme manages to utilise its many activities not only to engage in exchange and discussion processes with museum visitors but also to reflect on its own actions and self-conception as a research museum, and to develop best practice models. This is not just a service to the museum community but can also result in scientific output. The results are convincingly and very visibly communicated to the outside world and opened up to the international museum landscape. As recommended in 2012, there is now a remarkable exchange and intensive cooperation with a host of participants. Plans to further reinforce the area in the future are positive and are welcomed.

It is also positive that for some time the programme has been intensively examining its own performance in the transfer of museum knowledge and is keen to develop methods and indicators to measure this performance. This work should clearly be driven forward, also taking appropriate account of aspects of the impact and transfer of the museum knowledge to society (see Chapter 3). MfN should use the results to formulate an impact strategy for the entire museum. Conform to the guidelines on knowledge transfer passed in 2018, each of the museum's science programmes should have an impact strategy and monitoring performance and progress.

The programme contributes its expertise very effectively to national and European initiatives and networks. Programme employees were, for example, seminaly involved in establishing a European Association for Citizen Science and play here, as in other networks, a formative role. In the future, the programme should make greater use of this role internationally.

The publication record is excellent but it can benefit from an even more targeted and strategic research and publication strategy in the social and interdisciplinary sciences. Third-party income is impressively high. The programme has been particularly successful in raising funding from the Federal and *Länder* Governments (amongst others, several projects in the area of citizen science, knowledge transfer and integrating biodiversity research in science policy processes) as well as from the EU and DFG.

All in all, the Science Programme "Museum & Society" is rated as "very good to excellent".

8. Implementation of recommendations issued at the last external evaluation

MfN has successfully addressed the recommendations issued by the Leibniz Association Senate in 2013 (see Status Report, p. A-25f).

Appendix

1. Review board

Chair (Member of the Leibniz Senate Evaluation Committee)

Konrad Fiedler Department of Botany and Biodiversity Research, Division of Tropical Ecology and Animal Biodiversity, University of Vienna

Deputy Chair (Member of the Leibniz Senate Evaluation Committee)

Volker Rodekamp Museum of the City of Leipzig

Reviewers

Margaret Louise Beckel Canadian Museum of Nature, Ottawa

Olaf R.P. Bininda-Emonds Systematics and evolutionary biology, Carl von Ossietzky University Oldenburg

Michael J. Benton Professor of Vertebrate Palaeontology, School of Earth Sciences, University of Bristol, UK

Roland Brandl AG Allgemeine Ökologie und Tierökologie, Philipps-Universität Marburg

Roger Butlin Department of Animal and Plant Sciences, Sheffield University, UK

Scott V. Edwards Department of Organismic and Evolutionary Biology, Harvard University, Cambridge, USA

Kristina Hormia-Poutanen Library Network Services, National Library of Finland, Helsinki

Peter C. Kjærgaard Natural History Museum of Denmark, Copenhagen

Sara Russell Planetary Materials Group, Natural History Museum London, UK

Esther Turnhout Forest and Nature Conservation Policy Group, Wageningen University, The Netherlands

Representative of the Federal Government

Berit Ullrich Federal Ministry of Education and Research, Bonn

Representative of the Länder Governments (Member of the Leibniz Senate Evaluation Committee)

Marc Brüser Ministry of Science, Further Education and Culture of Rhineland-Palatinate, Mainz

11 February 2020

Annex C: Statement of the Institution on the Evaluation Report

**Museum für Naturkunde -
Leibniz Institute for Research on Evolution and Biodiversity
at Humboldt-Universität zu Berlin (MfN)**

We are humbled to receive such an uplifting, positive and remarkable review from the distinguished international evaluation commission. We thank them for their thorough, discerning and comprehensive evaluation of our Museum, its strategy and development. The evaluation report gives us clarity, asking us to continue to develop as a role model for (research) museums. The international evaluation commission acknowledges and praises the achievements of the Museum für Naturkunde in all areas of work over the last eight years. Their insightful recommendations will guide us in the next phase of development.

The evaluation report recognizes that we have become an integrated research museum, seamlessly intertwining and connecting research, infrastructure and (knowledge) transfer activities, thus creating unique added value. We are committed to keep to this path with the aim of developing into an *Open & Integrated Research Museum*.

We are determined to strengthen and develop national and international networks and partnerships, striving to be even more engaged and, when requested, taking leadership roles. We will continue to work *für Natur* and for much needed change in science and society. We are committed to be an active driver and partner in and for 1) the Leibniz Association, 2) German and European science and 3) our home city Berlin, a thriving international science hub.

We are particularly delighted with the endorsement of our strategic direction, the *Sonderetatbestand* 'Knowledge Lab for Nature' and the '*Zukunftsplan*'. We value the acknowledgement by the evaluation commission of the significant support by the *Bundestag* and the State of Berlin for the future development of the Museum für Naturkunde Berlin. We greatly appreciate that the evaluation report recognizes the need to adapt core funding in line with the advancement of the Museum für Naturkunde under the *Zukunftsplan*.

We want to thank the *Bundestag*, the Federal Government, and the Federation of *Länder* and, in particular, the *Land* Berlin for their trust in the Museum für Naturkunde Berlin and their substantial financial commitment to its future.

Above all, however, we thank everybody who works at and for the Museum für Naturkunde Berlin, Leibniz Institute für Evolutions- und Biodiversitätsforschung. Without their teamwork, commitment, knowledge, expertise, boundless energy and enthusiasm none of these achievements would have been possible.