APPENDIX D:
Project Description

APPENDIX D-1: AMNH Memorandum Re: Use of Space and the Gilder Center, October 10, 2017

APPENDIX D-2: Management Resources Memorandum Re: Gilder Center Attendance Projections, October 3, 2017

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APPENDIX D-1:
AMNH Space Planning and Capital Improvements Memorandum

AMERICAN MUSEUM of NATURAL HISTORY

To: Commissioner of Parks
From: Ann Siegel, Senior Vice President, Operations and Capital Programs
Date: October 10, 2017
Re: AMNH Use of Space and the Gilder Center

This memorandum addresses the public comments on the Draft Environmental Impact Statement (DEIS) for the Gilder Center for Science, Education, and Innovation (" the Gilder Center") that asked for further explanation as to why the proposed project cannot be contained within the existing complex via internal modifications and improvements or by relocating some uses off-site. This memorandum supplements the material presented in Chapters 1 ("Project Description") and 16 ("Alternatives") of the DEIS.

The Board of Trustees of the Museum began planning for future space needs in 2007 and, after 7 years of study examining many alternatives, approved the proposed project. During that period, the Board 1) looked back on the capital projects of the Museum since the early 1990s, 2) looked to the present and took an inventory of current space usage and needs, and 3) looked forward to 2020 for future needs of the Museum.

The "look back" revealed that since the early 1990s the Museum had reorganized, renovated, and revitalized existing spaces to modernize the Museum's infrastructure and facilities and to maximize efficient use of space. It had eliminated non-core operations to free up space for its essential needs by, for example, transferring to other institutions or entities three magazines (*The Curator*; *Micropaleontology Press*; and *Natural History Magazine*), by ending its long-standing member's tour program, and by outsourcing many of its data server needs. The Museum simultaneously squeezed more core uses into the same amount of space. In addition, mezzanines were added to some rooms with high ceilings to increase the amount of square footage. Further, three new buildings were constructed within interior courtyards of the Museum complex totaling nearly 500,000 square feet. Other improvements to revitalize the use of the existing complex included:

- Three new or restored entrance facades;
- New or refurbished roofs on 20 buildings;
- 21 exhibition halls and theaters built or renovated;
- Six science laboratories built or renovated;
- Build-out of the Richard Gilder Graduate School for Comparative Biology;
- 10 scientific collection storage facilities built or renovated;
- Over 20 major space modifications to accommodate administrative needs;
- A central chiller plant and distribution system, providing air conditioning for over 90% of the public spaces;
- Major electrical upgrades in 14 buildings;

- Museum-wide electronic security systems, including multi-year security upgrade of scientific collections, with specialized key boxes, cameras, and card readers; and
- A public address system, fire detection, and central control station for safety, as well as telecommunications and IT data centers are provided with emergency power.

The attached chart provides an inventory of major capital work from approximately 1991 through 2017. In sum, the Museum has a long record of maximizing use of the Museum complex and of looking first for solutions within the existing complex. All the Museum's existing spaces are fully occupied, functional, and efficiently used full-time, year-round, with the Museum open to the public 363 days each year.

In its assessment of the "present," beginning in 2007, the Museum engaged in extensive studies and analyses of its current space usage and challenges. Kliment & Halsband Architects (KHA) was retained for a space study that concluded in 2008. They measured the entire complex and produced a database of existing square footage and room usage with a report on circulation problems and needs within the existing complex. They found that the Museum was growing in terms of visitors, programming, and collections, yet was already constrained by the existing space. The Board studied the public circulation within the 27 buildings built over the last 140 years. Given the dead-ends that require visitors to double-back to access other portions of the Museum and with growing attendance, the corridors and exhibition spaces had become overcrowded, impairing the ability of the Museum to effectively carry out its mission.

Looking to the future, the Board was advised through the KHA work that the Museum needed over 300,000 square feet of new space by 2020 to adequately meet its needs and accommodate past and projected growth. The Board was provided options for meeting some or all of this need, which were discussed in an earlier memorandum entitled "SEIC Options: Existing vs. New Space Analysis." The Museum's Board of Trustees took the next 3 years to study and consider these options and to develop priorities and the program goals for the Museum of the future, placing these options in the context of rapid changes in science and the implications for education. Among other goals, The Board of Trustees concluded that the Museum needed to maintain integration of science, education, and exhibition space that distinguished the Museum. The Board also concluded that any new space would need to improve the connectivity, spatial logic, and function of the Museum's interior spaces and reduce overcrowding by permitting visitors to more efficiently move within the Museum. To do that, any new space would need to create a connective loop to all quadrants of the campus, complete the east-west axis of circulation and exhibition space, and create a north-south connection on the west side of the campus. The Gilder Center site, on the axis of West 79th Street and facing Columbus Avenue, in the gap between two existing buildings, is large enough to provide sufficient program and internal circulation space. It is connected on three sides to improve circulation throughout the complex. No other location in or around the existing complex could achieve such an improvement in visitor flow and access.

Various off-site options were considered following the KHA study but were rejected because they would be the literal opposite of integration and connectivity. The Board concluded that direct access by students and educators to the Museum's extraordinary halls and collections is one of the most valuable educational experience that we provide. They also concluded that collections are needed on-site to inform the daily work of scientists, students, and exhibition developers. Similarly, moving administrative space offsite would not be reasonable as departments must be physically proximate to the facility in order to carry out their work or to discharge their fiduciary responsibilities to manage a complex that is open 363 days per year, has over 5 million visitors, and operates three shifts. Moreover, administrative spaces are scattered across 18 locations on 6 floors in 11 buildings in order to provide necessary operational support for their respective departments. Thus, re-use of this dispersed space would not improve connectivity of Museum spaces or achieve the other goals of the proposed expansion. Accordingly, such moves were considered an unreasonable approach inconsistent with the goals of any proposed expansion.

In August 2013, The Board of Trustees selected Studio Gang Architects to provide a conceptual design from the given location and program goals. After review of a preliminary concept design from Studio Gang, the Board of Trustees in December 2014 approved release of a public announcement of its intent to construct an expansion so that it could begin discussion with the surrounding community and public officials.

The building program and preliminary footprint of the site were then vetted with relevant City agencies, elected officials, civic groups, and neighbors and the Museum continued with Studio Gang the process of analyzing options—e.g., demolishing existing buildings vs. building around them, how to make the critical connections to existing space, whether program could be arranged or eliminated to reduce the footprint above and below grade, how to accommodate safe egress and the required vertical circulation, etc.

In November 2015 the Board of Trustees approved Studio Gang's concept design that would place approximately 80 percent of the Museum's proposed project within the existing complex by demolishing three existing buildings and building on the footprint of the existing buildings, but consistent with the height of the adjacent buildings of the Museum. The placement, height, and massing of the proposed addition would support a harmonious gradual transition between the adjoining Museum adjacent to the north and south of the proposed project.

While the Gilder Center is designed primarily as an infill building, the design would extend a small portion of the proposed building into land that is currently public open space. The overall design was accompanied by a design for the surrounding park from Reed Hilderbrand, the landscape architects, and the proposed landscaping modifications and improvements would accommodate all of the current uses of that portion of the open space. An aerial view of the Park site plan, with and without the new building, is attached. Park users would continue to have access to areas for gathering, play, and respite, as well as pathways for Museum entry and traversing the Park. The proposed open space plan also incorporates two enhancements that

would result in a net increase in the amount of publicly accessible space in the park. Specifically, as part of the proposed project, the currently fenced Margaret Mead Green lawn would be made available for managed public access in a manner consistent with and supportive of the current character of Theodore Roosevelt Park. In addition, a portion of the currently fenced area adjacent to the Columbus Avenue sidewalk between West 78th Street and West 79th Street would be made available for public access. Further, in conjunction with the proposed project, the Museum has committed to provide One Hundred Thousand Dollars ($100,000) per year for a minimum of ten years for the management and maintenance of Theodore Roosevelt Park. The area in front of the Gilder Center would (as it currently does through the Weston Pavilion) provide an entrance point to the Museum.

As found by the Landmarks Preservation Commission, and stated in its November 2, 2016 report, the cumulative effect of the Gilder Center would result in a physical articulation of the Museum's full, integrated mission of science, education, and exhibition, one that would provide visitors with cross-disciplinary exposure to the natural world; and a project that would enhance the special architectural, historic, and cultural significance of the American Museum of Natural History complex and Upper West Side Historic District.

Attachments:

- December 10, 2014 Memorandum
- September 20, 2017 Capital Plan Achievements Chart (1991-2017)
- Aerial Existing and Proposed Campus Overview

AMERICAN MUSEUM OF NATURAL HISTORY

CONFIDENTIAL DRAFT

M E M O R A N D U M

TO: File

FROM: Lisa J. Gugenheim

DATE: December 10, 2014

RE: American Museum of Natural History SEIC Options: Existing vs. New Space Analysis

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The Center for Science, Education, and Innovation (the Center) is a proposed new building on the west side of the Museum complex that will address critical external and internal needs. Approximately one-half of the "footprint" of the Center is expected to be located within the existing footprint of the Museum complex, while the remainder will be located on the axis of West 79th Street and facing Columbus Avenue, in the gap between two existing buildings. The exact location and footprint remains to be developed, in coordination with the Parks Department, as the design process advances.

The Museum has completed extensive studies and analyses of the need for this project and the alternative ways to meet some or all of that need, including a 2008 master space planning study conducted by Kliment & Halsband Architects. This memorandum contains a summary of the analyses, ending with a brief comparison of three options that were considered in detail by the Museum:

1) continue to make ad hoc improvements throughout the existing complex;
2) renovate and expand the existing powerhouse building, located at the northwest corner of the complex, adjacent to the parking garage and terrace; or
3) develop a new building (i.e., the Center).

Option 3 emerged as the best solution that addresses the needs and challenges identified through the analysis process, while meeting a series of crucial planning objectives.

Importantly, the Museum looked first for solutions within the existing complex. Over the past decade, the Museum has undertaken a significant capital improvement program to renovate, reorganize and revitalize existing space. Further projects in this vein were studied. The results of the Museum's detailed analysis show that this option could meet only the short-term needs of the Museum and did not afford opportunities to address long-term needs and goals. Thus, the Museum studied the addition of new space via options 2 and 3. The opportunities of afforded by the location and potential massing of option 3 resulted in the best solution for meeting the Museum's needs and objectives.

Below is a summary of the Museum's studies and analyses:

A. Strategic planning. The Museum has completed an institution-wide strategic planning process focused on four key areas: Science, Education, Exhibition, and Digital. The resulting strategic plan was crafted to:

- Leverage our historic leadership to further pioneer a new role for museums in the 21st century
- Extend and deepen AMNH's impact on the world to meet critical societal needs
    - In Science, in new areas such as genomics
    - In Education, serve as the portal for learners of all ages to realistically understand the world around them and the problems of our time

B. External needs. As a leader in scientific research and science education, the Museum is ideally positioned to respond to the national crisis in science education and the critical need for greater public understanding of science. The Museum has played a role in both formal and popular science education since its founding. Recent initiatives in this area include:

- In 2004, Urban Advantage was developed. In FY2015, this program will serve 222 schools, 650 teachers, and over 65,000 students and is the largest formalized science program in the country.
- In 2008, the Museum created its educational pipeline, providing science-rich educational content for learners of all ages—pre-k through Ph.D.
- In 2009, the Museum became the first museum in the Western Hemisphere to grant a PhD through the inception and development of the Richard Gilder Graduate School.
- In 2012, the Museum became the first museum in the country to grant a stand-alone Masters in the Art of Teaching degree in earth science.

C. Internal needs. The increase in educational programs, as well as a dramatic upswing in attendance, reflect the tremendous success of the Museum in fulfilling its mission. Since the mid 1990s, annual attendance has increased from 3 million to 5 million total visitors today. The resulting overcrowding and inefficient use of space led the Museum, in 2008, to engage Kliment & Halsband Architects (KHA) to conduct a master space planning study. KHA identified challenges within the current campus and proposed corresponding solution objectives to address these space challenges.

1. **Science Research & Collections Challenge**: There are a number of specific collections that need improvement in their housing. There is a need to create housing for these collections that is on par with the other collections whose storage spaces have been recently upgraded and vastly improved.
2. **Education Challenge**: There is a shortfall of instructional space and the current spaces are out of date, fragmented, dysfunctional, and difficult to access. Education lacks a public face. The Museum must consolidate the scattered spaces to create a public presence for the Museum's substantial education programming.
3. **Exhibition/Public Space Challenge**: The Museum is difficult to navigate. Visitor amenities are poorly located. Because of minimal back-of-house space for events, valuable gallery space has been appropriated for storage. Galleries for temporary exhibitions are inadequate. The goal is to improve the visitor experience in public spaces, make more efficient use of available space, and free up gallery space by solving the identified priority issues.
4. **Circulation Challenge**: It is difficult for visitors and staff to navigate the Museum. One quickly becomes lost, and logical paths from entrance to exit have not been maintained. Halls dead-end, forcing visitors to retrace their steps. It is essential to restore and improve circulation by eliminating obstructions and creating new connections.
5. **Administrative Challenge**: While identified by KHA as a challenge, this is not a priority for the Center.

D. Recent solutions within existing complex. In response to these needs, the Museum has already undertaken a significant capital improvement program to renovate, reorganize and revitalize existing space, both before and after the master space planning study was completed.

Science:

- In 2004, the Sackler Institute for Comparative Genomics Lab was opened to house the Museum's growing genomics program
- In 2009, The Richard Gilder Graduate School was opened to facilitate the first doctoral program at a museum in the Western Hemisphere
- In 2005, a Data Center added space for data storage within our existing footprint

Education:

- In 2011, The Davis Classroom and a number of space modifications throughout administrative space made room for the Master of Arts in Teaching program
- In 2007, the Sackler Educational Laboratory for Comparative Genomics and Human Origins was opened for school group use.

Exhibition:

- Renovated 16 permanent halls
- Mount two new temporary exhibitions annually

Visitorship, circulation and overcrowding:

- The Central Park West and 77th Street entrances were renovated, increasing accessibility for daily visitors and public program attendees.
- Elevator 13 was removed on the lower level, first and second floors in order to improve visitor circulation throughout the campus.
- The LeFrak IMAX Theater was upgraded to include 3D technology. This upgrade drew more visitors into the LeFrak Theater, taking circulation pressure off other parts of the Museum.

E. Analysis of options. Following completion of these projects within the Museum's existing spaces to meet the growing external and internal needs, and growing out of the 2008 master space planning study, the Museum extensively studied three options for further progress toward addressing the challenges: 1) continue to make ad hoc improvements throughout the existing complex; 2) renovate and expand the existing powerhouse building, located at the northwest corner of the complex, adjacent to the parking garage and terrace; or 3) develop a new building. The Museum Trustees and senior administrators identified a list of nine objectives based on the results of the master space planning study, for use in evaluating these options. This matrix shows the nine objectives and a comparison of the options:

OBJECTIVES	OPTION 1 Renovate Existing Space	OPTION 2 Renovate & Expand Powerhouse	OPTION 3 New Center
1. Provide a plan to accommodate growth in science and education program			X
2. Enhance awareness of the Museum's science, education and exhibition mission throughout the complex			X
3. Ensure a clear identity for an entrance on Columbus Avenue to welcome neighborhood visitors and shift visitor flow			X
4. Offer multi-disciplinary, flexible space for science and education	*	X	X
5. Improve circulation and connections throughout the Museum			X
6. Create an actively sustainable facility		X	X
7. Provide visual and actual connections to the landscape		*	X
8. Create a highly accessible environment		X	X
9. Provide visitor and community amenities	*	*	X
Key: X = achieves goal * = does not achieve goal, but improves the existing condition			

The analysis made clear that option 3 is the preferred option.

MAJOR ACHIEVEMENTS OF CAPITAL PLAN: 1991 - 2017

September 20, 2017

STUDIES and CAMPUS PLANS

HVAC Campus Study and Plan

MEP Study

Steam Study, Buro Happold

Façade Study, WASA

Elevator Study, VDA

Roof Study, WJE

Space Planning Studies, Polshek (1998) and Kliment Halsband (2008)

Master Egress Study

Carbon Footprint Studies, Arup (2008), Buro Happold (2016)

Sustainability Master Planning Study, HOK and Arup (2008) and subsequent AMNH own Sustainability Master Plan (2014)

Emergency Management Plan

Disaster Recovery Plan

CAPITAL ASSET MANAGEMENT

<u>MEP Upgrades:</u>

* Central Chiller Plant and Cooling Towers
* Distrubution of Cooling System to over 90% of Museum
* Electrical Upgrades to 14 Buildings
* Hot and Cold Water Pipe Replacement
* Collections HVAC Retrofit

<u>Vertical Transportation Upgrades:</u>

* Elevator #9 Upgrade
* Roosevelt Elevators Upgrade
* Rose Center Escalator Upgrade
* 77th Street Elevator Upgrade
* Section 17 Elevator Upgrade

<u>Façade Upgrades:</u>

* 77th Street Façade
* Central Park West Façade
* Rose Center Façade
* Building 1 (Historic Vaux Building) Façade

Roof Renovation and Replacement on 20 Buildings

Upgrade to Subway Entrance

Energy Efficient Lighting

Steam System Upgrade (Partial)

A/C for SAN Room

Telephone Switch Upgrade and A/C

Sewer Upgrade

Gasline Replacement

SAFETY and SECURITY

Kaufmann - Linder Theater ADA Upgrade

PA System Upgrade

LeFrak Theater ADA Compliance

Control Room Upgrade

Egress Lighting

Security Upgrades (CCTV, Cameras, Alarms)

Fire Safety Upgrades

Fire Stair Security Hardware

Retractable Bollards, All Entrances

Card Access Installation

Fire Proofing Upgrade in Building 3A

IMAX Fire Stair

Chemical Storage Facility

Multi-Year Collection Security Upgrade

Fire Suppression - African People, Birds of the World, NWCI

SCIENCE, EDUCATION, and EXHIBITION

Hall of Human Biology

Fossil Halls and Orientation Center *(6 Halls)*

Biodiversity Hall

Meteorite Hall Upgrade

Hall of Ocean Life Renovation

LeFrak Theater

Hall of Human Origins

Audubon Hall

LeFrak Gallery Upgrade

Hall of North American Mammals Restoration

Theodore Roosevelt Memorial Hall Renovation

Theodore Roosevelt Rotunda Restoration

Natural Sciences Library

Natural Sciences Building

<u>Rose Center for Earth and Space:</u>

* Hayden Planetarium
* Hall of the Universe
* Hall of Planet Earth
* Garage
* Arthur Ross Terrace
* Roosevelt Park North Side Renovation
* Astrophysics Offices

3rd Floor Classroom Renovation

Discovery Room

Davis Classroom

People Center

Hall Media Upgrade to Fossil Halls

Hall Media Upgrade to the Hall of Human Origins

Hall Media Upgrades for Biodiversity

Hall Media Upgrades for Hall of Planet Earth

Hall Media Upgrade to Rose Center for 10th Anniversary

Hall Media Upgrade to Hall of Ocean Life

Graduate School Center - Space Modification

Science Master of Arts in Teaching Program Space Modifications

Sackler Institute for Comparative Genomics and Molecular Lab Upgrade

Entomology/Invertebrates Laboratory

Ornithology Molecular Systematics Laboratory

Earth and Planetary Science Laboratory

Frozen Tissue Laboratory

Confocal Laboratory

Entomology Collection Storage Upgrade

Mammalogy Collection Storage Upgrade

EPS Collection Storage Upgrade

Ichthyology Collection Storage Upgrade

Ornithology Collection Storage Upgrade

Anthropology Collection Storage Upgrade

<u>Scientific Equipment, e.g.,</u>

* Parallel Computer Cluster
* Grape 6 Motherboard for Astrophysics
* Cathodoluminescence Detection System
* Confocal Microscope

VISITOR AMENITY UPGRADES

Food Court, Children's Lunchrooms, and Annex

Powerhouse

Café-on-Four

Café-on-One

Museum Shop

Junior Shop Upgrade

Kiosks/Information Desk Renovation

Electronic Ticketing Signage

Coat Room Renovation

Elevator 13 Removal for School Reception Circulation Corridor

OPERATIONS

<u>Space Modifications/Conversions:</u>

* Office Space for NCSLET/NASA
* Off-Site Space for Scientific Storage

*Payroll Department

* Membership Department
* Human Resources Department
* Institutional Advancement Department
* Information Technology Department
* Government Relations Department
* Operational Planning Department
* Retail/Licensing Department
* Events and Conference Services Department
* Finance Department
* Construction and Facilities Deaprtment
* Custodial Department
* Biodiversity and Conservation
* General Counsel Department
* Audio Visual Department
* Rose Center Engineering Department
* Visitor Services Department
* Communcations Department
* Science Bulletins Department

Telephone System Upgrade

Service Drive Upgrade

IT and DIGITAL

Network Wiring Upgrade

Computer Upgrades Museum-wide

Base-level Connection of all AMNH Areas to Computer Network

Purchase of the Storage Area Network

HR/Payroll Upgrade

Server and Network System Upgrade

Two Expanded/Renovated Data Centers

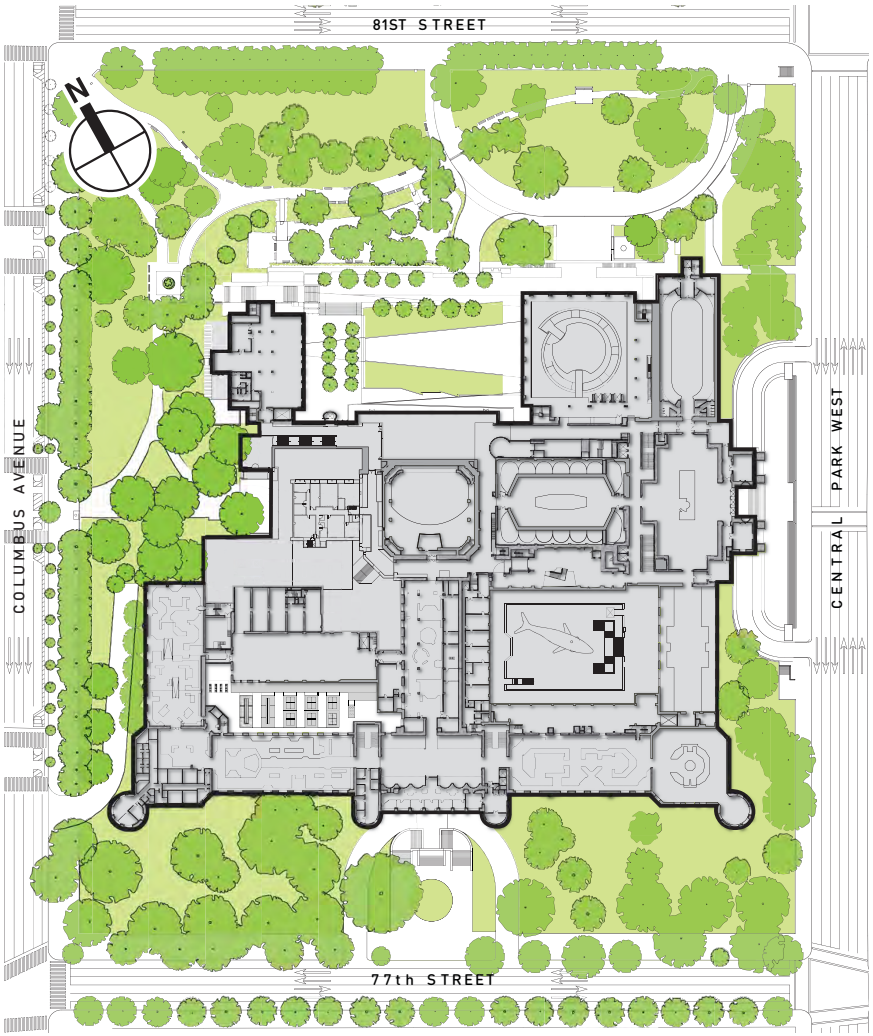
Ticketing System Upgrade

Museum-wide Public Wifi

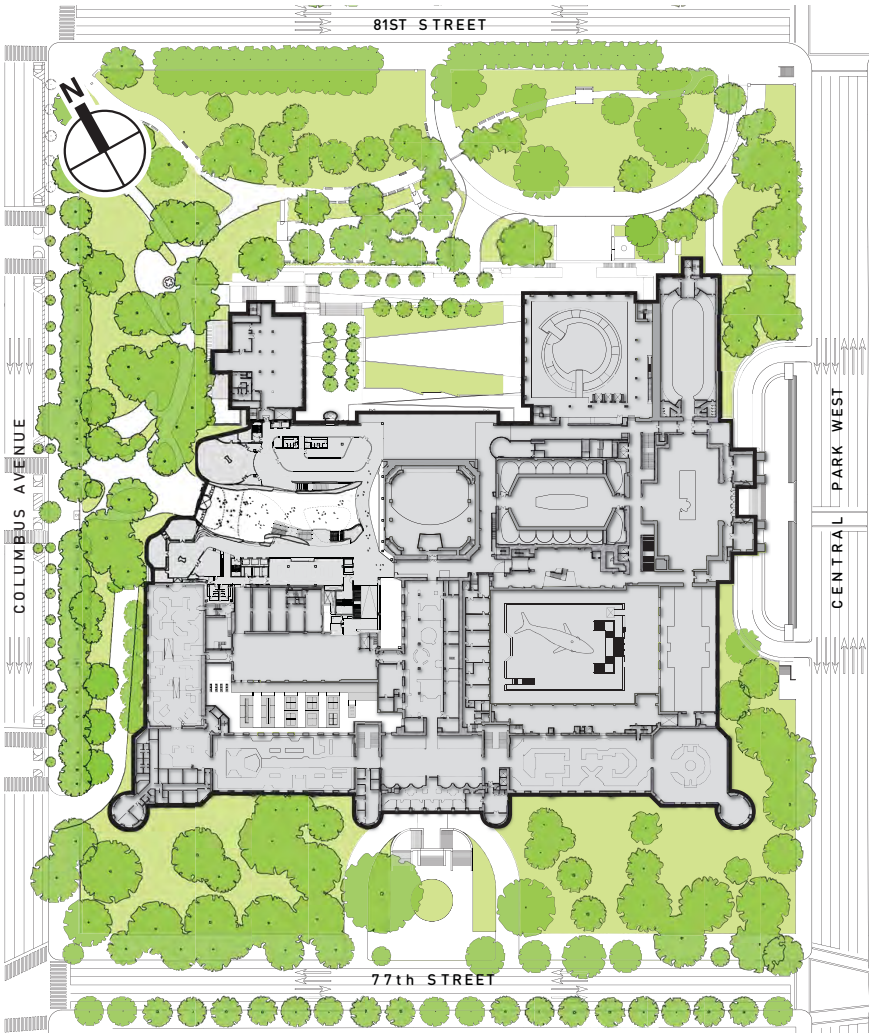
Website Development

Creation of Explorer App

Existing Site Plan



Proposed Site Plan



Existing and Proposed Campus Overview
Figure 1-12

APPENDIX D-2:
Attendance and Utilization Projection Memorandum

MANAGEMENT RESOURCES

MEMORANDUM

To: Ann B. Siegel, Senior Vice President, Operations & Capital Programs;
Rebecca Myers, Senior Director of Operational Planning and Services

From: Jim Higashi
Jim Harmon

Date: October 3, 2017

Re: Gilder Center Attendance Projections

We have been asked to elaborate on the attendance projections that we previously provided in 2016 in conjunction with our space and logistics assessment of the Gilder Center project.

Management Resources has worked with the Museum for more than twenty years in many aspects of planning and operations. This has included ticketing studies and the development of annual Museum operating assumptions, attendance projections, capacity analyses, visitor circulation studies, logistical requirements, staffing levels, and floor plan layouts of ticketing operations. We have drawn on that experience in our estimate of attendance for the Gilder Center.

In our services, we bring 30-plus years of experience in visitor attraction management consulting, including our work with numerous cultural institutions in the New York City area. These include the National September 11 Memorial & Museum, Brooklyn Botanic Garden, New York Botanical Garden, Intrepid Sea, Air and Space Museum, Liberty Science Center, the Museum of Modern Art, and the Whitney Museum of American Art. It also includes our work with other science and natural history institutions across the country including the Smithsonian Institution, California Academy of Sciences, the Field Museum, Kennedy Space Center, Natural History Museum of Los Angeles, and Natural History Museum of Utah.

The overall Museum ticketed attendance estimates incorporating the impact of the Gilder Center program are based on assessing and analyzing key factors:

- The size and composition of the project.
- Historical and most recent Museum attendance and ticket sales by market segment.
- The impacts of past capital projects and significant events on attendance and ticket sales.

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Gilder Center Project

The Gilder Center project will provide substantial improvements that are likely to attract additional visitors, thereby increasing ticketed attendance. The project will include:

- New exhibit spaces including an Insectarium as well as additional paid programming opportunities consisting of a new Invisible Worlds Immersive Theater and a Butterfly Vivarium.
- New and improved education spaces to grow and enhance educational programing.
- A Collections Core and science research spaces, many offering public access and visibility.

The exhibits and other project elements would be accessed through, visible from, and/or displayed in a new Central Exhibition Hall, which would also provide connections to the surrounding existing Museum spaces, including the Research Library and Learning Center and renovated Hall of Gems and Minerals.

Historical and Most Recent Museum Attendance and Ticket Sales by Market Segment

Ticketed Attendance Segments & Market Penetration

The Museum routinely tracks ticketed attendance to assist in improving the Museum's knowledge of the composition of visitors and visitation trends.

Ticketed visitors are categorized into one of four segments: General Public, School Groups, Adult Groups, and Members:

- General Public – visitors who purchase or receive complimentary admission tickets in advance or at the Museum.
- School Groups – visitors who come as organized school and camp groups and are ticketed as such.
- Adult Groups – visitors who purchase tickets as a group in advance of their visit.
- Members – visitors who have purchased a membership to the Museum and are ticketed as such.

The Museum also tracks attendance by the above segments at special exhibitions and shows offered at the Museum. This information is useful in determining the appeal and impact on attendance of specific programming elements. For the Gilder Center project, we believe that the variety of the improvements will appeal across all segments.

Finally, the Museum tracks the ticketed attendance as compared to the available market of visitors, defined as the total New York City population plus the annual visitation to New York City by non-residents as published by NYC & Co. The comparison between the Museum's ticketed attendance and the available market is referred to as the "market penetration rate".

Ticketed Attendance Trends

Over the past twenty years, the Museum's market penetration rate has fluctuated due to internal developments (e.g., the opening of the Museum's Rose Center for Earth & Space) and external conditions (e.g., September 11th, the economic recession). But it has averaged approximately 6.2% of the available market and has not exceeded 7.5% in any given year. The relative percentage of Museum ticketed attendance by segment has remained generally unchanged with General Public visitors by far comprising the largest segment, followed by Members, School Groups and Adult Groups.

Further, while yearly ticketed attendance has fluctuated over the past twenty years, in a recent five-year period, Museum ticketed attendance grew at a compound annual growth rate of approximately 1%.

Impacts of Capital Projects/Significant Events on Attendance and Ticket Sales

The opening of a major capital project or similar enhancements at museums and other visitor attractions will normally generate an initial larger increase in attendance and market penetration. However, over time, this jump in attendance and market penetration commonly decreases (stabilizes) to levels below the opening year. Following stabilization, a normal growth rate resumes.

To determine the impact of major capital projects or enhancements on ticketed attendance, we examined two notable capital projects at the Museum:

- New Dinosaur Halls opening in Fiscal Year 1995; and
- Rose Center opening in Fiscal Year 2000

Both the new Dinosaur Halls that opened in June 1995 and the Rose Center that opened in February 2000 had significant positive impacts on ticketed Museum attendance, in particular, on the General Public visitor segment.

The Museum's renovation of its Dinosaur and Fossil Halls lasted roughly four years, culminating in the opening of six new exhibition areas spread across a full floor of the Museum complex. The new Halls were a singular attraction in the New York City area, displaying specimens from one of the largest and most comprehensive and scientifically important collections of fossils in the world. It is a unique assembly of exhibition halls

and no other museum in the US or internationally have displays approaching the breadth and depth of the Museum's. The scope and subject matter associated with this project contributed to the Halls' significant popularity and attractiveness for visitors.

During the first full year of operation of the Dinosaur Halls, ticketed attendance increased by more than 600,000 visits, from approximately 1.8 million in Fiscal Year 1995 to approximately 2.4 million in Fiscal Year 1996 for a market penetration of 6.7%. As with many expansions or major capital projects, the attendance stabilized in the Fiscal Year 1998 at approximately 2.3 million annual visits for a market penetration rate of 5.6%.

The development of the Museum's north side similarly resulted in new and unique attractions for visitors. The hallmark of this expansion was the iconic Rose Center for Earth and Space—a 95-foot high glass structure surrounding a 2,000 ton sphere resembling a planet. The sphere in turn housed both the rebuilt Hayden Planetarium, one of the first planetariums ever built in the United States and renovated with the most advanced planetarium technology in the world at the time, as well as the "Big Bang" theater exploring the origins of the universe. The north side project also included the opening of two new exhibition halls: the Hall of the Universe and the Hall of Planet Earth. Finally, the project incorporated the Ross Terrace and fountain and a three-story parking garage that allowed more visitors convenience in getting to the Museum via car and serviced school buses more efficiently and safely, with loading and unloading inside the garage.

During the first full year of the Rose Center opening in Fiscal Year 2001, ticketed attendance increased by over 900,000 visits from approximately 2.3 million in Fiscal Year 1999 (the last full fiscal year prior to the Rose Center opening) to over 3.2 million in Fiscal Year 2001 and a market penetration of 7.5%. Stabilization would have been expected during the following years. However, the decrease in travel to New York City after the events of September 11, 2001 (the beginning of Fiscal Year 2002) caused Museum attendance to sharply decrease to approximately 2.5 million in Fiscal Year 2002. Ticketed attendance did not achieve a stabilized level until Fiscal Year 2006, when ticketed attendance reached 2.8 million for a market penetration rate of 5.4%.

Future Museum Ticketed Attendance

Available Market for Future Years

Based on historical resident data from New York City's Planning Division, visitation information published by New York City & Co., and the City's visitation goals, we have estimated a future annual growth rate of 2.3% for the available New York City visitor market and 0.5% growth rate for the New York City resident market. Using these applied growth rates, the available market for Museum attendance is expected to

grow to 75.8 million in 2021 (the first full year of operation for the Gilder Center) and to 79.1 million two years later in 2023 (the estimated stabilization year for the Gilder Center).

Without the Gilder Center Project

Estimating future Museum ticketed attendance without the Gilder Center included consideration of Museum ticketed attendance trends and more recent patterns of attendance growth. Future year-over-year annual attendance growth is likely to remain in the 1% range. Based on Fiscal Year 2015 Museum ticketed attendance of 4.1 million and applying an annual growth rate in the 1% range, absent a major capital project or enhancement, ticketed Museum attendance is estimated to reach approximately 4.4 million in Fiscal Year 2023 (the estimated stabilization year for the Gilder Center).

With the Gilder Center Project

Estimating the impact of the Gilder Center project on Museum ticketed attendance included consideration of the new visitor programming as well as the historic growth patterns for ticketed attendance resulting from past capital project programs, as described above. In our view, the Rose Center/north side expansion and the opening of the Museum's Dinosaur Halls are the most relevant points of comparison for the Gilder Center project given the Museum's unique position in its market.

Estimates of Museum ticketed attendance for the Gilder Center project were developed based on projected ticketed attendance gains to each attendance segment (General Public, School Groups, Adult Groups, and Members). We analyzed future overall market penetration within the framework of historical context and averages, and also assessed the expected market growth and penetration rate of each group listed above separately when calculating the projected attendance growth. Additionally, the General Public segment was further broken down by geographic region (New York City, New York Regional, Domestic, and International visitors) and market penetration rates were assessed for each of those groups. These estimates were in turn supported by the research and analysis of historical data at the Museum and the experience of other museums and visitor attractions.

As typically occurs for a major museum capital project, during the first year of operation there would likely be a more pronounced short-term attendance increase. For the Gilder Center, short-term attendance is expected to peak in 2021. By Fiscal Year 2023, the stabilized year of operation after the project opens, Museum ticketed attendance is estimated to be 5.0 million, approximately 630,000 more visitors (a 14% increase) than had the Museum not opened the Gilder Center. This annual attendance projected in Fiscal Year 2023 represents a market penetration rate of 6.4%.

Projected Incremental Growth in Ticketed Attendance with Project (2019-2023)

Fiscal Year	Projected Ticketed Attendance	Projected Ticketed Attendance Increase due to Gilder Center	Available Market	Market Penetration Rate
2019	4,220,252		72,687,251	5.8%
2020	4,262,455		74,230,995	5.7%
2021*	5,324,000	1,018,920	75,810,140	7.0%
2022	5,174,000	825,869	77,425,511	6.7%
2023**	5,024,000	632,388	79,077,954	6.4%

* The estimated opening year for the Gilder Center.

** The estimated stabilization year for the Gilder Center.

In making our estimates, we are assuming a relatively stable resident and visitor environment of safety and cost; however, unplanned external events can adversely affect attendance. These include terrorist incidents in or around NYC or on air, bridges or tunnel travel to NYC or the US generally, a new recession in the US or in foreign markets that provide international visitors, or a change in City school policy or school transportation budgets.

APPENDIX D-3:
AMNH Science and Education Memorandum

AMERICAN MUSEUM of NATURAL HISTORY

To: Commissioner of Parks
From: Lisa Gugenheim, Sr. Vice President for Institutional Advancement, Education, and Strategic Planning
Date: October 10, 2017
Re: AMNH Education and the Gilder Center

As we have planned for and reflected on what the Gilder Center might mean for the future of science education in New York and beyond, it's clear that the historic mission of this institution, our core values, and how we approach science education must drive this design. Since its founding in 1869, the American Museum of Natural History has embraced its responsibility to advance the public understanding of science, enhance the teaching and learning of science, and train and encourage the next generation of scientists. Education has always been a fundamental part of our mission.

Over the decades, the Museum has harnessed many new approaches and technologies to improve its practice and broaden its reach. Along with continually experimenting with new tools and technologies, we have also remained committed to understanding how learners learn, and to utilizing best practices in science education. Our commitment to education research and best practices has led us to create programs that meet learners at critical intersections in their lives as students—including early childhood, middle school, and college preparation. Research has also helped us quantify what we have long understood but that is now supported by rigorous research: that there is something critical about *doing* science, not just seeing or hearing about it (Bybee, R., 1997; National Research Council, 2000, 2005, 2012).

Intern interacts with hands-on Dino explorers

One of the questions we hear most, as we walk through the halls on any given day is, "Is it real?" Our vast collection of objects, specimens, and cultural artifacts spark the innate curiosity of children and adults alike, and our halls lead learners of all ages on daily journeys of exploration and discovery of the wonders—the real wonders—of the world around them. They can stand under a giant dinosaur or hold a butterfly in the palm of their hand and ask the questions scientists have been asking for centuries: How? What? When? What do we already know? What do we have still to learn? And our work within these spaces can help us build upon that initial question or spark of interest, to help learners of all ages, connect to the practices that scientists use, to begin to understand those questions and pursue them, and deepen their understanding and learning about the natural world.

Learning about discoveries that others have made is certainly the first step to an interest in science, but the undeniable second step is to start discovering something yourself. When students visit in class groups, we are able not only to share phenomena with them that scientists have already discovered, but take them through the actual processes of those discoveries. The in-classroom materials, technologies, and collections—like fossil casts, molecular biology equipment, and even pipettes—the Museum can provide are not available to many NYC school teachers, due to prohibitive cost. Students who have never been exposed to these resources and experiences may not even know they have an interest in or aptitude for science—and we have seen many students light up while exploring our labs and collections, as they begin to understand that they too can be part of science and discovery. Even more important, as they begin to do the work that scientists do, they start to pick up the skills, practices and ways of doing science that scientists do themselves—developing sought-after skills and practices that can help them in all areas of their lives, perhaps helping them imagine and visualize themselves as potential scientists.

Investigating our dynamic planet

Morpholution: studying physical specimens

Our out-of-school education programs can take this even further. One exemplary program, ***Morpholution*** *(pictured, left)* put high school students squarely in the shoes of scientists, and even used the same cloud-based database (MorphoBank) that scientists from across the globe use to collaborate and share data about living and extinct species. Students visited the Museum's mammal halls to directly observe and document physical characteristics and then used their collected data to form a large matrix representing the diversity of traits across the species they investigated. The study of unique and shared traits forms the backbone of evolutionary biology and is something scientists all over the world study vigorously. Students in this program grasp complex evolutionary processes by engaging in the practices of scientists: making observations, recording data, analyzing it, and sharing it collaboratively. Finally, they visualized their data by forming evolutionary trees—just as real scientists do—to make sense of and communicate their results. Again, these experiences not only help students develop important and valuable skills and practices, which may help them in all areas of their lives, but they may enable students to start to imagine themselves as scientists—or, as people who ask questions about the world and are constantly inquiring.

Experiences like these can only happen in a place like this. The Museum has the physical collections, the scientific tools, the research and education expertise, and the digital technologies—all under one roof. The Gilder Center is designed to be a natural extension of these practices, and represents a new moment for us to deepen, enhance, and transform the important work we've been doing for over a century—and advance it into the future.

Recording observations in the Dinosaur Halls

The new Center will integrate the Museum's research, collections, and education activities as never before. It will offer flexible, technologically advanced spaces that encourage creative, multi-disciplinary thinking; collaboration; experimentation; and new ways of presenting material to capture and maintain students' interest in science—all in proximity to exhibitions and portals to the Museum's scientific collections. We will be able to deepen our practices, expand our offerings, and extend our resources for all our City's learners—particularly those who would not otherwise have access to such opportunities.

The Gilder Center represents the first time that the Museum will be able to offer classroom and laboratory spaces that are designed for specific age groups. There will be four new and renovated learning zones dedicated to Family and Early Learning, Middle School, High School, and College & Career Readiness. Within these zones, there will be more than a dozen new and improved classrooms and environments tailored for children, youth, high school students, teachers, adults, and families. This is unprecedented in our history, and as such is an unprecedented opportunity to reach all types of learners. Learners at different ages have the capacity to engage with big scientific ideas and practices in ways that evolve and change as they grow and learn (National Research Council, 2005, 2000). The potential to offer specific spaces that both reflect and support those developmental needs and possibilities is both critical and exciting. While a four year old and a fourteen year old are both able to develop a scientific explanation or to create a model of a phenomenon, they do so in different ways and draw upon their capacities in ways that reflect their growing conceptions about science. Being able to target learners' specific needs and

Collaborative learning in an after-school program

Girls learning to code

abilities, and to work with children at the 'edge of their potential' at every stage of their development, is an especially exciting feature of these spaces. Each space will be designed to be interactive, collections- and technology-rich, to encourage independent exploration as well as collaborative learning, to incorporate both the tools and the practices of science, to connect to Museum halls, and to reflect and support national science learning standards (Achieve, 2013).

Using real tools of science

The dedicated new education space will significantly expand the Museum's ability to provide advanced science learning to poorly resourced NYC public school students, especially in middle schools and high schools. Additionally, the new facilities will have a wider reach to many more of our City's students than would installing similar facilities in a few individual schools, with the additional benefit of being integrated with the Museum's many other resources. School groups visiting from schools without adequate science lab facilities will be able to take advantage of **classroom lab programs** during the days—exposure that is critical for middle and high school students. These spaces will also be able to incorporate more science visualization tools and techniques to help students start to work with and make sense of complex scientific concepts, computational science, genetic, and microbial studies. Such experiences are especially important for students in under-resourced schools, who often do not have the opportunity to access and work with such materials—and can provide important experiences that may help increase their experience with and connections to the work of science and scientists.

The Gilder Center will provide more access to the Museum's collections than ever before through the new **collections core** and programming around it will enable visitors and students to understand how to gain evidence from observing artifacts of the natural world. A new **Insectarium** will showcase what is the Museum's largest area of collection, with an integrated education program. Live insects, scientific tools used for conducting research on insects, and digital content will help visitors understand what an insect is, and why they are so numerous and diverse—accounting for 80% of the world's biodiversity. This important hall will directly illustrate how collections help scientists address some of the most pressing challenges of our time, including challenges in human health and the environment.

Our youngest naturalists

Master of Arts in Teaching candidates

We will also **focus on teacher education**, utilizing the new classrooms as **learning labs** for new and in-service science teachers who will be trained with state of the art tools and techniques of scientific investigation so that they are fully prepared to teach the Next Generation Science Standards. The **Teacher Education Zone** will serve as both a dedicated physical space and an intellectual hub that will enable the Museum to unify and expand its teacher education and professional development offerings, while also redefining the

role that institutions such as ours can play in improving how science is both learned and taught. The new facility will dramatically improve the Museum's ability to serve teachers and their students in the New York City metropolitan area and nationally, integrating onsite and online offerings that together will help to foster the next generation of scientists and scientifically-literate citizens.

The Gilder Center will also provide greater access to **library resources**, revealing a key scholarly asset for the Museum's scientific staff and for visiting scholars from all over the world by making library resources more accessible to visitors, including new opportunities for public programming and **adult learning**, including teacher education. Teachers do not often have spaces for collaboration or research; the new library resources will also be a draw for educators all over New York seeking opportunities to deepen their scientific content, to gather materials that can support rich scientific curricula, to learn about curricula that reflects current science teaching standards, and to share and collaborate with their peers around ambitious science teaching.

Learner in adult course on the Brain

The Museum's long history of education partnerships, experimentation, evaluation, and now research has prepared us as educators for this important moment when, in the new Gilder Center, we can finally reach for the full depth and scale of our aspiration. With these new facilities, designed according to our greatest understanding and outfitted with our most effective tools and resources, we will now be able to engage our learners wherever they are in age and understanding, increase the capacity of our out-of-school programs, work with schools more deeply, and engage schools and districts for longer periods of time. Taken together, these improvements will enable us to maximize and sustain science learning for all of our audiences as never before.

Urban Advantage Science Expo 2017

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National Research Council (2000). *How People Learn: Brain, Mind, Experience, and School: Expanded Edition.* Washington, DC: The National Academies Press. https://doi.org/10.17226/9853.

AMERICAN MUSEUM of NATURAL HISTORY

To: Commissioner of Parks
From: Michael J. Novacek, Senior Vice President, Provost, Curator
Date: October 10, 2017
Re: AMNH Science and the Gilder Center

Science is not only the foundation but also the driver of the mission in both research and education at AMNH. Museum scientists carry out research, curate collections, train students, generate topics, concepts, themes and content for exhibitions and educational programs, and collaborate with exhibitors and educators in designing, developing, and carrying out these projects. All these programs fully depend ultimately on the scientific research. This memorandum describes this aspect of the AMNH mission and how the Gilder Center will be an essential resource for our working scientists and educators as well as providing visitors with an authentic encounter with the science of the Museum.

Science at AMNH

Research at AMNH is the responsibility of a full-time scientific staff of more than 200 who work in astrophysics, earth sciences, paleontology, biological sciences and anthropology. AMNH scientists publish their research in peer-reviewed journals at the rate of about 400 publications each year. The science effort is led currently by 40 tenure track curators whose research publications have attracted over 200,000 citations. Senior curators have an average citation index (H-index) of 45, regarded as an indication of "outstanding" impact characteristic of only top research institutions[1]. Research facilities utilized by AMNH include the Museum's collections, a substantial natural history library and state-of-the-art laboratories as well as other research facilities off site which are available at university consortiums in which AMNH participates.

AMNH research is partially funded by federal agencies including the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA) and the National Institutes of Health (NIH). It includes research centers that advance basic research in molecular biology and that survey and study biological diversity, and strive to mitigate threats to the Earth's ecosystems. Significant funding for research is also received from private foundations. In FY 16, 56% of all proposals submitted to federal agencies were awarded, an extremely high success rate, as some programs that are a major source of Museum funding yield a national average success rate of less than 18%. Some outstanding recent grants include a $3.5 million DARPA (DOD) grant for integrating linguistic, ethnographic, and genetic information of human populations, a $550,000 NSF grant for collaborative research on the evolution of the Amazonian biota and its environment (total US and Brazil funding is $4 million), a $1.5 million Simons Foundation grant for the study

[1] Nature 436/18:900 http://www.readcube.com/articles/10.1038/436900a

Figure 1. A sample from the Museum's butterfly and moth collection of 3.5 million specimens, one of the world's largest

of the genomics and evolution of microbial eukaryotes, and a $1.5 million Kleberg Foundation grant for a collaborative project between Museum curators and scientists at Memorial Sloan Kettering for study of the evolution of pancreatic cancer.

The Museum's collections number more than 33 million specimens and artifacts and are among the largest and most comprehensive in the world. The collections constitute an invaluable record of life on Earth and are maintained to facilitate the study and understanding of 4.5 billion years of change in Earth's geology, climate, and the 3.5-billion-year history of its habitats and life forms. New collections and facilities include the Museum's frozen tissue collection of DNA with tissue samples that form a repository for research at AMNH and other institutions, often including specimens of endangered species such as those deposited by researchers under permit from the National Park Service. Other new forms of collections include large scientific digital databases of genomic and astrophysical data.

The collections and research assets are enriched by continued exploration of such diverse areas as Mongolia, Kenya, Canada, Argentina, South Africa, Guatemala, Cuba, Congo, Costa Rica, China, Belize, Bahamas, Arctic islands, Antarctica, Vanuatu, Thailand, Chile, Brazil, Colombia, Peru, Australia, Indonesia, New Guinea, Romania, and many others. AMNH provides research material for other institutions, typically with loans of hundreds of thousands of specimens outstanding at any given time. Its collections are also made available for study on site to research scientists and students annually, to more than 1,400 researchers in FY 2016.

Integral to the AMNH scientific mission is its important role in training the next generation of scientists. In FY 2007, AMNH established the Richard Gilder Graduate School (the "Graduate School") to confer the degrees of Doctor of Philosophy ("Ph.D.") and Master of Philosophy ("M. Phil"), the first and only museum in the United States to do so. The Graduate School is accredited by the Board of Regents of the State of New York.

To further advance training of the next generation of scientists, the Graduate School also conducts a doctoral training program in collaboration with four universities: Cornell, Columbia, New York University, and the City University of New York, and maintains an active post-doctoral program. The Graduate School also offers an undergraduate training program, which provides a select group of undergraduate students with intensive research experience in such subjects as evolutionary biology, earth and planetary sciences, and astrophysics. The Graduate school also confers Masters of Arts (MAT) degrees in teaching Earth Sciences for graduates assigned to New York City's high schools.

The Contributions of AMNH Science to Research and Society

The AMNH is a leading international institution for an extremely broad spectrum of science, covering such diverse disciplines as astrophysics, geology, paleontology, physical and cultural anthropology, and comparative and evolutionary biology. All of these fields have been fueled by the great leaps in 21st Century technology—revolutions in the advancement of imaging, high speed computation, digital data capture, genomics, and many other areas[2]. For example, DNA sampling for only a few genes was, until recently, laborious, time-consuming, and hugely expensive. Today, new tools and approaches in sampling and isolating DNA, cost-effective high throughput sequencing (whole genomes can now be sequenced for a few thousand dollars instead of the millions required for the original human genome project), computational science, and bioinformatics allow scientists to recover information from proteins, thousands of genes, and even whole genomes[3]. Currently, many Museum scientists, graduate students, and postdoctoral fellows working on extant organisms—and even some paleontologists—use some aspect of genomics in their research. The Museum's contributions in this area are duly recognized by its membership as the only non-biomedical institution in the recently established New York Genome Center (NYGC).

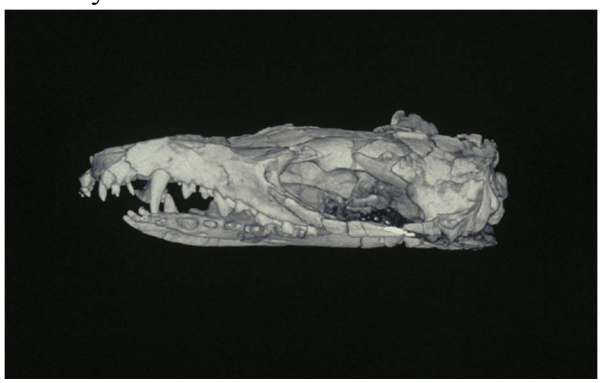

Figure 2. Ukhaatherium nessovi, and 80-million-year old fossil mammal imaged using the AMNH CT Scanner.

Comprehensive biomolecular sampling is most successful with newly collected specimens or frozen tissues extracted from fresh material. New techniques, however, now allow the retrieval of gene and other molecular information from specimens in the Museum's historic collections. Such sampling is even now possible for fossil specimens. Sophisticated imaging and analysis with CT scanners, transmission and scanning electron microscopes, and confocal microscopes, as carried out in the Museum's Micro-Imaging Facility (MIF) located adjacent to the space for the future Gilder Center, capture exquisite details of morphology and histology in well-preserved specimens.

Armed with these new technologies, AMNH scientific research not only continues to make contributions that advance the fields represented by its scientific divisions; it is of importance to society in ways that will be powerfully revealed in the Gilder Center. Roughly 1.8 million biological species have been named[4], described and classified, but this, by any estimate, is far short of the actual diversity of species living at present. A recognition of our incomplete knowledge of some highly diverse groups such as insects, and our extremely poor knowledge of many groups of

[2] Encyclopedia of Biodiversity, Volume 5 http://dx.doi.org/10.1016/B978-0-12-384719-5.00420-2.

[3] GigaScience (2015) 4:38 DOI 10.1186/s13742-015-0077-2.

[4] Wilson, E. O. (2003). The encyclopedia of life. *Trends in Ecology and Evolution* **18**, 77-80.

invertebrate animals, fungi, algae, and especially diverse bacteria, protists, and other microbial organisms, suggests that the total number of species could range notably upward from at least 10 million species[4]. The challenge of mustering a better accounting of biodiversity is compounded by the current rate of environmental degradation and the loss of species. That loss, estimated to be at levels 100-1,000 times the normal or background rate of extinction recorded in the fossil record, constitutes what many biologists call the current biodiversity crisis, an event that possibly could result in loss of anywhere between 30% and 50% of all living species during the 21st Century, a biological catastrophe approaching the level of the five major mass extinction events of the last 500 million years. Many of these species will be extinct before scientists have a chance to account for them. Thus, the work of the AMNH and related institutions is critical to our understanding of both the scope and richness of life and the magnitude of the impacts on the natural world resulting from land degradation and loss, climate change, pollution, invasive species, over-harvesting, and other drivers caused by human activities.

Our realization that mass extinction is a reality in life's past and a possibility in life's future derives from two essential timescales that Museum research and collections represent. The massive fossil and geological collections at AMNH open the window on deep time: the dynamic history of change in the geology and life of our planet, spanning 100's of millions of years, including tectonic shifts in the continents and the rise and fall of major groups of organisms. A second timescale is roughly defined by recent human history that dates back roughly 150 years to the time when the AMNH and other natural history museums and gardens were established. This important interval, with a world population that grew from 1.2 billion to 7.6 billion[5], is increasingly referred to as the *Anthropocene*: the recent changes, as documented in our collections and field data, in biodiversity, ecosystems, natural habitats, and climate resulting from the impact of modern humans, including historical extinction of species, shifts in the distribution and abundance of species, and the emergence of new pests and diseases[6].

At the core of much of this work is the Museum's leadership in mapping the evolutionary tree of life, the great branching framework of relationships that connects all of Earth's species[7]. These studies draw on evidence from several levels of increasing complexity—from genes, to proteins, subcellular organelles, cells, tissues, organs, and organ systems. Moreover, organisms do not thrive in a vacuum, but instead survive as members of communities of competing, collaborating, and co-evolving species. They are also the result of 100's of millions of years of ancestry and descent, and their evolutionary success is a product of both their ability to adapt and their own genealogical histories. The grand challenge of biology is come to a more synthetic understanding of the relationship between different levels of biological complexity as part of evolutionary pattern and process. Thus, we strive to know more about how genes and genomes influence the

[5] http://www.worldometers.info/world-population/world-population-by-year/ https://esa.un.org/unpd/wpp/

[6] Crutzen P.J. (2006) The "Anthropocene". In: Ehlers E., Krafft T. (eds) Earth System Science in the Anthropocene. Springer, Berlin, Heidelberg. https://doi.org/10.1007/3-540-26590-2_3.

[7] Mindell, D. P. (2013). *Systematic Biology*. **62** (3): 479–489. doi:10.1093/sysbio/sys115.

architecture of more complex structures, whether they are the myriad neural connections in the human brain or the special physical properties of spider silk. Museum scientists possess distinctive knowledge of organisms and their structure, habitats, and evolutionary histories as well their genomes. This modern perspective and knowledge—a 21st Century version of natural science—helped in shaping a synthetic approach envisioned as the Museum's *Architecture of Life (ArcLife)* initiative, the multidimensional study of life from genomic, protein, and cellular levels and above to address major questions concerning the origins and evolution of life's diversity and complexity.

A key to understanding the architecture of life is a much better resolution of the most primitive and basic branches of life represented by micro-organisms[8]. The genomics, cell structure, and metabolic pathways seen in such organisms as bacteria and the single-celled eukaryotes, such as algae and protists, provide the clues to the fundamental and major transformations in the evolution of life[9]. In the first decade of the 21st Century the AMNH became the first natural history museum devoted to comprehensive research on the evolution and phylogeny of microbial species. Work in this area has already yielded significant discoveries and has become a priority for funding by both government and private foundations. Some of the Museum's high impact research on microbes concerns the origin of different modes of energy capture. Humans and other animals as well as many microbial species are *heterotroph*s, or simply, eaters: They ingest other organisms as food and thus rely on an external source of organic carbon for growth and metabolism. Plants, green algae, and a variety of one-celled organisms are, in contrast, capable of *photosynthesis*: They synthesize organic carbon compounds from inorganic sources by utilizing light energy from the sun. It is thought that certain primitive one-celled heterotrophs at some point in the very early history of life evolved into species capable of photosynthesis[10]. This transition has far-reaching implications for our understanding of the evolution of life and indeed Earth's chemical evolution, in the latter case notably including the rise of atmospheric oxygen levels produced by photosynthetic organisms over a billion years ago.

Figure 3. Cymbomonas, a green alga capable of feeding on bacteria.

It has been assumed that photosynthesis arose when an algae-like cell ingested a bacterium capable of photosynthesis, but for many years this process had not been observed. AMNH scientists recently made the exciting discovery of a single-celled eukaryotic green alga that ingests bacteria as food[11]. This finding provides important, and unprecedented, evidence for a transition that occurred over a billion years ago in the early evolution of life. The investigative team also has made significant progress in research on the genomic basis for the dramatic transition to photosynthetic life. AMNH

[8] Hug L. A. et al. (2016) *Nature Microbiology*. **1**: 16048. PMID 27572647. doi:10.1038/nmicrobiol.2016.48.

[9] Nisbit E. G. et al. (1999) *Proceedings of the Royal Society B*. **266** (1436): 2375–2382. PMC 1690475 . doi:10.1098/rspb.1999.0934.

[10] Margulis L. (2011). *Paleontological Journal*. **44** (12): 1525–1539. doi:10.1134/S0031030110120087.

[11] Maruyama & Kim E. (2013). *Current Biology* 23: 1081–1084. (featured article)

scientists are undertaking exploration and discovery, both in the field and the laboratory, of new lineages of microbial eukaryotes. This involves a comprehensive survey, supported by the Simons Foundation, of genomes in hitherto poorly known branches of microbial species.

In addition to these fundamental contributions to the understanding of nature at multiple levels, the kind of science carried out at AMNH has major applications and societal benefits. One area of clear impact concerns the bearing of AMNH science on environmental strategy and practice, relating to many aspects of conservation, and land and water management. Many AMNH scientists are conducting expeditions to so-called hot spots[12], areas that contain diverse species that are endemic, or confined to specific areas of forest, desert, or other habitats that are also under threat. These core scientific efforts have been linked to recommendations for conservation practices through the work of the Museum's Center for Biodiversity and Conservation, or CBC. Since its establishment 22 years ago, the CBC has supported survey and biodiversity work and in-country training by both Museum curators and Center scientists in such hotspots as forests in Vietnam (a country that has lost over 50% of its original forest land[613]), the biologically spectacular, but environmentally devastated, island of Madagascar, and the small islands of the West Pacific where diverse species and even human settlements have been threatened by rising sea level due to climate change. Results from these studies are the basis for recommendations that have been adopted by host countries or more local communities. For example, CBC recommendations regarding science-based conservation practices in Vietnam, where deforestation has threatened primates and other species, led to major revisions in the national plan for land preservation and management. An important, and successful, aspect of the CBC's effort is in the training of local expertise in both biodiversity science and conservation. This is an essential contribution, as many biodiversity-enriched countries have little of the infrastructure, knowledge, and experience necessary to understand and manage their precious natural resources.

Figure 4. AMNH Center of Biodiversity scientists collaborating with in-country scientists in Vietnam's rainforests.

AMNH research also has major applications in areas not always associated with Museum science. Human health is dependent on recognizing the relationships between humans and other species[714]. Many problems related to diseases that afflict humans involve the capacity of infectious organisms to evolve and adapt, sometimes transferring from one animal host to our own species. AMNH scientists are tracking the evolution of non-human malaria-infecting *Plasmodium* parasites and the origin of the jump of *Plasmodium* to humans[15]. Another specialist

[12] Myers N. et al. (2000) *Nature* 403: 853-58.

[13] FAO (2006) *Global Forest Resources Assessment 2005* (Rome),*www.fao.org/ forestry/site/ 32038/en*.

[14] Tewksbury J. J. et al. (2014) *BioScience* 64: 300–310.

[15] Perkins S. L. (2014) *Journal of Parasitology* 100:11-25.

works with anticoagulant proteins in leeches[16]. The evolution of these important blood-clotting proteins is of immediate interest to researchers in health fields. Some of the collaborations between Museum scientists and colleagues at biomedical centers have produced the first rigorous human papillomavirus evolutionary tree (or phylogeny) of relationships[17]. The Museum-led research team is using this phylogeny to follow cancer cell lineages and is developing new methods to follow the movement of genetic elements amongst pathogenic bacteria. This approach led to the discovery that most of the pathogenic (cervical cancer-causing) viruses can be traced back to a single common ancestor. Tracking the genomes of single cells in cancer tumors allows the team to trace the progression of cancer and also the genes that are being altered along the way. Pathogenic bacteria are capable of transferring large portions of their genes to other bacteria, thus transferring their pathogenicity. Antibiotic resistance and the global dissemination of infectious diseases constitute a massive threat to public health and a new priority for research, intervention, and prevention. Fortunately, the enormous amounts of data produced by modern genomic sequencing allow an unparalleled and detailed view of the evolution and spread of diseases. The core techniques for analyzing these data come from the techniques developed in the field of systematic and evolutionary biology[18], where the Museum has been a world leader. Such techniques allow us to track specific strains of pathogens, and reconstruct the timing of the key evolutionary events that led to their spread. Moreover, these techniques can lead to the identification of specific virulence genes that can be targeted for therapy or to prevent dissemination.

Medicine has changed greatly in the past decade due to the massive amounts of genomic data, both from our genomes and the genomes of pathogens. It is now possible to sequence hundreds of infectious agents in a single day and to use this sequence information to inform diagnosis and treatment. The evolutionary techniques pioneered by the Museum are at the heart of many of the analytical approaches to this end. This has launched an exciting new age of unprecedented collaboration between the kind of evolutionary biology taking place at the AMNH and medical science. This new direction for the AMNH is a vivid example of how its work in the natural sciences can co-opt new and exciting technologies to yield powerful and practical applications in human health and other areas.

The Gilder Collections Core as a Scientific Resource

The intersection of current and future AMNH science and modern technology underscores the importance of the new **Collections Core** planned for the Gilder Center. As noted, DNA sequencing, high resolution imaging, and other techniques allow scientists to make discoveries in their collections at levels of integration and detail not imagined a decade ago. Such opportunities, however, come with the expectation that important collections are housed and managed in modern,

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[16] Siddall M. E. (2016) *Journal of Parasitology* 102 (1): 143-150.

[17] Chen Z. et al. (2017) *Journal of Virology*, JVI. 01285-17.

[18] Pennisi E. (2009) *Science* 324:5924: 162-163.DOI: 10.1126/science.324.5924.162a.

state-of the art facilities, with appropriate climate-control, specimen conservation and preservation, and ample space and organization. Over the years, the Museum has invested heavily in improved collections storage, but in order to maximize the use of these valuable collections, there is still a pressing need for additional, high-quality onsite storage. AMNH is responsible for not only one of the world's largest natural history collections, but one of its most rapidly growing ones. In addition to its repository of more than 33 million specimens that represent nearly 150 years of cumulative effort, the Museum grows its collections by an average of 50,000 additional specimens a year, the product of over 100 annual expeditions by Museum scientists. The Museum collections are studied onsite and visited by more than 1,400 scientists annually. Expansion of modernized space is desperately needed to accommodate all this collections growth and activity. It is also important that the great majority of new and historic collections stay on the Museum campus, where they can be sufficiently cared for and managed and where specimens can be readily and safely studied in proximate laboratories onsite.

The new Collections Core is vitally needed in serving this aim. The 21,000-square-foot, glass-walled Core will be both a critical resource and a spectacular feature of the Gilder Center, housing 3.9 million specimens, or approximately 10 percent of the Museum's more than 33 million specimens and objects. In addition, the Collections Core will serve as the new home for some of the Museum's most important collections, including a large portion (1 million specimens) of the one of the world's largest butterfly collections, as well as the Museum's important bee collection. The exquisite fossil fish collection over 29,000 specimens will be installed in the new Core. Also accommodated will be the massive collections of recent fishes of over 2.8 million specimens, to be located just below the new and fully modernized laboratories for scientists in the Ichthyology Department that will occupy the Fifth floor of the Gilder Center. These spaces will be equipped with the most up-to-date technologies and the highest standards for quality-, climate-, and environmental control in ways that best serve modern scientific research.

The Gilder Center and the Visitor Experience: An Encounter with Science

The fundamental importance of AMNH science to understanding nature and the benefits to society delivered by the natural sciences are central themes in the new exhibitions and educational programs resident in the Gilder Center. These features will invite visitors and students to encounter, enjoy, and learn about the wonders and beauty of nature and the process, discovery, and importance of the kind of science underway at AMNH. The Gilder Center is designed to optimize this encounter with science. The visitor who enters the great hall of the Gilder Center can see the portals in the bordering walls that reveal the new Insectarium and Vivarium, the entrance to the Gem and Minerals Hall, the new threshold for the Library, displays projecting vivid digital images and information, active classrooms, and the towering Collections Core that reveals a major part of the Museum's working research collection that has hitherto been out of public view. The juxtaposition of these different features allows the visitor to visually connect the various facets of information and evidence that are the essence of scientific process and discovery.

Collections Core exhibitions comprising selected specimens, images and media on the outer transparent "shell" of the Core will reveal how scientists use collections to answer fundamental questions, identify new species, and formulate new research questions and directions. Visitors and students will, for the first time in the Museum, have the opportunity to appreciate the Museum's collections for their massive size, the diversity of nature and the evidence they represent, the effort expended to collect, grow, and organize them, and the exciting and relevant scientific discoveries they yield.

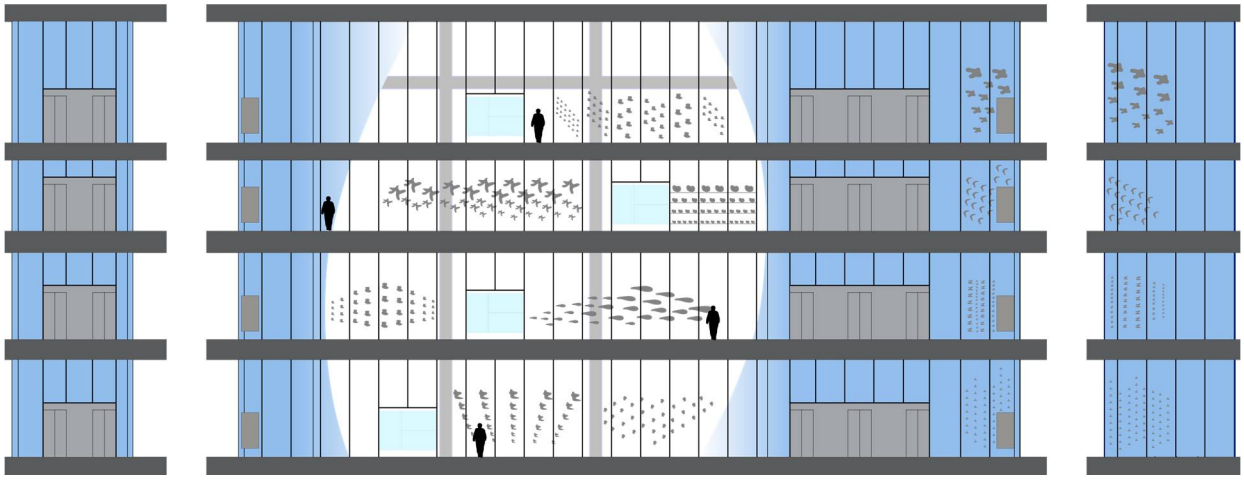


Figure 5. A draft schematic of the Gilder Center Collections Core.

An **Insectarium** drawn from the Museum's entomological and other arthropod collections of over 17 million specimens—one of the world's largest and most important collections of its kind—will celebrate Earth's most diverse and abundant animal group. The hall will be the new home for the Museum's beautiful live butterfly conservatory as well as new exhibits of other live insects, showcasing the spectacular variety and enrichment of the insect world. Insects play key and dominant roles in maintaining ecosystems on land and are critical to any consideration of the habitat degradation and species loss that currently pose major threats to the environment and the quality of human life.

An **Invisible Worlds Theatre** will show dimensions of nature that can only be revealed through scientific research and technology. Today, scientists use CT scanners and scanning electron microscopes, computer models and simulations, and high-resolution and high-speed cameras to observe, measure, and reproduce invisible worlds every day. The new theater will present a compelling and radically new understanding of nature and current science that visitors will experience through authentic science visualizations inside this dramatic counterpart to the Museum's Hayden Planetarium in the Rose Center for Earth and Space.

The Library and Learning Center on the fourth floor of the Gilder Center will be connected to the rest of the Museum and made broadly accessible to visitors, becoming a dynamic nerve center that connects users with its many unparalleled resources and helps them navigate flows of information, whether printed or digital. With its 400,000 volumes and unparalleled special collections that include letters, photographs, digital resources, and films, the Museum has one of

the largest and most important natural history libraries in the world. Like the Museum's collection of specimens and objects, the Library is a key scholarly asset for the Museum's scientific staff of 200 and for visiting scholars from all over the world. Yet even though the library is currently open to the public on a limited basis, it is located deep in the Museum's interior and visitors too rarely find their way to it. In addition to providing a spectacular threshold for public access, the Museum's new Research Library and Learning Center will include an **Adult Learning Zone** where visitors can stop during the day for reading as well as for organized programming. Its windows will overlook the central hall and Theodore Roosevelt Park, and a long interior wall will be used to display collections that, among other things, tell the history of science through holdings such as the Library's Rare Book Collection, which includes unique, historically significant volumes that document emerging scientific knowledge.

APPENDIX D-4:
AMNH Lease with the City of New York

-B-

Department of Public Parks

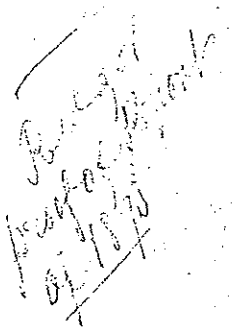
of the City of New York

— with —

The American Musem of

Natural History

Contract.



This Agreement made and concluded on the twenty second day of December, in the year One thousand eight hundred and seventy-seven. Between the Department of Public Parks of the City of New York, the party of the first part, and the American Museum of Natural History, party of the second part.

Witnesseth:

Whereas, by an Act of the Legislature of the State of New York, passed April twenty second, eighteen hundred and seventy six, entitled "An Act in relation to the powers and du-"ties of the Board of Commissioners of the Department of Public "Parks, in connection with the American Museum of Natu-"ral History, and the Metropolitan Museum of Art," the said party of the first part is authorized and directed to enter into a contract with the said party of the second part, for the occupation by it of the buildings erected, or to be erected, on that portion of the Central Park, in the City of New York, known as Manhattan Square, and for transferring thereto and establishing and maintaining therein its museum, library and collections and carrying out the objects and purposes of said party of the second part;—

And whereas a building contemplated by said act has now been erected and nearly completed and equipped in a manner suitable for the purposes of said Museum, as provided in the first section of the Act of May fifteenth, eighteen hundred and seventy five, known as Chapter 351, of the Laws of 1875, for the purpose of establishing and maintaining therein the said Museum, as provided by the said last named Act, and by the Act of April fifth, eighteen hundred and seventy one, known as Chapter 290 of the Laws of 1871;—

And whereas, it is desired as well by the said party of the first part, as by the said party of the second

part, that immediately upon the completion and equipment of said building, the said party of the second part should be established therein, and should transfer thereto its Museum, Library and Collections and carry out the objects and purposes of the said party of the second part.

Now, therefore, it is agreed by and between the said parties as follows, viz:

First. That the said party of the first part has granted and demised and let, and doth, by these presents, grant, demise and let, unto the said party of the second part, the said buildings and appurtenances thereunto belonging, to have and to hold the same so long as the said party of the second part shall continue to carry out the objects and purposes defined in its charter, or such other objects and purposes, as by any future amendment of said charter may be authorized; and shall faithfully keep, perform and observe the covenants and conditions herein contained on its part to be kept, performed and observed, or until the said building shall be surrendered by the said party of the second part, as hereinafter provided.

Secondly. That neither the party of the first part, its successor or successors, nor the Mayor, Aldermen and Commonalty of the City of New York, shall be in any manner chargeable or liable for the preservation of the said building, or the property of the party of the second part which may be placed therein, against fire, or for any damage or injury that may be caused by fire to the said properties; but it is agreed that, damages as aforesaid excepted, the said party of the first part will keep said building, from time to time, in repair.

Thirdly. That as soon after the completion and equipment of said building as practicable, said party of the second part

shall transfer to and place and arrange in, said building, its Museum, Library and Collections, or such portion thereof as can be properly displayed to the public therein and shall have and enjoy the exclusive use of the whole of said building, subject to the provisions herein contained, and the rules and regulations herein prescribed during the continuance of the term hereby granted, or until a surrender thereof as herein provided.

Fourthly. That the Exhibition halls of said building, shall, on Wednesday, Thursday, Friday and Saturday of each week, and on all legal or public holidays, except Sundays, be kept open and accessible to the public, free of charge, from Nine o'Clock, A. M. until half an hour before sunset, under such rules and regulations as the party of the second part shall from time to time prescribe; but on the remaining days of the week the same shall be only open for exhibition to such persons, upon such terms as the said party of the second part, shall from time to time direct. But all professors and teachers of the public schools of the City of New York, or other institutions of learning in said City, in which instruction is given free of charge, shall be admitted to all the advantages afforded by the said party of the second part, through its Museum, library, apparatus and collections, or otherwise, for study, research and investigation, free of any charge therefor, and to the same extent and on the same terms and conditions as any other persons are admitted to such advantages, as aforesaid.

Fifthly. That the Museum, Library and collections and all other property of the said party of the second part, which shall or may be placed in said building, shall continue to be and remain absolutely the property of said party of the second part, and neither the said party of the first part, nor the said The Mayor, Aldermen and Commonalty, shall by reason of said

property being placed in said building, or continuing therein have any right, title, property or interest therein, nor shall the said party of the second part, by reason of its occupation and use of said building, under this agreement, acquire, or be deemed to have any right, title, property or interest in said building, except so far as expressly granted by this agreement.

Sixthly. That the said party of the second part shall, on or before the first day of May, in every year, during the continuance of this agreement, submit to the said party of the first part, its successor or successors, a detailed printed report of the operations and transactions of the said party of the second part, and all its receipts and payments, for the year ending with the thirty first day of December next preceding.

Seventhly. That said party of the first part shall have at all times, access to every part of said building for general visitation and supervision and also for the purpose of the performance of the duties devolved upon it by the laws of the State of New York, or of the City of New York. That the police powers and supervision of said party of the first part shall extend in, through and about said building. That the said party of the second part may appoint, direct, control and remove all persons employed within said building, and in and about the care of said building, and the Museum, Library and Collections therein contained.

Eighthly. That said party of the second part may, at any time after the expiration of three and before the expiration of six months from the date of the service of a notice in writing to said party of the first part, its successor or successors, or to the Mayor of the City of New York, of its intention so to do, quit and surrender the said premises and remove all its property therefrom;

and upon and after such notice, the said party of the second part shall and will, at the expiration of the said six months, quietly and peaceably yield up and surrender unto the said party of the first part, and its successors all and singular the aforesaid demised premises —

And it is expressly understood and agreed by and between the parties hereto, that if the said party of the second part shall omit to do, perform, fulfil or keep any or either of the covenants, articles, clauses and agreements, matters and things herein contained, which on its part are to be done, performed, fulfilled or kept, according to the true intent and meaning of these presents, then and from thenceforth this grant and demise shall be utterly null and void. And in such case it shall and may be lawful for said Department to serve or cause to be served on the said party of the second part a notice in writing declaring that the said grant hereinbefore made has become utterly null and void and thereupon the said party of the first part, its successor or successors (ninety days time being first given to the said party of the second part to remove its property therefrom) may re-enter, and shall again have, repossess and enjoy the premises afore mentioned, the same as in their first and former estate, and in like manner as though these presents had never been made without let or hindrance of the said party of the second part, anything herein contained to the contrary notwithstanding.

Ninthly. And it is further expressly understood and agreed by and between the parties hereto, that this agreement may be wholly cancelled and annulled, or from time to time, altered or modified, as may be agreed in writing, between the said parties, or their successors, any thing herein contained to the

contrary in any wise not[illegible]standing.

In witness [illegible]ereof the party of the first part hath caused th[illegible] agreement to be executed by their President and Se[illegible]tary, pursuant to a Resolution of the Board of C[illegible]missioners of said Department, adopted at a meet[illegible] held on the thirtieth day of January, in the year of [illegible] Lord one thousand eight hundred and seventy eigh[illegible] [illegible]d the said party of the second part hath caused [illegible] to be executed by their President, and their off[illegible]al sea[illegible] [illegible]ixed thereto, pursuant to a resolution [illegible] the Trustee[illegible] of the American Museum of Natural [illegible]tory, adopt[illegible] at a meeting held on the twelfth day o[illegible] February i[illegible] the year of our Lord one thousand eight [illegible]undred and s[illegible]ntyseven

In presence of

D. Porter Lord

Jas. [illegible] [illegible]man

President [illegible]partment [illegible] Public Parks, of [illegible] City of [illegible] York.

[illegible] Davis

[illegible]retary Depart[illegible]ent of Public [illegible]arks of the City of New York.

Robert [illegible] Stuart

[illegible]ident [illegible]merican Museum of [illegible] History

Seal

State of New York
City and County of New York } S.S.

On this 12th day of February in the year 1878. before me — personally came James F. Wenman President of the Department of Public Parks of the City of New York, and William Irwin Secretary of the said Department of Public Parks, with both of whom I am personally acquainted, and both of whom being by me duly sworn, said that they reside in the City and County of New York; that the said James F. Wenman is the President, and the said William Irwin is the Secretary of the said Department of Public Parks, and that they signed their names to the foregoing Agreement by order of the Board of Commissioners of the said Department of Public Parks, as such President and Secretary.

W. C. Lee
Notary Public (78)
N.Y. Co.

State of New York.
City and County of New York } S.S.

On this 12th day of February in the year 1878. before me personally came Robert L. Stuart, the President of the American Museum of Natural History, with whom I am personally acquainted, who being by me duly sworn, said that he resides in the City and County of New York; that he is the President of the American Museum of Natural History, and that he knows the Corporate Seal of said Museum; that the seal affixed to the foregoing agreement is such Corporate Seal; that it is affixed thereto by order of the Board of Trustees of said American Museum of Natural History, and that he signed his name thereto by the like order, as President of said Museum.

W. C. Lee
Notary Public (78)
N.Y. Co.

Recorded in the office of the Registrar of the City and County of New York in Liber 1826 of Deeds page 400 on February 16th A. D. 1878. at 9 O'Clock A. M. and examined.

Witness my hand and official seal.

Signed Frederick W. Laws
Registrar

Seal.

Department of Public Parks of the City of New York
with
The American Museum of Natural History

Contract.

This Agreement made and concluded on the twenty second day of December in the year One thousand and eight hundred and seventy-seven. Between the Department of Public Parks of the City of New York, the party of the first part, and The American Museum of Natural History, party of the second part.

Witnesseth:

Whereas, by an Act of the Legislature of the State of New York, passed April twenty second, eighteen hundred and seventy six, entitled "An Act in relation to the powers and duties of the Board of Commissioners of the Department of Public Parks in connection with the American Museum of Natural History and the Metropolitan Museum of Art", the said party of the first part is authorized and directed to enter into a contract with the said party of the second part, for the occupation by it of the buildings erected, or to be erected, on that portion of the Central Park, in the City of New York, known as Manhattan Square, and for transferring thereto and establishing and maintaining therein its museum, library and collections and carrying out the objects and purposes of said party of the second part;

And whereas, a building contemplated by said act has now been erected and nearly completed and equipped in a manner suitable for the purposes of said Museum, as provided in the first section of the Act of May fifteenth, eighteen hundred and seventy five, known as Chapter 351 of the laws of 1875, for the purposes of establishing and maintaining therein the said Museum as provided by the said last named Act and by the Act of April fifth, eighteen hundred and seventy one, known as Chapter 290 of the laws of 1871.

And whereas, it is desired as well by the said party of the first part, as by the said party of the second [page 2] part that immediately upon the completion and equipment of said building, the said party of the second part should be established therein, and should transfer thereto its Museum, Library and Collections and carry out the objects and purposes of the said party of the second part.

Now, therefore, it is agreed by and between the said parties as follows, viz:

First, That the said party of the first part has granted and demised and let, and doth, by these presents, grant, demise and let, unto the said party of the second part, the said buildings and the appurtenances thereunto belonging, to have and to hold the same so long as the said party of the second part shall continue to carry out the objects and purposes defined in its charter, or such other objects and purposes, as by any future amendment of said charter may be authorized; and shall faithfully keep, perform and

observe the covenants and conditions herein contained on its part to be kept, performed and observed, or until the said building shall be surrendered by the said party of the second part, as hereinafter provided.

Secondly, That neither the party of the first part, its successor or successors, nor the Mayor, Aldermen and Commonalty of the City of New York, shall be in any manner chargeable or liable for the preservation of the said building, or the property of the party of the second part which may be placed therein, against fire, or for any damage or injury that may be caused by fire to the said property; but it is agreed that, damages as aforesaid excepted, the said party of the first part will keep said building, from time to time, in repair.

Thirdly, That as soon after the completion and equipment of said building as practicable, said party of the second part [page 3] shall transfer to and place and arrange in said building its Museum, Library and Collection, or such portion thereof as can be properly displayed to the public therein and shall have and enjoy the exclusive use of the whole of said building, subject to the provisions herein contained, and the rules and regulations herein prescribed during the continuance of the term hereby granted, or until a surrender thereof as herein provided.

Fourthly, That the exhibition halls of said building, shall, on Wednesday, Thursday, Friday and Saturday of each week, and on all legal or public holidays, except Sundays, be kept open and accessible to the public, free of charge, from Nine o'clock, A.M. until half an hour before sunset, under such rules and regulations as the said party of the second part shall from time to time prescribe; but on the remaining days of the week the same shall be only open for exhibition to such persons, upon such terms as the said party of the second part, shall from time to time direct. But all professors and teachers of the public schools of the City of New York or other institutions of learning in said City, in which instruction is given free of charge, shall be admitted to all the advantages afforded by the said party of the second part through its Museum, Library, apparatus and collections, or otherwise, for study, research and investigation, free of any charge therefore, and to the same extent and on the same terms and conditions as any other persons are admitted to such advantages, as aforesaid.

Fifthly, That the Museum, Library, and collections and all other property of the said party of the second part, which shall or may be placed in said building, shall continue to be and remain absolutely the property of said party of the second part, and neither the said party of the first part, nor the said The Mayor, Aldermen and Commonalty, shall by reason of said [page 4] property being placed in said building, or continuing therein have any right, title, property or interest therein, nor shall the said party of the second part, by reason of its occupation and use of said building, under this agreement, acquire, or be deemed to have any right, title, property or interest in said building, except so far as expressly granted by this agreement.

Sixthly, That the said party of the second part shall, on or before the first day of May, in every year, during the continuance of this agreement, submit to the said party of

the first part, its successor or successors, a detailed printed report of the operations and transactions of the said party of the second part, and all its receipts and payments, for the year ending with the thirty first day of December next preceding.

Seventhly, That said party of the first part shall have at all times, access to every part of said building for general visitation and supervision and also for the purpose of the performance of the duties devolved upon it by the Laws of the State of New York, or of the City of New York. That the police powers and supervision of said party of the first part shall extend in, through and about said building. That the said party of the second part may appoint, direct, control, and remove all persons employed within said building, and in and about the care of said building, and the Museum, Library and Collections therein contained.

Eighthly, That said part of the second part may at any time after the expiration of three and before the expiration of six months from the date of the service of a notice in writing to said party of the first part, its successor or successors, or to the Mayor of the City of New York, of its intention so to do, quit and surrender the said premises and remove all its property therefrom; [page 5] and upon and after such notice, the said party of the second part shall and will, at the expiration of the said six months, quietly and peaceably yield up and surrender unto the said party of the first part, and its successors all and singular the aforesaid demised premises.

And it is expressly understood and agreed by and between the parties hereto, that if the said party of the second part shall omit to do, perform, fulfill or keep any or either of the covenants, articles, clauses and agreements, matters and things herein contained, which on its part are to done, performed, fulfilled or kept, according to the true intent or meaning of these presents, then and from thenceforth this grant and demise shall be utterly null and void. And in such case it shall and may be lawful for said Department to serve or cause to be served on the said party of the second part a notice in writing declaring that the said grant hereinbefore made has become utterly null and void and therefore the said party of the first part, its successor or successors (ninety days time being first given to the said party of the second part to remove its property therefrom) may re-enter and shall again have, repossess and enjoy the premises afore mentioned, the same as in their first and former estate, and in like manner as though these presents had never been made without let or hindrance of the said party of the second part, anything herein contained to the contrary notwithstanding.

Ninthly, And it is further expressly understood and agreed by and between the parties hereto, that this agreement may be wholly cancelled and annulled, or from time to time, altered or modified, as may be agreed in writing, between the said parties, or their successors, anything herein contained to the [page 6] contrary in any wise notwithstanding.

In witness thereof the party of the first part hath caused this agreement to be executed by their President and Secretary, pursuant to a Resolution of the Board of Commissioners of said Department, adopted at a meeting held on the thirtieth day of

January, in the year of our Lord one thousand eight hundred and seventy eight and the said party of the second part hath caused the same to be executed by their President, and their official seal affixed thereto, pursuant to a resolution of the Trustees of the American Museum of Natural History, adopted at a meeting held on the twelfth day of February in the year of our Lord one thousand and eight hundred and seventy seven.

In presence of
[signature]

[signature]
President, Department of Public Parks of the City of New York

[signature]
Secretary, Department of Public Parks of the City of New York

[signature]
President, American Museum of Natural History

[SEAL]

Seal

[Notarization Page follows with Signatures]

NYC Parks

Alessandro G. Olivieri
General Counsel

T 212.360.1314
F 917.849.6433

E alessandro.olivieri@parks.nyc.gov

City of New York
Parks & Recreation

The Arsenal
Central Park
New York, NY 10065
www.nyc.gov/parks

VIA HAND DELIVERLY
September 27, 2013

Gerald R Singer
Senior Vice President and General Counsel
American Museum of Natural History
79th Street at Central Park West
New York, NY 11201

Dear Mr. Singer,

Enclosed, please find one fully executed original of the Lease Amendment between the American Museum of Natural History and the New York City Department of Parks & Recreation for your files.

Cordially,

Alessandro G. Olivieri

Lease Amendment made this 25th day of September, 2013, by and between the American Museum of Natural History, a New York not-for-profit corporation, located at Central Park West at 79th Street, New York, New York 10024 ("Museum"), and the City of New York (the "City"), a municipal corporation acting through the Department of Parks and Recreation, with an address at 830 Fifth Avenue, New York, New York 10028.

WHEREAS, the Museum and the City entered into an agreement dated December 22, 1877 ("Lease Agreement") whereby the City granted the Museum the right to occupy the building located at Central Park West at 79th Street, New York, New York; and

WHEREAS, the Lease Agreement provided that the Museum keep the permanent exhibition halls open and accessible to the public free of charge on Wednesday through Saturday each week and on all legal and public holidays: and

WHEREAS, in May 1971 the Museum, with the permission of the City, instituted a policy of discretionary admission fees to its permanent exhibition halls whereby the amount of the admission fee is left entirely to the discretion of the individual visitor; and

WHEREAS, the policy of discretionary admission fees was modified from time to time to provide for suggested admission fees to the public; and

WHEREAS, the City and the Museum want to amend the Lease Agreement to allow the Museum to set the terms of admission to the general public with the consent of the City.

NOW THEREFORE, in consideration of the mutual covenants and conditions hereinafter set forth, the parties hereto hereby agree as follows:

1. The Lease Agreement is hereby amended to delete paragraph "Fourthly" in its entirety and substitute therefore the following (the "party of the second part" herein referred to as

2013-043781

the "Museum"):

> The Museum may set the terms of admission to the general public for its permanent exhibition halls, including admission fees and days and hours the permanent exhibition halls shall be open to the public, with the written consent of the Commissioner of the City of New York Department of Cultural Affairs, which consent shall not be unreasonably withheld. In granting such consent the Commissioner shall consider the fiscal needs of the Museum in light of the Museum's commitment to serving the public, its capacity to fulfill its mission and preserve its collections, and the City's monetary support. Admission for educational programs, performances, lectures, events, conferences, symposia, classes, temporary exhibitions and for shows at the planetarium and any theatres may continue to be charged in such amounts as the Museum shall from time to time prescribe.

2. Except as may be modified herein, all terms of the Lease Agreement shall remain in full force and effect.

IN WITNESS WHEREOF, the parties have executed this Amendment as of the date first above written.

CITY OF NEW YORK

By: _____
Veronica M. White
Commissioner
New York City Department of Parks & Recreation

AMERICAN MUSEUM OF NATURAL HISTORY

By: _____
Ellen Futter
President

Approved as to Form:

_____
Acting Corporation Counsel CS

SEP 10 2013

APPENDIX D-5:
1876 State Statute

Chapter 139 of the laws of 1876 - An Act in relation to the powers and duties of the board of commissioners of the Department of Public Parks in connection with the American Museum of Natural History and the Metropolitan Museum of Art

Chap. 139.

AN ACT in relation to the powers and duties of the board of commissioners of the department of public parks in connection with the American museum of natural history and the Metropolitan museum of art.

Passed April 22, 1876; three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Commissioners of parks to contract with American museum, etc.

SECTION 1. The board of commissioners of the department of public parks in the city of New York, is hereby authorized and directed to make and enter into a contract with the American museum of natural history for the occupation by it of the buildings erected or to be erected on that portion of the Central park, in the city of New York, formerly known as Manhattan square, in accordance with the second section of chapter two hundred and ninety of the laws of eighteen hundred and seventy-one, and chapter three hundred and fifty-one of the laws of eighteen hundred and seventy-five, and transferring thereto and establishing and maintaining therein its museum, library and collections, and carrying out the objects and purposes of the said society.

Also with Metropolitan museum of art.

§ 2. The board of commissioners of the department of public parks of the city of New York, is hereby authorized and directed to make and enter into a contract with the Metropolitan museum of art for the occupation, by it, of the buildings erected or to be erected on that portion of the Central park, in the city of New York, east of the old receiving reservoir, and bounded on the west by the drive, on the east by the Fifth avenue, on the south by a continuation of Eightieth street, and on the north by a continuation of Eighty-fifth street, in accordance with the second section of chapter two hundred and ninety of the laws of eighteen hundred and seventy-one, and transferring thereto, and establishing and maintaining therein its museum, library and collections, and carrying out the objects and purposes of the said museum of art.

§ 3. This act shall take effect immediately.