

**Natural
History Museum
Malaysia**





Natural History Museum Malaysia



Planning and Development



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Frontispiece: *Licuala cordata*, a rare endemic palm in Sarawak



Foreword

This report, by a team of national and international consultants, deals with the planning and development for a natural history museum in Malaysia, to be known as the Natural History Museum Malaysia (NHM Malaysia).

This report explains the role of natural history museums as custodians of the reference materials upon which scientific knowledge of the natural world is based. It describes how the leading museums of natural history have become centres for cutting-edge scientific research on biological diversity and how they have simultaneously become world-famous for the professionalism and scientific credibility of their exhibitions and educational services.

NHM Malaysia will, through its location and operations in one of the richest biodiversity regions of the world, play a vital role in strengthening the knowledge base for sustainable management of the tropical environment for the benefit of Malaysia and the world.

I would like to thank the United Nations Development Programme (UNDP) for funding this study, the Forest Research Institute Malaysia for

acting as the Executing Agency, the national and international members of Project Team that carried out the study, the management and staff of all the museums and institutions that welcomed the Project Team, and the scientific community in Malaysia that has been promoting the concept of a natural history museum for Malaysia for many years.

This report was reviewed by the Project Steering Committee established the Ministry of Natural Resources and Environment (NRE) and approved at its meeting on 6 May 2008.

Datuk Suboh Md Yassin
Chairman of the Project Steering Committee
Secretary-General of the Ministry of Natural Resources and Environment

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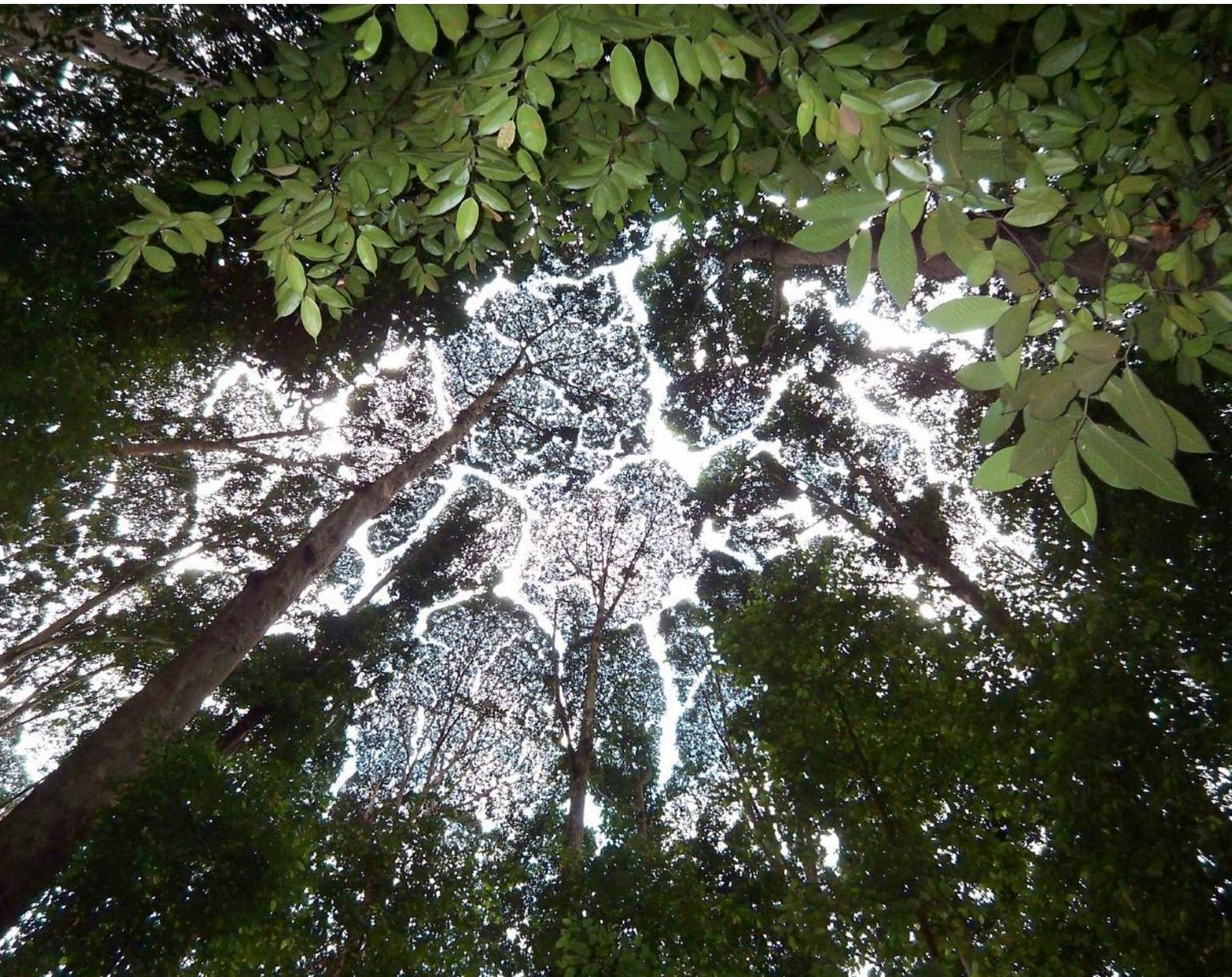
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Kapur (*Dryobalanops aromatica*) forest in Malaysia displaying the phenomenon of *crown shyness*.

EXECUTIVE SUMMARY



Background

Natural history is the scientific study of plants and animals and their natural environments. It provides the scientific basis for the management of the natural environment and the sustainable use of natural resources. It provides the scientific rationale for the UN Convention on Biological Diversity. One of the major thrusts in natural history has been and continues to be the discovery, naming, documentation and classification of all living things. In 250 years of global effort, 1.8 million species of plants and animals have been discovered, named, documented and classified. This accumulated knowledge, coupled with advances in molecular biology, has propelled biology to the forefront of science in the 21st Century.

The centres for natural history are natural history museums. Almost every country in the world has at least one natural history museum and these are nearly always prominent cultural, scientific, educational and architectural landmarks. Many countries are building new natural history museums. Malaysia, although 12th in the ranking of countries by richness in biodiversity, is one of the few countries without a natural history museum.

Malaysia's National Policy and Vision in Biological Diversity

Malaysia's location in Southeast Asia, the region of highest biological diversity in the world, gives it a big advantage in natural history. This is where many new discoveries can be made and where round-the-year field observation and experimentation are possible. Recognizing Malaysia's advantage, a National Policy on Biological Diversity was adopted in 1998 with the Vision:



To transform Malaysia into a world centre of excellence in conservation, research and utilization of tropical biological diversity by the year 2020.

Decision to establish a Natural History Museum

At the Fifth National Biodiversity and Biotechnology Council (NBBC5) meeting on 29 September 2006, chaired by the Prime Minister of Malaysia, a decision was made to establish a Natural History Museum in Malaysia.

Following the NBBC5 decision, the Ministry of Natural Resources and Environment formulated a project to develop a framework for the establishment of the Natural History Museum. A Project Steering Committee was established and a Consultancy Team was appointed to develop the framework. The Team made a study of natural history collections/museums in Malaysia, Singapore, the USA, England and the Netherlands, and its findings are reported here.

The world's leading natural history museums

The leading natural history museums of the world are thriving intellectual centres, generating new knowledge and providing a broad range of educational and scientific services to support diversified modern economies. They are premier visitor centres, showcasing the wonders of biodiversity and reflecting national scientific, artistic and technological capabilities. Their exhibitions inspire visitors of all ages, and are trusted for their scientific integrity, intellectual and aesthetic content, educational value, and global relevance. Simultaneously, they are centres for cutting-edge science. The NHM London houses 350 staff scientists and 70 million specimens representing all forms of life, accumulated in 250 years of global exploration, including fossils that go back hundreds of millions of years. The National Museum of Natural History of the Smithsonian

Birds in flight, at Naturalis, Leiden.





Institution in Washington, D.C. holds an even larger collection, of 126 million specimens. The significance of these extensive collections is that they allow comparative studies to be made across space and time, whereas studies 'on location' are tied to particular locations and times. Furthermore, because museum specimens are real, they hold information that can be progressively unlocked as new scientific tools are developed. Recent advances in molecular biology are providing tools for extracting genetic information from long-dead and even extinct animals and plants. This dramatic new development has made museum collections even more valuable than ever before.

Natural history collections in Malaysia

There are over 22 organizations in Malaysia supporting natural history units and collectively holding 3 million specimens. These include the government departments and institutions responsible for forestry, fisheries, wildlife, agriculture, and medical services; some universities; and some museums of culture and history. The existing units reflect the political and administrative organization of Malaysia, each unit having operational responsibilities only for Peninsular Malaysia or Sabah or Sarawak but not for the whole country, and each unit organized to cover only one particular sector of biodiversity, viz. forestry, fisheries, wildlife, agriculture, or tropical medicine. Working with limited research agendas, on collections defined by administrative and departmental boundaries, Malaysia's natural history scientists have had difficulty developing national overview and even more difficulty developing regional and global expertise. The existing institutional framework is too weak and fragmented to support Malaysia's national policy and vision in biodiversity.

Main recommendations

Status and name of the new natural history museum

The new natural history museum should be established as a statutory body and be designated as the national institution for realizing the national Vision on Biological Diversity. Its name should reflect its national status. Among natural history scientists, the preference is for the name Natural History Museum Malaysia (NHM Malaysia). This is also the choice of the Project Steering Committee.

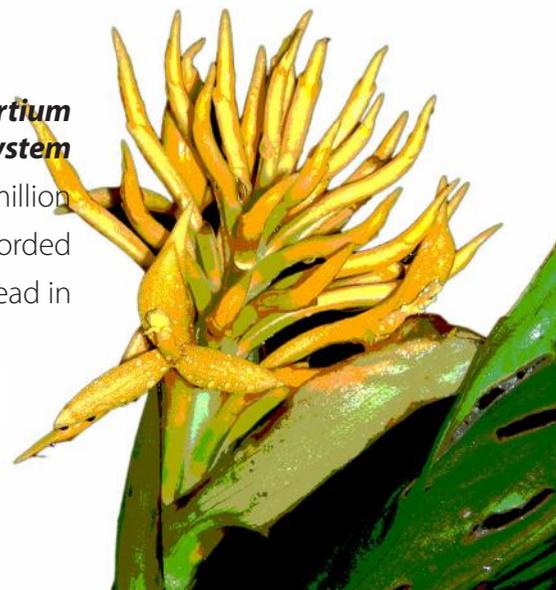
Establishment and performance targets

For NHM Malaysia to be a world centre of excellence, it will need to be equipped with state-of-the-art facilities and its performance must be benchmarked against the leading natural history museums of the world. The establishment and performance targets must include

- excellent physical facilities for the secure storage of scientific specimens
- strong programmes of research by its own staff and associated scientists
- strong programmes in exhibition and other public outreach activities
- rapid build-up of scientific collections
- modern laboratories
- scientific relations with leading natural history museums overseas
- comprehensive library and database facilities
- collaborative programmes with universities
- a peer-reviewed scientific publications programme

Establishment of a Natural History Consortium and Accreditation System

The existing natural history collections in the country, totaling 3 million specimens, are scientific heritage collections that should be accorded national recognition and support. NHM Malaysia should take the lead in



establishing a Natural History Consortium through consultation between stakeholder institutions, to function as a forum for

- establishing national standards for natural history collections
- developing an Accreditation System
- helping members of the Consortium to achieve accreditation through training, staffing, equipment and other support programmes

Projected expenditures

It is estimated that a five-year development budget of RM400 million will be needed to implement these recommendations. This does not include the cost of land (about 50 ha recommended), salaries of permanent staff and other annually recurrent expenditures.

Benefits

Natural history museums are respected worldwide for their ability to provide educational experiences at preschool, school, and adult levels. NHM Malaysia will deliver the benefits of continuing life-long education to all levels of society. In addition, several sectors of the economy will get a very special boost, e.g.

- tourism, because NHM Malaysia will share in the global reputation of natural history museums as premier tourist attractions
- higher education, because the comprehensive collections in NHM Malaysia will enable Malaysian universities to offer world-class tropical biodiversity programmes
- economic development, because NHM Malaysia's growing expertise on natural resources will be available to support the information needs of a growing economy

National and global significance of the Natural History Museum Malaysia

The Natural History Museum, as the national centre for reference materials, information, and expertise in biological diversity, will strengthen Malaysia's ability to sustainably manage and benefit from its rich biological resources. At the same time, Malaysia's entry as a major player in biodiversity research will strengthen global understanding, management, and utilization of biodiversity and help ensure that tropical concerns are well-addressed in global environmental management.

Tyrannosaurus rex at
the Field Museum,
Chicago.





1. INTRODUCTION

1.1 Background

At the Fifth National Biodiversity and Biotechnology Council (NBBC5) meeting on 29 September 2006, chaired by the Prime Minister of Malaysia, a decision was made to establish a Natural History Museum in Malaysia at national level. Following this decision, the Ministry of Natural Resources and Environment established a Steering Committee and formulated a consultancy project to develop a framework for the establishment of the Natural History Museum. A team of consultants was appointed to implement the project. The team consisted of

- Dr Francis SP Ng, FASc (Lead Consultant)
- Tan Sri Dr Ahmad Mustaffa Babjee, FASc (National Consultant)
- Datuk Dr Mohinder Singh, FASc (National Consultant)
- Datuk Dr Robert Inger (Field Museum, Chicago; International Consultant)
- Prof. Dr Peter Ng (Raffles Museum, Singapore; International Consultant)
- Ms Emma Freeman (Natural History Museum, London; International Consultant)

An unknown mushroom in the Maliau Basin of Sabah.

The Consultancy Team visited 15 institutions in Malaysia that hold and manage natural history collections, four of the best-known natural history museums overseas, and two in Singapore. The reports on these visits are provided in Appendices 1 – 3. The museums and institutions visited were

Malaysia:

- Institute for Medical Research, Kuala Lumpur
- Sabah Museum, Kota Kinabalu
- Universiti Malaysia Sabah, Kota Kinabalu
- Fisheries Research Institute, Kota Kinabalu
- Forest Research Centre, Sandakan
- Sarawak Biodiversity Centre, Kuching
- Sarawak Museum, Kuching
- Forest Research Centre, Kuching
- Universiti Malaysia Sarawak, Kuching
- Forest Research Institute Malaysia, Kepong
- Institute for Biodiversity, Department for Wildlife and National Parks, Bukit Ringgit, Pahang
- University of Malaya, Kuala Lumpur
- National Repository for Agricultural Pests, Agriculture Department, Kuala Lumpur
- School of Environmental and Natural Resource Sciences, Universiti Kebangsaan Malaysia, Bangi
- Muzium Negara, Kuala Lumpur

Overseas:

- The Field Museum, Chicago
- The National Museum of Natural History of the Smithsonian Institution, Washington, D.C.
- The Natural History Museum, London
- Naturalis, Leiden



Singapore:

- Botanic Gardens Singapore
- Raffles Museum of Biodiversity Research, National University of Singapore

Great egret, at
Kota Kinabalu

Comparative data for the Malaysian institutions are summarized in Table 1 and for the overseas museums in Table 2.

On 15 November 2007, a workshop was organized in Kuala Lumpur to bring together all natural history scientists in Malaysia. About 150 scientists attended. The workshop served to inform natural history scientists about the consultancy, and it enabled the consultants to interact with and obtain a measure of the interests and concerns of the participants. Proposals for a national natural history museum have been made by Malaysian scientists through governmental and non-governmental channels for over 20 years. The decision by the Government to establish such a museum was welcome news to the participants of the workshop.

1.2 Terms of Reference

The Terms of Reference (TOR) of the Project Management Team (incorporated into the TOR of the Lead Consultant) and the responses of the Project Management Team are as follows:

Terms of Reference	Responses
Provide recommendations for both short- and long-term strategies towards the establishment of a natural history museum (NHM) in Malaysia that will complement the biodiversity initiatives in the country.	Short- and long-term strategies are covered in Section 4: An Institutional Framework for Realizing the Vision; Section 5: Human Resources; Section 6: Physical Infrastructure; and Section 7: Budget and Funding Mechanisms.
Make recommendations as appropriate, on programmes for scientific work and other activities for natural history inventory, research, conservation, education and public awareness that can be supported by a NHM in Malaysia.	Recommendations for inventory, research, education and public awareness are made under Subsection 4.4: Establishment and performance standards; Subsection 4.6: Public support; Box 2: Reaching out to the region, the tropics and the world; Box 3: North – South collaboration; Box 5: Synergy in collections and research; and Box 6: Excellence in exhibition and public engagement. A Policy Studies Unit is proposed that will, among its responsibilities, develop conservation programmes.
Provide technical inputs to the Project Steering Committee and National Project Director for museum collections, state-of-the-art curation, exhibit design and human resource planning and development for the NHM in Malaysia.	Section 2: Review of Natural History provides an account of museum collections, state-of-the-art curation, exhibit design, human resources planning and development in the leading museums of the world. It also reviews the state of natural history collections and activities in Malaysia. The difference gives a measure of the distance Malaysia has to cover between now and 2020.
Provide expert advice and to assist in the curation of existing museum collections, especially in the pilot project stated in the project.	Subsection 4.5: Establishment of a Natural History Consortium and an Accreditation System deals with support for existing natural history collections. The pilot project was to digitize and make available on the World Wide Web rare reference works in natural history that natural history scientists in Malaysia have always had trouble accessing. This pilot project was to be subcontracted to the team involved in the international Biodiversity Heritage Library Project, but this team was unable to make progress. The pilot project had to be terminated.
Review and reconcile all relevant technical reports and information produced by the project.	All relevant technical reports have been reviewed and cited.

Table 1. Main natural history collections in Malaysia

	Institute	vascular plants	bryophytes & algae	fungi & lichen	mammals	reptiles & amphibians	birds	insects	crustaceans & spiders	fresh water fish	marine fish	molluscs	others
1	DoA	30,407						60,000	200			150	200
2	DoF	60	102		2				50	378	1,147		
3	FRC, Sabah	254,000	526					100,000					
4	FRC, Sarawak	200,000	290	4,500				458,133					
5	FRIM	300,000		1,360		2,106		620,200					100
6	IMR				10,000	5,000	500	1,500				3,500	1,500
7	IMU		160										
8	Jabatan Muzium Malaysia	1,439			1,191	316	4,328	17,623		92	2,498	13,468	108
9	Jabatan Muzium Sabah	7,624		124	3,519	5,194	3,628	5,639	304	2,893	272		
10	MARDI	22,100		2,029				29,000					
11	Marine Research, Sabah Parks		32		6	5			2		6	81	10
12	PERHITAN				6,329	2,000	720	4,000	20	577			
13	Sabah Parks	27,842	54	1,174	1,821	7,920	2,527	52,106	312	2,652		487	
14	Sarawak Biodiversity Centre	5,946	93		94	441		4,079	7,801	913		468	11,952
15	Sarawak Museum				12,000	3,400	12,000	102,200	1,000	4,000	1,500	1,200	1,000
16	UKM	72,000						130,000					
17	UM	65,000	29,000		1,227	1,110	455						
18	UMS	2,800	3,600	200	1,086	2,141	472	100,000		2,588		60,617	
19	UNIMAS	2,500	20	2,500	1,977	1,600	65	48,110	220	1,130	100	570	1,474
20	UMT					50		300	60	1,000	500		
21	UPM	2,168											
22	USM	12,000											
	Total	1,005,886	33,887	11,887	39,252	31,283	24,695	1,732,890	9,969	16,223	6,023	80,541	16,344
Grand Total		3,008,870											

DoA: Department of Agriculture; DoF: Department of Fisheries; FRC: Forest Research Centre; FRIM: Forest Research Institute Malaysia; IMR: Institute for Medical Research; IMU: International Medical University; MARDI: Malaysian Agricultural Research & Development Institute; PERHILITAN: Department for Wildlife and National Parks; UKM: Universiti Kebangsaan Malaysia; UM: Universiti Malaya; UMS: Universiti Malaysia Sabah; UNIMAS: Universiti Malaysia Sarawak; UMT: Universiti Malaysia Terengganu; UPM: Universiti Putra Malaysia; USM: Universiti Sains Malaysia).

Table 2. Comparison of selected natural history museums

	Natural History Museum, London	National Museum of Natural History of the Smithsonian Institution, Washington, D.C.	Field Museum, Chicago	Naturalis, Leiden	Raffles Museum of Biodiversity Research, Singapore	Botanic Gardens Singapore
Establishment year	1753	Opened 1910	1893, as the Columbian Museum of Chicago	1820, as the National Museum of Natural History	1849, as the Raffles Library and Museum, absorbed by NUS in 1996	1859
Legal status	A non-profit organization under Dept of Culture, Media and Sport	Government organization	A non-profit organization	A Foundation established by Act of Parliament to manage national collections	A department of the Faculty of Science, National University of Singapore	A department of the National Parks Board of Singapore
No of visitors a year	3,200,000	7,200,000	2,000,000	300,000	Not applicable	3,200,000
No of visiting scientists a year	9,200 (2005/06)	7,748 (2007)	607	250	100	37
Governing Board	Board of Trustees of 12 members	Advisory Board of 22 members	Board of Trustees of 80 members	Governing Board of 7 members	Not applicable	National Parks Board of 10 members
Size of collections	Total 70 m specimens. Animals 28 m Plants 5.2 m Minerals 350,000 Fossils 9 m Insects 28 m	Total 126 m specimens. Insects 30 m Plants 4.5 m Fish 7 m	Total 23 m specimens	Total 12 – 15 m specimens Insects 5.3 m Other invertebrates 2.3 m Vertebrates 1 m Fossils 1 m Rocks and minerals 440,000	Total 500,000 specimens Animals over 400,000	Total 650,000 plant specimens
Scientific fields	Botany Entomology Zoology Paleontology Minerology	Anthropology Botany Entomology Mineral sciences Palaeobiology Zoology	Anthropology Botany Zoology Geology	Zoology Entomology Geology	Zoology Botany	Botany
Admittance	Free	Free	By ticket	By ticket	Free	Free
Days closed	Christmas Day	Christmas Day	Christmas Day	Mondays	Weekends	Weekends (herbarium only)

2. REVIEW OF NATURAL HISTORY

2.1 The scope of natural history

Natural history is the scientific study of plants and animals and their natural environments. In particular, it deals with the discovery, naming, documentation and classification of all forms of life, collectively known as biodiversity. It is the science most closely connected with

- survey and management of natural resources
- bioprospecting for useful species and natural products, e.g. new species for horticulture and new products for pharmaceutical use
- search for biological processes with agricultural and industrial potential, e.g. for biological control of pests and diseases, bioremediation of polluted soil and water, and biological conversion of biomass to energy

Natural history provides the scientific rationale for the UN Convention on Biological Diversity¹.

Discoveries in natural history have consistently made up a large proportion of published scientific discoveries in the world. In 250 years of global scientific effort, about 1.8 million species of plants, animals,

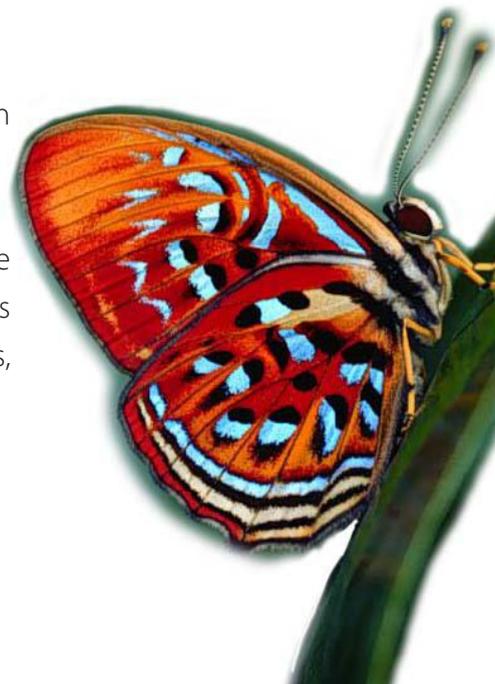




Table 3. Number of species known to science²

Kingdoms	Described species
Bacteria	4,000
Protictists (algae, protozoa, etc.)	80,000
Animals	1,320,000
Fungi	70,000
Plants	270,000
Total	1,744,000

and other living things have been named, documented and classified (see Table 3). This accumulated knowledge, coupled with advances in molecular biology, has propelled biology to the forefront of science in the 21st Century.

2.2 The method of natural history

Natural history as a science dates back to the 1700s (see Box 1), but the practice of preserving specimens from nature began earlier, with herbal medicine. To meet the need for accuracy in plant identification, authenticated specimens were preserved for reference by pressing, drying and gluing such specimens to sheets of paper. On the same paper, the name of the plant and other notes would be written in, together with the signatures of those responsible for the names and annotations. Such authenticated and annotated specimens were used in reference and teaching and sometimes bound into books. The idea of preserving specimens for reference and teaching was extended to animals, minerals, and other natural objects, and the buildings housing such collections became the first natural history museums.

The anchoring of the name of a species to a particular specimen preserved in a museum has become the standard practice for all species. New specimens are identified by matching with existing named specimens.

Specimens that do not match anything already known may then be interpreted as new species.

The particular specimen serving as the anchor for a name is designated as its holotype. Additional specimens of each species serve to provide fuller information about the species. Dates and localities of collection, and descriptions of habitat, are particularly important and are preserved together with the specimens. Thus almost every statement about a species is backed by a preserved specimen and its notes, and these are available for cross-checking and verification at any time.

Natural history museums accept responsibility for preserving the reference specimens together with the data associated with them, and making them available for scientists to study. Museum collections allow scientists to work out the geographical distribution and habitat of each species, to compare species that never occur next to each other in nature, to

Box 1. Natural history as a science

The mission to map and understand the full extent of life on earth has been one of the driving global missions of science. Its leading personality was Carl Linnaeus (1707 – 1778) a professor at the University of Uppsala in Sweden, who in his own lifetime, built up a world collection of 14,000 plants, 158 fish, 1,564 shells, 3,198 insects and 1,600 books. This collection is now owned by the Linnean Society of London. Linnaeus developed the 'scientific' or 'binomial' system of naming species. 'Binomial' refers to the two words that make up the name of a species, e.g. *Hibiscus rosa-sinensis*, of which the first word, *Hibiscus*, denotes the scientific group or genus (pl. genera) to which the species belongs. The binomial naming system requires the discoverer of a new species to find out what existing species it resembles most and to maintain such species within the same genus. The naming of a species thereby incorporates the first stage in its classification. Genera are grouped into families, families into orders, and so on up to the level of Kingdom. Classification is what converts an otherwise hopeless jumble of names into structured knowledge. Common names are a hopeless jumble whereas scientific names are anchored to a system of structured knowledge.

By the time he published the 10th edition of his *Systema Naturae* (1758), Linnaeus had named 7,700 species of plants and 4,400 species of animals. After Linnaeus, the total number of species known to science has been increased to its present total of over 270,000 plants and over 1,320,000 animals. The original two Kingdoms (Plant and Animal) have been split into five (Table 3), and more changes are being proposed. The manner in which the inventory and classification of life has been carried out—any person with knowledge and interest can take part—reminds of the way today's Wikipedia, a global public encyclopedia, has come about.

The mission to document and classify all life on earth represents a very large segment of the total scientific activity in the world, but the mission is still a long way from completion. Estimates for the total of number of species range between 5 and 100 million!

compare specimens from different periods in time, and to detect changes in biodiversity and environment. There is continuous synergy between natural history collections and natural history scientists: good collections attract the attention of the world's scientists, who review and keep the collections up to date with current concepts in classification. Poorly-managed collections do not attract scientific attention and quickly lose scientific relevance.

2.3 The functions of natural history museums

The best-known natural history museums in the world are major visitor/tourist landmarks, staging exhibitions that inform, entertain and inspire. However, it is the quality of the scientific collections and scientific research at the back that provides the authority for the exhibitions in the front. Hence the leading natural history museums excel in three core functions:

- management of scientific collections
- scientific research
- exhibitions and outreach programmes

In consequence, such museums are

- major visitor/tourist attractions
- centres for advanced training in the life sciences
- providers of advisory and consultancy services to a wide range of users

2.3.1 Management of scientific collections

The most important physical resources of a museum are its collections of natural history specimens. The Natural History Museum of London holds 70 million specimens representing all forms of life, accumulated by 250 years of global exploration, including fossils that go back hundreds of millions of

years.³ It continues to add to its collections at the rate of 150,000 specimens a year. The National Museum of Natural History of the Smithsonian Institution in Washington, D.C. holds 126 million specimens.⁴ The level of comprehensiveness of a museum collection and the quality of its maintenance or curation define the level of research that the museum can support.

In a museum with comprehensive collections, species that never occur side by side in nature, species that no longer exist, and specimens collected recently, can all be laid out beside each other in the laboratory for comparative study. Scientists with new questions are often able to find the answers in a comprehensive museum collection. Hence the leading museums attract visiting scientists from all over the world. The Natural History Museum in London attracts over 9,000 visiting scientists a year. The National Museum of Natural History in Washington, D.C. attracts about 8,000. Visiting scientists magnify the power and prestige of museums. The leading museums welcome visiting scientists and further engage the experts of the world by allowing them to borrow specimens for study. The Natural History Museum in London loaned out 70,000 specimens to 3,084 experts or venues/centres in 2005/06. The National Museum of Natural History in Washington, D.C. and the Field Museum in Chicago loaned out specimens to 1,562 and 663 venues/centres respectively in 2007.

Each specimen in a museum is a real record of something from a



DNA research at the National Museum of Natural History, Smithsonian Institution, USA

particular place and time. For many species, museum specimens are the only indisputable evidence of where and when the species used to occur and of the environments in which they lived. The effects of climatic and other forces, if they have affected the lives of living things, are captured and fixed in museum specimens, waiting to be deciphered by scientists with the right tools and questions. The electron scanning microscope is an example of a tool that allows new details to be mined from museum collections. Even more dramatically, advances in molecular biology are making it possible to extract genetic information about extinct species from long dead and even fragmentary specimens.

Opp page:
Snake collection
at the Institute for
Medical Research.
Kuala Lumpur

Realizing the unique scientific and strategic importance of their collections, the leading museums have given top priority to the effective and permanent preservation of their collections. At the National Museum of Natural History in Washington, D.C. a new magnificent facility called the Museum Support Center has been built to house the museum's collection of 126 million specimens. At the Natural History Museum in London, two storage facilities are being built, known as Darwin Centres One and Two. At Naturalis in Leiden, its 15 million specimens are kept in a specially designed 20-storey block that towers over the city of Leiden—this facility is sealed off from the outside world by double walls, absence of windows, totally controlled and uniform temperature and humidity, filtered dust-free air, and UV-free lighting.⁵ In all the leading museums, there is a constant watch for beetles and other insects that degrade specimens. Specimens are cleaned by deep freezing at -18°C to destroy insect pests and their eggs.

2.3.2 Scientific research

Because much of the biodiversity of the world still remains unknown, the discovery, documentation and classification of species remain a major research activity of all museums.

As a product of such research, new, interesting and useful species are made known for horticultural, agricultural, pharmaceutical and other uses. New species have driven and inspired horticulture ever since the introduction of tulips from Turkey to the Netherlands in 1593.

Nature is a vast laboratory of life that has generated not only millions of species but also millions of solutions to the problems of life on earth. These solutions include natural processes for biological control of pests and diseases, for bioremediation of polluted environments, for the biological conversion of biomass to energy, and even for the extraction of minerals from soil and water. A major part of biotechnology has to do with the harnessing of such processes for industrial-scale application.

Natural history museum scientists are increasingly involved in research to improve our understanding of the processes driving change in the environment. Such understanding is essential for the design of methods for conservation and management of the environment. For example, the dangers of uncontrolled pesticide usage came to light when scientists compared eggs preserved in museum collections and found that the eggshells of eagles and other birds of prey had become thinner and more fragile after the widespread introduction of pesticides in agriculture. Birds of prey occupy the top positions in their food chain and accumulate toxins picked up by lower members of the food chain. The fragility of eggs was the reason for the decline observed in populations of such birds. This knowledge contributed to better controls over the use of pesticides in agriculture and to the rise of organic farming.

The scientific reputation of a natural history museum is based on the quality of its scientific publications. The leading natural history museums

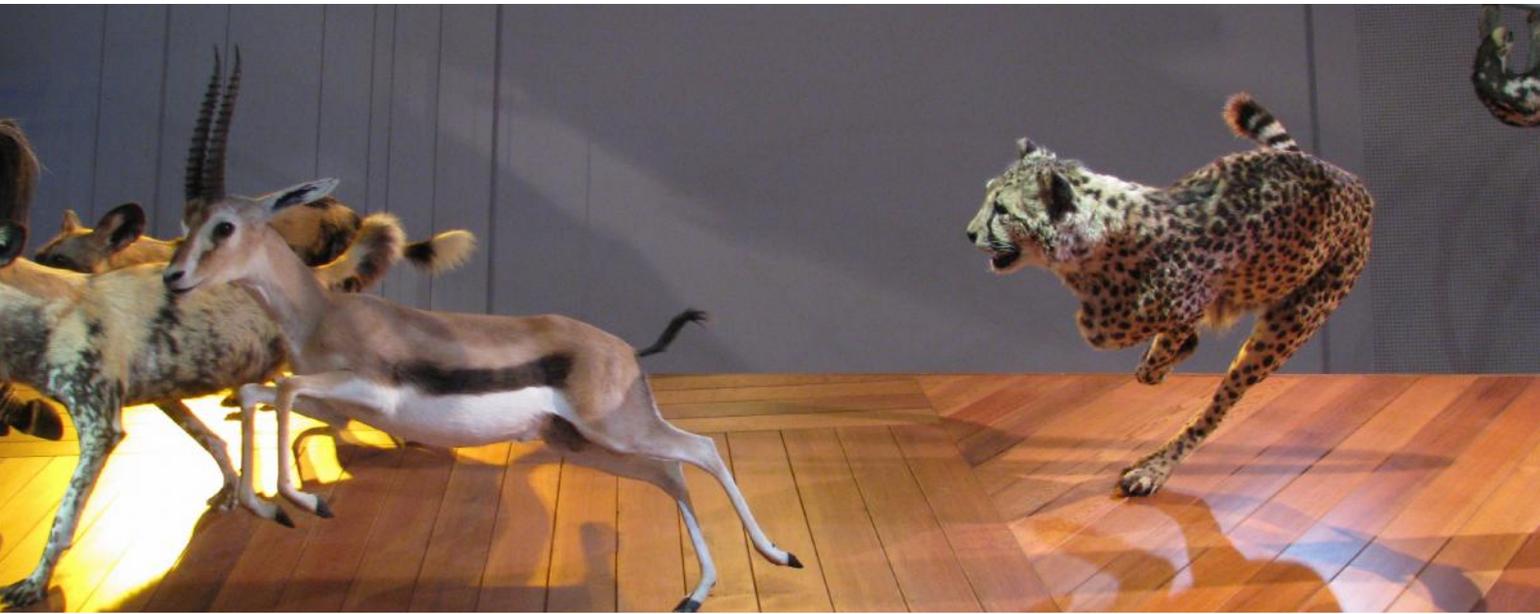
maintain their scientific credentials through the publication of peer-reviewed articles, journals and books.

2.3.3 Exhibitions and outreach programmes

The leading natural history museums organize informative, culturally-enriching, and often spectacular exhibitions aimed at all levels of society, from children to senior citizens. These attract millions of visitors, national and international each year, e.g. 7.2 million at the National Museum of Natural History in Washington, D.C. and 3.2 million at the Natural History Museum in London. A survey commissioned by the American Association of Museums in 2001 found that 87% of Americans view museums as the most trustworthy sources of objective information—followed by books (61%), television (49%), newspapers (34%) and the Internet (23%). As a primary resource for educating children, schools were rated first in importance (98%) followed by museums (86%).

Natural history museums have found that people think and learn in many different ways. Natural history museum exhibitions use “specimens, models, dioramas, hands-on activities, videos, animations, artists’ renderings, and audio components geared to communicate complex messages succinctly and clearly while accommodating a wide variety of learning styles” (quote from the 2006 Annual Report of the Field Museum⁶). In all the four leading museums visited by the consultants, exhibitions and associated outreach activities are managed by full-time professionals with expertise in events-management, designing, writing, graphic arts, model-making, education, science communication, public relations, information technology, and related subjects.

As the quality of exhibitions has improved, the leading museums have discovered that there is a world demand for educational experiences of high scientific value. The exhibition *Ice Station Antarctica*, currently on



A cheetah in action — new dynamism in museum display - at Naturalis, Leiden.

show in the Natural History Museum in London, is booked as a traveling exhibition for the next five years. The Field Museum's traveling exhibition *A T. rex Named Sue* has been in many parts of the US and Asia. It is rented at USD95,000 per three months. During its stint in Singapore it not only paid for itself but also made a good profit for its sponsors. Touring exhibitions increase the museum's profile overseas and provide additional income that can support the museum's activities.

Because of rapid changes in natural history and all areas of science, and increasing levels of anxiety over the state of the environment, there is a need to keep the public informed and updated on a continuous basis. Natural history museums have been the most successful of all public institutions in catering to public information needs about the natural environment. The busiest natural history museums not only deliver outstanding educational experiences in the form of blockbuster exhibitions, but also arrange lectures and other special events, and put heavy emphasis on the maintenance of active and popular websites.

2.3.4 Major visitor/tourist attractions

Natural history museums are major visitor attractions. Local people interested in their own country and international visitors wanting to know more about the country they are visiting, would normally think of a museum as the best place for information. Children are particularly attracted to dinosaurs, mammals, birds and reptiles, while adults may head for the minerals and gems, the wildlife photo gallery, and so on. Natural history museums increase understanding of the natural potential of a country. It contributes to the sense of national identity and to a better understanding of the natural relationship of the country with its region and the world.

2.3.5 Centres for advanced training in the life sciences

The leading natural history museums attract thousands of visiting scientists from all over the world (9,200 at NHM London in 2005/06, and 7,700 in the National Museum of Natural History in Washington, D.C.). The universities situated nearby benefit greatly from proximity to such museums, and collaboration is strengthened by the appointment of museum staff as adjunct professors at the universities and the appointment of university professors to honorary positions in the museums. Young scientists training in such museums, being exposed to global collections and global experts, quickly develop global competence and ambitions themselves, and are positioned to become the scientific leaders of the future. Working together, the leading natural history museums and their associated universities have produced most of the leading biologists of the world.

2.3.6 Providers of advisory and consultancy services

The range of specialist advisory and consultancy services that a comprehensive natural history museum can provide is indicated by the following client list of the Natural History Museum, London (viewable on

the NHM website “Science enquiries and NHM consulting”):

- the food industry and retailers
- customs officers, importers and shipping agents
- health authorities, public analysts, laboratories, veterinary practices, including officers requiring identifications of venomous or noxious species
- farmers, agriculturists, horticulturists and gardeners
- scientists, environmentalists and agencies undertaking terrestrial, marine and freshwater surveys
- the legal profession requiring expert witnesses
- forensic scientists and the police, including officers investigating evidence relating to fly larvae or the movement of contraband
- publishers requiring validation of technical content (both images and text)
- mining, petroleum, water and waste disposal industries
- material technologists, architects and other users of building stones
- auctioneers requiring information on amber, carved materials, and natural history artifacts

2.4 Natural history in Malaysia

2.4.1 The state of collections

There are 22 institutions in Malaysia holding natural history specimens (Table 1). The total number of specimens is about 3 million. The older collections were established in government departments, primarily to provide scientific identification services, and this is still their main function. In the fight to control tropical diseases, it was vital to accurately identify the organisms causing sickness and death so that research could be targeted at them. Similarly, it was necessary to identify the diseases and pests of crop plants and livestock. In the case of forestry, it was necessary

to identify trees so that their timbers could be better promoted in the international timber market and the forests could be more scientifically managed. Correct identifications were also necessary for the management of fisheries and wildlife, to support quarantine efforts at national entry points, to enable certification of timber and other exported natural products (often required under WTO regulations), to support legal and commercial transactions involving biological materials, and to provide verification of materials used in pharmaceutical and food products.

Identification is done by comparing specimens against a reference collection of authenticated specimens. Once a well-authenticated reference collection has been established, routine identifications by

Wet Collection
(preserved in alcohol)
at the Natural History
Museum, London.





comparison can be done by para-taxonomists. Para-taxonomy is effective for the identification of specimens from an area against a reference collection from the same area, e.g. a specimen collected in Sabah against a reference collection from Sabah. A para-taxonomist would not be able to identify a specimen that is not already represented in the reference collection. The development of a reference collection of authenticated specimens requires the combined skills of many taxonomists, each one a world specialist in a particular group of plants or animals. Building up a comprehensive collection of authenticated specimens therefore takes an immense amount of time and effort. The current fee charged for expert identification by the Natural History Museum, London, is £89 per specimen. The £89 charge conveys a message—that an expert identification service is valuable and should not be treated lightly. This charge is levied for ‘commercial enquiries’ and may be waived. The Forest Research Centre in Sabah receives free identification support from NHM London. The Institute for Medical Research in Kuala Lumpur gets free identification support from the National Museum of Natural History in Washington D.C.

Natural history museums do not charge each other for identifications. Such services are provided under scientific exchange agreements. NHM Malaysia, as the national focal point for natural history, would be able to obtain identifications through its exchange agreements with other natural history museums in the world, and in turn support the identification services of natural history units throughout the country.

Authenticated reference collections, once they have been built up, are invaluable national assets. In our study, we found the standard of maintenance of collections in Malaysia to be below international best practices except in the new facilities at the Universiti Malaysia Sabah. Almost nowhere are the collections stored under round-the-clock air-conditioned, humidity-controlled, UV light-shielded, and totally pest-free conditions. The up-

grading of standards requires urgent national attention, otherwise some priceless authenticated reference collections, representing many decades of scientific effort, will be lost. Common problems are loss of expertise and breaks in continuity when experienced staff retire, lack of space, and insufficient funds for maintenance. Nationally, it is not generally appreciated that the 3 million collections in the country collectively constitute a priceless national scientific heritage. This is in sharp contrast to the situation in, for example, the Netherlands, where the natural history collections are treated as the scientific heritage of the nation. The nation pays Naturalis, a non-profit foundation, to look after the collection and sends inspectors to check that the collections are looked after according to very stringent standards.

2.4.2 *The state of research*

Natural history collections in Malaysia are limited by state and national boundaries. As a result, the scientists associated with them work within small intellectual boxes. For example, a scientist working on a museum collection in Sabah would have Sabah specimens to examine but very few from outside Sabah. In such a situation, it is not possible for the scientist to decide whether a specimen new to Sabah is really new to science. It may be a species already known across the border, in Kalimantan, Brunei, Sarawak, Philippines or Peninsular Malaysia. All the natural history units in Malaysia are in this limiting situation. No natural history unit in Malaysia has responsibility to overview the whole of Malaysia or Southeast Asia.

As for the monitoring of changes through time, there are very few specimens from over 100 years ago. The vast majority of specimens collected over 100 years ago from Malaysia were deposited overseas, but there are many collections going back about 50 years, and these are important. For example, an identified collection of fishes from the waters of Sabah made 50 years ago contains information about the fishes and

Opp page:
An unknown
climber, one
of hundreds of
climbing species
in Malaysian
forests.

waters of Sabah at that time. If the collection is lost, it will be very costly to build up another identified collection and the new collection will not contain information about the past.

Because of the segmented and limited nature of Malaysian natural history collections, only few scientists in Malaysia have pan-Malaysian experience. Only a few have made impact regionally or globally, although in its wealth of biodiversity, Malaysia ranks 12th in the world (see Table 4).

Table 4. World biodiversity rankings according to the National Biodiversity Index (NBI), based on vertebrates and vascular plants.

Rank	Country	NBI
1	Indonesia	1.000
2	Colombia	0.935
3	Mexico	0.928
4	Brazil	0.877
5	Ecuador	0.873
6	Australia	0.853
7	Venezuela	0.850
8	Peru	0.843
9	China	0.839
10	Costa Rica	0.820
11	Madagascar	0.813
12	Malaysia	0.809
13	Panama	0.793
14	Philippines	0.786
15	Brunei	0.777
16	Papua New Guinea	0.775
17	Guatemala	0.744
18	India	0.732
19	Bolivia	0.724
20	Equatorial Guinea	0.714
21	South Africa	0.714
22	Cuba	0.703

Southeast Asia, has been a magnet for natural history scientists and graduate students from Europe, North America and Japan. However, it is rare for a Malaysian natural history scientist to do field work in a neighbouring country. The natural history scientists of neighbouring countries like Indonesia, Philippines, Thailand and Brunei also tend to confine themselves to their own countries. As a result, the regional experts on Southeast Asian natural history are based almost entirely in Europe, USA and Japan. Whenever regional expertise is needed, the experts have to be invited from outside the region. For example, in a conference on mosquitoes and mosquito-borne diseases organized by the Academy of



Sciences Malaysia in year 2000, regional overviews on the ecology and taxonomy of mosquitoes had to be provided by invited Japanese experts who had worked on mosquitoes all over Southeast Asia.⁷ No Southeast Asian mosquito scientist had regional expertise. Malaysia can and should play a pivotal role in breaking through habits rooted in the colonial past that have inhibited cross-boundary scientific collaboration in the region (see Box 2).

2.4.3 Exhibitions and public outreach

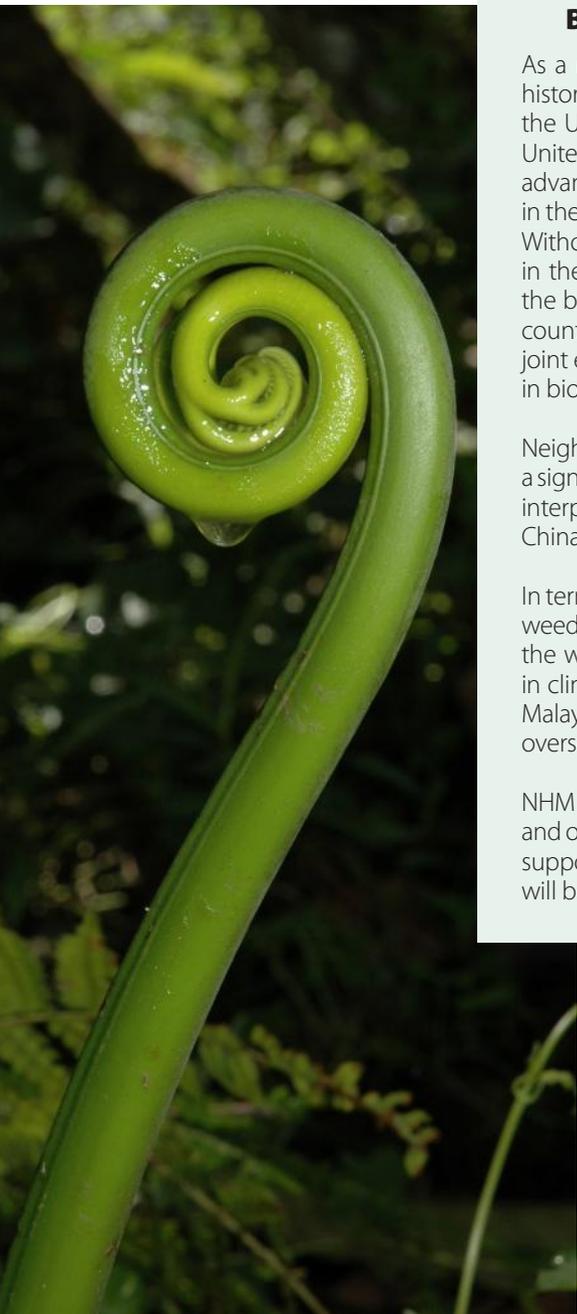
Box 2. Reaching out to the region, the tropics and the world

As a result of the colonial history of Southeast Asia, linkages between natural history museums have been parallel and separate: Malaysia and Singapore with the United Kingdom, Indonesia with the Netherlands, the Philippines with the United States, and Vietnam, Cambodia and Laos with France. This has hindered the advancement of knowledge in natural history across Southeast Asia. The species in the region are closely related to each other and may even be the same species. Without a holistic regional overview, many studies in natural history undertaken in the former colonies have been deficient due to ignorance of what lies over the borders. NHM Malaysia should initiate links with museums in neighbouring countries for the exchange of duplicate specimens and for the organization of joint expeditions to promote collaborative research and region-wide knowledge in biodiversity.

Neighbouring countries should initially be defined as those of Southeast Asia but a significant percentage (5 – 10%) of Malaysia's biodiversity cannot be satisfactorily interpreted without reference to the greater Asian region that includes India and China.

In terms of species, Malaysia shares many agricultural and horticultural plants and weeds with tropical America and tropical Africa. In terms of ecology, countries in the whole of the tropical belt share many common features due to similarities in climate. We also share many economic interests, and these are expanding as Malaysian businesses grow and as Malaysian graduates take up employment overseas.

NHM Malaysia, as a resource centre for Malaysian scientists, businesses, students, and others should, though international networking, build up its ability to provide support for Malaysia's national, regional and global interests even though its focus will be on Malaysia and its immediate region.

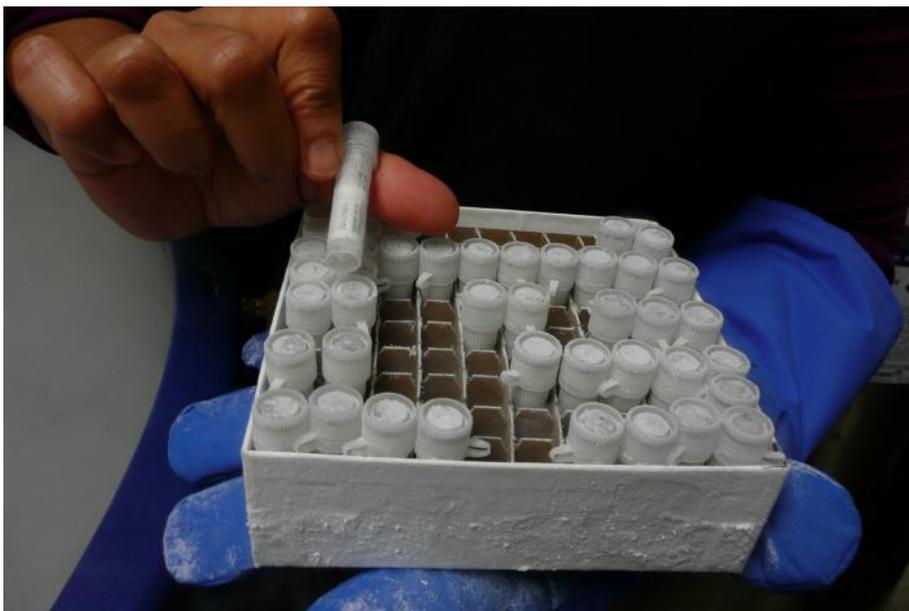


Since the natural history collections in Malaysia are mostly collections established within government departments to serve the departments' own needs, public outreach programmes have never been priority activities. Wherever exhibitions have been set up, they have been the result of one-time efforts. Newly developed exhibitions look fresh and attractive while old ones deteriorate through time.

The popularity and effectiveness of an exhibition are best indicated by the number of visitors. Institutions that host exhibitions and other public outreach programmes should monitor their effectiveness through visitor records and establish mechanisms for prompt remedial actions whenever a decline is indicated. Regular monitoring is rarely practised in Malaysia.

2.4.4 Training and professional development

Natural history museums with comprehensive scientific collections attract scientists from all over the world and become places where young scientists can meet and work with experienced scientists. In such



Tissue samples stored in liquid nitrogen

an intellectual environment, young scientists naturally develop global ambitions and capabilities. A good natural history museum would serve as a central resource that all the universities can use.

Malaysia needs a natural history museum with collections large and comprehensive enough to support the universities in the development of world-class training programmes in the life sciences and in the management of natural resources and environment. Such training will increase in importance as natural resources and the environment become critically endangered by the unintended consequences of human activities. Malaysia could be the centre for such training in the tropics.

Rare plants in the Conservatory of the University of Malaya, Kuala Lumpur.



3. MALAYSIA'S NATIONAL POLICY AND VISION ON BIODIVERSITY

3.1 Malaysia's international biodiversity interests and commitments

The Convention on Biological Diversity¹, internationally negotiated and adopted in 1992, puts a responsibility on national governments to conserve biodiversity, use it sustainably and share the benefits arising from the use of genetic resources in a fair and equitable way. This “most complex and wide-ranging environmental treaty in existence” calls for a high level of integrated knowledge and coordinated action on the part of national governments in matters concerning biodiversity, genetic resources and environment.²

Already, economic activities such as ocean fishing, trade in animal products as diverse as ivory, furs, shark's fins, timber, orchids, birds, and other forms of wildlife, the management of forests and freshwater systems, the use of biofuels, the regulation of genetically modified organisms and the management of genetic resources, have come under critical international scrutiny. International regulations have already come into effect in many areas of concern. The health of biodiversity is intertwined with the health of the environment and both are under increasing pressure, with effects



spilling across national boundaries. Ultimately it is the health and well-being of humanity that is at stake. Continuing international and national assessments on the state of biodiversity and biological resources require sustained and comprehensive attention by governments.

3.2 Assessment of biological diversity in Malaysia

Following the Convention on Biological Diversity, the Ministry of Science, Technology and the Environment Malaysia commissioned a Malaysia Country Study on Biological Diversity⁸. This study, entitled Assessment of Biological Diversity in Malaysia and published in 1997, contains many recommendations, one of which is to establish a national institute on biodiversity.

3.3 National policy and vision

In 1998, the Ministry of Science, Technology and the Environment published the National Policy on Biological Diversity⁹ with the vision statement:

To transform Malaysia into a World Centre of Excellence in Conservation, Research and Utilization of Tropical Biological Diversity by the year 2020.

3.4 Decision to establish a Natural History Museum

At the Fifth National Biodiversity and Biotechnology Council (NBBC5) meeting on 29 September 2006, chaired by the Prime Minister of Malaysia, a decision was made to establish a Natural History Museum in Malaysia.





4. AN INSTITUTIONAL FRAMEWORK FOR REALIZING THE VISION

4.1 Mission and status of the Natural History Museum

With the decision made at the Fifth National Biodiversity and Biotechnology Council (NBBC5) meeting to establish a Natural History Museum in Malaysia, we recommend the Natural History Museum to be designated as the national institution for realizing the vision of the National Policy on Biological Diversity.

The new museum should be established as a statutory body under the Ministry of Natural Resources and Environment. This Ministry is appropriate because it oversees most of the departments concerned with nature and environment, in particular Forestry, Wildlife and National Parks, Minerals and Geoscience, and Environment. An Act to establish the new museum will need to be prepared by the Ministry.

4.2 The name of the museum

The name of the museum should reflect its national status. The Consultancy Team considered a dozen possible names and found that among natural history scientists, the most preferred name is NATURAL HISTORY MUSEUM MALAYSIA (NHM MALAYSIA). This is also the name preferred by the Steering Committee.

4.3 The Governing Board

In common with other statutory institutions in Malaysia, NHM Malaysia should be governed by a Board appointed by the Minister. Its members should be eminent persons from the Government at Federal and State levels, and from corporate, civic, and academic organizations. The Director-General should be a member of the Board.

4.4 Establishment and performance standards

To be comparable with other world centres of excellence in natural history, the new museum will need to be equipped with state-of-the-art facilities for natural history, and its performance must be benchmarked continually against the leading natural history museums of the world. The implementation and performance targets must include

- excellent physical facilities for the secure storage of scientific specimens
- strong programmes of research by its own staff and associated scientists
- strong programmes in exhibition and other public outreach activities
- rapid build-up of scientific collections



A budding scientist at the Investigate Centre, NHM London.

Box 3. North – South collaboration

The early European explorations of the 18th and early 19th centuries resulted in collections of plants and animals all of which were brought back to Europe for study and housed in the then newly established museums. From mid-19th century to mid-20th century, collections were carried out mainly by scientific expeditions from Europe, with most of the materials being sent back to European museums, but duplicate collections were maintained in regional colonial museums, notably in Singapore and Bogor. Scientific analysis of the biodiversity of Malaysia and adjoining territories was pursued first by Europeans and later by American, Australian, and Japanese biologists, who published their results in journals and books in their home countries.

Following Independence, Malaysian biologists have been carrying out explorations on the biodiversity of Malaysia, but the 250-year tradition of collecting, research, and publication by biologists of the North means that the bulk of the physical and intellectual resources still remain in the North. For the NHM Malaysia to become a strong contributor to global knowledge in biodiversity, it should work with scientists and their museums in the North in partnership and exchange programmes. Such programmes could include

- visiting curatorships and fellowships
- joint research programmes
- training programmes
- joint field efforts to collect specimens and information on biodiversity
- joint authorship of research papers and books

For example, an expert from overseas could be invited to spend one to three months in residence at the new museum, making joint field collecting trips, directing the preparation of the new specimens, and identifying these and others already in the collection. The new museum would benefit from access to the older museums' collections, stimulation of the scientific staff, training in collecting, preservation, and maintenance of specimens, and joint publication of scientific work.

Holotypes of newly discovered species should remain in the new museum but the remainder of specimens collected under these programmes should be divided between the new museum and the home museum of the visiting scientist by prior agreement. Many museums allow their curators to travel for field work only if the work results in additions to their collections. A partnership and exchange programme should result in

- growth of the collections
- training of staff and students
- increase in knowledge of the biodiversity of Malaysia and adjacent regions



- modern laboratories
- scientific relations with leading natural history museums overseas (see Box 3)
- comprehensive library and database facilities (see Box 4)
- collaborative programmes with universities
- a peer-reviewed scientific publications programme

4.5 Establishment of a Natural History Consortium and an Accreditation System

The existing natural history collections in the country, totaling 3 million specimens and managed by different organizations under different federal and state mechanisms, should all be recognized and supported as national heritage scientific collections.

Many of the existing collections suffer from lack of continuity in staff expertise. Typically, these collections represent a small part of the activities of a large organization (government regulatory department, university, or museum of culture and history). The person who builds up the collection in a lifetime of effort would retire and the replacement officer would be someone new to the discipline, not fully appreciative of the scientific value of the collection, and too low in the hierarchy to get support from higher levels in the organization. The collection deteriorates physically. The number of visiting scientists declines to zero. The public stops referring to the collection because the absence of expertise cannot be disguised. The collection sinks lower and lower in the organization's order of priorities. Instead of knowledge of biodiversity being built up progressively year by year, we face the prospect of knowledge being eroded year by year on many fronts. Malaysia's ambitions to be a leader in tropical science based on its wealth in biological diversity cannot be realized under such circumstances.

Box 4. Natural history in the Information Revolution

There is a quiet but massive revolution taking place in the management of scientific information. Modern science is based on the premise that knowledge is most reliable and beneficial to society when it is open, transparent, and publicly accessible. However there has been a limitation to accessibility due to the cost of storing, multiplying and distributing paper documents. This limitation has now been removed by advances in digitization of information, and the removal of distribution, storage and other barriers by the global reach and power of the Internet. Now the information resources of the world's natural history museums can be made truly public.

The most exciting prospect is that all of the world's scientific literature, beginning with the rare old classics carefully preserved in the great libraries, are being digitized and made available freely to the public on the Internet. Some of these books are so rare that a copy cannot be found even within the combined library holdings of the ten largest museums in world. As for current and copyrighted publications, more and more publishers are putting their publications on the Web and providing free and open access. The world of scientific publication is being shaken up drastically.

The movement to make digitized images of type specimens available on the Web is gathering strength, especially for plant specimens, which are flattened and easy to photograph. All the type specimens of plants of the world are likely to be available in the next ten years. Technology is now moving to the stage where a three-dimensional specimen such as an insect can be mounted under a microscope in a museum and revolved, manipulated, and image-transmitted instantaneously to a viewer elsewhere.

Even more significantly, the collector's notes made at the time of collection, which include details of location and date of collection, are now being painstakingly transferred into electronic databases to be made available on the Web. It is such information that gives a specimen its scientific value. Access to such information has always been very difficult because a collector makes notes only once, and copying such information has been a tedious process. Museums are now tackling the problem with determination, and database platforms are being developed to handle the vast amounts of information rapidly and reliably.

To reverse these negative trends, NHM Malaysia should take the lead in establishing a Natural History Consortium, to function as a forum for

- establishing national standards for natural history collections
- developing an Accreditation System
- helping members of the Consortium to achieve accreditation through training, staffing and other support programmes

The Consortium should be established as soon as possible through consultation between stakeholder institutions.





4.6 Public support

The leading natural history museums, particularly those in the USA, derive strength from the public and have established many mechanisms for cultivating public support. Support may be in the form of (a) volunteers working as guides, interpreters, researchers and research assistants, (b) gifts of specimens, and (c) donations, endowments, and financial sponsorship of exhibits, equipment and events.

The best place to obtain exposure and training in museum public relations and fund-raising would be in a non-government museum in the USA, such as the Field Museum in Chicago, where public relations and fund-raising are regarded as part of the job of everybody involved with the museum, from its president to its scientists, ticket counter staff, security officers, volunteer workers, members and donors.

4.6.1 Council of Trustees

A Council of Trustees should be established by the Board to advise the Board on the management of gifts, donations, endowments, and income from membership and museum enterprises. The Council will help to raise funds for the museum, oversee its investments, and provide assurance to the public that the agreed terms of donorship will be respected.

4.6.2 Membership and Fellowship systems

We recommend the establishment of a system by which the public may contribute to the support of the museum through membership. Members pay a membership fee and may be provided with membership privileges such as newsletters, previews of exhibitions and other events. Corporate Members are corporations which support the museum with corporate donations. A membership system would strengthen the finances of the

museum. At the same time, membership growth or decline will provide an objective measure of the quality of management.

Individuals who have made distinguished contributions in natural history should be recognized through the award of fellowships. To initiate the fellowship system, the first Fellows—to be known as Foundation Fellows—should be appointed by the Minister upon the advice of a committee set up for this purpose by the Ministry. Thereafter, new Fellows should be persons nominated by two Fellows, and approved by the existing body of Fellows. Honorary Fellows will be non-citizens nominated by two Fellows and approved by the body of Fellows.

4.7 Code of Ethics for Museums

The museum should be a member of the International Council of Museums (ICOM) and subscribe to the ICOM Code of Ethics for Museums, viewable on the ICOM website. The ICOM Code sets the minimum standards of professional practice and performance for museums and their staff. The guiding ethos of ICOM is “service to society, the community, the public and its various constituencies.” The guiding principles of the ICOM Code of Ethics for Museums are as follows:

Museums preserve, interpret and promote the natural and cultural inheritance of humanity

Principle: Museums are responsible for the tangible and intangible natural and cultural heritage. Governing bodies and those concerned with the strategic direction and oversight of museums have a primary responsibility to protect and promote this heritage as well as the human, physical and financial resources made available for that purpose.



Museums that maintain collections hold them in trust for the benefit of society and its development

Principle: Museums have the duty to acquire, preserve and promote their collections as a contribution to safeguarding the natural, cultural and scientific heritage. Their collections are a significant public inheritance, have a special position in law and are protected by international legislation. Inherent in this public trust is the notion of stewardship that includes rightful ownership, permanence, documentation, accessibility and responsible disposal.

Museums hold primary evidence for establishing and furthering knowledge

Principle: Museums have particular responsibilities to all for the care, accessibility and interpretation of primary evidence collected and held in their collections.

Museums provide opportunities for the appreciation, understanding and promotion of the natural and cultural heritage

Principle: Museums have an important duty to develop their educational role and attract wider audiences from the community, locality, or group they serve. Interaction with the constituent community and promotion of their heritage is an integral part of the educational role of the museum.

Museums hold resources that provide opportunities for other public services and benefits

Principle: Museums utilise a wide variety of specialisms, skills and physical resources that have a far broader application than in the museum. This may lead to shared resources or the provision of services as an extension of the museum's activities. These should be organised in such a way that they do not compromise the museum's stated mission.

Museums work in close collaboration with the communities from which their collections originate as well as those they serve

Principle: Museum collections reflect the cultural and natural heritage of the communities from which they have been derived. As such they have a character beyond that of ordinary property which may include strong affinities with national, regional, local, ethnic, religious or political identity. It is important therefore that museum policy is responsive to this possibility.

Museums operate in a legal manner

Principle: Museums must conform fully to international, regional, national, or local legislation and treaty obligations. In addition, the governing body should comply with any legally binding trusts or conditions relating to any aspect of the museum, its collections and operations.

Museums operate in a professional manner

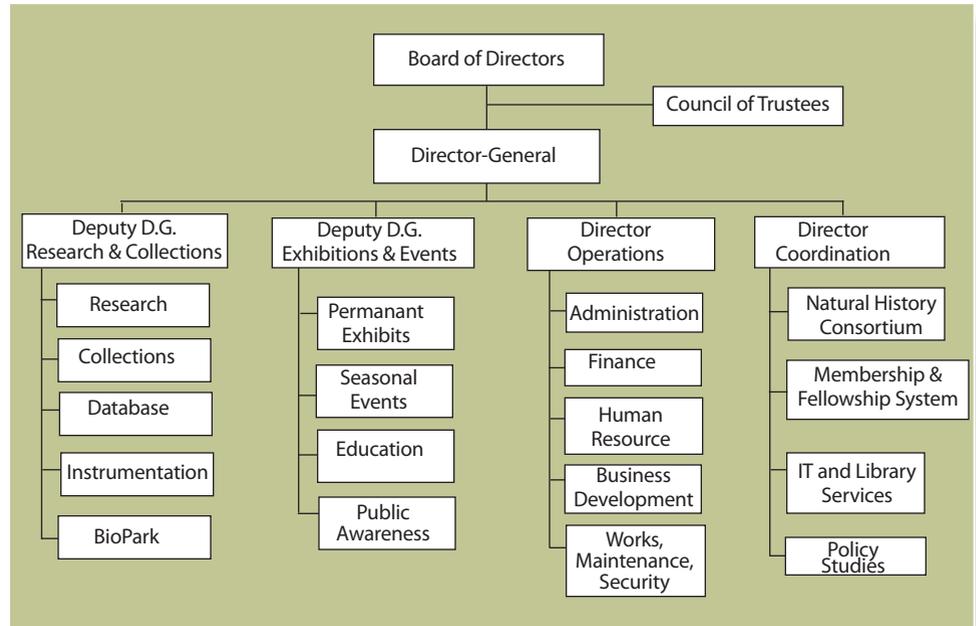
Principle: Members of the museum profession should observe accepted standards and laws and uphold the dignity and honour of their profession. They should safeguard the public against illegal or unethical professional conduct. Every opportunity should be used to inform and educate the public about the aims, purposes, and aspirations of the profession to develop a better public understanding of the contributions of museums to society.



Tiger (*Panthera tigris*)

4.8 Proposed organization

We propose that the museum be organized into four divisions each consisting of a number of operational units.



4.8.1 The Research and Collections Division

This Division will manage research and collections (see Box 5) and be responsible for

- research in traditional and molecular taxonomy, biodiversity, ecology and conservation
- the collection, preparation, preservation, labeling, cataloguing, storage and maintenance of dry and wet specimens of fauna, flora and minerals
- the databases of information on specimens in the collections
- the scientific instruments, facilities and laboratories, such as electron microscopes, facilities for tissue storage, and laboratories for molecular biology

- the BioPark, which will be a living laboratory and a model conservation area in an urban setting, to provide expanded possibilities for research, public education, and conservation of living genetic materials

4.8.2 The Exhibitions and Events Division

This Division will promote excellence in exhibitions and public engagement (see Box 6) and be responsible for

- permanent natural history exhibitions, which though ‘permanent’, will need to be upgraded from time to time
- seasonal (temporary) events to focus on issues of current interest, including traveling exhibitions to cater for distant audiences
- educational programmes to introduce children to science, to support the school curriculum, and to support teachers in the environmental and life sciences
- public awareness programmes on issues of current interest including organization of seminars and the development and maintenance of the museum’s websites.

Mineral Gallery in the Field Museum

Exhibitions may be designed in-house, outsourced in part or whole, hired, or purchased.

4.8.3 The Operations Division

This Division will be responsible for

- the Administration unit
- the Finance unit
- the Human Resources unit
- the Business Development unit
- the Maintenance and Security units





Box 5. Synergy in collections and research

A natural history museum's contribution to knowledge is based on the synergistic relationship between collections and research. In simple terms, collections are samples taken from nature at particular times and places and preserved as physical evidence for reference and to support current and future studies. A collection by itself is not knowledge. Knowledge is made by researchers who study and interpret the evidence. Since interpretations are based on collections, interpretations are subject to revision as collections grow in quality and quantity. Collections of groups that have been neglected before, collections from localities previously underexplored, and collections based on new methods of detection, all have the potential to change our understanding of nature. Old specimens already interpreted, can be reinterpreted in new ways when re-examined alongside new specimens.

Collections programme. The most acclaimed natural history museums, like the Natural History Museum in London, the Field Museum in Chicago, and the National Museum of Natural History of the Smithsonian Institution, have had over 100 years to accumulate large and comprehensive collections. To establish a significant collection within ten or twenty years will be an immense challenge for the new NHM Malaysia, requiring a sustained goal-driven effort with three general thrusts:

- Thrust 1: To build up collections representative of the country's total biodiversity. This thrust has two components: (a) short-term efforts to plug knowledge gaps in lesser-known groups of organisms, and to explore lesser-known geographical regions and habitats, and (b) a long-term target to build up the total collection.
- Thrust 2: To build up collections of those groups of plants and animals that the museum's staff and research associates will specialize in. No museum has expertise in everything. Instead, museums are defined scientifically by the particular areas of strength in which they publish the most research papers and books.
- Thrust 3: To build up representative collections of plants and animals of Southeast Asia. This third thrust will be linked to partnership and exchange programmes between NHM Malaysia and the natural history museums in neighbouring countries.

A good way to build up collections would be through expeditions. Scientists from other museums can be invited to participate, and specimens can be shared among the participating museums. Such expeditions will promote networking between participating natural history scientists.

Those parts of the country that are underexplored are the most likely to yield new discoveries. Groups of organisms that have been neglected, such as mollusks, nematodes, certain groups of insects, and macro-fungi, will present the best opportunities for making



whole suites of discoveries. Attention should also be given to fossils, of which there are few collections in the country.

NHM Malaysia can lay the foundations for future impact by establishing what will become globally important ecological benchmarks. This can be done by selecting key habitats (terrestrial, aquatic and marine) for repeated collecting and monitoring. In this way, the collections of the present will yield maximum information when studied alongside collections to be made in 5, 10, 50 or 100 years from now.

Research Programme. The research programme of NHM Malaysia should have the following broad goals:

- add to knowledge of the biodiversity of Malaysia
- contribute to understanding of the relationships of the biodiversity of Malaysia with that of adjoining territories of the wider world
- contribute to the professional training of young scientists and scientists-to-be

The selection of the scientific staff is critical to the success of the museum. Since the scientific impact of a natural history museum is measured by its scientific publications in refereed scientific journals, the scientific staff should be selected on the basis of their ability to contribute to science by publication.

The publication impact of a museum can also be raised with the help of research associates. These research associates may be scientists from anywhere in the world who can contribute to the research programmes and add to the international status of the new museum. A budget should be set aside to support visits by short-term researchers (one to two months) or longer-term ones (six months to a year).

A comprehensive natural history museum is a resource that students in disciplines related to natural history—taxonomy, ecology, evolution, conservation and environmental management—will find vital to their professional development. Students may study under the guidance of the museum's scientists and use the museum's collections to advance their studies. This relationship may be formalized by universities giving honorary faculty appointments to museum scientists, and the museum appointing university scientists as museum research associates.

Synergy between research and collection is promoted by the physical design of buildings. The duplex modules at the Museum Support Center of the National Museum of Natural History in Washington DC provide a good example whereby scientists and laboratories are located close to the reference collections.



Box 6. Excellence in exhibitions and public engagement

Given the necessary funding and support, the new natural history museum will be the centre for discovering and experiencing the extensive biodiversity of Malaysia and Southeast Asia. Importantly, it will inspire the public to protect and conserve the natural environment, contribute to the training of future scientists, and support government priorities through

- increasing the number of students pursuing science
- providing knowledge and skills useful in daily life
- delivering hands-on, innovative approaches to learning
- fostering societal values and attitudes that recognize science and technology (S&T) as critical to future prosperity
- participating actively and effectively in regional and global efforts towards environmental conservation and protection
- encouraging care and respect for the environment
- conserving natural ecosystems
- enhancing access to knowledge for all
- developing a supportive attitude in society for change through increasing S&T awareness

It will be important for the museum to create exhibits that engage the target audiences in a variety of different ways, in order to hold their interest, encourage them to look at, and experience topics in different ways and to maximize the opportunities for learning. It is well documented that different people have different preferred ways of learning. The museum's galleries should therefore appeal to a range of different learning styles, for example, learning through sight, sound, touch, smell, interaction, immersion and discussion. The museum should also provide a seasonally changing visitor offer that caters for seasonal visiting patterns, encourages repeat visits and prompts first-time visitors.

Market appraisals should be carried out on visitor numbers, target audiences and visiting patterns across the year. These will guide the development of the public programmes, the style of the galleries and the learning experiences offered.

The themes presented in the exhibition galleries should have the potential for visitors to

- understand the importance of biodiversity/natural heritage and why we need to conserve it
- understand the issues that threaten biodiversity
- become aware of their own cultural links with the natural environment



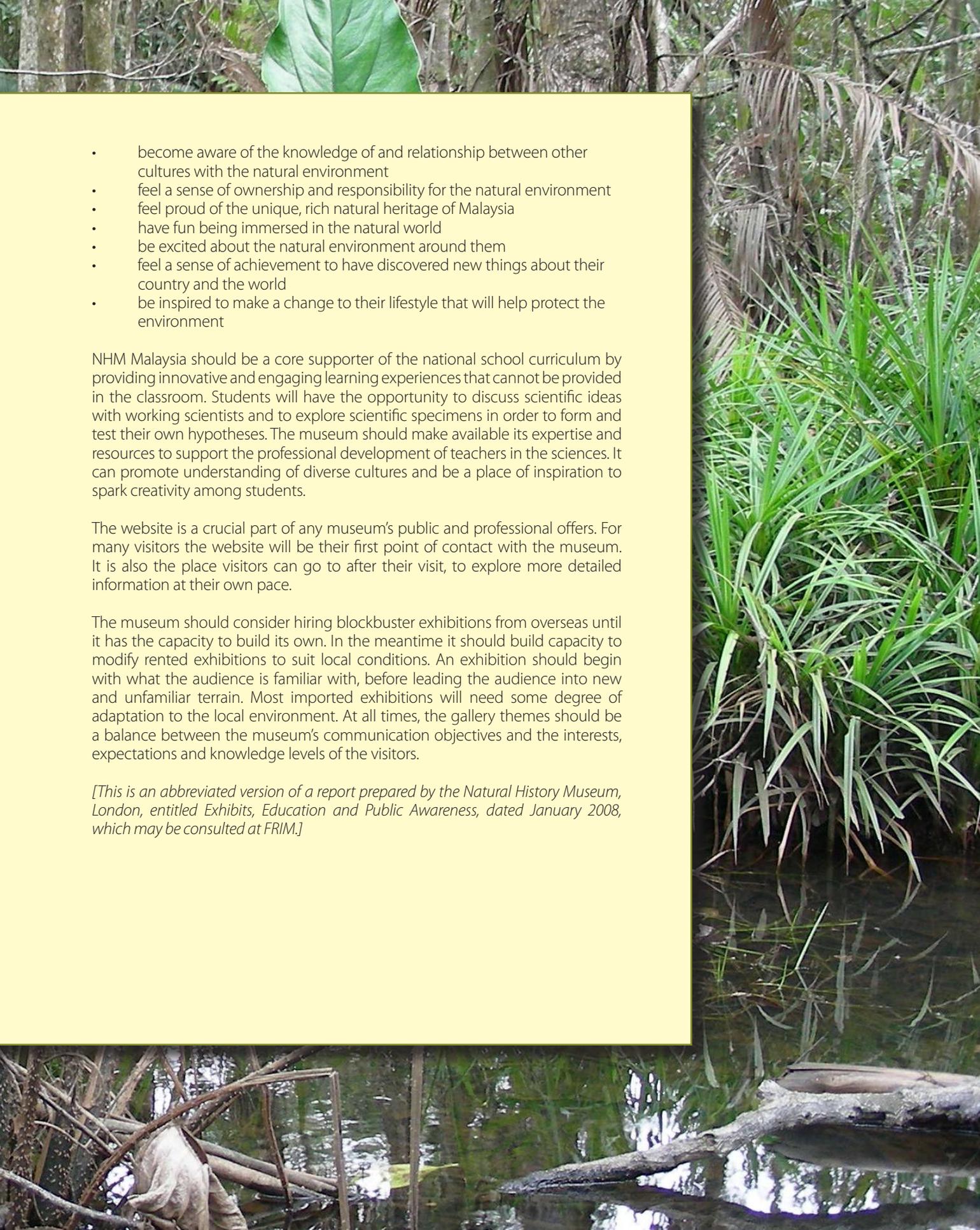
- become aware of the knowledge of and relationship between other cultures with the natural environment
- feel a sense of ownership and responsibility for the natural environment
- feel proud of the unique, rich natural heritage of Malaysia
- have fun being immersed in the natural world
- be excited about the natural environment around them
- feel a sense of achievement to have discovered new things about their country and the world
- be inspired to make a change to their lifestyle that will help protect the environment

NHM Malaysia should be a core supporter of the national school curriculum by providing innovative and engaging learning experiences that cannot be provided in the classroom. Students will have the opportunity to discuss scientific ideas with working scientists and to explore scientific specimens in order to form and test their own hypotheses. The museum should make available its expertise and resources to support the professional development of teachers in the sciences. It can promote understanding of diverse cultures and be a place of inspiration to spark creativity among students.

The website is a crucial part of any museum's public and professional offers. For many visitors the website will be their first point of contact with the museum. It is also the place visitors can go to after their visit, to explore more detailed information at their own pace.

The museum should consider hiring blockbuster exhibitions from overseas until it has the capacity to build its own. In the meantime it should build capacity to modify rented exhibitions to suit local conditions. An exhibition should begin with what the audience is familiar with, before leading the audience into new and unfamiliar terrain. Most imported exhibitions will need some degree of adaptation to the local environment. At all times, the gallery themes should be a balance between the museum's communication objectives and the interests, expectations and knowledge levels of the visitors.

[This is an abbreviated version of a report prepared by the Natural History Museum, London, entitled Exhibits, Education and Public Awareness, dated January 2008, which may be consulted at FRIM.]





Publications of scientists of the Field Museum, Chicago

Field Museum in Chicago and other natural history museums in the USA.

Except for Business Development, such units exist in most public organizations and their functions are well known. The Business Development unit will be responsible for generating income through entrance tickets, operation of cafeterias, souvenir shops and bookshops, renting out of space for private functions, renting out of exhibits and traveling exhibitions, and other business activities. The Business Development unit should model its activities on the income-generating experiences of the

4.8.4 The Coordination Division

This Division will be responsible for

- Administrative support for the Natural History Consortium and its Accreditation System
- Administration of the membership and fellowship systems
- Information Technology (IT) and library services including engagement in international information projects pertaining to natural history
- Policy studies on biodiversity, conservation, environment and related issues of national and international concern

5. HUMAN RESOURCES

An organization is as good as the human resources that lead, manage and operate it. There is no substitute for personnel driven by passion for the work they do. Managerial, technical and scientific qualifications, though formally required, will not be sufficient to create a centre of excellence. The aim from the start should be to establish an institutional culture with high professional and ethical standards.

To launch the museum and to provide training and leadership during its establishment period, experienced senior staff will have to be recruited on contract while permanent staff are being trained. Such senior contract appointments should not be limited to Malaysians. In some areas of museum development, there may be no suitable Malaysians available.

It would also be useful to have some junior positions available for young graduates or 'post-docs' from overseas to help broaden the outlook of local scientists and to promote the museum among young scientists internationally.

The Director-General should be a scientist and manager with ample

experience in project implementation and management, and in public relations.

All senior staff should regard public relations as part of their job and be provided with guidance and training in public relations. Senior scientists will be expected to lead the institute's scientific programmes and to train young scientists. The serious lack of taxonomists in certain areas, e.g. fungi, mollusks, certain groups of insects, and nematodes, will need to be addressed; such neglected areas will provide good opportunities for discovery. When fully operational, the museum is expected to have scientists in Biodiversity, Ecology, Ethnobiology, Arachnology, Entomology, Herpetology, Ichthyology, Malacology, Mammalogy, Marine Biology, Mineralogy, Ornithology and so on. These scientists will provide the country and the region with a comprehensive range of scientific research, education, conservation and advisory services. Because the shortage of taxonomists is a universal problem, the museum may play a role in the development of taxonomists for the tropical world in years to come.

Lifelong education of all staff should be a policy of the museum. As a general principle, all staff should be trained and skilled in whatever duties they are assigned to perform. The training of scientists, technicians and other staff should commence well ahead of the completion of infrastructures. It is proposed that two modes of training be adopted. One is the training of trainers at established foreign museums. The second mode is training conducted locally by local and international experts, particularly in techniques of collection, preparation, cataloguing, recording, storage and managing specimens as well as preparation of specimens for exhibitions. In the long term the institute itself should aim at becoming a national and regional training centre.



The great hall of NHM London



The scientists will be expected to become world leaders in their chosen fields of research. To enable them to concentrate on science they should be provided with good career paths within the museum by allowing for parallel/column-rise promotions as in other statutory bodies like FRIM and MARDI.

Technicians with special skills, including taxidermists and illustrators, are in short supply, and good ones are difficult to retain. The technical staff should also be provided with good career paths within the museum.

Due to the complexity and stringent requirements of the environmental control facilities in the buildings, a team of engineers and technicians would be necessary to check, service and maintain the facilities of the museum. It is recommended that this service be contracted out to competent companies or special units of the Public Works Department (JKR).

The external security of the museum (grounds and perimeter) can be contracted to security organizations, but the internal security would require specially trained and motivated officers who can help direct visitors, maintain order in crowds, keep watch on valuable exhibits, and monitor the CCTV surveillance system. Internal security may be better organized and managed as an internal staff function.

An estimate of the human resource requirements for NHM Malaysia is provided in Table 5, in which the salary scales suggested are guided by the scales currently applied at research institutes in Malaysia. The entry point for any scheme will be based on qualifications and experience as decided by the Jabatan Perkhidmatan Awam. It is assumed that the buildings will be ready for occupation at the end of year 3, but staff will be recruited, trained and operational before then. The exhibition galleries should be open in year 4.

**Table 5. Projected human resource requirements
[10th Malaysia Plan: Year 1 to Year 5]**

Designation	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Director-General (VU 5)	1	1	1	1	1
Deputy DG (VU 6)	1	1	1	2	2
Senior Research Officer (Q 54)	4	4	8	8	12
Research Officer (Q 48)	9	11	18	25	32
Asst. Research Officer (Q 36)	6	8	16	16	16
Asst. Research Officer (Q 27)	4	4	8	10	10
Business Dev. Ex. (Q 43)	-	2	2	2	2
Asst. Business Ex. (Q 41)	-	-	2	2	3
Marketing Ex. (Q 43)	-	-	1	1	1
Asst. Marketing. Ex. (Q 41)	-	-	2	2	4
Technician (Q 17)	10	20	30	30	30
IT Officer (F 54)	1	1	1	1	1
IT Officer (F 44)	2	2	2	4	4
IT Officer (F 38)	2	2	2	4	4
IT Assistant (FT 26)	4	4	4	4	6
Instrument Operator (F22)	4	4	4	4	6
Computer Technician (F 17)	2	2	2	4	6
Admin. Officer (N 54)	1	1	1	1	1
Events Ex. (N 41)	1	1	1	2	2
Asst. Admin. (N 36)	2	2	2	4	6
Junior Admin. Asst. (N 11)	-	2	2	2	3
Office Asst. (N 1)	1	1	2	2	2
Public Relations (N 22)	1	1	1	1	1
Asst. Public Relations (N 17)	2	2	2	4	4
Publication Officer (N 41)	-	-	1	1	1
Asst. Public. Officer (N 17)	-	-	1	2	2
Personal Asst. (N 26)	2	2	3	3	3
Personal Asst. (N 22)	2	2	6	8	10
Audio/Visual (N 17)	1	1	1	2	2
Storekeeper (N11-17)	1	1	1	4	4
Librarian (S 48)	-	-	-	1	1
Asst. Librarian (S 27)	1	1	1	2	2
Accountant (W 52)	-	-	-	1	1
Asst. Accountant (W 36)	1	1	2	4	4
Audit (W 27)	-	-	1	1	1
Designer (B 38)	2	2	2	4	4
Illustrator (B 38)	2	2	2	4	4
Photographer (B 17)	1	1	1	2	3
Artist (J 22)	-	-	-	2	4
Charge-Man (R 17)	-	-	-	1	2
Workshop/Carpenter (R 9-22)	-	-	2	6	8
Driver (R 3)	6	6	8	16	20
Manual Worker (R 1)	8	8	8	15	25
Security (R 4)	-	2	4	6	8
Total	85	105	159	221	268

Opp page: The Kinta weed, *Papilionanthe hookeriana*, one of about two thousand orchid species in Malaysia.



6. PHYSICAL INFRASTRUCTURE

The estimated internal space requirement is 39,800 sq m (Table 6). Natural history museums everywhere are specially designed landmark buildings, but where the scientific collections have outgrown the available space, there is a trend for the scientific collections and laboratories to be moved out of the iconic main building to new buildings of plainer design. We recommend two separate designs for NHM Malaysia: an iconic landmark building for exhibitions and administration, and a plainer complex for collections and research. The designs should allow for effective security and easy maintenance, and incorporate the 'green standards' being devised and adopted internationally for buildings and grounds. Attention should be paid to energy and water conservation measures, the harvesting and use of rainwater, the composting of kitchen and garden waste, and ease of access by public transportation.

6.1 Requirements for the Exhibitions and Administration Building

The building to house exhibitions and administration should include an impressive lobby/ entrance hall with high ceilings, eight galleries for





exhibitions, rooms for seminars and meetings, studios and workshops for the preparation of exhibitions, restaurants/food courts, souvenir shops, bookshops, storerooms, and rest rooms. This building should cater for one million visitors per annum, with peaks on weekends and public holidays. For comparison, the Sarawak Museum has recorded up to 500,000 visitors in one year.

It is expected that the museum will attract high visitor numbers initially following its public launch. If there are no new exhibitions, visitor numbers are then likely to drop over the following two or three years. The museum should plan to launch new exhibitions every year and to refresh the permanent galleries in rotation, starting at about year five. The renewal of the galleries in phases should be approached as part of regular ongoing museum development. Hence, the exhibition galleries should be designed so that each gallery can be closed for renewal without in any way interfering with visitor flow and other activities. The lobby and seminar rooms should be accessible for evening functions. Passages and lifts should be wide enough for the movement of large exhibits. The building should be designed so that the administration part is internally separated from the public part.

The exhibition galleries must be air-conditioned at 25°C round the clock and protected from damp. The roof must be completely leak-proof and moisture-proof and the floor insulated from soil moisture. Ventilation and lighting must be completely controlled.

The restaurants/cafeterias, souvenir shops and book shops must be designed and located so that they contribute positively to the visitor experience. Good food and good shopping should be among the attractions of a natural history museum.

6.2 Requirements for the Collections and Research Complex

The collections and research building should be designed as a series of interconnected modules that can be added to from time to time. Visitors to these buildings will be mainly those with scientific business.

Each module will consist of two parts separated by a wide corridor. One side will accommodate the scientists, laboratories, offices, and specimen-preparation rooms, and provide a comfortable work environment, open to natural daylight through glass windows. The other side will be for the permanent storage of the museum's scientific collections, sealed off environmentally by close-fitting doors and totally shielded from UV light. It will have no windows. The lighting will be UV-free and only switched on when necessary. The internal climate will be maintained round the clock at 25°C and at 55% Relative Humidity. This part of the module will only be accessible to staff and visitors with special passes.

The interface between the two parts of each module should be carefully considered during the design phase so that access by the scientists to the collections is not hampered. The design of the Museum Support Centre (MSC) in Washington DC is close to the ideal. In the MSC, scientists only have to cross a dividing corridor to get to the collections.

Initially, two modules should be built, one for fauna and the other for flora. As the collection grows, more modules should be added without interfering with basic concepts.

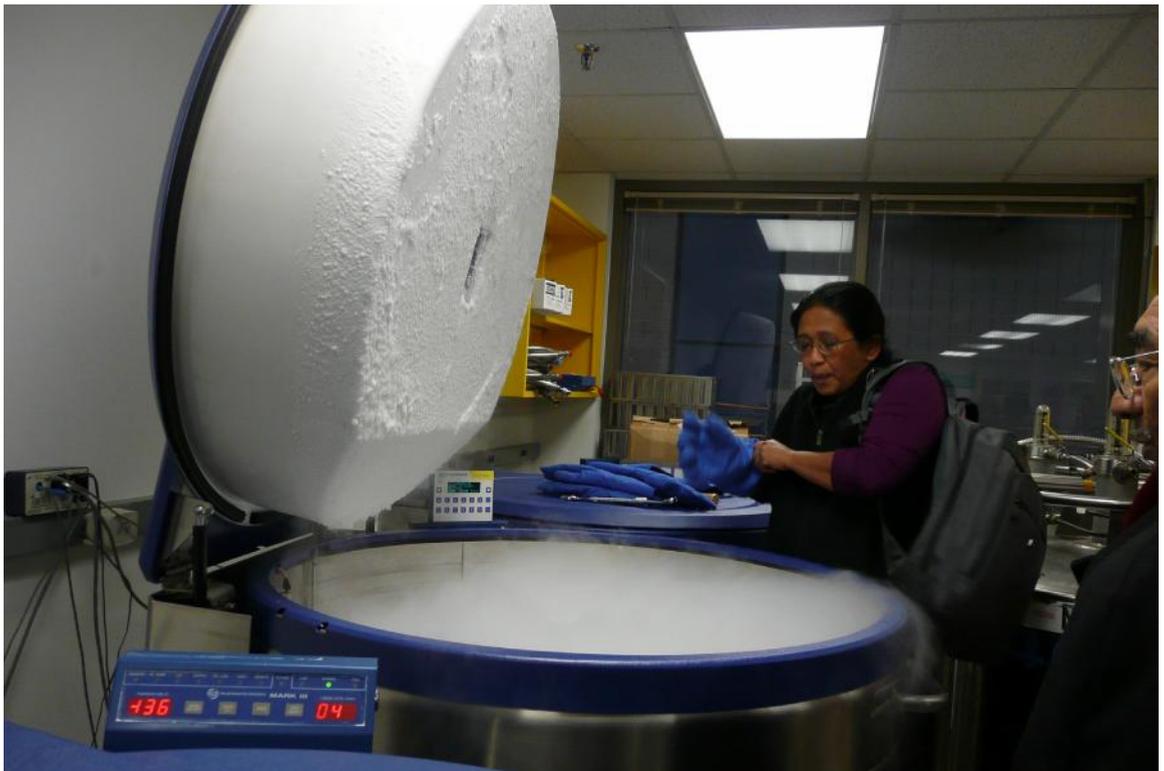


Table 6. Space requirements

Exhibitions and Administration Building

	space (sq m)
Public areas	
Lobby	200
Great Hall	1,500
Seven permanent galleries @ 1,500 sq m	10,500
Plants; mammals; birds;	
reptiles and amphibians;	
fish; invertebrates; minerals	
One seasonal gallery	1,500
Children's gallery	500
Workshops, studios, storerooms	3,000
Theatre for 500 persons	500
Four seminar rooms with movable partitions	500
Restaurants, canteens, shops	500
Rest rooms and miscellaneous	2,100
Restricted areas	
Administration and finance	2,000
Total	22,800

Collections and Research Complex

Library/documentation/database/reading rooms	1,000
Rooms for 20 scientists @ 50 sq m each	1,000
Laboratory spaces for visitors, students and technicians	1,000
Molecular biology laboratory	500
EM and SEM laboratory	200
Specimen preparation area for plants	500
Specimen preparation area for animals	500
Scientific collections	
Herbarium	4,000
Fauna and minerals	7,500
Rest rooms and miscellaneous	800
Total	17,000

Grand total 39,800



Opp page, top:
Bird's eggs at
Muzium Negara,
Kuala Lumpur.

Opp page, bottom:
Facility for low
temperature
storage of tissue
samples, at the
National Museum
of Natural History,
Washington, D. C.
demonstrated by
staff member Nor
Faridah Dahlan



7. BUDGET AND FUNDING MECHANISMS

We estimate that a development budget of RM400 m will be needed to establish the NHM Malaysia in five years, based on the breakdown in Table 7.

Table 7. Development Budget

	RM million
Buildings	120
Fixtures and fittings	20
Equipment	20
Development of exhibition galleries with purchase of exhibits	180
Contract staff	20
Manpower training	10
Support for Natural History Consortium and Accreditation System	20
Acquisition of the foundation collections	10
Total	400

The annual recurrent expenditure is expected to be:

Year 1: RM 5 m; Year 2: RM 7 m; Year 3: RM10 m; Year 4: RM 14 m; Year 5: RM 18 m.

The cost of the buildings is about RM 3000 per sq m. This is higher than normal buildings because of the need for special internal environmental controls, state-of-the-art fire and other safety features, and special requirements for electron microscopy and other laboratories.

The exhibition galleries must be ready on opening day. Exhibits that can be depended upon to make memorable impacts, such as dinosaurs, mammoths, and whales are expensive. The leading museums of the world have all found that the development of an exhibition gallery requires an experienced team about three years of intensive work. Our estimate of RM180 m for the development of exhibitions in a combined area

Children on a discovery tour at the Botanic Gardens, Singapore.





of 14,000 sq m (the Great Hall and all the galleries) is equivalent to about RM12,900 per sq m. For comparison, the average cost of exhibition galleries in NHM London is about at £1,500 per sq m. Most of the materials and skills will have to be imported in Malaysia.

The budget item under Contract Staff, of RM20 million, is for the hire of staff on 1 – 5 year contracts while permanent staff are being recruited and trained. Contract staff will be experienced and senior staff already equipped with the required expertise for their jobs. They will play the all-important roles of establishing the museum, recruiting and training permanent staff, and laying the foundations for future success.

The new museum will have to initiate a crash programme to acquire a sizable 'foundation' collection of natural history specimens representative of major habitats and life forms in Malaysia. Expeditions will have to be organized in collaboration with partners in the Natural History Consortium.

Natural history collections demand state-of-the-art maintenance. In Malaysia's climate, any decline in maintenance, even for a few months, will have serious consequences on the collections. The cost of maintaining the collections will increase from year to year as the collections increase in size. Hence the budget for the new museum must include provisions for an annual increase proportionate with the rate of growth of its collections and exhibitions and to cover the cost of maintaining the buildings and facilities.

The museum should be funded primarily by the Government as a public institution responsible for what will become the growing and increasingly valuable national scientific heritage collections. The Natural History Museum in London and the National Museum of Natural History

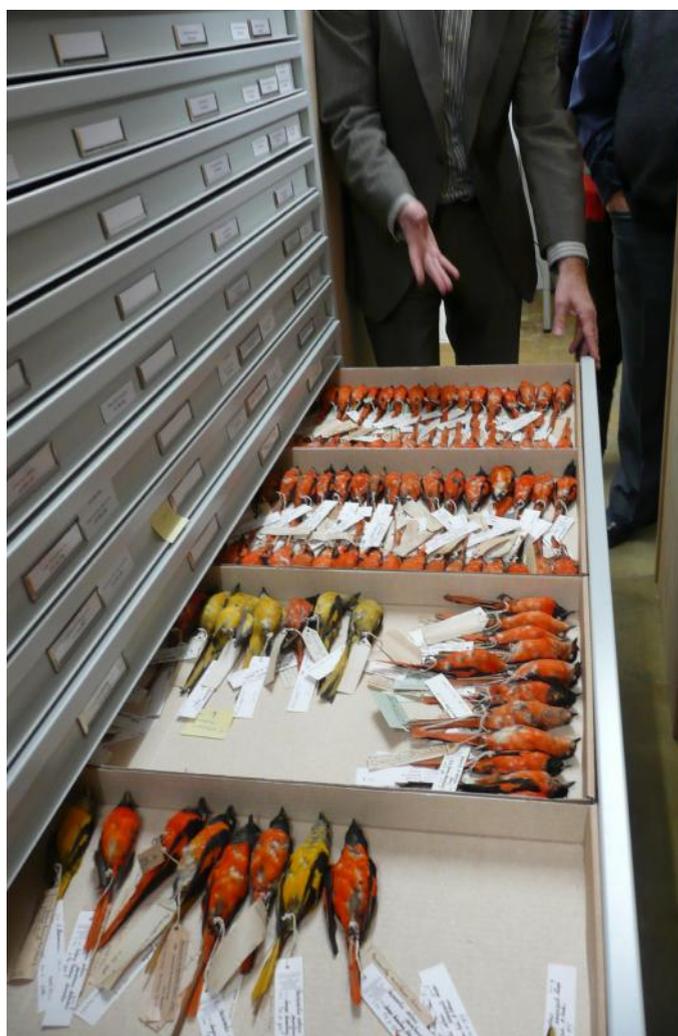
of the Smithsonian Institution in Washington DC are similarly funded by their national governments. However, they are also supported by the public. These museums have found that members of the public respond positively when given the opportunity to share in the museums' development and mission.

If the museum is located in a central location within easy reach of a large population of residents and visitors, it can and should, after establishment, aim for at least 30% of its annual expenditure to be met from its own fund-raising and income-generating activities.

Provision should be made for the new museum to

- solicit and receive gifts, donations and endowments
- establish a membership system
- earn income in various ways, e.g. entrance tickets; renting out of space, materials, exhibits and facilities; and operation of food outlets, bookshops and souvenir shops

Birds of Southeast Asia, at the Naturalist, Leiden





8. LOCATION

The leading natural history museums are easily accessible to the public. In Washington, London and Leiden, the museums of natural history are close to other scientific and cultural institutions, to form national complexes for science, culture and learning. The location of a natural history museum should take into account the desire of visitors to fit two or more experiences into one day, e.g. a museum visit plus shopping, or a business meeting plus museum plus shopping. A poor location will have a serious dampening effect on the number of visitors and make it difficult for the museum to sustain good visitor facilities.

We recommend a location that has room for modular growth of buildings in the future and for the development of a biopark. An area of about 50 ha would be ideal. For comparison, the Botanic Gardens Singapore occupies 52 ha and is within walking distance of the business, shopping and entertainment complexes of Orchard Road.

Possible locations are

- Federal Hill (Bukit Persekutuan)
- Bukit Kiara
- Putra Jaya



Of these, Federal Hill, close to the heart of Kuala Lumpur, would be most ideal. The large size of the resident and visitor population in Kuala Lumpur will ensure that the high investment needed to stage world class exhibitions will be supported by the maximum number of people.

Insects of the world, in the NHM, London, demonstrated by Max Barclay (left) and Howard Mendel (right).



Dipteris lobbiana,
one of hundreds
of fern species in
Malaysia.

9. PROJECT DEVELOPMENT

9.1 The interim period prior to the 10th Malaysia Plan

In the interim period before the 10th Malaysia Plan, a project management team should be established by the Ministry of Natural Resources and Environment to

- facilitate the drafting of the Act to establish the Natural History Museum Malaysia
- acquire the site
- initiate the development of the master plan, the building designs, and the tender process
- establish temporary quarters until the new buildings are ready
- initiate the establishment of the Natural History Consortium and Accreditation System

9.2 Medium-term development under the 10th Malaysia Plan

In the medium term, which will coincide with the 10th Malaysia Plan, the following activities should be in place:

- award of contracts for work on buildings and grounds
- hiring, deployment and training of staff according to the human resources plan
- planning and design of exhibition galleries and sourcing of services and exhibits

- occupation of the completed buildings in Year 3 of the Plan Period
- installation of equipment and exhibits in Year 3
- installation of the scientific collections and commissioning of laboratories in Year 3
- official opening of the exhibition galleries in Year 4
- launching of research programmes in Year 4
- establishment of membership and fellowship systems in Year 4
- launching of the scientific publication programme at end of Year 5



The seladang, (*Bos gaurus*), in Malaysia

Starting in Year 5, the museum should gear itself to a cycle for redevelopment of galleries at one gallery per annum and one new temporary exhibition per annum.

9.3 Long-term development

Since each gallery will take an average of three years to plan and implement, NHM Malaysia should target, by its 8th year, the capacity to plan and develop three or more exhibitions simultaneously.

NHM Malaysia should aim to attract gifts of scientifically valuable specimens from individuals and institutions and to undertake initiatives to increase public knowledge via public contributions, e.g. the establishment of a virtual museum of public-contributed digitized / photographic images. This will require the establishment of a good reputation for managing resources for the public good.

Natural history museums are respected worldwide for their ability to provide educational experiences at preschool, school, and adult levels. NHM Malaysia will deliver the benefits of continuing life-long education to all levels of society. In addition, some sectors of the economy will get a very special boost, e.g.

- tourism, because NHM Malaysia will share in the global reputation

- of natural history museums as premier tourist attractions
- higher education, because the comprehensive collections in NHM Malaysia will enable Malaysian universities to offer world-class tropical biodiversity programmes
- economic development, because NHM Malaysia's growing expertise on natural resources will be available to support the information needs of a growing economy

9.4 International review

At the end of the first five-year plan, there should be a review of NHM Malaysia to assess how it is progressing towards becoming "a world centre of excellence in conservation, research and utilization of tropical biological diversity", and to recommend adjustments where needed. The Review Team should include local and overseas experts covering the major functions of (i) collections management, (ii) scientific research, and (iii) exhibitions / public outreach. The reviewers may also be invited to review human resources development and other matters that the Board of Directors may decide upon. Measurable indicators that should be examined by the Review Team should include the following:

Collections management:

- physical condition of the specimens and their storage facilities
- progress of computerization of collections data
- size and coverage (taxonomic and habitat) of collections
- effectiveness of the Natural History Consortium

Scientific research:

- programme of research
- number of peer-reviewed publications by staff and associates
- number of visiting scientists using the collections each year
- number of students using the collections for thesis research



Exhibitions and public outreach:

- number of visitors to the exhibition galleries each year
- amount of financial support from the public (donations, fees, sales, etc)
- growth of membership

The frequency of future reviews should be decided by the Board of Directors when they assess the outcome of the first review.

9.5 Development timelines

The great hall of the Field Museum, Chicago.

The proposed development timelines and milestones are indicated in Table 8.



10. NATIONAL AND GLOBAL SIGNIFICANCE OF THE NATURAL HISTORY MUSEUM MALAYSIA

The Natural History Museum Malaysia, as the national centre for reference materials, information, and expertise in biological diversity, will strengthen Malaysia's ability to sustainably manage and benefit from its rich biological resources. It will provide a whole range of services that existing institutions cannot provide.

The scientific resources and knowledge needed for global management of biological diversity have always been concentrated in countries with long-established natural history museums. Malaysia's entry as a major player in biological diversity research will strengthen global understanding, management, and utilization of biological diversity, and help ensure that tropical concerns are well-addressed in global biological diversity and environment management.

Herbarium of the
Forest Research
Centre, Sandakan

