

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

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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 1. und 2. Oktober 2012 das Museum für Naturkunde – Leibniz-Institut für Evolutions- und Biodiversitätsforschung (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 17. Juli 2013 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 den 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 zu sammeln, zu erschließen, die Forschung an den Sammlungen zu ermöglichen und selbst zu forschen sowie insbesondere über seine Schausammlung und über Ausstellungen Wissen zu transferieren. Das MfN wurde im Jahr 2009 in die Leibniz-Gemeinschaft aufgenommen.

Die im Museum untergebrachten Sammlungen sind von außergewöhnlicher wissenschaftlicher und wissenschaftshistorischer Bedeutung. Sie umfassen ca. 30 Millionen zoologische, paläontologische und mineralogisch-petrographische Objekte aus allen Teilen der Erde. Die Bestände gehen bis auf das 18. Jahrhundert zurück. Eine zentrale Aufgabe des MfN ist es, diese Sammlungen so zu sichern und zu betreuen, dass sie dauerhaft von Wissenschaftlerinnen und Wissenschaftlern aus aller Welt genutzt werden können. Am Museum sind Forschungs-, Sammlungs- und Bildungsaufgaben gut aufeinander bezogen.

Das MfN hat sechs Forschungsbereiche, deren Schwerpunkte auf der Evolutions- und Biodiversitätsforschung liegen. Hinzu kommen Aspekte der Planetologie. Zwei der Forschungsbereiche werden als „sehr gut“, einer als „sehr gut bis exzellent“ und ein weiterer als „exzellent“ bewertet. Diese Forschungsbereiche haben hervorragende Publikationsleistungen vorzuweisen, wobei insbesondere der große Anteil an referierten Veröffentlichungen auch in hochrangigen wissenschaftlichen Zeitschriften hervorzuheben ist. Zwei neue Forschungsbereiche befassen sich übergreifend mit Themen der Sammlungsentwicklung bzw. der Wissenschaftskommunika-

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

tion. Es war richtig und wichtig, diese beiden Bereiche einzurichten. Sie leisten in ihren einzelnen Pilotprojekten bereits sehr gute Arbeit und müssen sich nun insgesamt noch weitergehend profilieren. Da sie sich im Aufbau befinden, können sie noch nicht abschließend bewertet werden.

Die wissenschaftlichen Dienstleistungen, die das MfN auf seinen Sammlungen aufbaut, werden von der internationalen Fachgemeinschaft stark nachgefragt. Die digitale Erschließung der Sammlungen ist grundlegend, um sie verfügbar zu machen und gleichzeitig die Bestände zu schonen. Der Senat begrüßt die Leistungen des Museums auf diesem Gebiet. Es ist notwendig, diese umfassende Aufgabe mit Nachdruck weiter voranzutreiben. Der Wissenstransfer hat am MfN einen hohen Stellenwert. Das Ausstellungskonzept mit dem Fokus auf Originalobjekten ist sehr gut. Das Museum hat hohe Besucherzahlen. Es führt sehr viele Veranstaltungen durch und ist mit seinen Aktivitäten sowie mit Medienbeiträgen in der Öffentlichkeit sehr präsent.

Die institutionellen **Kooperationen** des MfN sind ausgezeichnet. Das Museum arbeitet eng und erfolgreich mit der Humboldt-Universität zu Berlin (HU) und der Freien Universität Berlin (FU) zusammen. Fünf Wissenschaftlerinnen und Wissenschaftler sind gemeinsam mit der HU berufen, elf weitere haben eine Lehrbefugnis an HU oder FU. Das MfN ist an zahlreichen wichtigen internationalen Großprojekten beteiligt. Zudem ist es in den einschlägigen sammlungs- und museumsbezogenen Konsortien und wissenschaftspolitischen Beratungsgremien vertreten.

Die jetzige **Leitung** des MfN ist seit Anfang 2012 (Generaldirektor) bzw. Ende 2011 (Geschäftsführer) im Amt. Sie hat in kurzer Zeit hervorragende Arbeit geleistet und der Entwicklung des Museums bereits deutliche Impulse gegeben. Zur inhaltlichen Weiterentwicklung des MfN gibt es vielfältige Pläne und Ideen. Diese müssen nun in ein umsetzungsfähiges Konzept mit klaren Priorisierungen überführt werden. Wissenschaftlicher Beirat und Aufsichtsgremium begleiten das MfN kritisch und konstruktiv.

Der Erhalt der **Bausubstanz** des MfN und der infrastrukturellen Voraussetzungen für die Unterbringung der Sammlungen wurden über Jahrzehnte hinweg vernachlässigt. Erfreulicherweise wurde nach 1990 damit begonnen, die Situation zu verbessern. Die großen Anstrengungen, die seitdem gemeinsam von Museum und öffentlichen Geldgebern unternommen wurden, haben zu ersten hervorragenden Ergebnissen geführt. Nach wie vor besteht jedoch umfangreicher und dringender Handlungsbedarf.

Dem MfN sollte eine angemessene apparative und personelle **Ausstattung** zur Verfügung stehen. Wie im Bewertungsbericht dargelegt, gibt es einen dringenden zusätzlichen Bedarf in Laboren und an IT-Services. Die Zuwendungsgeber sollten die dafür notwendigen Mittel zusätzlich zur Verfügung stellen. Neben der institutionellen Förderung erzielt das MfN Erträge aus Leistungen und Spenden. Bei DFG, EU und bei Stiftungen wirbt es umfangreiche Drittmittel für Forschungs- und Sammlungsarbeiten ein.

Der Senat begrüßt es, dass die neue Leitung des MfN der **Personalentwicklung** einen hohen Stellenwert beimisst. Insbesondere im Sammlungsbereich ist dies wichtig, um die Forschungsorientierung des Personals zu unterstützen und gleichzeitig eine möglichst gute Sammlungsbetreuung und -entwicklung zu gewährleisten. Die Leitung des MfN hat dies erkannt und bereits wichtige Weichenstellungen vorgenommen. Auch wird sich positiv auswirken, dass das Land Berlin mittlerweile die Verbindlichkeit des Stellenplans unterhalb der Leitungsebene aufgehoben hat.

Das MfN hat erkannt, dass bei der **Gleichstellung der Geschlechter** Nachholbedarf besteht. Zwar ist der Frauenanteil am wissenschaftlichen Personal erfreulich hoch; auch sind am MfN

hervorragend ausgewiesene Wissenschaftlerinnen beschäftigt. Auf wissenschaftlicher Leitungsebene sind Frauen allerdings noch deutlich unterrepräsentiert. Das MfN muss die Gleichstellung der Geschlechter auf Leitungsebene vorantreiben und sich dabei entsprechend der GWK-Vorgaben am Kaskadenmodell der DFG orientieren.

Das Museum ist für den **wissenschaftlichen Nachwuchs** ein sehr attraktiver Arbeitsort. Das wird auch durch eine hohe Zahl an Stipendiatinnen und Stipendiaten deutlich. Sehr viele von ihnen kommen aus dem Ausland. Es wird begrüßt, dass das Museum Leitlinien zur Nachwuchsförderung beschlossen hat. Das Museum sollte seine Pläne für ein strukturiertes Doktorandenprogramm zügig umsetzen.

Das MfN ist ein bedeutender Teil der internationalen naturwissenschaftlichen Forschungsinfrastruktur. Die Sammlungs- und Wissensressourcen werden zur Erforschung von gesellschaftlich und politisch relevanten Fragen, beispielsweise der Biodiversitätsdynamik bzw. Ökosystemstabilität, herangezogen. Das MfN erfüllt die Anforderungen, die an eine Einrichtung von überregionaler Bedeutung und gesamtstaatlichem wissenschaftspolitischem Interesse zu stellen sind. Im Zusammenspiel von Forschungs-, Sammlungs- und Bildungsauftrag erbringt es wichtige und sehr spezifische Leistungen, die in dieser Form von einer Hochschule nicht erbracht werden können. Eine Eingliederung des Museums in eine Hochschule wird daher nicht empfohlen.

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.

Annex A: Status Report

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

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1. Structure and tasks

Development, legal form and funding

The Museum für Naturkunde was established in 1810 as part of the University of Berlin (today: Humboldt-Universität zu Berlin). It was located in the main building of the university at Unter den Linden. The museum building at today's location in Invalidenstraße was opened in 1889 and extended between 1914 and 1917.

From 1989/90 until 2008, the Museum's status was similar to other university faculties or facilities. Its main funding came from the *Land* Berlin. On 1 January 2009, the "Museum für Naturkunde – Leibniz Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin" (Museum für Naturkunde – Leibniz Institute for Research on Evolution and Biodiversity at Humboldt-Universität zu Berlin) became an independent foundation under public law ("Stiftung öffentlichen Rechts") and a member of the Leibniz Association. Since then, the Museum has been jointly funded by the Federation and the *Länder* according to AV-WGL¹.

- *Responsible department at Länder level:* Berlin Senate Department for Economics, Technology and Research (Senatsverwaltung für Wirtschaft, Technologie und Forschung, Berlin)
- *Responsible department at federal level:* Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF)

Structure and organisation

In 2009, the Museum's corporate structure and legal framework were re-aligned to match its new status as an independent foundation ("Gesetz über die Stiftung Museum für Naturkunde Berlin, Satzung der Stiftung"). The by-laws assign the following specific duties to the Museum:

- to be primarily a research facility in natural history, history of science, and research on public engagement, in addition to being a centre for teaching and learning
- to be a centre focused on collections, documentation and services in natural history and history of science
- to engage in public education in evolution, the development of the earth and its biodiversity, in particular by maintaining and continuing to develop permanent exhibitions, as well as by staging temporary exhibitions, touring exhibitions, and museum education activities
- to provide advice on research matters relating to biodiversity and its protection, ecosystems, and their fossil heritage, as well as on the current consequences of geological processes and environmental changes
- to offer a social and cultural forum for activities linked to the natural sciences

The Museum is divided into three departments and a directorate (including the administration; see appendix 1). The **Director General** and the **Managing Director** are appointed by the Board of Trustees after being nominated by a selection committee. Both were appointed in 2011 on five-year, renewable contracts. The departments are:

- Department for Collections
- Department for Research Infrastructure
- Department for Exhibitions and Public Education

¹ Implementation Agreement on the Administrative Agreement between the Federal and *Länder* Governments on the Establishment of a Joint Science Conference with regard to the joint funding of member institutions of the Leibniz Association dated 27 October 2008.

The research activities are organised in cross-cutting science programmes (SP). Individual researchers and research groups can be members of several science programmes. The number of SPs is flexible and depends on the academic foci of the Museum at a given time. Each science programme has its own spokesperson. At present, the Museum has the following six science programmes (described in detail in chapter 4):

- Science Programme 1 “Discovery of Biodiversity”
- Science Programme 2 “Genome – Organism – Environment”
- Science Programme 3 “Diversity Dynamics”
- Science Programme 4 “Impact, Meteorites and Geological Processes”
- Science Programme 5 “Collection Development”
- Science Programme 6 “Science Communication and History of Science”

MfN has eight analytical core facilities with central optical laboratories, electron microscopy facilities, DNA laboratory, micro-computed tomography (μ CT), isotope & geochemical laboratories, geoscientific microanalytical facilities, a computer cluster, and an animal care facility. Additionally, MfN has preparation facilities, facilities for graphic design, photography, and a library, all of which serve as core research infrastructure. The Museum’s most important infrastructure is its collection.

The Museum für Naturkunde has two governing boards: the Board of Trustees (“Stiftungsrat”) and the Scientific Advisory Board. The Museum’s supervisory body is the **Board of Trustees**. It consists, among others, of one representative each from the Senate of Berlin and from the Federal Government as the funding institutions, the president of Humboldt-Universität zu Berlin, and up to eight public figures. The Board of Trustees supervises the scientific, programmatic and economic affairs of the Museum. For example, it approves the business plans and annual accounts, appoints the Director General, the Members of the Scientific Advisory Board and the Heads of Department and decides on the establishment of the science programmes. The **Scientific Advisory Board** (SAB) has up to seven members. They should be internationally renowned scientists from Germany and abroad, whose scientific expertise matches the scientific disciplines of the Museum. The SAB’s main task is advising the Director General and the Board of Trustees on scientific and programmatic issues and evaluating the museum’s scientific work and its strategic development. The SAB usually visits the Museum twice annually (for the work of the SAB see chapter 6).

2. General concept and profile

Development of the institution in the last years

From 1989/1990 until 2006, the Museum für Naturkunde had three departments: Mineralogy, Zoology and Palaeontology. The chairs of these university departments rotated as directors of the Museum. Following the recommendations of an international expert group (see chapter 6), a full-time Director General was appointed in 2006 and the three disciplinary departments were abolished. Also, a museum-focused structure with three departments was established: Research, Collections, Exhibitions and Public Education.

This structure was designed as a first step towards facilitating better cooperation within the Museum. The Museum began to focus on (a) collection-based research in evolution, biodiversity and earth science, (b) the development and integration of research infrastructure, (c) the accessibility and development of the collections and (d) close cooperation between the Department of Exhibitions and Public Education and the museum scientists in order to find new ways to create permanent exhibitions.

A structured process aimed at finding an appropriate organisational form for the Museum began in 2009 and is ongoing. The Museum states that the implementation of this research-oriented strategic realignment is flanked by intense debate with the Scientific Advisory Board and with staff at all levels within the Museum.

Meanwhile, an evolved structure of departments and science programmes has been adopted. The Museum defines itself as an “integrated research museum”, characterised by the close interaction and interdependence of its three main activities: collection management and development, collection-based research, and public engagement with science. In its own view, the Museum is a research institute, a research infrastructure, and an interface between science and society. Its mission is: “Discovering and describing life and earth – together with people, through dialogue”.

MfN sees itself as an internationally recognised partner in the fields of biodiversity, evolutionary biology, and planetary science positioned amongst the top ten global natural history museums. The Museum’s collections with more than 30 million natural history specimens and samples constitute a research infrastructure of international significance.

Results

During the reporting period 2009-2011, on average, just over 300 **publications** by MfN scientists appeared annually. Some 120 papers per year were published in ISI listed peer-reviewed journals, including 13 papers in the top research journals (four in *Science*, four in *Nature* and five in *Proceedings of the National Academy of Sciences* – PNAS in 2009-2011). MfN scientists presented more than 700 lectures and poster contributions at **scientific conferences** or at the invitation of other institutes. Forty-one scientific conferences in 2009-2011 had MfN staff in their organising or scientific programme committees. Some of the conferences were hosted in Berlin, some abroad.

MfN publishes three scientific **journals**: *Deutsche Entomologische Zeitschrift* (since 1857), *Zoosystematics and Evolution* (formerly *Mitteilungen aus dem Zoologischen Museum Berlin*), and *Fossil Record*. The three journals contain between 50 and 60 articles each year. All manuscripts submitted undergo review by one internal and two external reviewers. The journals are published in English and are available in print as well as online. They are ISI-listed.

In 2009-2011, MfN prepared nine special **exhibitions** on various topics. Six of these exhibitions travelled to other museums. Additionally, seven external exhibitions were accepted for presentation. The Museum attracts 500,000 visitors per year. By providing specimens and/or advice, MfN participated in the preparation of 43 exhibitions at other museums. MfN staff also advise other museums, especially on their exhibition concept. During the evaluation period, 432 exhibition planners from other museums came to consult MfN. For further results see chapter 3, science programme 6.

During the reporting period, 1,870 researchers from 72 countries visited the **scientific collections**, totalling 4,504 working days in the collections. The total number of loans was 2,529 (collections and library), the total number of specimens lent was 85,990. Guidelines for collection management and preventive conservation were developed. For further results relating to the collections see chapter 3, science programme 5.

The **library** with 369,000 media units (books, journals, special prints and maps) has developed from a subsidiary of the Humboldt-Universität Library to become the Museum’s specialist library. It is open to the public as a reference library.

MfN researchers provide **scientific and policy advice**, especially in the field of national and international biodiversity and other environmental policy issues. Museum staff also support biodiversity

conservation policies by serving on various expert groups and panels at state, national, and European levels. These include the establishment and updating of so-called “red lists” of threatened organisms, as well as activities for international organisations such as the *International Union for Conservation of Nature* (IUCN) and the wildlife trade monitoring network (TRAFFIC). At the more scientific and technical level, MfN regularly contributes expertise to other scientific institutions and museums, as well as to scientific organisations, such as the *OECD Global Science Forum* initiative on *Scientific Collections International* (SciColl), the “biogenesis” core project of DIVERSITAS, and the German Research Foundation (DFG) working group on *Access and fair and equitable benefit-sharing of genetic resources* (ABS).

MfN scientists work as editors, associate editors, and regular reviewers for international scientific journals; they serve as experts for different funding agencies, inter alia, DFG, EU, Humboldt Foundation, NASA. Museum staff are engaged in working groups and initiatives of the Leibniz Association and are regularly approached by the media and societal interest groups for interviews and to provide views and opinions on a wide range of issues (e.g. sightings of meteorites, the discovery of new organisms). Curators answer more than 1,000 enquiries per year.

The main target groups for **knowledge transfer** are (a) politicians involved with environmental conservation, agriculture, associations, and funding institutions, (b) scientists, technical staff, administration, IT technicians and librarians from other museums, (c) amateur scientists, and (d) teachers. From 2009 to 2011, there were more than 1,300 consultations with representatives of these target groups (see chapter 3, science programme 6 for more).

MfN disseminates some of its working results in licensed form. **Licensing**, common for popular science publications such as exhibition catalogues, has been extended to other types of merchandise since 2007 when the museum started cooperating with Humboldt-Innovation GmbH. Another long-time partnership exists between the Museum and a German toy producer whose series “Replica Saurus” was developed together with MfN staff (MfN own the commercial protection rights.).

The **public events** organised by the **PR department** are usually closely linked to the scientific topics that the Museum is working on and often run in parallel to exhibitions. The 134 events held between 2009 and 2011 covered a wide range of formats, including scientific lectures, theatre performances, concerts, a science slam, and the launch of exhibitions. These special events attracted 58,268 visitors. In 2009-2011, twelve news conferences were held on major events in the life of the Museum, such as the launch of the Biodiversity Year 2010, the completion of the east wing, the exhibitions and special stamp to mark the bicentenary of the Museum, and an exhibition on parasites. In total, 86 press releases were published as well as 12 monthly briefings per annum with more details on events and special focus on MfN’s research results. Media monitoring for the year 2011 collated 2,298 reports/articles, 122 TV reports and 105 reports on the radio. Since the launch of the new website in 2011, monthly site-visitor numbers have increased from 10,000 to 34,000.

Strategic work planning for the next few years

After only having become independent in 2009, MfN sees itself as an organisation in transition. A new Managing Director started work at the Museum in September 2011, and a new Director General took office in February 2012. In April 2012, MfN, with the help of professional facilitators, initiated an inhouse strategy development process. MfN will provide the Review Panel with a draft strategy outlining the major goals for 2020 by mid-September, prior to the evaluation committee’s visit.

MfN's vision today is to be an excellent research museum and innovative communication hub, engaging in, and actively contributing to, the scientific and societal debate on the future of the planet. Specifically, the Museum aims to strengthen its position

- in the Berlin-Potsdam area by establishing a Leibniz centre for integrative, interdisciplinary, international biodiversity science (LIIB)
- in Germany by closer cooperation and programmatic alignment with the major German natural history museums
- in Europe by leading and actively participating in major interdisciplinary scientific or collection/infrastructure initiatives, such as the *Consortium of European Taxonomic Facilities* CETAF, the EU-funded programme *Building the European Biodiversity Observation Network* EU-BON and SYNTHESYS
- globally by supporting the development of strategies and the programmatic alignment of major collection-based (research) institutes and initiatives to support the delivery of the Aichi 2020 targets, the *Intergovernmental Platform on Biodiversity and Ecosystem Services* (IP-BES), and other international treaties and commitments

Appropriateness of facilities, equipment and staffing

In 2011, the total revenue of the Museum für Naturkunde was approx. €21m. The joint institutional funding by the Federal and *Länder* Governments was €10m. This is the funding for research and academic services according to AV-WGL which is the subject matter of the evaluation. The share of revenue from project funding grants in relation to this joint institutional funding was 28 percent (DFG, EU et al.) in 2011. As a museum, MfN receives further institutional funding, e.g. from the *Land* Berlin. It has income from entrance fees and donations and it receives additional means for building operations (e.g. from federal government, EU structural funds). For detailed information on MfN's revenue and expenditure see appendix 3.

MfN states that it suffered from 70 years of neglect and underfunding and requires more independence, flexibility, and resources. The Museum argues that, currently, it only receives approximately one-third of the developed world average for institutional core funding for major national natural history museums. It requests to be raised to international standards in institutional core funding and to be provided with substantial capital costs within the coming years. The Museum is aware that this is a significant request, but, not having benefitted from the efforts to re-build former GDR scientific institutions until 2006, it feels that it has a legitimate case for such high demands. Already in 1996 and 2002, two evaluation groups (see chapter 6) asserted that additional resources needed to be provided. Not until 2006, were the first steps undertaken (capital funds for rebuilding 10% of the estate), and only from 2009 onwards, as a member of the Leibniz Association, was MfN able to benefit from a steady increase in institutional core funding. MfN acknowledges this development but still sees itself lagging a long way behind in developing into a well-equipped and truly modern national natural history museum.

In the evaluation package the Museum provides a list of "Current urgent needs" with regard to facilities, equipment and staffing in collections, research laboratories, IT services and others. The Museum states that meeting these needs would consolidate current research capacity but that a longer term vision is needed if the Museum is to be developed to the standards and provided with the resources of other major national natural history museums in the developed world.

The reconstruction of the Museum's east wing in 2010 was the first stage of renovation (5,363 m² functional area; €29.6m). Phase II of this renovation is in the advanced planning phase (6,619 m²

functional area; €31.5m) and, amongst others, aims to fulfil the conservation needs of the dry collections (climate and air humidity), optimise storage volume and merge collections distributed around the building. After completion of Phase II in 2016, and taking into account the partial renovation of exhibition areas by EU funding in 2007, 38 percent of MfN estate will have been modernised according to current functional, technological and conservational standards. The estimated costs for accelerated reconstruction of the MfN estate to meet the agreed demand of 37,525 m² of functional area (certified by Berlin State Science Administration in 2008) amount to an investment of €200m by 2020.

For short- to medium-term improvements to consolidate current operations the Museum requires the following administrative changes:

- a global budget (“Globalhaushalt”) should be implemented
- funding should be comprehensive and cover the full expenditure – including providing some flexibility in the personnel budget to address current vacancies for curators and technical staff supporting research infrastructures
- any income generated by the Museum should no longer result in a reduction of the core funding
- fiscal years with budget transfers (“Überjährigkeit”) should be implemented
- the rigorous staffing plan (“Stellenplan”) should be abolished
- the continuing large-scale reconstruction of the estate should be achieved more efficiently, with less interference from the state building administrations involved (“staatliche Bauverwaltung”)

3. Science Programmes of the Museum für Naturkunde

Science Programme 1 “Discovery of Biodiversity” (SP1 – 12.24 FTE) focuses on the taxonomic description and classification of organisms (taxonomy, systematic), the clarification of the relatedness of these organisms (phylogeny), and the study of their distribution (biogeography). The work programme of SP1 investigates two core questions: “What is the biological diversity on Earth?” and “What new methods and techniques can accelerate the process of discovery?”

In describing biodiversity, SP1 works with the MfN collections and conducts field work. Species are identified and, where necessary, scientifically described or revised. This service to the broader scientific community and to users (e.g. nature conservation) ranges from descriptions of single species to monographs covering whole taxonomic groups or regions. In 2009-2011, researchers in SP1 described a total of 497 species (living and fossil) as new to science and published 328 publications, 122 with ISI listing. To concentrate efforts, foster better integration of research projects, and focus on the most relevant research questions, SP1 selected priority regions, one temperate (the Western Palaearctic with particular focus on central Europe) and two tropical (Asia and Africa). In these focal regions projects are embedded in international collaborations. For instance, SP1 currently has two German Research Foundation (DFG) projects on the biogeography of gastropods and freshwater shrimps in Southeast Asia. In Africa SP1 is working on DFG, BMBF (i.e. BIOTA-Africa) and other projects on the diversity and biogeography of various insect orders and amphibians.

In SP1 biodiversity is assessed using a multitude of specific methods, partly developed and/or standardised by MfN researchers. While all taxonomic work requires familiarity with the classical comparative-morphological methodologies, SP1 aims at the advancement of existing methods and the further development and application of new methods for identification and rapid assessment.

SP1 states that it has worked successfully on automated procedures (computer-based illustration techniques), new visualisation formats (computer tomography), automatic sound recording (laser vibrometry) and molecular techniques (genetic barcoding). Most information and data generated at MfN are made freely available.

By trying to combine, compare and contrast various sets of characters from different lines of enquiry (e.g. morphology, bio-acoustics, molecular data, behavioural and ecological data as well as biogeographic arguments), SP1 aims at setting examples for the approach which has recently become known as 'integrative taxonomy'. In order to accelerate the discovery of global biodiversity SP1 will focus on three main tasks:

- improving the theoretical background, the infrastructure and the methodological tools for biodiversity assessments
- identifying crucial taxonomic groups and geographic regions to help answer the most pressing overarching research questions
- developing tools and projects to transfer knowledge to fundamental stakeholders and, thus, further accelerate "biodiversity discovery"

Science Programme 2 "Genome – Organism – Environment" (SP2 – 12.17 FTE) focuses on the study of the genetic and phenotypic adaptations of organisms, both extant and fossil, in relation to their ecology and evolutionary history. The core questions of SP2 are:

- What are the mechanisms of speciation?
- What is the relationship between development and evolutionary change?
- What is the relationship between evolutionary form and function?
- How does a taxon's ecology shape its phenotype?

SP2 focuses on the evolution of the phenotype (e.g., morphological or behavioural traits) by studying proximate mechanisms, such as the genetic basis of phenotypic traits, as well as selective forces, such as modes of natural and sexual selection. This includes deciphering the relationship between genes, ecology, and phenotype, the causes of speciation, and ecological adaptations triggering phenotypic evolution. The study systems range from populations to species-rich clades, both in recent and deep time, taking advantage of the biological and fossil collections at MfN and elsewhere. The methodological spectrum ranges from genetic and genomic approaches via methods of classical descriptive comparative anatomy and behavioural ecology to digital imaging techniques such as computed tomography (CT) and 3D surface scanning.

The overall publication output of SP2 in 2009-2011 was 140, including 106 ISI-listed publications. Highlights: SP2 developed a particularly effective model system, acoustically communicating grasshoppers, to demonstrate how populations differentiate and what role effective hybridisation barriers play in speciation. Also, SP2 performed integrative studies involving both fossil and extant taxa to decipher the evolutionary origin of novel forms, particularly with regards to squamate reptiles. SP2 collaborates both nationally (e.g. in the DFG Research Unit 533 *Biology of the Sauropod Dinosaurs: The Evolution of Gigantism*) and internationally (e.g. with The Field Museum in Chicago).

In order to tackle these core questions successfully, MfN considers it necessary to increase SP2's methodological toolkit, particularly to strengthen its expertise in genomics, bioinformatics, and digital imaging. In early 2012, MfN was awarded three research projects focusing on the genomic aspects of speciation (a project on the functional genomics of biological speciation funded through the Leibniz competitive procedure included). The non-invasive character of digital imaging is a great advantage especially for research projects involving the use of valuable collection material. Therefore, a micro-CT facility was established in 2010 in SP2. MfN will now make major efforts to

establish this technique throughout. A special feature of SP2 is that there is an almost equal number of neontologists and palaeontologists. MfN plans to exploit this potential more by developing integrated projects addressing both the present and deep time.

Science Programme 3 “Diversity Dynamics” (SP3 – 5.42 FTE) assesses biodiversity changes on multiple temporal and spatial scales – from geological time-scales to days, and from global to local. Besides documenting different metrics of diversity dynamics (origination, immigration, extinction, extirpation, and diversification) and standing diversity, SP3 assesses which abiotic and biotic factors drive these changes. The core questions are:

- What is the role of environments in governing biodiversity dynamics?
- What is the role of climate change on modern and ancient ecosystems and evolutionary pathways?
- What is the role of evolutionary key innovations in driving diversification?
- How stable are biogeographic provinces and biodiversity hotspots over time?
- What are the long-term biodiversity consequences of biotic interactions?

To achieve these objectives SP3 uses two different methodological approaches. First, comprehensive and high quality datasets on the occurrence of taxa make it possible to synthesise and analyse biodiversity dynamics from geological to human time scales. Second, molecular genetic studies in combination with modern bioinformatics make it possible to use numerous traces of the evolutionary history of biodiversity hidden in the genomes of contemporary taxa to reconstruct past diversity patterns and their dynamics through time. Phylogenetic, phylogeographic and population genetic approaches are used to analyse different evolutionary time scales. SP3 also endeavours to improve the assessment of biodiversity dynamics by developing methods to balance heterogeneous sampling and seeking new methods of recording diversity changes.

Work in SP3 resulted in 144 publications in 2009-2011, 89 of them ISI-listed. The MfN journal *Fossil Record*, edited by SP3 staff members, was ISI-listed in 2008 and received its first impact factor in 2011. As biodiversity dynamics can only be analysed with large and high-quality datasets, SP3 is active in developing open-access research databases (e.g. as a core facility in the Palaeobiology Database consortium). SP3, for example, assessed the relative role of large-scale environmental gradients in generating biodiversity. The study analysed the global marine fossil record from the Palaeobiology Database and found that habitat complexity, latitude, substrate, and water depth are all significant determinants of origination rates. The DFG Research Unit *Precambrian-Cambrian Biosphere Revolution* focuses on large-scale diversity dynamics during the Cambrian radiation, using biogeochemical methods and analyses. Two out of the Research Unit’s seven projects are led by SP3 researchers.

In order to move from descriptive and correlative analysis towards the prediction of future biodiversity dynamics, SP3 aims at the integration of palaeontological and neontological time scales. The Pleistocene climatic fluctuations and their impact on biodiversity dynamics are seen as an ideal playground for this. Another goal for the next five years is to assess the ecological and evolutionary consequences of habitat fragmentation today (rainforest and swamp ecosystems) and in the past (rainforests, coral reefs, open marine shelf, and oceanic plankton). The DFG project bundle on *Controlling Factors of Evolutionary Rates* will be taken further by developing current and new palaeozoological projects (e.g., oceanic plankton), and supplementing these with neontological and (palaeo-)botanical approaches. SP3 intends to intensify database activities, e.g. by making mobilised primary collection data more useful for the analysis of diversity dynamics. This will be done by geo-

referencing initiatives, automated taxonomic cleansing (through linking with taxonomic archives), and student projects on particular taxonomic groups.

The MfN **Science Programme 4 “Impacts, Meteorites, and Geological Processes”** (SP4 – 6,25 FTE) is focused on investigating the evolution of planet earth with a special emphasis on the planet’s collision history and its implications for the evolution of lithosphere and biosphere. Core questions of SP4 are:

- What is the 3D nature of large, complex impact structures and how can the original morphology, structure, and, in particular, the genesis of specific impact modified / generated rocks be revealed by means of drilling, field work, experiment and laboratory analysis, and numerical modelling?
- How can laboratory- and micro-scale hypervelocity impact processes be related to large-scale observations at natural impact structures?
- Is the evolution of planets and life linked to large collision events in the history of the solar system?

SP4 combines fieldwork at natural impact structures, laboratory hypervelocity shock wave and impact experiments, and mineralogical and chemical analysis of impactites, meteorites, and other rocks. This generates an evidence base for comprehensive numerical modelling of the highly energetic and dynamic processes involved, and contributes to a better understanding of the implications of collisions for the evolution of earth and life. Research in SP4 covers a wide range of scales, from micrometres to planetary scales. The SP4 research topics benefit from a large meteorite collection that is hosted at MfN: The Museum states that the collection of impact related material includes specimens from approximately 36 percent of all globally recognized impact structures. Samples and drill cores from the Ries impact structure are stored at the *Centre for Ries Crater Impact Research in Nördlingen* (ZERIN), an external facility of MfN (run jointly with the City of Nördlingen, Bavaria).

SP4 researchers produced 72 publications in 2009-2011, 42 of them ISI-listed. During the evaluation period, results were achieved in the analysis of terrestrial impact structures through involvement in a number of international research consortia. These involved leading roles in four major ICDP drilling projects (Chicxulub, Bosumtwi, Chesapeake Bay, and El’gygytgyn). The German Research Foundation (DFG) funded MEMIN Research Unit (*Multidisciplinary Experimental and Modelling Impact Research Network*), located at MfN in 2009, is aimed at bridging the gap between large natural impacts and laboratory-scale processes. Since 2010, three projects have been based at the museum, with strong links, inter alia, to the University of Freiburg, the Fraunhofer Ernst-Mach-Institut (EMI) and the Geoforschungszentrum (GFZ) in Potsdam. SP4 is contributing to one work package and is participating in another work package of the Helmholtz Alliance programme *Planetary Evolution and Life*, coordinated by the German Aerospace Centre (DLR), that deals with the direct and indirect relationships between the formation and development of planets and the origin and evolution of life.

SP4 aims to acquire a better understanding of the late accretion phase after the formation of the early earth-moon system, and how impacts contributed to the formation of habitable environments, as well as the catastrophic consequences of large impact events for the biosphere. It is also planned to broaden research activities to include the study of other natural hazards besides meteorite impact. By predicting the environmental consequences of future impacts, the intention is to investigate how mitigation measures can be developed, and how ore deposits at impact structures and in large magmatic complexes are formed and can be exploited more efficiently.

The collections are MfN's central scientific infrastructure (see Chapter 2). **Science Programme 5 "Collection Development"** (SP5 – 22.02 FTE) focuses on the strategic improvement of this infrastructure, its physical integrity, and its contextual information. Long-term preservation of specimens and their accompanying records (labels, locality and collectors' information, diary notes, literature references, illustrations, etc.) are essential for maintaining this infrastructure. The objectives are to continue improving collection care, maintenance and management, develop collections in line with the current and future research needs – of the wider scientific community – and to improve physical and digital access. The core questions of SP5 are:

- How can large natural history collections be efficiently managed?
- How can preservation and preventive conservation of collections be improved?
- How can museums organise and guarantee full access to MfN collections?

In 2010, after nearly six years, the redevelopment programme of the east wing of the Museum building as a collections and science space was completed (budget: €29.6m). It includes a collection hall with partial visitor access (to the 276,000 ethanol jars of the wet collections). In parallel with the building programme the research programme KUR, funded by the *Kulturstiftung des Bundes* (German Federal Cultural Foundation) and the *Kulturstiftung der Länder*, allowed SP5 to conduct a research project on wet collections care and development. The issues addressed were the chemistry of the preservation fluid, the design of containers and labels, and label restoration. Through SP5, MfN is part of several externally funded large-scale, collaborative science and science infrastructure projects. SYNTHESYS (2004–2013) enables increased access to physical collections. It has also resulted in staff training and in the development of an internal collection management policy that deals with aspects of collection development, risk management, management of specimens, access management, and legal compliance. Digital visibility is being improved through, e.g., the EU-funded *Open Up!* programme, contributing thousands of digital images and animal sounds to the Europeana Portal. MfN is involved in other projects aimed at enabling world-wide access to collection data and digital representations for research, as well as the development of appropriate tools and strategies for digitising collections. These include mass digitisation tools and methods for the extensive entomological collections (high resolution digitisation of whole insect drawers) and new methods of "3D imaging" (360° images) of insects in order to reduce the number of loans of particularly valuable and fragile objects.

MfN has supplied some 140,000 of the 500,000 datasets of entomological and palaeontological objects and observations mobilised since the beginning of the current GBIF-D project (*Global Biodiversity Information Facility*, December 2010). MfN hosts and administers the *Biodiversity Heritage Library Europe* (BHL-E) that makes European biodiversity knowledge freely available to everyone (see also chapter 4). In order to facilitate collection access, MfN has recently combined efforts with the DINA-Network to develop a collection management software tailored to the individual needs of the project partners. The 40 publications produced by SP5 researchers dealt with conservation science, annotated type catalogues, and historical collection research. About 150 external publications were based on or referred to MfN collections.

In the short- to medium-term, the main activities of SP5 will be related to storage, collection preservation, staff development, standards, networks and accessibility. Central projects include the reconstruction of the Museum's core area with several collection halls. SP5 aims to achieve an internationally recognised level of collection care across MfN. Over the next few years, national and international networking on a strategic and coordination level will aim at establishing a centre of competence for the management of MfN's natural history collections.

The objective of **Science Programme 6 “Science Communication and History of Science”** (SP6 – 6,28 FTE) is to develop formats and methodological concepts that make scientific content accessible for the public and political decision makers through, e.g., exhibitions, educational courses, and political consultancy. The contents in focus are current MfN research topics, overarching scientific issues, and, in particular, research on historic documents and exhibits. Core questions of SP6 are:

- How can we keep the public up-to-date on scientific research and involve them in our research?
- How can the media and existing networks be used effectively to raise awareness of research and the problems and solutions it deals with in the eyes of the public and politicians?
- What can the history of science add to our current view of nature?

During the evaluation period, MfN prepared nine special exhibitions in-house on various topics, and six of these exhibitions went on to be shown at other museums. MfN also participated in 43 exhibitions held at other museums. The main objectives of MfN’s exhibition concept are, among others, to focus on originals (with as few casts and models on display as possible) and to focus on research topics of in-house scientists, building a content hierarchy with an emphasis on narratives that can be linked to individual exhibits. Highlights during the evaluation period were the bicentenary celebrations of the foundation of the museum. They included the opening of the rebuilt east wing with its publicly accessible wet collection, and the special exhibition *Klasse, Ordnung, Art* (Class, Order, Species). Over the reporting period, nearly 1.5 million visitors came to see the exhibitions at MfN (not including the visitor numbers for special events).

In 2009-2011, SP6 published 211 titles, including 13 written or edited monographs and books. Articles on the history of knowledge are still frequently written in German and published in national journals. SP6 published eight articles in international peer-reviewed and ISI-listed journals. In 2010, many publications on the history of science appeared to celebrate the Museum’s bicentenary.

MfN exhibitions are complemented by educational programmes and guided tours developed by SP6 in cooperation with education specialists, teachers, museum scientists, and the museum’s exhibition designers. Cooperation with the Biology Teaching Department at Humboldt-Universität and the Department of Museum Management and Communication at HTW Berlin (Hochschule für Technik und Wirtschaft, University of Applied Sciences) also comprises continuing professional development programmes for staff in museum education and joint supervision of education research projects. In the reporting period, nearly 96,000 members of the public took part in the education programmes. In 2006, the Carl Zeiss Microscopy Centre, a laboratory for pupils, was founded. The high-grade microscopes are regularly used by schools, science clubs and student groups. It is sponsored by the Carl Zeiss company, the Robert Bosch Foundation and others. MfN’s participation in the Long Nights of Museums was organised by SP6 in close cooperation with the Public Relations Department and a variety of partners, such as scientists of different disciplines, educationalists, artists, writers and theatre directors. During the Long Nights of Museums in the reporting period, over 20,000 visitors took part in guided tours behind the scenes, watching theatre performances and science events.

SP6 is part of the network on biodiversity research in Germany (NeFo, supported by the Federal Ministry of Education and Research since 2009) the objective of which it is to build a network of German biodiversity researchers and to facilitate dialogue between researcher, policy-makers and professionals in the field. Partners within the framework of DIVERSITAS D are the Helmholtz Centre for Environmental Research (UFZ) and the University of Potsdam. The NeFo website and news-

letter reach a wide audience – around 4,000 website visitors per month and 1,000 newsletter recipients. In 2011, a project presenting the cultural history perspective of collection items was launched (supported by the Fritz Thyssen Foundation). It involves the transcription of Friedrich Sellow's journals (1789–1831). Sellow travelled extensively in Brazil between 1818 and 1831 as a naturalist and collector and his journals contain information about the circumstances surrounding the finds (of objects catalogued by the museum's curators) and about aspects of social and cultural life in the early 19th century.

SP6 plans to develop a programme that combines practical and theoretical public approaches to engagement with science, to conduct interdisciplinary scientific studies, and to develop new approaches. Especially the increasing opportunities for communication research, as well as visitor retention, which are offered by new communication channels such as Web 2.0, or upcoming technologies like tablet and mobile apps, will play a key role. One of the projects aiming in this direction is an exhibition commemorating the 60th anniversary of James Watson's and Francis Crick's structural analysis of DNA. In future, SP6, in close cooperation with Humboldt-Universität, will address fundamental issues of educational work in museums. SP6 launched a new initiative called PAN (Perspektiven auf Natur, Perspectives on Nature) which is intended to initiate the discourse with the humanities and the arts on the Museum's collections and research.

4. Collaboration and networking

Collaboration with universities

Having been part of Humboldt-Universität zu Berlin for nearly 200 years, MfN states that it has maintained strong links since the Museum became independent in 2009. Five MfN scientists hold joint professorships with Humboldt-Universität (so-called S-professorships), three of them newly appointed since 2009. A further eleven scientists hold the qualification "Privatdozent (PD)", having gained the right to teach at a university and to supervise PhD students and work independently. These posts are held at Humboldt-Universität (9) and Freie Universität Berlin (2). MfN staff offer a total of 45 courses, practical classes, extracurricular university lecture series, summer schools, field excursions, and seminars. MfN's scientific disciplines are often no longer taught as part of university curricula. That makes the Museum and the universities appropriate partners with good potential for joint student education. A number of special courses are offered at MfN to students from all Berlin/Potsdam universities, and beyond. MfN scientists formally supervise more than 60 students and postgraduates from Germany and abroad.

Collaboration with other domestic and international institutions

MfN scientists initiated or were an active partner in a total of 124 externally funded projects, of which some 75 were based on collaborative grants and projects with institutions in more than 40 different countries. In 2009-2011, they published 367 ISI-listed peer-reviewed papers with partners from 58 other countries. Examples of MfN collaborations (see science programmes in chapter 3 for more):

The *Berlin Centre for Genomics in Biodiversity Research* (BeGenDiv) has been jointly operated by six partners since 2009: three Leibniz Institutes, the Berlin Botanic Garden and Botanical Museum, the Universität Potsdam and Freie Universität Berlin. The Centre aims to coordinate biodiversity research activities in the Berlin-Brandenburg area, also fostering synergies between the institutions. It is funded by the Leibniz Association and the German Research Foundation (DFG) and provides its members with access to high-throughput genome sequencing facilities. MfN researchers currently

use the Centre for projects in molecular phylogeny and functional genomics. Since 2008, MfN has been a full partner in the German Branch of the *Global Biodiversity Information Facility* (GBIF-D), supported by a larger grant from the Federal Ministry of Education and Research (BMBF, 2010-2013). The Museum coordinates the national data nodes for entomology and palaeontology and thus supports the mobilisation, digitisation and sharing of biodiversity occurrence data from collection-based records and other sources.

Within the framework of the BMBF-funded *Biodiversity Monitoring Transect Analysis* (BIOTA-Africa) cooperation, several MfN researchers have participated in biodiversity monitoring programmes, particularly of amphibians and insects, in several countries in western and southern Africa. These projects were conducted in close collaboration with partner institutions in the respective countries, and other German institutions.

Starting in 2004, MfN took on the role of German coordinator in the **EU-funded** infrastructure project SYNTHESYS, together with the Botanic Garden and Botanical Museum Berlin-Dahlem. SYNTHESYS is a network of natural history institutions comprising 19 National Taxonomic Facilities in ten European countries with more than 337 million specimens in their collections (see also Chapter 3, SP5).

In the EU Commission's FP6 Network of Excellence *Towards a European Distributed Institute of Taxonomy* (EDIT), in which the museum became a partner in 2009, MfN took on the lead role for a work package "Applying Taxonomy to Conservation", and the co-lead for a second work package concerned with stakeholder and policy liaison. This project led to intensified collaborations between larger European natural history museums and collection-based institutions and new approaches to field data recording for biodiversity inventory and monitoring activities.

In 2008, MfN successfully coordinated a proposal for funding from the European Commission entitled *Biodiversity Heritage Library – Europe* (BHL-Europe, 2009-2012). This consortium is coordinating the mobilisation of digital content on biodiversity from older scientific literature and print media amongst 18 European partners as a European contribution to the globally organised Biodiversity Heritage Library (BHL) project.

MfN is also a partner in two further EU funded projects, *Distributed Dynamic Diversity Databases for Life* (4D4Life, 2009-2012), and the *Virtual Biodiversity Research and Access Network for Taxonomy* (ViBRANT, 2009-2013). Most recently, MfN coordinated a proposal in response to a European Commission call under FP7, which was approved: starting in late 2012, the EU BON (Building the European Biodiversity Observation Network) project will make a European contribution to the global Biodiversity Observation Network, involving some 28 partners from 18 countries.

MfN is an active member of the Consortium of European Taxonomic Facilities (CETAF) and a member of the *Consortium of Scientific Partners of the UN Convention on Biological Diversity* (CBD: CSP), which is dedicated to coordinating scientific training and education activities relating to biodiversity conservation and sustainability. It is a founding member of *Scientific Collections International* (SciColl), a body for collection-based natural science institutions and of the *Network Forum on German Biodiversity Research* (NeFo), a platform that brings different disciplines together and supports political and interdisciplinary discourse on biodiversity governance.

Other collaborations and networks

The Museum is attractive for scientists from abroad: scholarship-holders from 12 different nations came to MfN in 2011 (including Humboldt and DAAD fellows). In 2009-2011, approx. 200 guests

came to the Museum for more than a week (for researchers visiting the collections see chapter 2, Results) and 24 MfN staff stayed at other institutions.

Scientists at MfN view capacity building in tropical countries, where most of the world's biodiversity is to be found, as one of their most important tasks. For example, MfN is engaged in a Master's course on "Biodiversity and Conservation" in Indonesia. Since 2009, four PhD students from West Africa and one from Jordan were supervised at MfN and have successfully defended their work at their home universities. MfN has initiated national herpetological reference collections in Benin, Cameroon, Ghana and Burkina Faso.

5. Staff development and promotion of junior researchers

Personnel structure and staff development

At the end of 2011, MfN employed 252 staff, corresponding to 205.7 full-time equivalents (FTE). Of the 99 staff involved in research and scientific services (82.9 FTE, not including student research assistants), 27 were doctoral candidates (14.4 FTE). A further 107 staff (98.6 FTE) work in science support positions and public engagement. They are closely involved in the broader scientific work of the museum, such as collection management, laboratory management, maintenance of animal facilities, library and IT services, public outreach, and visitor care (see appendices 4 and 5). Additionally, 71 volunteers worked at the Museum and played an important part in its scientific work and social life.

At the end of 2011, just over 55 percent of research and scientific staff had fixed-term employment contracts. Most of the permanent scientists are curators of scientific collections, heads of facilities, or staff managing exhibitions or education programmes. The German public sector collective agreement (TV-L) was introduced at the museum in 2011. MfN requires more flexibility in its staffing plan (Stellenplan).

From 2009 to 2011, three full professors were newly recruited (so-called S-professorships), including the new Director General (Professor for Biodiversity and Public Science). The Professor for Evolutionary Palaeoecology previously held a Lichtenberg Professorship (funded by Volkswagen Foundation) and the Professor for Palaeozoology originally came to MfN with an Emmy Noether Fellowship (DFG), leading to a full professorship. At the end of 2011, five MfN scientists held joint professorships with Humboldt Universität. Another leading scientist came to MfN with a Sofja Kovalevskaja Award from the Alexander von Humboldt Foundation. The Museum is about to appoint him to a five-year W2 S-professorship for Palaeobiology and Evolution together with Humboldt-Universität.

In addition to hiring new staff, development amongst existing staff is a priority at the Museum. In autumn 2011, an MfN commission was established to draw up guidelines for staff consultation on this issue. The commission agreed on annual orientation and development (status) consultation with all employees. At a later stage, performance assessments will also be adopted.

Promotion of gender equality

The Museum is subject to Berlin's Equal Opportunities Act. At the beginning of 2012, it was certified as being a family-friendly employer by berufundfamilie GmbH. In 2009, an equal opportunities officer was elected. At the end of 2011, the share of women in research and scientific services was 39 percent. The proportion of women in leading positions was, however, somewhat lower (19.2 percent), whereas 66 percent of PhD students were female (see appendix 5). In 2011, a total of 27 female employees and 16 male employees were hired in the scientific sector.

Promotion of junior researchers

In the reporting period, MfN scientists evaluated 97 Bachelor's, Master's, Diploma, and PhD theses, prepared reports for a number of *Habilitation* and tenure-track evaluation proceedings, and were members of appointment committees.

By 31 December 2011, a total of 47 PhD students were working at the museum. Of these, 27 held an MfN employment contract and 20 held independent scholarships or had other private support. During the last three years, 17 students have finished their PhD at the Museum. Each doctoral student is supervised by at least one MfN scientist, generally a professor or senior scientist. All doctoral students participate in seminars and colloquia at MfN. They are given the opportunity to present their work at an international conference at least once during their PhD, preferably once per year, and they are encouraged to take part in general training seminars. In late 2011, the Museum established a committee to develop uniform standards for the supervision and support of PhD projects. It is currently developing a structured programme for doctoral students.

The MfN support system for Post-doctoral Research Associates is similar to that for doctoral students (scientific mentoring, participation in seminars and colloquia, performance-based incentives, conference travel grants). From 2009 to 2011, two scientists received their *Habilitation* (the German qualification for becoming part of a university faculty and being able to teach and supervise PhD students). MfN only recently started to appoint scientific staff to permanent positions using the tenure-track system. This system will, however, become standard procedure in the future. In 2010 and 2011, two scientists received tenure. During 2011, 22 postdoctoral scholarship-holders worked at MfN.

Vocational training for non-academic staff

The Museum states that, for a long time, staff development – especially in the field of collection management – was not a focus of natural history museums. At MfN, this has recently been addressed, e.g., (i) through participation in EU-wide training courses in the SYNTHESYS project; (ii) by workshops on preservation techniques under the auspices of the KUR project, and (iii) workshops on safe handling and efficiency of specimen loans and transport. In 2013, further opportunities will be opened up for individual training visits for MfN staff to European partner institutions funded under the European LEONARDO DA VINCI Mobility Programme for Life-Long Learning.

Between 2009 and 2011, the Museum supported 254 training courses. In both 2009 and 2010, two apprenticeships in office communication and administration (Fachangestellte für Bürokommunikation, Verwaltungsangestellte) were established at the museum. This figure increased to three per year in 2011. From September 2012, two dual study trainee placements will be available – one in service management, the other in facility management, in cooperation with the Berlin School of Economics and Law. In 2011, 49 school students and 101 school leavers and students benefitted from work experience placements.

6. Quality assurance

Internal quality management

MfN abides by the rules of good scientific practice as recommended by the German Research Foundation (DFG). The researchers at MfN elected an Ombudsperson to be addressed in cases of suspected scientific misconduct.

Scientific Quality Assurance for all analytical research output is regularly monitored. International compatibility in terms of data quality is checked through standardisation and calibration, through employment of international reference materials, and round robin laboratory inter-calibration. The availability of the necessary international reference materials was also checked during the evaluation period and resulted in the acquisition of additional standards and, in some cases, in the re-evaluation of their suitability for various applications. Data and samples employed in original research are retained for periods of at least 10 years, or are appropriately integrated into the research collections in the form of physical samples or digitals for permanent storage and long-term access.

During the budget year 2010, the conversion from annual economic planning to an output-oriented programme budget was completed. Since then, accounting according to commercial principles has become possible. Thus, in the budget year 2012, financial resources will be managed according to a programme budget. For evaluation and performance-related funding of the science programmes this still has to be supplemented by a system of cost units, reflecting the performance indicators and values of goods and services produced by the science programmes. Procedures for allocation of overhead funds from external funding have been introduced. There is a budget – if rather limited – for incentive grants. Applications for start-up grants, bridging finance, or for research travel, are evaluated and decided in a screening procedure involving the spokespeople of the six science programmes.

To ensure long-term integrity and safety and to aim at improvement of the developmental potential of a collection-based research institution, control and management instruments have been introduced that allow regular monitoring based on newly developed Curatorial Guidelines and Policies.

Quality management by the Scientific Advisory Board

The Scientific Advisory Board (SAB) met six times in the period 2010-2012. It advised MfN during its transformation from a university institute to a research museum. The main objectives were the shaping of the science programmes, including the selection of the spokespeople for the science programmes and the academic monitoring of the appointment process for the Director General. Due to the reshaping of the scientific programme, no audit was carried out prior to the external evaluation in 2012.

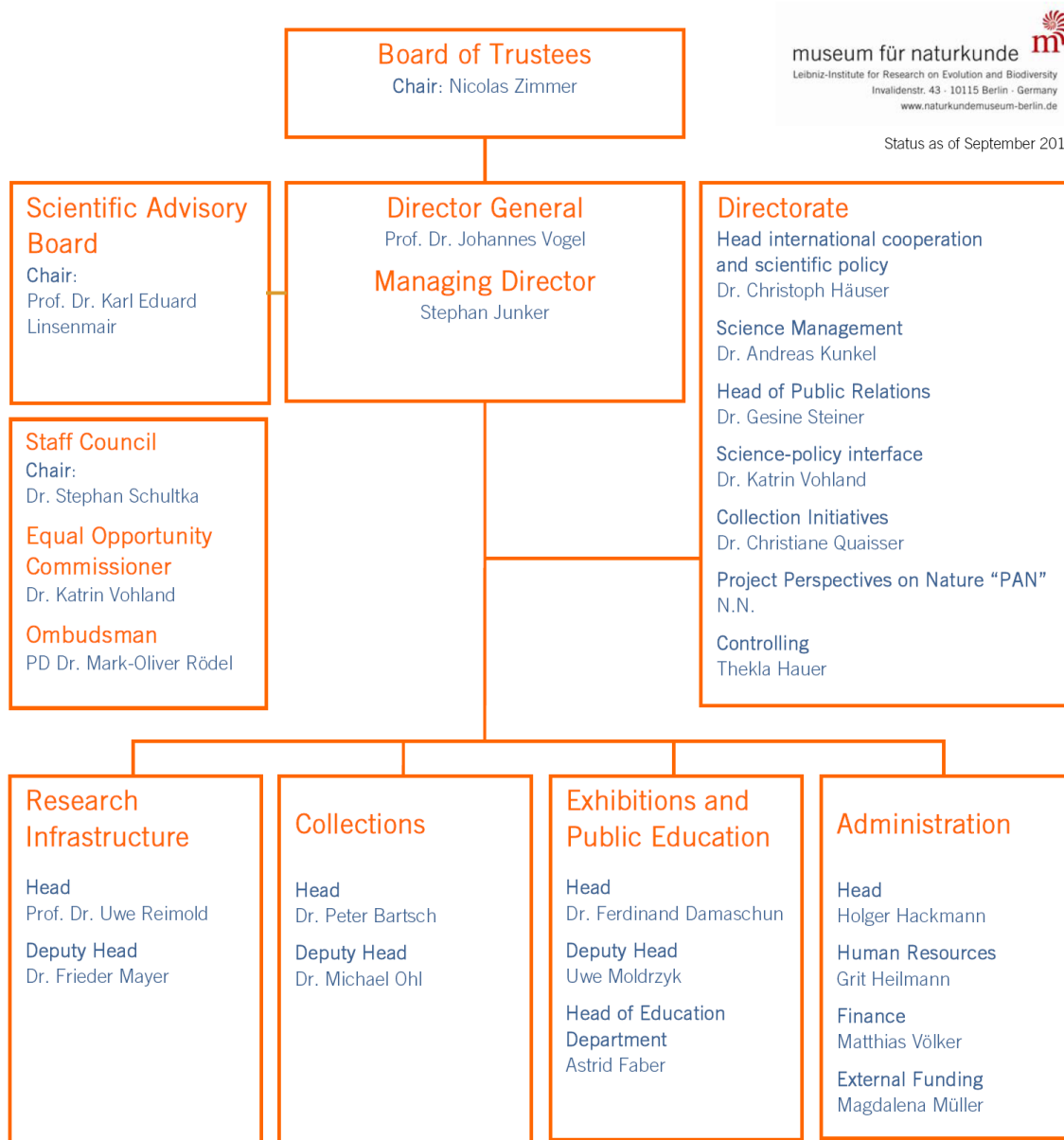
Implementation of recommendations from the last external evaluation

In 1995/6, the *Wissenschaftsrat* (German Council of Science and Humanities) evaluated the Museum in the process of restructuring research institutions after German reunification. The aim was to establish whether the Museum met the requirements for receiving joint funding from Federal and *Länder* Governments and whether the *Projektgruppe Entomologie*, Eberswalde (Entomology Project Group), evaluated at the same time, should be integrated into the Museum für Naturkunde. The evaluation report was positive on both issues. However, it was only in 2007 that the *Gemeinsame Wissenschaftskonferenz* (Joint Science Conference) decided to grant the Museum joint funding. This came into effect on 1 January 2009 when the Museum became a full member of the Leibniz Association. In the same year, the Entomology Project Group became part of the *Senckenberg Gesellschaft für Naturforschung* (Senckenberg German Entomological Institute Müncheberg).

In 2002, an international commission of experts was tasked by the President of Humboldt-Universität zu Berlin and the Senator of Science of Berlin to “develop a modern concept for the future of the Museum für Naturkunde“. In the evaluation package the Museum für Naturkunde addresses the recommendations made in both reports in detail.

Appendix 1

Organisational Chart



Cross-Cutting Science Programs

Discovery of Biodiversity	Acting Spokesperson: PD Dr. Michael Ohl
Genome – Organism – Environment	Spokesperson: Prof. Dr. Johannes Müller
Diversity Dynamics	Acting Spokesperson: PD Dr. Mark-Oliver Rödel
Impacts, Meteorites and Geological Processes	Spokesperson: Dr. Kai Wünnemann
Collection Development	Spokesperson: Dr. Peter Bartsch
Science Communication and History of Science	Spokesperson: Dr. Ferdinand Damaschun

Appendix 2

Publications

	2009	2010	2011
Monographs and editorships	7	11	6
Individual contributions to edited volumes: peer review	15	42	16
Articles in journals: ISI-listed, peer review	152	106	109
Articles in journals: non-ISI-listed, peer review	42	50	35
Others	90	145	95
Total	306	354	261
Publications per FTE (excluding PhD students)	4.75	5.50	4.05
Peer-reviewed publications per FTE (excluding PhD students)	3.36	3.25	2.58
ISI-listed publications per FTE (excluding PhD students)	2.36	1.65	1.69

"Others" - articles in journals or edited volumes (not peer reviewed), book reviews and published working and discussion papers. / FTE = Full-Time staff Equivalent.

Appendix 3

Revenue and Expenditure

	Revenue	2009			2010			2011 ^[1]		
		0	€	% ²⁾	% ³⁾	€	% ²⁾	% ³⁾	€	% ²⁾
Total Revenue (Amount I., II. und III.; excluding DFG fee)		15.763,2			19.877,7			20.716,6		
I.	Revenue (Amount I.1., I.2. und I.3)	13.766,7	100,0%		14.899,0	100,0%		16.960,4	100,0%	
1.	Institutional funding (excluding construction operations and acquisition of property)	9.810,2	71,3%		11.012,3	73,9%		12.787,3	75,4%	
1.1.	Institutional funding (excluding construction operations and acquisition of property) by the federal government and states according to AV-WGL	8.148,7			8.809,8			10.089,8		
1.1.1.	Proportion of these funds received through the Leibniz Competition Scheme (SAW Scheme) [4]	41,5			0,0			0,0		
1.2.	Institutional funding (excluding construction operations and acquisition of property), provided that it is not according to AV-WGL	1.620,0			2.202,5			2.697,5		
2.	Revenue from project funding grants	2.584,0	18,8%	100,0%	2.475,0	16,6%	100,0%	2.864,4	16,9%	100,0%
2.1.	DFG	374,7		14,5%	528,0		21,3%	999,9		34,9%
2.2.	Leibniz Association (competition scheme) [4]	0,0		0,0%	0,0		0,0%	26,5		0,9%
2.3.	Federal government, states	717,4		27,8%	772,4		31,2%	457,4		16,0%
2.4.	EU: EDIT, BHL, SYNTHESYS, OpenUp!, 4D4Life, ViBRANT	614,0		23,8%	346,7		14,0%	498,7		17,4%
2.5.	Economy (incl. Bayer Health Care AG: Parasites Exhibition)	503,0		19,5%	0,0		0,0%	29,4		1,0%
2.6.	Foundations (mainly VolkswagenStiftung, Sofja-Kovalevskaja-Preis, Kulturstiftung des Bundes, der Länder)	345,1		13,4%	788,3		31,9%	746,4		26,1%
2.7.	Other sponsors (mainly SMFG: Amphibien des Monts Nimba, Hauptstadtkulturfonds: Ben Wagin Exhibition)	29,9		1,2%	39,6		1,6%	106,1		3,7%
3.	Revenue from services	1.372,5	10,0%		1.411,7	9,5%		1.308,7	7,7%	
3.1.	Revenue from commissioned work	0,0			0,0			0,0		
3.2.	Revenue from publications	16,4			15,9			12,2		
3.3.	Revenue from the utilisation of intellectual property for which the institute has received IP rights (patents, utility models, etc.)	80,3			95,7			72,2		
3.4.	Revenue from the utilisation of intellectual property without commercial protection rights	0,0			0,0			0,0		
3.5.	Museum Tickets Revenue	1.275,7			1.300,1			1.224,3		
II.	Miscellaneous revenue (e.g. membership fees, donations, rent, reserve fund withdrawal)	1.996,5			3.734,9			2.744,3		
1.	Donations	271,0	1,72%		103,2	0,52%		43,6	0,21%	
2.	Other miscellaneous (KP2-Investments for equipments, rent, revenue prior year, carried forward, other in I., II.1. and III. not allocable)	1.725,5	^[5]		3.631,8	^[5]		2.700,7	^[5]	
III.	Revenue for construction operations (institutional funding by federal government and states, EU structure funds, KP2 etc.)	0,0			1.243,7	^[6]		1.011,9	^[6]	

[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 "Revenue 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 sources of "Revenue from project grants".

[4] Competitive procedure of the Leibniz Association: until 31 December 2010, funds allocated through this procedure were designated as institutional funding. Since 1 January 2011, the Leibniz Association has granted these funds as project grants.

[5] 2009: Transfers from Humboldt-Universität based on independence as of 1.1.2009: €1.383 K, KP2 Equipment Investment: €300 K, other non-allocable income from rent, cost revenue and interest: €42 K; 2010: remaining project funds €1.525 K, remaining funds €1.324 K, infrastructure €745T K, Debts vis-à-vis tax office: €37 K; 2011: remaining project funds €1.847 K, remaining funds €720 K, other non-allocable income from rent, cost revenue and interest: €134 K

[6] 2010: thereof construction: €300 K, KP2: €944 K; 2011: thereof construction: €700 K, KP2: €312 K

Expenditures		T€	T€	T€
Expenditures (excluding DFG fee)		15.763,2	19.877,7	20.716,6
1.	Personnel	7.896,9	9.291,3	10.001,1
2.	Equipment	4.067,8	5.745,3	6.939,7
2.1.	<i>of that: registration of commercial protection rights (patents, utility models, etc.)</i>	<i>0,0</i>	<i>0,0</i>	<i>0,0</i>
3.	Equipment investments and acquisitions	856,4	939,7	1.806,1
4.	Construction operations, acquisition of property	0,0	961,5	1.050,2
5.	Reserves (e.g. cash assets, expense carryovers)	2.942,0	2.940,0	919,5
6.	Miscellaneous	0,0	0,0	0,0
		-		
DFG fees (to the extent that they were paid for the institute - 2.5% of the revenue from institutional funding)		162,0	224,7	258,2

Appendix 4

Staff Financing

– Actual numbers in full time equivalents and number of employees; basic financing and third-party funding
(as of: 31 December 2011)

	FULL-TIME EQUIVALENTS		PERSONS	
	Total	Proportion of third-party funding		Total employees
	Number (= 100%)	Number	Percent	Number
Research and scientific services	90.5	33.6	37.1	126
Directors	2	0	0	2
Professors	4	0	0	4
Academic staff in executive positions	11	0	0	11
Junior research group leaders and Privatdozenten	9	1	11.1	9
Scientists in non-executive positions	42.5	13	30.6	46
PhD students	14.4	13.4	93.1	27
Undergraduate and Master's students	7.6	6.2	81.6	27
Service positions	98.7	3.7	3.8	107
Laboratory	13.4	1	7.5	14
Animal care	2	0	0	2
Workshops	7	0	0	7
Library	4	0	0	4
Information technology - IT	6.8	1	14.7	7
Staff unit/Public relations	4.8	0	0	5
Education department	2.8	0	0	3
Collections management	19.2	0	0	21
Taxidermists	17.6	1.7	9.7	19
Visitor care	9.9	0	0	12
Media design/Photography	5.8	0	0	7
Secretariats	5.4	0	0	7
Administration	16.5	1.9	11.5	19
Head of the administration	1	0	0	1
Internal administration (financial administration, personnel etc.)	15.5	1.9	12.3	18
Total	205,7			252
Scholarship recipients at the institution				
Doctoral candidates				20
Post-doctoral researchers				8

Appendix 5

Temporary Employment Contracts and Proportion of Women on Academic Staff¹

– Actual numbers of employees; basic financing and third-party funding (as of: 31 December 2011) –

	Total staff members	On temporary contracts		Total staff members	Proportion of women		Total of female employees	On temporary contracts	
	Number (= 100%)	Number	Percentage		Number (= 100%)	Number		Percentage	number (= 100%)
Research and scientific services	99	55	56	99	37	37	37	31	84
Directors	2	2	100	2	0	0	0	0	0
Professors	4	0	0	4	1	25	1	0	0
Academic staff in executive positions	11	0	0	11	3	27	3	0	0
Junior research group leaders and Privatdozenten	9	1	11	9	1	11	1	0	0
Academic staff in non-executive positions	46	25	54	46	16	35	16	13	81
Doctoral candidates	27	27	100	27	18	67	18	18	100

Scholarship recipients at the institution
Doctoral candidates
Post-doctoral researchers

20	12	60
8	2	25

¹ Employment acc. to BAT, TVöD or classification according to other pay and wage tariff schemes for persons who are financed from institutional resources (incl. vocational trainees and visiting scientists, provided that they are paid from basic institutional funding or from third-party funding, etc., but not incl. internships (0), diploma students (16), ancillary staff (12), scientists without payment (7), PhD students without payment (3), and persons under other contracts for work and services (1)). In the case of joint appointments: persons whose salaries are reimbursed proportionately by the institute.

Annex B: Evaluation Report

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

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Appendix:

Members of review board and guests; representatives of collaborative partners

1. Summary and main recommendations

With more than 30 million zoological, palaeontological and mineralogical specimens and samples, the Museum für Naturkunde (Natural History Museum, MfN) is one of the largest natural history collections in the world. The beginnings of the collections go back as far as the 18th century and are of outstanding significance both for science and the history of science. MfN's collections are part of an international natural history research infrastructure which is used by scientists from all over the world.

In addition to developing these collections, in its six Science Programmes (SPs) the museum has a major focus on evolution and biodiversity research. Certain aspects of planetology are also addressed in "Impacts, Meteorites and Geological Processes". Museology and Science Communication Studies are new fields at MfN.

Of the six science programmes, two are very good, one is very good to excellent and one is excellent. These four programmes (SP 1-4) have an excellent publication record. SP 5 and 6 were established more recently. They involve cross-cutting activities and do very good work in their individual projects but they have not yet developed a sufficiently clear profile as research programmes. In these cases, strategic decisions should be made and clear priorities set (also with regard to equipment). MfN's exhibition strategy is very good and the museum is highly engaged in knowledge transfer. The comprehensive services carried out by the museum are in great demand in the international scientific community. The statistics document impressive visitor numbers, requests and loans. In some of the collections, however, the terms of use are sorely in need of improvement and should be developed further.

MfN's leadership has only been in place since the arrival of the Director General at the beginning of 2012 and the Managing Director at the end of 2011. In a very short time, they have already made substantial improvements to science, infrastructure and the visitor experience, and clearly have driven the museum's development. They have diverse plans and very interesting ideas for meeting the challenges they must overcome in the future. The approaches to improve the situation are excellent. However, they must now be translated into concrete plans. It is necessary to develop a strategy with clear priorities which is feasible in terms of both financing and timetable. The number one priority must remain the improvement of the building situation and the infrastructure for housing the collections. In addition to appropriate equipment and staffing in laboratories and IT, highest priority should also be given to the development of a structured doctoral programme. Other plans and ideas for developing the museum should be addressed at a later stage.

Particular attention should be paid to the following recommendations in the evaluation report:

General concept (Chapter 2):

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.
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 cu-

rators 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.

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.
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.

Science Programmes (Chapter 3):

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.

Staff development and promotion of junior researchers (Chapter 5):

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.
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.

2. General concept and profile

The zoological, palaeontological and mineralogical/petrographic collections held at the Museum für Naturkunde (MfN) comprise some 30 million specimens and samples of signal international importance to science and the history of science. The beginnings of the collections go back as far as the 18th century. The objects in the collections have been brought together from across the globe and contain some particularly outstanding objects, such as a nearly complete skeleton of the large herbivorous dinosaur *Brachiosaurus brancai* or the *Archaeopteryx* fossil. Their international importance is enhanced by the large number of holotypes (animal specimens that served as the basis for describing species). The objects are contained in 130 distinct collections. They are the basis for MfN's research work and part of an international natural history research infrastructure which is used by scientists from all over the world. One of the museum's core tasks is to maintain and secure

the collections so that they can continue to be used. Thus collection maintenance, development and management are central to MfN's mission.

The science and research conducted at the museum are the foundations for the high quality of collection development and for public education through exhibitions and other educational activities (knowledge transfer, science communication). Both MfN's collection and exhibition strategies are research-driven.

Development of the institution

Since becoming a research museum under the umbrella of the Leibniz Association in 2009, six Science Programmes (see 3. Science Programmes) have gradually evolved, to which the various research projects are assigned. The Science Programmes (SPs) conform with the museum's scientific focus areas. They are fixed-term and cut across the three departments: Research Infrastructure, Collections, and Exhibitions and Public Education. **MfN's organisational form appropriately underpins internal cooperation at the museum. Care is taken to ensure that there is an ongoing 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.**

The scientific work conducted in the six SPs is rightly related to the museum's own collections. This connection is important and should be a decisive criterion in selecting new science projects. It should, furthermore, be possible to enrich the museums' research by extending the range of methods employed (e.g. novel molecular techniques such as Next Gen Sequencing) or adding approaches to certain research fields (e.g. data interpretation from an ecological perspective). In these cases, however, care should be taken to ensure that the work is result-oriented and produces outcomes that can be published well.

MfN's collections are arranged in approximately 20 curation groups which are managed and headed by scientific curators. Staff working on the maintenance, development and management of the individual collections (e.g. preparators, taxidermists, conservators, collection assistants) are assigned to scientific services.

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 emphasised 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 also recognized as scientific work. Activities in these fields should be acknowledged appropriately and supported. 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 positions (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.

The example of materials and conservation research illustrates the necessity for setting priorities: MfN has very good museum-related expertise in this field. In the preservation of fur and feathers MfN preparation techniques are at the forefront. But the staff are already working to full capacity on their important tasks in collection maintenance. In order to produce important publications to influence the international research debate, MfN's materials and conservation research must be bolstered.

Results

The **publication record** of four of MfN's Scientific Programmes is excellent (SP 1-4). Particularly pleasing for a museum is the number of peer-reviewed publications, many in high-ranking scientific journals, demonstrating that the museum is able to compete for a top rank among natural history museums world-wide. Science Programmes 5 and 6 were established more recently. They have not yet developed a sufficiently clear profile as research programmes. Thus, their publication record is much more modest.

Permanent exhibitions and special exhibitions are specific tools with which a museum presents research results to the public. MfN's **exhibitions** are linked to the research conducted at the museum. They communicate sophisticated themes in an appropriate manner. The exhibition strategy with a focus on original objects is very good, also with regard to the modest use of resources (see also SP6). MfN has high visitor numbers. It develops special exhibitions which are lent to other museums; this can be seen as an indication of their quality.

Meaningful indicators document the manifold services provided by the museum. The achievements include, for example, high numbers of new species descriptions. The services related to MfN's **collections** are in great demand in the international scientific community. The statistics show an impressive number of visitors, requests and loans. Therefore, the digitisation of the holdings is essential for the preservation, accessibility and visibility of the collections. In this context, the museum has achieved a great deal and made remarkable progress in digitisation, mostly through EU collaborative projects. However, there is still need for further efforts and investment in data base infrastructure in order to continue driving this comprehensive task. The housing of the "wet collections" (the museum's specimens preserved in alcohol) on public display in the rebuilt east wing of the museum is not only outstanding in terms of conservation and safety but is also pathbreaking in terms of museology. In some of the other collections, however, the terms of use are sorely in need of improvement.

MfN staff are active in academic self-government as well as on (science) policy advisory committees. **Knowledge transfer** to schools and the public in general is a priority area and consequently a large number of events are held for these target groups. With diverse public relations activities and media coverage of exhibitions and research results the museum is very visible. In the German context, its presence in social media is state-of-the-art, but could be much improved by international standards.

Strategic work planning for the next few years

MfN's leadership has only been in place since the arrival of the Director General at the beginning of 2012 and the Managing Director at the end of 2011. In a very short time, they have already done

outstanding work and clearly driven the museum's development. They have diverse plans and very interesting ideas for meeting the challenges they must overcome in the future (see below). The approaches to improve the situation are excellent. However, they must now be translated into concrete plans. It is necessary to draw up an implementable strategy with clear priorities which is feasible in terms of both financing and timetable.

i) The number one priority must remain the improvement of the building situation and the infrastructure for housing the collections. ii) Furthermore, MfN should have appropriate equipment and staffing in laboratories and IT (see below, appropriateness of funding) and a disaster plan should be drawn up for IT. iii) The development of a structured doctoral programme should also be given very high priority (see 5. Staff). In these areas justified additional financial requirements will arise. Thus the museum should formulate plans for the various proposals (prepare concrete project plans and costs projections) so that they can be submitted to the Scientific Advisory Board and subsequently discussed with public funding providers in order to achieve results.

The other plans and ideas for developing the museum should only be addressed at a later stage together with MfN's committees. During the evaluation visit, for example, ideas were presented for a School of Collections and a School of Public Engagement with Science which can be pursued.

Appropriateness of facilities, equipment and staffing

The joint funding for science and research provided by the Federation and the *Länder* (according to AV-WGL) increased from approx. 8 million EUR in 2009 to approx. 10 million EUR in 2011. In relation to this, the proportion of third-party income is appropriate (2011: 28%). Extensive third-party research funding was raised from the DFG, EU and foundations for projects which fit well with MfN's strategic development. The museum was particularly successful in the EU context, participating in major consortia. Including additional institutional funding (which stems, for example, from the *Land* Berlin in addition to joint funding by the Federation and the *Länder*) and other income (e.g. entrance fees and donations) as well as the funding for building operations, the museum had a budget of approx. 21 million EUR in 2011 (2009: approx. 16 million EUR).

In the decades since the Second World War, a major investment backlog has built up at MfN, and it is only in the last few years that anything has been done to deal with it. Major efforts by the museum and funding providers have started to show extremely good results (East Wing, wet collections). **However, 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.** It is therefore welcomed that as a next step to improve the situation a second building phase has been initiated during which, amongst others, the conservation conditions for the dry collections shall be improved.

MfN's IT facilities are poor. The museum has outstanding equipment in its laboratories (the scanner, for example, is unique) but it does not have a programme for regular maintenance. Staffing in these laboratories, which in some cases are currently supervised by doctoral candidates, must be improved. **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.**

It is welcomed that the *Land* which hosts the institute has in principle agreed to funds being reallocated and transferred to another fiscal year in line with the resolutions of the Federal and *Länder* Governments.

3. Science Programmes of the Museum für Naturkunde

The overall performance of **SP 1 “Discovery of Biodiversity”**, one of the museum’s largest Science Programmes, is very good. In its recording of recent biodiversity and the biodiversity of past ages it addresses fundamental research issues, including taxonomic descriptions of new animal species and the phylogenetic classification of species. The integrated taxonomy approach, whereby morphological, molecular and other methods are combined with “classic taxonomy” is convincing. Developing methods to accelerate classification processes is a particular challenge, and MfN has already made impressive technical progress in this area. Most of the research projects in SP1 are closely linked to the collections. Discoveries in these collections have spawned highly-acclaimed publications (e.g. the fossil spider in amber carrying a parasite). In addition, interesting field research projects are conducted. It makes a great deal of sense that the museum focuses on certain geographical regions. The research in this programme is central to the museum. The projects undertaken by SP2 and SP3 are based to a large extent on the work of SP1.

The group receives major funding from DFG and has unique scanner facilities. The publication output is excellent. This is a remarkable achievement, particularly in the field of taxonomy, as it is difficult to place papers in internationally-recognised journals. Only recently has awareness of the importance of taxonomy for research increased in the relevant scientific communities once again. MfN is partly responsible for this positive development.

SP 2 “Genome – Organism – Environment” is also rated as very good. It investigates the changes in organisms in relation to their evolutionary history and ecology. The group uses innovative methods combining different approaches to study genetic and phenotypic adaptations. They have, for example, done very interesting work on adaptation (e.g. in early whale evolution), morphological change (e.g. in amphibian evolution) and vision in invertebrates (e.g. on the evolution of larval eyes).

The programme conducts diverse projects which often build on the results produced by SP1 and are usually based on MfN’s collections. Most of the work is currently properly focused within the self-chosen methodological and collection-related framework. However, some projects deviate from it, for example because they concentrate too much on ecological questions (e.g. arid-dwelling African lacertids). The group should focus on the museum’s strengths and use the critical mass available. Thus the highly appropriate framework should be kept well in mind when selecting new projects. The genetic projects, some of which are very ambitious, should also be clearly linked to the collections.

The programme’s publication record is excellent. Revenue from project funding grants (e.g. from the DFG) is impressive and includes many new projects. It is quite extraordinary to what extent it has been possible to attract outstanding scientists to the museum.

SP 3 “Diversity Dynamics” mainly conducts palaeontological projects addressing deep-time diversity. These projects form a cohesive unit within the programme. Other projects focus on living (recent) organisms. It is a very promising approach to integrate in these projects palaeontological and neontological data. Examples are projects on the diversification of reef corals or Southeast Asia’s biodiversity hotspots. It is recommended to shift the focus of the programme from its current palaeontological emphasis in order to maximise the connection to projects on recent species. Some of this research has produced novel insights into macroevolutionary dynamics. It is less convincing

to pursue purely neontological or ecological projects in SP3, such as the work on the biogeography of West African amphibians and the impact of habitat quality on the genetic diversity of tropical bats. These projects should be transferred to SP1 or SP2 in order to achieve greater cohesion in SP3.

In the past, the work of SP3 has generally been very good to excellent. The unit's DFG fundraising is also very good. The group is very visible internationally. However, it is difficult to assess how the programme will develop as the renowned head of the programme has departed for a professorship at a German university. It will not be easy to compensate for this loss. Should it not be possible to fill this position with an outstanding scientist, the museum's leadership should consider whether and in which way the programme should continue as an independent unit.

SP 4 "Impacts, Meteorites, and Geological Processes" is excellent. The programme investigates the impact of collision events on the development of the planets and the evolution of life. Apart from field work, geophysical and mineralogical methods as well as computer simulations are used. The research programme is based on the museum's very good collection of meteorites and the exceptionally good impact collection at the *Centre for Ries Crater Impact Research* in Nördlingen (ZERIN). The research programme is coherent and very well focused. There are very good connections to SP1 and SP3 as well as to the exhibition programme.

The scientific output of SP4 is very good; the group is internationally renowned and manages to attract and retain very good people. The programme has impressive infrastructure but research is strongly dependent on equipment which means that instrumentation maintenance and infrastructure supervision are important for success. Therefore the equipment and laboratory staffing requirements are very reasonable (see overall concept).

SP 5 "Collection Development" focuses on the long-term maintenance of the collections and their optimal accessibility. This center scientifically mentors the museum's comprehensive actions (including construction) to preserve and prepare the specimens and to ensure ideal storage. As a result, it conducts projects that cover a broad thematic spectrum, ranging from a research project on wet collections care and development (KUR) through new methods of 3D imaging (360°) to a project on the challenges of compiling annotated type catalogues for entomological collections. Great progress has been made in digitising the holdings – a very important research-related service that is vital to ensure the accessibility of the museum's holdings – driven by MfN's participation in major EU collaborative projects. An interesting, innovative approach is being developed with a crowdsourcing portal providing access to a large volume of biodiversity information resources that were previously only available in hand-written form, such as the entry books of the Coleoptera collection and the diaries of explorers.

SP5 is still under construction and thus the current projects tend to be pilot projects. In consequence, the publication record is more modest than that of MfN's other programmes. Thanks to participation in major EU projects (BHL-Europe, Synthesys, EDIT, 4D4 Life; see Status Report p. A-14) the programme has considerable income from third-party funding.

As stated above, MfN took a strategically important step in turning collection development into a Scientific Programme (see 2. General concept, development of the institution). The individual projects are scientifically relevant and address interesting issues. It is now necessary to develop a research programme that creates an appropriate strategic framework for the various areas of work and also sets priorities with regard to equipment.

SP 6 “Science Communication and History of Science” is under construction. Research will essentially focus on communications and networking with users (not only visitors but also society and policy-makers). This includes exhibition-related and museological research as well as elements of visitor and educational research. The main objective is to promote public engagement with science. The museum’s history of science projects are also conducted in this programme (e.g. the transcription of the diaries of F. Sellow, who explored the flora of Brazil). Very interesting perspectives on the interaction with cultural studies disciplines have been opened up by the newly-acquired PAN project (Perspectives on Nature).

SP6 has only recently been established and has relatively modest resources. Against this backdrop, performance is very good. For example, a lot of dedication has gone into developing the museum’s exhibition strategy. This has led to very good results (see Results section). However, the outcomes might be further improved with more engagement with recent museological theory and debate. This assessment is reflected in the publication record. The catalogue produced for the museum’s 200th anniversary (“Klasse, Ordnung, Art”), for example, is of high quality with regard to museum practice and the transfer of results. However, the programme has not had any publications in leading field journals.

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 (see 4. Collaboration). Thus, SP6 is strongly recommended to use collaborations to recruit additional expertise.

4. Collaboration and networking

MfN cooperates closely and successfully with Humboldt-Universität (HU Berlin) and Freie Universität (FU Berlin). Five scientists hold joint professorships with HU. The current Director General has a chair in Biodiversity and Public Science which is an innovative combination in the German context. Eleven other scientists are also qualified to teach (*venia legendi*) at HU and FU. A significant number of the subjects that are important to the museum are no longer taught to the required extent at university. Thus it is essential that MfN staff engage in university teaching in order to train the next generation of museum-based researchers; this is explicitly welcomed.

MfN is very well connected both nationally and internationally. This is witnessed, amongst others, by its participation in numerous important major projects (e.g. SYNTHESIS, EDIT; for abbreviations see Status Report p. A-14). MfN staff conduct joint research projects with partners at many universities and museums at home and abroad for which they have raised third-party funding (e.g. MEMIN). The museum has been remarkably successful in securing projects funded under the EU’s research framework programmes (e.g. EU BON, BHL-Europe). MfN is represented in important international collection- and museum-related consortia and bodies. Its participation in capacity building in Southeast Asia and Africa is welcomed (e.g. Master’s course in Indonesia).

MfN also has good connections within the Leibniz Association. It participated successfully in the Leibniz Competition (SAW procedure) with GENART (functional genomics of biological speciation). Current efforts to significantly intensify networking with the other eight research museums in the Leibniz Association as well as with other natural history museums and collections (e.g. the association of German research museums, Humboldt Ring) are highly welcomed.

5. Staff development and promotion of junior researchers

Staff development and personnel structure

On 31 December 2011, 99 members of staff (83 full-time equivalents) were employed in research and scientific services. At 56%, the proportion of fixed-term contracts is high for a museum. In the last few years, MfN has developed into an attractive destination for postdocs from abroad. Excellent researchers have been recruited for the museum and, not least, it has been possible to fill the positions of both Director General and Administrative Director with eminent individuals.

MfN's staff are exceptionally dedicated and interested in continuing education. Thus the museum's engagement in this field is particularly worthy of support. Due to its involvement in EU projects, for example, it opens up interesting training and exchange opportunities for its staff. It is therefore welcomed that the museum is adopting a structured approach to the theme of staff development. In the future, regular annual orientation and development (status) consultations will be held. The relevant guidelines have already been drawn up. When undertaking performance assessments it will, of course, be necessary to ensure that consideration is given to the entire spectrum of activities carried out by museum staff (research and exhibitions, outreach, collection development). However, the lack of opportunities for staff development is a major problem. The abolition of the staffing plan, agreed by the *Land* Berlin and commencing at the beginning of 2013, should soon provide for greater flexibility.

Particularly in the area of collections a great deal of attention should be paid to staff development in order to ensure support for the research expertise of the staff whilst securing the best possible level of collection care and development (see 2. General concept). MfN's leadership is fully aware of this and – against the backdrop of permanent staff – intends to implement it in each individual collection/curation group. The leadership has already demonstrated far-sightedness and is prepared to supervise the process rigorously.

Promotion of gender equality and combining work and family

It is welcomed that MfN is certified as being a family-friendly employer. The museum has recognised that there is some catching up to be done in the area of equal opportunities. Last year, as a consequence, more women were employed so that now 66% of doctoral students and 37% of staff in research and scientific services are female. These include women who are world-class. Consequently, it is astounding that at scientific management level, i.e. on the Executive Board and in the leadership of departments and Scientific Programmes, there is only one woman. **Therefore 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 Supervisory Board is charged with monitoring the implementation of the cascade model to promote equal opportunities.

Promotion of junior researchers

Due to its collections and its analytical infrastructure the museum is a very attractive destination for junior researchers. This is clearly evidenced by the large number of fellows who work at the museum, many of whom come from abroad.

At the end of 2011, a total of 47 PhD students worked at the museum where they are well supervised. They attend training sessions and present their work at conferences and meetings. In the last

three years, 17 doctorates were completed. **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.**

Postdocs are also appropriately supported at MfN. During the period under review, two junior researchers completed their *Habilitation*. It is welcomed that MfN has introduced a tenure-track system. To date, two postdocs have been granted tenure after an assessment of their performance. The museum is recommended to introduce a code of conduct with regard to staff development for junior researchers. For this purpose, it should draw on the relevant recommendations made by the Leibniz Association.

Vocational training for non-academic staff

Since becoming independent the museum has involved itself in vocational training. Now, three apprenticeships in office communication and administration are offered as well as two dual study trainee placements – one in service management, the other in facility management – in cooperation with a Berlin *Fachhochschule* (university of applied sciences). However, MfN is encouraged to further increase the number of apprenticeship positions as recommended by the Joint Science Conference and the Leibniz Association. Being an institution of some considerable size with a large infrastructure segment the museum should offer additional apprenticeships in technical occupations. It is particularly recommended to pass on MfN's existing traditional expertise in taxidermy, especially as training opportunities in technical assistance in this field are only available at one location in Germany.

6. Quality Assurance

Internal quality management

MfN uses appropriate tools for internal quality control and offers suitable internal performance incentives (procedures for allocation of overhead funds, incentive grant, travel grants). There is an ombudsperson at MfN.

Since 2012, financial resources have been managed according to a programme budget. During the reporting period, cost and performance accounting was introduced. So far, it is only partially effective for management control (e.g. performance-related funding of the Science Programmes) as it has not yet been possible to break down in- and output information according to individual Science Programmes.

It is particularly welcomed that the museum has developed Curatorial Guidelines and Policies as a control and management instrument that allows regular performance monitoring of the collections and curatorial activities.

Quality management by the Scientific Advisory Board and Supervisory Board

The Scientific Advisory Board supervises MfN critically and fairly. It was particularly engaged in the transition phase to independence and change of management. In line with the museum's new focus areas it is recommended to appoint an expert on Public Engagement with Science to the Supervisory Board.

Implementation of recommendations from the last external evaluation

The Science Council evaluated the Museum für Naturkunde in 1996, examining in particular whether MfN and the Entomology Project Group in Eberswalde fulfilled the requirements for joint funding by the Federation and the *Länder*. Since then, enormous changes have taken place at MfN and – against the recommendation of the Science Council – the Entomology Project Group was not amalgamated in MfN. Thus a comparison with the recommendations of the 1996 evaluation by the Science Council has become obsolete.

Appendix

1. Review Board

Chair (Member of the Leibniz Senate Evaluation Committee)

Susanne Foitzik Institute of Zoology, Department of Evolutionary Biology, University of Mainz

Vice Chair (Member of the Leibniz Senate Evaluation Committee)

Reinhard Krämer Institute of Biochemistry, University of Cologne

Reviewers

Scott V. Edwards Department of Organismic and Evolutionary Biology and Museum of Comparative Zoology, Harvard University

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

Monica Grady Department of Physical Sciences, Planetary and Space Science, Open University Milton Keynes

Sharon Macdonald Department of Sociology, University of York

Bruce MacFadden Division of Vertebrate Paleontology, University of Florida and Florida Museum of Natural History

Thomas Söderqvist Medical Museion and University of Copenhagen

Diethard Tautz Max Planck Institute for Evolutionary Biology, Plön

Miguel Vences Zoological Institute, TU Braunschweig

An additional reviewer called off at short notice

Representative of the Federal Government (Member of the Leibniz Senate Evaluation Committee)

Dietrich Nelle Federal Ministry of Education and Research, Bonn

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

Martin Dube Ministry for Education, Science and Culture of the State of Mecklenburg-Vorpommern, Schwerin

2. Guests

Representative of the relevant Federal Ministry

Cedric Janowicz

Federal Ministry of Education and Research,
Bonn

Representative of the relevant Land Ministry

Katharina Spiegel

Berlin Senate Department for Economy, Technology and Research

Chairman of the Scientific Advisory Board

Karl E. Linsenmair

Department of Animal Ecology and Tropical Biology, University of Würzburg

Representative of the Leibniz Association

Heribert Hofer

Leibniz Institute for Zoo and Wildlife Research (IZW), Berlin

Representative of the Joint Science Conference (GWK)

Rebekka Kötting

3. Museum's Collaborative Partners (for talk of approx. one hour with review board and guests)

Walter Berendsohn

Botanical Garden and Botanical Museum, Berlin-Dahlem

Christian Köberl

Museum of Natural History and University of Vienna

Volker Mosbrugger

Senckenberg Gesellschaft für Naturforschung, Frankfurt/Main

Jan-Hendrik Olbertz

Humboldt-Universität zu Berlin

Ian Owens

Natural History Museum, London

18 April 2013

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)**

The Museum für Naturkunde (MfN) has received the Evaluation Report. We are grateful for the very positive feedback and strong encouragement in relation to the MfN's performance as an Integrated Research Museum and its position, role and status within the international scientific community.

The MfN is grateful for the acknowledgement and support for the work and the plans of its leadership team. We find the recommendations for our future developments most helpful. We fully understand the need to prioritize and to convert strategy into corporate plans – we will continue to do so.

Recent building work for collections, research and public spaces are world class and we gratefully acknowledge the major support we are already receiving for this building program. However, the continuation of this building program over the next decade is a major priority. In this context the MfN would like to express its strong agreement with the statement by the Review Board on page B-7 that *“the number one priority must remain the improvement of the building situation and the infrastructure for housing the collections”*.

The Evaluation Report also recognizes our international standing in research and collections. We have attracted very good staff, but keeping them and further improving our position in a very competitive and international environment is becoming increasingly challenging. We are also greatly encouraged by the Evaluation Board's statements about public engagement with science at the MfN, in particular that 1) it is a new area for Germany and that 2) Berlin is a good place to develop an (inter-)national Centre of Excellence.

The MfN gratefully acknowledges that the Evaluation Board's recommendations are intended to further strengthen: a) the museum's science, b) the museum's position and contribution within the global scientific community, c) the development and care of its collection and estate, d) staff development (including promotion of gender equality) and promotion of junior researchers, and e) the harnessing and delivery of the museum's great potential in public engagement with science. The museum will consider all implementations with its Scientific Advisory Board.

The Museum is very pleased that the Evaluation Board is recognizing the commitment of MfN staff by stating: *MfN's staff are exceptionally dedicated and interested in continuing education.*

Finally, the MfN agrees with and thanks the Review Board for its endorsement of the MfN's plans for meeting future challenges that the museum must and will overcome. We are very happy and greatly encouraged that our efforts and approaches to improve the situation are judged as excellent by the Review Board.