The History of the Building and Its Context
The Arts & Industries Building (AIB), built between 1879 and 1881 and known originally as The National Museum Building, was constructed to receive, exhibit, and preserve the collections of the natural resources, arts, and industries belonging to the national government. It was the first such building on the National Mall. The impetus for construction of the building was the acceptance by the U.S. Congress of the enormous donations of both foreign and domestic exhibits from the 1876 Centennial Exposition in Philadelphia. The design of the building was inspired by exposition architecture as it had developed since the Crystal Palace in London in 1851. Although Congress appropriated the funds, designated the site, and approved the design, the trust-funded Smithsonian Institution (SI) was responsible for planning and actually building the museum. Once completed, the Smithsonian Institution was responsible for building exhibition cases and preparing to open the museum to the public. At a time when the idea of the museum as an encyclopedic national collection and place of public education and recreation was still evolving, this was a challenging task.

The National Museum Begins in the Smithsonian Institution Building
The English scientist James Smithson (1765-1829) died on June 27, 1829, bequeathing more than half a million dollars to the United States of America “to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men.” In 1846, after lengthy deliberation on the proper disposition of this bequest, Congress established the Smithsonian Institution. The enabling legislation directed the construction of an appropriate building and creation of a museum, library, art gallery, and lecture hall with half of the income from the Smithson fund. The museum thus established by law in the care of the Smithsonian Institution was described as follows:

That, in proportion as suitable arrangements can be made for their reception, all objects of art and of foreign and curious research, and all objects of natural history, plants, and geological and mineralogical specimens belonging, or hereafter to belong, to the United States, which may be in the city of Washington, in whosesoever custody the same may be, shall be delivered to such persons as may be authorized by the board of regents to receive them, and shall be arranged in such order, and so classed, as best [to] facilitate the examination and study of them, in the building so as aforesaid to be erected for the institution.2

In November 1846, the governing Board of Regents accepted the Norman Romanesque design of architect James Renwick, Jr. (1818–1895) for the construction of the Smithsonian Institution Building (SIB). Eminent American scientist Joseph Henry (1797-1878), appointed by the Regents as the first secretary or director of the Smithsonian Institution, arrived in Washington in December 1846 with clear programmatic goals. Steadfastly focused on the creation of a great institution dedicated to original scientific research and the dissemination of the results through publication, Henry bitterly criticized diversion of half the income of the Smithson fund to purposes...
unrelated to this goal. He considered the design and the expense of construction and continued maintenance of the SIB excessive and unnecessary. At the same time, he acknowledged that a museum was “not incompatible” with his plan of research and publication, and that a working library was necessary to carry on the work of the Institution.\(^3\) In spite of Henry’s objections, the cornerstone of the SIB was laid on May 1, 1847. In the years to come, Henry would continue to protest diversion of the limited Smithsonian funds for the support of the museum collections and the Smithsonian Institution Building (See Figure 1).

In 1851, Joseph Henry wrote to fellow scientist Michael Faraday (1791-1867), “I regret to say that the building, though picturesque, is not well adapted to the wants of the 19th. I consider the crystal palace the true architectural exponent of the feelings and wants of the present day.”\(^4\) The Crystal Palace, built in London that year, housed the world’s first international exhibition — the Great Exhibition of the Works of Industry of all Nations. Glass and iron, light and soaring space, a single open exhibition floor, the building was perfectly adapted to the display of the natural resources, arts, and industries of the exhibiting countries. It became itself the most impressive of these exhibits and would be the inspiration for the many international expositions that would follow. These expositions would, themselves, become the inspiration for modern museums and groups of museums world-wide (See Figures 2 and 3).

The Crystal Palace was very different from the historically referential Norman Romanesque castle then under construction for the use of the Smithsonian. Design of the complex red sandstone building preceded the final determination of the Smithsonian program. Symbolic in concept, it had little to do with the work Henry planned for the Institution. Henry commented, “It is surely better, in the construction of such an edifice, to imitate the example of the mollusc, who, in fashioning his shell, adapts it to the form and dimensions of his body, rather than that of another animal who forces himself into a house intended for a different occupant.” As the construction of the building progressed, Henry requested a number of changes in the interior layout.

Footnote 3: Ibid, 8-10.

that would adapt the building more effectively to the needs of the Smithsonian. These included enlargement of the lecture room to seat 1000 persons, a more convenient arrangement of the physical apparatus and laboratory rooms, increased library space, and additional fire-proofing.5

Spencer Fullerton Baird (1823–1887) joined the Smithsonian staff in 1850, appointed by the Board of Regents as Assistant Secretary in the Department of Natural History. Baird found a collection of unorganized, privately donated, natural history specimens already in the possession of the Smithsonian. He added his own collection and received donations of many others as he developed the basis for a great museum of natural history. Henry, still opposed to the idea of a museum under the care of the Smithsonian, resolved “to confine the collections, principally, to objects of a special character, or to such as may lead to the discovery of scientific generalizations.”6 In vain, he advised the Regents to refuse the government’s collections. With completion of the construction of the SIB in 1855, work began on museum exhibition cases. The transfer of the collections of the national government, which were held at the U.S. Patent Office, occurred in 1858. Relieved of this responsibility, the Department of the Interior arranged for the annual Congressional appropriation of $4,0007 to be transferred to the Smithsonian for the care and exhibition of the collections. The Commissioner of Patents had entered into a cooperative agreement with Henry the previous year to continue and expand, at the U.S. government’s expense, the system of meteorological reporting initiated at the Smithsonian. Henry’s interest in the museum grew as he recommended that the Regents accept the collections from the Patent Office:

Since experience has shown that the building will ultimately be filled with objects of natural history belonging to the general government, which, for the good of science, it will be necessary to preserve, it may be a question whether, in consideration of this fact, it would not be well to offer the use of the large room immediately for a national museum, of which the Smithsonian Institution would be the mere curator, and the expense of maintaining which should be paid by the general government.8

The cases in the museum room which were to receive the collections from the Patent Office were “arranged in two stories, forming a series of alcoves and a gallery on each side”9 doubling the space that had been available in the Patent Office. As the size of the collections predictably increased, Henry repeatedly suggested that Congress take over the major part of the building for use of the National Museum and appropriate funds to support both the National Museum and the Smithsonian Institution Building (See Figure 4).
On January 24, 1865, a fire heavily damaged the Smithsonian Institution Building and its contents. Richard Wallach (1816-1881), mayor of Washington and a regent of the Smithsonian, recommended Washington architect Adolf Cluss (1825-1905) as architect of the necessary reconstruction. Cluss had recently completed the highly acclaimed Wallach School on Capitol Hill, the first in a series of prototypical modern, multi-story urban public school buildings for the city. Cluss’ design approach was rational, using modern materials and methods of construction in new building types. His ideas for lighting, acoustics, heating, ventilation, and fireproofing expressed function through design and were based upon scientific investigation. Like Henry and Baird, he believed that the exterior design of buildings should express the interior function. This was the beginning of a continuous 25-year relationship between Cluss and the Smithsonian Institution. After the fire, Henry transferred the library of the Smithsonian to the Library of Congress for safekeeping. Parts of the art collections were transferred to the Library of Congress and the Corcoran Gallery of Art. The plant and insect collections were transferred to the Department of Agriculture, but were returned to the Smithsonian after Baird became Secretary. The National Museum, with contributions from private individuals and institutions, government agencies, and the surveying and exploring expeditions of the U.S. government, remained in the SIB.

These collections soon increased beyond the capacity of the building to house them and the available staff to catalogue, display, and maintain them. In 1870, Congress first indicated its intention to fully support the National Museum, appropriating $10,000 for the maintenance of the government’s collections and an additional $10,000 for improvements to the building for the better display of the collections.¹⁰ Henry urged Congress to take over the entire SIB for the museum, separate the Institution from the museum, and reimburse the Institution for at least part of the building cost to allow construction of a smaller building that would more appropriately meet the needs of the Institution.¹¹ By the end of 1873, the situation was urgent. Henry pleaded for additional space for the proper display of the collections of the National Museum, “either by transfer of the entire collection to new buildings or by making additions to that of the Smithsonian Institution.”¹² Congress responded by gradually appropriating funds for the support of the library and the museum, leaving most of the Smithson fund for Henry’s plan of original scientific research and publication of the results. The National Museum continued under the administration of the Smithsonian’s Board of Regents with Assistant Secretary Spencer Baird as its capable director.

Planning the National Museum Building

On January 23, 1874, President Ulysses S. Grant (1822-1885) created a board to plan the collective participation of the U. S. Departments of the Interior, Treasury, Post Office, Agriculture, War, and Navy and the Smithsonian Institution at the 1876 Centennial International Exposition in Philadelphia. The exhibition would include “such articles and material as will illustrate the functions and administrative faculties of the Government in time of peace and its resources as a war-power, and thereby serve to demonstrate the nature of our institutions and their adaptation to the wants of the people.”¹³ Henry and Baird realized immediately that government participation in this

Footnote 10: Henry, AR 1870, 15.
Footnote 11: Henry, AR 1872, 16.
Footnote 12: Henry, AR 1873, 50.
Footnote 13: Baird, AR 1875, 58.
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5: 1876 Centennial Government Building. SIA, RU 95, B 61, F 5.

6: Philadelphia Centennial Exhibits, 1876. SIA RU 285, B24


event would increase the collections of the National Museum to such an extent that a new building would be absolutely necessary. The only consideration that remained would be whether the new building would be “an extension of the present Smithsonian edifice, or an entirely separate building;” and whether it would be “advisable to continue, at least without some modification, the connection which now exists between the Smithsonian Institution and the National Museum.”

Secretary Henry again stated his preference for the separation of the Smithsonian and the National Museum. He observed, however, that “the museum is destined to an extension far beyond its present magnitude. It is an object of much interest to all who visit the National Capital, and is of great value as exhibiting the natural resources of the country, as well as a means of public education.”

Henry appointed Spencer Baird, now Assistant Secretary in charge of the National Museum, to represent the Smithsonian and the National Museum at the Centennial. The Smithsonian’s exhibit included items illustrating the character and operations of the Institution and the mineral and animal resources, ethnology, and fisheries industries of the United States. Baird took charge of all the government exhibits, arranging them so that there would be as much new material as possible with no duplication of effort. He assisted the various departments with selection, classification, and transport of scientific exhibits to Philadelphia. Congress appropriated a meager $505,000 for the work, including construction of a temporary building to present the U.S. government exhibits as a dignified, unified whole. Architect James Hamilton Windrim (1840–1919) designed the building, which was recalled in a contemporary memoir as “one of the most striking within the Centennial enclosure.”

Construction on the wood and glass building began in July 1875 and was completed in mid-February 1876. A Latin cross in plan, this lofty single-story building was 500’ long and 360’ wide with entrances at the termination of each arm. Longitudinal views toward a lofty octagonal central rotunda, reached through easily accessible interconnected exhibit areas, provided an effective spatial organization. Generous clerestories and lanterns provided natural light for the displays (See Figures 5, 6, and 7).

Footnote 14: Henry, AR 1874, 8.


Footnote 16: Baird was assisted by G. Brown Goode. Goode was appointed Assistant Director of the U. S. National Museum in 1881 after Baird became Secretary of the Smithsonian Institution. AR 1881, 81.

Meanwhile, in Washington, Joseph Henry and Spencer Baird directed Adolf Cluss to begin work on plans for expansion of the SIB. In a letter of September 4, 1875, Cluss wrote to Baird discussing progress made in the design of an intermediate connecting wing of the Smithsonian Institution:

I think that all the conditions you consider essential for this wing which forms so to say the keystone of the problem are solved. We have two exhibition halls, 39 feet by 49 feet reaching through the full height of the first story; further twenty offices, mainly 18 by 20 feet in size in first and Entresol story, four of which rooms have light from the North. Imposing main stairs about thirteen feet wide, easily accessible, which we hope, will please you. To give you a better idea of the looks of these Main Stairs we add a section longitudinally through this wing with indications of the effect in perspective since the whole building is no doubt heated by steam, there can be no objection to surround the ground well hole by a balustrade merely and thus have the benefit of light and air all the way down, and no break in the Exhibition-Halls above. The plan is elastic, that is to say we can stretch or contract it in all dimensions, though we believe, that it is carefully studied out, please think over it, and let us know your views. You will find elevators indicated in the corner adjoining the proposed new south wing (South of the connecting wing). What do you say of the sizes of the larger Elevator?

We think windows in the new Main building about 6 feet in width and piers about 8 feet in width will do so that our roof trusses are set 14 feet between centres which is favorable for strength and economy in the construction of the Iron roof, as well as in the floor. In the new part of the Main building we shall, I think, certainly resort to skylights, wherever it is of advantage.18

This letter reveals the views of Spencer Baird and Adolf Cluss on museum design at the beginning of the planning process, including glass and iron open construction, steam-heating, and elevators. It is probable that the intermediate wing discussed was an extension of the east end of the SIB. However, it is not

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Footnote 18: Adolf Cluss to Spencer Baird, 4 September 1875, Assistant Secretary Incoming Correspondence 1875-1877, Box 29, 187:369, SIA.
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Footnote 21: Cluss to Baird, Assistant Secretary Incoming Correspondence 1875-77, Box 29, 186-7:371, SIA.

Footnote 22: Frederick Daniels and Adolf Cluss were in partnership as Cluss & Daniels from 1875 to 1878.

possible to know with any certainty since no plan has been found. Later correspondence between Cluss & Schulze and the Smithsonian Institution states that during 1874 and 1875 the firm was directed to design an extension of the SIB “by wings and a front of South B Street so as to form a hollow square.”19 Baird later noted to the National Museum Building Commission the loss Cluss & Schulze sustained from preparation of drawings and estimates requested by Secretary Henry for a museum extension of the SIB that was never built.20

Some thought had been given to acquiring the Main Building in Philadelphia to house the Centennial exhibits in Washington. This was a building constructed with standardized glass and iron parts that, like the Crystal Palace, could be easily assembled, disassembled, and reassembled in another location (See Figures 8 and 9). Cluss, writing to Baird in Philadelphia on November 2, 1876, noted that it appeared that the Philadelphians had been successful in retaining the building. In preparation to either receive this structure or build anew he had surveyed the site south of the Smithsonian. Finding it “well level, so as not to form any obstructions for occupation,” he offered, “If the matter takes any new turn and I can be of any service, here or even in Philadelphia, please command my services.” He also observed, “I flatter myself that the plans of extension of the Institute buildings also in outside appearance will meet your approval, having taken all in consideration which was elicited in our subsequent interviews upon the subject.”21 The drawings by Cluss & Daniels22 for this proposed extension, dated December 1876, are in the collection of the Smithsonian Archives (See Figures 10, 11, and 12).

At the close of the exhibition on November 10, 1876, the United States government received extensive donations for the National Museum of exhibits from state and foreign governments as well as private sources. Baird directed an intermediate transfer of the donated exhibits to the Government Building where they were assigned to the appropriate government departments and packed in preparation for shipment to Washington. On July 31, 1876, Congress had provided the Armory building on the Mall, at Sixth Street, S.W., near the Smithsonian, for the storage...
and maintenance of these items since there was no room for them in the Smithsonian Institution Building. The great volume of the new acquisitions was then unanticipated by Congress. While 20 railroad cars were required to carry the government exhibits to Philadelphia, it appeared that 60 would be required to carry the expanded collection back to Washington. On November 17, 1876, President Grant, in response to an appeal by The National Academy of Sciences, ordered these exhibits held in Philadelphia until the Congress could determine how they would ultimately be maintained in Washington.

Since the government’s contract with the Centennial Commission required removal of their building within 60 days, the request for a new museum building was now a priority.

The December 1876 drawings by Cluss & Daniel for the addition to the Smithsonian’s original building presented a formal brick entrance façade on South B Street designed in a modern Romanesque style compatible with that of the Smithsonian Institution Building. Behind this formal entrance façade, a lofty iron and glass shed provided exhibition space on ground and mezzanine levels. Brick spandrel panels in tripartite bays were similar to those finally used in the walls of the AIB. On January 19, 1876, General Montgomery C. Meigs (1816-1892) provided Spencer Baird with a rough sketch of an idea for a museum. The building would be 300’ square and located south of the Smithsonian with entry through the South Tower. Two tiers of 50’ wide interconnecting exhibition halls would surround a central rotunda. Brick walls with interior arches, a range of clerestories, and metal roofs laid on wooden planks were all part of the idea. Baird gave the sketch to Cluss (See Figure 13). Carefully detailed drawings by Cluss & Daniel, dated January 1877, adapted their December drawings to a square plan. The rhythmic design of the exterior walls, the entrance door, and clerestories remained the same. Two-story towers flanked an entrance pavilion and one-story pavilions defined the corners of the building. A dome with a cupola, recalling that of the Government Building at the Centennial, was similar in design to the three lanterns used on the museum roof in the December drawing (See Figure 14). Meigs responded by superimposing a large semi-spherical dome onto the Cluss drawing and

Footnote 23: Appropriation “repairing and fitting up the so-called Armory building on the mall, between Sixth and Seventh streets, and to enable the Smithsonian Institution to store therein and take care of specimens of the extensive series of the ores of the precious metals, marbles, building-stones, coals, and numerous objects of natural history, now on exhibition in Philadelphia, including other objects of practical and economical value, presented by various foreign governments to the National Museum, four thousand five hundred dollars: Provided, That the said sum shall be expended under the direction of the Secretary of the Smithsonian Institution,” (Act July 31, 1876; Digest of Appropriations, 106.) quoted in AR 1876, 121.

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1.1 – 9Smithsonian Institution Arts & Industries Building

Historic Structure Report & Conditions Assessment
Smithsonian Institution Arts & Industries Building

labeling it Meigs & Cluss. The ideas of the two men for the new museum building were clearly diverging (See Figures 15 and 16).

In his report of January 1877, Baird suggested to the Regents that a new building could be cheaply constructed with a concrete floor laid on grade, “using brick walls and piers and a roof with iron beams, and wooden sheathing covered with tin. Several plans have been proposed for this building, some one of which it is hoped will find favor and be adopted,”25 Henry approvingly commented, “This building will be of durable though inexpensive material, and expressly adapted to the uses for which it is designed. In its construction, care will be exercised not to sacrifice utility to architectural effect, but the fact will be kept in view that architecture is essentially a useful art, and that the mind receives pleasure and improvement from the contemplation of perfect adaptability no less than from imposing exterior effect.”26

On February 5, 1877, the Board of Regents sent a formal message to Congress that detailed the magnitude and value of the Centennial exhibits and the dire conditions in which they were stored. They commented, “The Government of the United States is now in possession of the materials of a museum, exhibiting the natural products of our own country, associated with those of foreign nations, which would rival in magnitude, value, and interest the most celebrated museums of the old world.”27 The Regents requested an appropriation of $250,000 for the immediate construction of an appropriate museum building. After careful consideration of cost estimates prepared by Cluss and reviewed by Meigs,28 the Regents accepted this amount as the minimum and adequate cost of the proposed construction. Their request for appropriation stated that a plan of such a building had been offered at no charge by General Meigs, quartermaster-general of the United States Army.29

Senator Justin S. Morrill of Vermont (1810-1898), chairman of the Senate Buildings and Grounds Committee, met with Meigs on February 13 to discuss the plans. Senator Morrill did not want what he viewed as a temporary building to be attached to the SIB. He felt that the design of the proposed

Footnote 25: Ibid, 70.
Footnote 26: Henry, AR 1876, 13-14.
Footnote 27: Regents, AR 1876, 129-137.
building was incompatible with that of the fine Norman Romanesque Smithsonian Institution Building. He preferred a detached building sited so that the Smithsonian and Agriculture buildings could be seen from the Capitol and so that wide drives could be provided through the Mall and on all sides of the building. Meigs advised Baird, “Better not attempt to thwart him. The thing is to get a store-house. If the interior is so satisfactory as to make it desirable to preserve it, the outside can at any future time be raised higher or surrounded by a building of cut stone; or the arrangement can be used as a model for Museums, Libraries, & c. on another site. Get under cover with your collections and let the U. S. watch and guard them.”

Spencer Baird succeeded Joseph Henry as Secretary after Henry’s death on May 13, 1878. He continued to vigorously press for a new museum building. His vision differed from Henry’s in emphasizing the importance of using the collection for practical and educational purposes: “In what is now a fairly complete series of economical minerals, such as ores, combustibles, building stones, clays, earths, &c., from all parts of the world, with their incidentals of reduction and application, and specimens of similar objects of art and industry derived from them, we have a collection of very great industrial importance, for it furnishes to the American manufacturer and designer information of the utmost value.” He noted that the bill for the appropriation for construction of the new museum building would be reintroduced into Congress at the current session (See Figure 17).

On March 3, 1879, Congress appropriated $250,000 for the erection of a fireproof building, 300’ square, to house the National Museum. The appropriation provided for construction of the building under the direction and supervision of the Regents of the Smithsonian Institution according to plans then filed with the Joint Committee of Public Buildings and Grounds. Congress approved a site for the building on the Smithsonian grounds, southeast of the SIB and no less than 50’ distant. The appropriation further required that the new building be set back with its north façade on a line with the south façade of the Smithsonian so that views from the Capitol of the Smithsonian and Department of Agriculture

Footnote 30: The buildings of the Department of Agriculture and its conservatories, located on the Mall west of the Smithsonian Institution building, were designed by Cluss & Kammerhuber and built in 1867-68.

Footnote 31: Meigs to Baird, 13 February 1877. Assistant Secretary Incoming Correspondence 1875-1877. Asst. Secretary 1850-1877. Ph-Q Box 40, 202: 452. RU 53, SIA.

Footnote 32: Baird, AR 1878, 41.
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buildings would not be obstructed. The plans and estimates approved were those of Cluss & Schulze, consulting architects. A model of the proposed building was exhibited in the lower hall of the SIB. Spencer Baird, in his report of 1879, anticipated an early completion of the building and requested an additional appropriation for cases. He commented, “The new building will be devoted more particularly to industrial exhibits, intended to show the animal and mineral resources of the United States and their practical applications to the wants or luxuries of man.” (See Figure 18)

Spencer Baird had worked toward this moment since arriving at the Smithsonian in 1850 to take charge of the natural history collections. He had classified and arranged exhibits, exchanged duplicates and information with other institutions here and abroad, trained amateur and volunteer naturalists to assist in collection of specimens, and endlessly lobbied for construction of a building for the National Museum. Through Baird’s success, Joseph Henry gradually came to appreciate the importance of a National Museum. Henry had noted in his 1871 report to the Regents the richness and usefulness of the anthropology collections. Improvement of the museum exhibition space after the fire of 1865, completed that year, made it possible to exhibit the interrelationships of these collections and “to illustrate the gradual progress of the development of the arts of civilized life.”

Footnote 33: 45th Cong 3rd session, chapter 182, 1879, March 3.


Footnote 35: Baird, AR 1879, 71.

Footnote 36: Henry, AR 1871, 40.

Footnote 37: The 16-side polygonal Rotunda is topped by a dome-like structure. Cluss & Schulze use “domical structure” to describe the upper part of the Rotunda. Various other documents dating to the construction period use the term “dome” for the entire Rotunda. Although not vaulted, the structural roof system of the Rotunda is constructed similar to a dome structure, with a compression ring at the upper part and a tension ring at the lower part.

Design of the National Museum Building

The National Museum Building, today the Arts & Industries Building, was designed by Washington architects and engineers Cluss & Schulze with Adolf Cluss, FAIA, as architect-in-charge, and was constructed from 1879 to 1881. The design of the building is rationally volumetric. It radiates axially from a high central domed Rotunda, extending from center to center through all four facades and corner to corner through the terminating pavilions. The 17 individual exhibition halls are defined on the exterior by individual roofs, monitors, and clerestories of varying design. The plan features a Greek cross incised in a square with a central Rotunda as the focal point. It ingeniously groups office and shop functions in four three-story corner pavilions and four central entrance towers — leaving almost the entire 300’ square museum floor as a single space for exhibition use. There were originally 17 exhibition halls, each defined within a structural system of interconnected brick masonry arcades. Each hall has its own roof and clerestory or monitor system providing the “perfect light” that Cluss considered necessary for a museum. The height of these halls rises in stages toward the Rotunda, providing a clear directional focus through high, well-lighted longitudinal entrance halls toward this grand central exhibition space. The great mass of the building is lightened and diffused through a variety of line, proportion, and color. The originally open-plan interior allowed freedom of movement for visitors while providing separate and secure working areas for the administrative, scientific, and technical staffs. The design avoids monumentality, welcoming the public to explore, celebrate, and learn about the natural resources, arts, and industries of their country.
The National Museum Building Commission
Preparations for the construction of the new building moved ahead rapidly. On March 7, 1879, Spencer Baird, now both Secretary of the Smithsonian Institution and Director of the National Museum, and Regents General William Tecumseh Sherman (1820-1891) and the Hon. Peter Parker (1804-1888), members of the Executive Committee of the Board of Regents, organized themselves as the National Museum Building Commission. Sherman served as chairman of the commission; Daniel Leech, a Smithsonian clerk, served as secretary. The Commission invited Quartermaster General Montgomery Meigs of the Army to serve as advisor and referee or consulting engineer. Meigs and Architect of the Capitol Edward Clark (1822-1902) verified the sufficiency of the construction cost estimate. Meigs noted that the plan by Cluss & Schulze proposed more interior divisions and a smaller central hall than his own plan and would probably be more expensive to construct. He recommended strict economy in contracting. Baird ordered Cluss to prepare duplicate sets of plans for contracting purposes and to provide an accurate survey of the site (See Figure 19).

On March 8, 1879, the Treasury Department informed Baird that the appropriation was immediately available and ready for disbursement by an official of their department. The Commission chose Cluss & Schulze as superintending architects with Cluss as architect-in-charge and authorized Baird to request working drawings from Cluss. On March 22, 1879, the question of compensation for Cluss & Schulze was discussed since the enabling act specifically stated that no fee would be paid from the appropriation for plans. Baird explained the extent of the work that had been and would be required of the architects and recounted the long connection of Cluss with the project. An extended discussion ended with a vague agreement for payment of no more than $10,000 for bringing the project in under $250,000. The Commission ruled that they would open and award all contracts, but named Baird as their authorized agent in the contracting process.

Following a presentation of the plans and estimates by Adolf Cluss, the Commission got down to work. Sherman demanded that there should be no economies in construction of the foundations and walls, and that the heating should be placed below grade outside of the building. Meigs suggested that the plastered cylindrical columns that he had proposed in his plan were more aesthetically pleasing and stronger than the piers in Cluss’ plan. He thought that the extra cost could be absorbed by leaving the inner walls unplastered — a design detail that he preferred. He supported his views with photographs of famous Old World buildings. The other members of the Commission diplomatically turned down this idea as too expensive and not authorized by Congress. Meigs objected to Cluss’ plan to buy...
Brick masonry walls in progress, arch moulds in place. Note Warren trusses fabricated for Ranges by Phoenix Iron Co. in right foreground. Looking east from Smithsonian building. August 1879. SIA RU 95, B32, F 7.


Bricks by the lot. Cluss was sustained by Sherman. It was agreed that lime should be bought in quantity and by weight — not by the barrel. Meigs asked for the installation of a scale at the job site to weigh materials as received. The Commission decided to advertise proposals in three local newspapers, and in one Boston and one New York newspaper. Later, they would also advertise in Philadelphia. The office of the Boston Herald was designated as a depository for copies of the specifications for cut-stone work. [55] The initial proposal for bids on the foundation and brick work drew 59 responses.

Footnote 40: The Hon. Peter Parker, retired Minister to China and physician, served as Regent and member of the Executive Committee of the Smithsonian Institution from 1868 to 1884. A native of Farmingham, Massachusetts, Parker graduated from Yale College in 1831. Afterwards studying medicine, he journeyed to Canton, China, where he founded a hospital and practiced his profession. Later named resident Minister of the American legation, he remained in China for twenty-eight years.
Foundations and Walls
The contract for grading, excavating, concrete foundations, rubble-stone masonry, concrete stone, and brick-work was let to Gleeson & Himber on April 11, 1879. Excavation for the foundations began on April 17, 1879, and was carried to solid ground at least three feet below the surface. Hard clay was encountered beneath the topsoil and, below this, a layer of clean, dry gravel, providing a natural drainage for the building and indicating the proximity of the Potomac River shoreline. Placing the concrete foundations began on April 29, 1879, with footings of waterproof hydraulic cement concrete. Gneiss rubble-stone, laid with hydraulic cement mortar, was carried to grade from these footings. Hydraulic cement mortar, with a composition of one barrel dry cement to two barrels of unslaked lime, was used to parge the exterior cellar walls below grade. The foundation work was completed on June 9, 1879. Cutting and laying of a granite base course began on May 19, 1879, and the brick-work above this base course began on May 21, 1879. Both the exterior and interior brick walls were substantially completed by November 1, 1879. John Miller contracted for the sand; Rothwell & Lloyd, for the gravel; Joseph A. Blundon, for the gneiss rubble-stone; Carson & Son, of Riverton, Vermont, for the lime; and the Cumberland Hydraulic Cement Company of Cumberland, Maryland, for the cement. Richmond granite and Euclid sandstone were selected for the cut-stone work [59].

Before the bidding process began, Cluss reduced the amount of cut-stone work originally planned and increased the amount of the less expensive ornamental brick-work. This would compensate for the additional cost of granite base course, doorway sills, and entrance platform construction. For the exterior walls, Cluss ordered two grades of brick in lots — the higher grade for facing. Meigs thought that this was unnecessary as within the 4,000,000 bricks ordered there would surely be enough of sufficient quality for facing. He felt that more than $1,600 could be saved by buying only one grade of brick. Cluss pointed out that the bidding process did not bear this out since the lowest bid for the two grades specified did not exceed the approved estimate. [49] The Washington Brick Machine Company agreed to deliver the entire lot of bricks within four months of the date of contract and so received the brick contract. Gleeson & Himber began the brick-work on May 21, 1879, and by November 1, 1879, had completed the principal walls, laying 4,740,000 bricks.

A dispute arose when, midway through the project, the contractors asked for extra pay for extra work not in the contract. They claimed they had bid on an ordinary red brick job only to find that the facing bricks were press bricks that required a more highly skilled and highly paid worker. The buff bricks caused the same concern, as did the cutting and fitting of the buff bricks for the wall above the arches. Gleeson & Himber complained to the members of the Building Commission, “A mechanic takes pride in his work and with superior brick he cannot be prevented trying to make a fine job.” [89] This extra care was expensive. In addition, they demanded pay for miscellaneous work not in the contract, including building the walls of the basement in the northeast corner, setting stone sills and window frames, making and furnishing centers for the arches, and setting iron floor beams and walling them in. Sherman, Cluss, and Baird
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recommended payment for work well done to avoid a crisis. Meigs voted against payment. In the end, payment for the miscellaneous work was approved and payment for pressed brick work was denied. It was noted that the contract price was considerably below the estimate so some assistance to the contractors was justifiable.

Work stopped on September 22, 1879, as the dispute continued and the contractors failed to pay the workers. The Building Commission called a meeting of the contractors, brick-layers, and laborers to present grievances. Gleeson & Himber stated that although the contract called for red brick, the Washington Brick Machine Company had decided to furnish pressed brick for advertising purposes. The brick-layers and laborers complained that they had not been paid for three weeks but were “anxious to go on with the work.” They “felt a pride in the building and wanted to see it completed.” [105] Work resumed on September 23, 1879, [110], as the Building Commission guaranteed payment for the workers and refused further payment to the contractors until they had satisfied their obligations. The contractors complied on September 26, 1879, but the dispute was far from over. On October 31, 1879, Gleeson & Himber declared the work, according to their contract, completed. Although there were still 200,000 bricks to be laid, Cluss advised closing the contract and finishing with their own foreman. Meigs finally agreed that this was in the best interest of the government. In the end, about 5,250,000 bricks were laid both under contract with Gleeson & Himber and by day labor under the supervision of the Smithsonian’s foreman. This included both face and ordinary red brick, shaped red arch bricks, blackened, buff and sand-blasted enameled blue bricks.


Footnote 42: The original descriptions refer to the structures topping the Rotunda, halls, courts and pavilions as lanterns. For this report, the terminology used is “lantern” for the roof structure allowing light into the Rotunda, and “monitors” for the roof structures allowing light into the halls, courts and pavilions.

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The concrete flooring was not in the contract for the foundations. Cleaning the outer faces of the walls was not in the contract for the brick work. The Commission authorized Cluss to buy Gleason & Himber’s scaffolding and begin laying the floor arches where needed. Baird and Cluss stood fast in denial of extra payment for pressed brick work. Cluss commented in his year-end report:

The specifications call for a superior class of brickwork, laid in black mortar on the facades without resorting to the expensive “tucked” or “ruled” joints commonly used in first-class pressed brick-work, and this has been duly enforced. In this we were aided by the commendable ambition of the Washington Brick Machine Company, who have furnished a superior quality of brick for the facades. We, on the other hand, have spent a large amount of money in bringing out the beauty of the material by cleaning down and oiling the facades.41

Roofs

The Building Commission received five proposals for the important and complicated wrought and cast iron work of the roofs, stairs, and railings. They chose the bid of C. A. Schneider & Sons of Washington, D.C. [71]. The galvanized iron work, with three bids, went to D. W. Stockstill & Co. on July 11. [11 July 1879, 78] The work included: (1) the pediments with acroterias over the four main entrances; (2) the pediments and copings over the gables of the main walls; (3) the facing of the lantern dome with patent leaded iron roof, and the base mold of the flagstaff; (4) the finials of the towers; (5) the dormers of the towers with water-shedding louvers backed with galvanized wire-netting, and all necessary precautions against leakage; (6) the finials of the lanterns42 of the
square halls and corner pavilions; (7) the pediments of the lanterns of the corner pavilions; (8) ridge-mold for the main halls and their skylights; (9) base-mold and cornice of the skylights; (10) casings of the sides of the skylights of the main halls and square halls, and corner pavilions; and (11) main cornice of outer halls, main entrances, corner pavilions, main halls, square halls, towers, and dome.

The Commission received nine bids for slate and slaters work, opening the bids on July 5 [75]. Cluss had specified blue slate for the roofs of the towers, pavilions, square halls, and naves. The vast expanses of blue were relieved by green slate laid in bands and red slate in plain patterns for decorative effects. The slates were to be 12" × 24" × 1/4" allowing a 4" lap with 10" to weather. Originally, they were to be hung on 1 1/2" by 2' angle-iron purlins with annealed copper wire. Cluss recommended Maine slate. He felt that this slate would guarantee the most durable colors, while that of Pennsylvania would fade. He urged taking Maine slate; if not Maine, then Buckingham. Meigs countered that the Commission should take the lowest bid, as even the best slate would fade in time. He felt that the difference in color retention did not compensate for the higher price. Sherman agreed. The contract for slater’s work and fastenings was awarded to John O. Jones [79]. On July 29, Cluss submitted the results of experiments he had conducted on the strength and absorption of the several blue slates offered to the Commission. He urged acceptance of the proposal for Maine slate. Meigs did not think the extra strength and resistance to water absorption demonstrated by the Maine slate would compensate for the increased cost. Sherman again agreed. [82] The contract for blue slate was awarded to Edwards & Roberts of Ore Banks, Virginia, for Buckingham slate. The contract for red and green slate went to Story & Wilbur of Boston for Vermont slate.43

The Commission opened six bids for metal roofing on October 6, 1879. As the prices of tin and leaded iron were advancing day to day, the Building Commission had recently taken advantage of a favorable opportunity and had purchased the necessary quantity of roofing material from the Phelps Dodge Co. of New York. They had obtained orders from the Treasury Department to admit this tin free of duty.44 The contract was awarded to D.W. Stockstill & Co. as the Commission felt it was advantageous to have one firm responsible for both the tin and the galvanized iron work. [120] On October 29, the Commission considered installing a layer of felt between the tin roof and the ceiling gratings. Asbestos, introduced at the 1876 Centennial Exposition, was suggested but rejected as too expensive. General Meigs suggested laying a light wood grating encased in a fireproof mixture of plaster of Paris, lime, coal-ashes, and cinders. The Commission adopted this method in lieu of the metal ceiling originally specified by Cluss. By December 10, 1879, the flat roofs were installed and plastered. Delay in delivery of some of the iron beams prevented completion of the roof. By March 10, 1880, all of the iron was on site and work on the framing of the dome was underway. Cluss explained to the Commission that the slating work had been discontinued until completion of the dome, since walking over the slate caused breakage. He noted that a ¾” layer of plaster would be applied to the slate, but recommended an iron lathing under the plastered slating if money allowed. By May 12, 1880, all of the roofs were complete and Cluss reported to the Commission that he had been in the building during the hard rain of May 11 and found that the roofs were perfectly tight with no leaks.

Footnote 43: Maine Geological Survey, Department of Conservation, State of Maine, Maine.gov © 2005. “From 1880-1904 Maine was among the top five slate-producing states in the country, providing slate of excellent quality for roofing tiles and other purposes. Many Maine homes and public buildings dating to that time are still protected by their original slate roofs.”

Footnote 44: New York Public Library, Rare Books and Manuscript Division, Accession Sheet, # *86 M 27. Phelps, Dodge & Co. was founded in 1834, importing metals — including tin, iron, and copper — from England and exporting American cotton for sale in England. New York Public Library.
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Windows Five proposals were submitted for the window frames and sash. The Building Commission awarded the contract to Barbour, Henderson & Co. on May 5, 1879 [67]. On July 7, 1879, Cluss complained about the unsatisfactory condition of some of window frames and backwardness of their delivery. [77] Five proposals for glass were submitted. One of the contractors remarked that while American glass was available in the market, it was of an inferior quality and was advancing in price. The Building Commission approved Cluss’ design using double panes of glass set with an intermediate air space for insulation purposes in all exterior sash and using ground glass in one of the panes in all exhibition halls. [45] Peter Parker suggested that the glass should be set by the parties supplying the material.

Since there was little glass of the desired sizes then in the United States, the Building Commission decided to import glass from Belgium. They contracted with Seamon, Bache & Co. for window glass and double-thick transom glass and Holbrook Bros., for plate glass. These glass-importing firms were located in New York City. [117] On October 29, Seamon Bache replied, noting that although the price of glass had advanced considerably since they had made their proposal, they would furnish an additional quantity at about the same rates as for the original order. On December 10, 1879 [155], Holbrook Bros. notified the Commission that some of the plate glass had arrived in New York. By December 31, 1879 [160], about 6,000 lights of glass had arrived. The Commission ordered contracting of the glazing. [164] The remainder of the plate glass had arrived in New York as well as 528 boxes of window glass. Permits for free entry were requested. By February 18, 1880 [172], work had begun priming the sash and setting the glass for the windows of the corner pavilions.

Entrances The contract for cut-stone work, including the sandstone wrought work of the four main entrances and inscription plates, granite base blocks, thresholds, and sills, was let to Rothwell & Lloyd on April 24, 1879. On August 14, 1879, the Building Commission accepted the design of New York sculptor Casper Buberl (1834-1899) for an allegorical sculptural group for installation over the gable end of the north nave at the main entrance. A committee of residents of South B Street asked the Commission to provide a similar sculptural group for the south entrance. [45] The group, representing “Columbia Protecting Science and Industry,” was cast in zinc and finished with plaster. The completed sculpture arrived on December 3, 1879, [149] together with a model for a second group, “Peace with the Fine Arts.” Meigs and Cluss argued in favor of having the group cast. Sherman opposed, arguing that there might not be enough money, and the group was not cast. [155] Cluss had originally planned similar groups over all four main entrances, but only the statuary for the main entrance was provided. Below the sculptural group a plaque simply reads “National Museum 1879.” Three illuminated windows in rolled cathedral glass, designed by Cluss & Schulze, are included in each of the gable ends of the naves. The contract, including cutting, ornamenting, and glazing, was let to L. E. Gannon. [46]

Footnote 45: The location of the ground glass pane remains unclear. The 1980s restoration project documented the ground glass at the interior pane of the windows.

Footnote 46: L. E. Gannon to Cluss & Schulze, 23 Dec. 1879, (SI-AHHP, Box 2) Proposal to furnish above in “Rolled Cathedral Glass, cut to sizes and ornamented in full accordance with the plans and designs, including glazing.” Accepted by Cluss & Baird, 661, Numbered Correspondence. Box 1, RU 71, SIA.
walnut veneers and oak panels, each to be twelve feet wide in four folds, and fifteen feet high; two sets to have imposts and transoms, also to furnish and finish the frames and trimmings to correspond.\footnote{47}

On October 17, 1879, Meigs questioned the need and expense for the main entrance platform proposed by Cluss, but was overruled by the Commission \footnote{120}. Cluss comments, "A spacious tiled platform bounded by granite side blocks is constructed in front of this entrance. It is approached by four low and wide granite steps of 37 feet in length, which are flanked by molded base-blocks, carrying stately candelabras." \footnote{48}

Sherman proposed a sloping concrete walk on the east and west sides at least 2' from the building \footnote{160}. Plans for modifications in the roadways and landscaping of the grounds were presented to the Commission on January 16, 1880. Colonel T. L. Casey, commissioner of public buildings and grounds, agreed to do the landscaping \footnote{170}.

**Plastering and Interior Decorative Detail**

On October 27, 1879, Sherman demanded that the plastering work proceed \footnote{125}. On November 5, 1879, the Commission directed one room to be plastered in order to determine whether the work should be done by day labor or by contract. On February 18, 1880 \footnote{172}, Meigs demanded that the plastering begin without further delay, and that the work be contracted by the job and not by the square yard. On March 3, 1880 \footnote{174}, the Commission opened 12 bids for the plastering contract. Cluss recommended George W. Harness as most advantageous for the progress of the work. Although Harness was not the lowest bidder, his proposal was accepted by the Commission. On May 12, 1880 \footnote{181}, with the completion of the roofing, the Commission bid the remainder of the plastering. An insufficient amount of scaffolding caused a delay in the plastering work \footnote{June 2}. Sherman impatiently directed Cluss to get it done. Finished in sand and washed in tints to provide a neutral background for the exhibits, the work was completed in August 1880.

The piers were scored to resemble stone. The Commission contracted with fresco painter H. Mattill, on April 20, 1880, to provide stenciled decorations for the Rotunda:

…according to the designs and full size details of Messrs. Cluss & Schulze, Archt. And in such colors as will be directed by them – 1) Frieze and spandrels over the 16 windows of the dome; 2) Panels under the sills of the 16 windows of the dome; 3) Twenty four niches on sidewalls of dome; 4) Continuous frieze underneath those niches; 5) Spandrels over the eight doorways of dome; 6) Twelve large sized segmental panels over the doorways in Main Halls which lead into the dome.\footnote{49}

These stenciled decorations were apparently inspired by the popular decorative art publications by Owen Jones and Auguste Racinet with designs based on the historical precedent of Moorish, Greek, Byzantine, and other original sources.

**Floors**

The contract for rolled iron beams for the fireproof floors of the pavilions, towers, and annexes went to the New Jersey Steel and Iron Company on June 9 \footnote{70}. These floors, with brick arches sprung between

Footnote 47: August Glass to Cluss & Schulze, 12 December 1879, SI-AHHP, Box 2.


Footnote 49: H. Mattill, 20 April 1880, SI-AHHP, Box 2
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26: North Hall decorated for the Inaugural reception of U.S. President James A. Garfield, a Regent of the Smithsonian Institution, March 4, 1881. Garlands are entwined with electric lights. SIA RU 95, B 32, F 10.

rolled iron beams, were leveled with concrete and finished with Florida pine. This was a fireproof floor design used by Adolf Cluss throughout his career. Originally, the hydraulic concrete slab on grade of the exhibition halls was to be finished with asphalitic concrete in the main halls and Rotunda, and with Georgia pine in the smaller halls. An additional appropriation from Congress allowed finishing the main hall floors with “white-veined red, black, and gray marble tiles laid in chaste patterns. The marble tiling was surrounded by a frieze of dark blue Pennsylvania slate of sufficient thickness to bridge the ducts containing the steam-pipes, wires, &c.; and around the frieze a border of parti-colored Portland cement pavement was extended.”

The low bid of E. Fritsch, of New York, was accepted, and the work completed by the middle of September, 1881. The architects reported that “An octagonal fountain with sides of molded and polished granite, and floor of Portland cement, was constructed and finished in the early part of August, 1881. The floor of the rotunda around the fountain was laid with encaustic tile, according to our designs.” The Building Commission had sought bids from both domestic and foreign manufacturers, selecting the United States Encaustic Tile Company, of Indianapolis, Indiana. The work was finished by October 1, 1881.

Systems The contract for the glazed terracotta and cast iron drain pipe was awarded on July 12, 1879 to Blinkhorn & Hannan [78]. The Commission requested that installation be delayed until the walls were in place. The cost of the steam heating apparatus, radiators, and underground piping for water, gas, and steam was not included in the original estimate of costs for the museum building. Anticipating an additional appropriation from Congress for these items, the Commission advertised for proposals. They received nine bids on November 9, 1879, for a steam heating apparatus, including supplying, delivering, and setting up in complete working order [147]. Before making a selection, Cluss went to New York City to examine the heating apparatus of certain large buildings in that city. Back in Washington on December 10, 1879 [153], he submitted a heating apparatus schedule with a report upon several plans and propositions to the Building Commission. He recommended acceptance of the bid of Baker, Smith & Co. [154]. The Building Commission agreed, with Meigs suggesting that the radiators should not be against the wall. Congress appropriated an additional $25,000 for a steam heating apparatus and fuel; $12,500 for water, gas fixtures, and electrical apparatus; and $1,000 for construction of a relieving sewer, with the necessary manholes and traps for the new National Museum to the Seventh Street sewer — all to be immediately available.


Footnote 51: Ibid.

Footnote 52: Forty-sixth Congress, second session, chapter 235; 1880.
Completion of the National Museum Building

Spencer Baird wrote to Adolf Cluss on January 5, 1880, “Did I tell you the other day that the Director of the British Museum, on receiving a copy of the plan of our new building, says that as far as he can judge, he likes our building better than his, and asks how many years it took to erect it! The new British Museum has been eight years in process of construction and is not yet finished.”53 In the summer of 1880, Baird reported, “A portion of the building is already occupied for its legitimate objects.” The work, done within estimates, “promises to be even more suitable to its purpose than was anticipated. All the requirements in regard to light and heat are fully met; and in this respect, and in that of its slight cost in proportion to the space obtained, the building is believed to have no parallel in the country.”54 The work in 1880 included completion of the roofs, glazing, plastering, floors, cast iron interior stairs and platform railings, painting, miscellaneous decorative features, and various systems details (See Figure 25).

As construction neared completion, General James A. Garfield (1831-1881), one of the Regents of the Smithsonian Institution, was elected President of the United States. The Regents agreed to hold Garfield’s March 4, 1881, inaugural reception in the new museum. The few exhibits already in the museum were locked away. The floors in the main halls and Rotunda were hurriedly finished with temporary polished wooden dance floors. An inaugural committee, directed by Adolf Cluss, decorated the hall with a series of emblematical and allegorical shields, monograms of the president and vice-president, American flags, tropical plants, and miles of evergreen festooning suspended from the roof trusses (See Figure 26). Five thousand feet of gas pipe with jets about a foot apart, was installed horizontally from pier to pier above the crowd throughout the building. Sculptor Caspar Buberl created a colossal figure of the “Goddess of Liberty” for display in the Rotunda. The next day the Washington Post rhapsodized, “The face of the figure is benignant and the pose natural. In the uplifted right hand is borne a lamp in which burned the new light, the great electric light, which is to revolutionize the world and make dark places to shine with the all-effulgence of noonday.”55 (See Figures 27 and 28) Refreshments were served in a temporary building erected at the east entrance of the museum building. The Smithsonian grounds were decorated with calcium lights, the Evening Star commented:

The new Museum Building was conspicuous from a long distance, its lights within giving a good view of its outlines and making it resemble a crystal palace. The contrast between the whiteness of the electric lights in the rotunda and dome and the yellowness of the thousands of gas burners elsewhere produced a very fine effect.

Footnote 53: Baird to Cluss, 5 January 1880, Outgoing Correspondence, Office of the Secretary, 1865-1891, 90: 81, RU 33, SIA.

Footnote 54: Baird. AR 1880, 1.


The statue was constructed of excelsior and lath covered with plaster of Paris, the head and shoulders were cast and modeled after the Centennial gift of France to the U. S. which had been displayed at the 1876 Centennial Exposition in Philadelphia and which was then on display in N.Y. Buberl constructed it in less than a week. It was demolished on August 21, 1881 as work began on the fountain and paving of the Rotunda. [Washington Post, 8 March 1881, 2; 21 August 1881, 4.]
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Historic Structure Report & Conditions Assessment

Smithsonian Institution Arts & Industries Building

29: Early exhibit in South Hall, c. 1881-1887. Looking N. Note views through open arcades.
SIA RU 95, B 43, F1.

as seen through the many windows. None of the numerous scenic effects of the day or evening surpassed this."

Seven thousand invited guests attended the extremely successful event. Many more attended a promenade concert on the following night. The museum was open to the public from the time of the reception. Thousands came through while construction progressed, noting each exhibit as it was put in place. At the end of the year, 24,000 visitors had signed the visitor’s book, and it was thought that this represented at least 150,000 visitors since most did not bother to sign.

A Museum for Education

Finally, in October 1881, the building was complete and ready for permanent occupancy. Spencer Baird appointed G. Brown Goode as Assistant Director of the United States National Museum. Goode, in his report to Baird that year, enthusiastically detailed his ideas for the organization and future of the National Museum. He observed that the history of the development of the National Museum fell into three periods — before 1857 as a museum for record, between 1857 and 1876 as a museum for research, and from 1876 forward as a museum for education. “The World’s Fair of London in 1851, the first of a long series of international exhibitions, was utilized by the Government of Great Britain as a starting-point for a number of national and educational museums, the most perfect which have as yet been organized, and the subsequent World’s Fairs have been utilized in a similar manner, so that nearly every civilized country now has great museums of this description.”

Goode theorized, “The present demand is for something better, more systematic, more definitely instructive in its aims—something which shall afford the same long vistas into the palaces of nature and art, and at the same time provide guide-marks to explain their meaning.”

Goode, following Baird, envisioned the National Museum as a great industrial museum, one which, in a few years could become, “the most comprehensive and instructive museum in the world.”

The new building for the National Museum was constructed to receive, exhibit, and preserve the collections of the natural resources, arts, and industries belonging to the national government. It “has proved to be so well adapted for the reception of a great industrial museum, that many manufacturers and commercial houses have been induced to contribute materials for its expansion.”

Goode proposed classification, arrangement, and labeling of exhibits as the basis of a successful educational museum. He described the past year as one of experimentation with a view “(1) to enable the visitors to make their examinations with the least possible fatigue of eye and limb; (2) to label the objects in the most concise and instructive manner, and (3) to make the Museum as a whole as beautiful as possible.”


Footnote 57: Goode, AR 1881, 83.

Footnote 58: Ibid, 83.

Footnote 59: Ibid, 84.


Footnote 61: Ibid, 94.
Like Spencer Baird, he was pleased with the new building, exclaiming that it exceeded all expectations. He praised the perfect illumination, the generous space available for exhibitions, and the importance of ground-level exhibition space for both staff and visitors (See Figure 29).

Goode consulted with other museums, both in the United States and abroad, on the design of cases, considering metal, walnut, and mahogany for their construction. He ordered a number of metal cases, but soon found that the greater visibility afforded the exhibits did not justify their heavy weight and lack of portability. At first, he had ordered cases from outside contractors in Philadelphia and Baltimore. Soon he was able to use Smithsonian carpenters and day laborers for the vast and continually increasing numbers of cases required. The design of the exhibition cases by W. Bruce Gray was innovative and ingeniously adapted to the modular plan of the museum (See Figures 30, 31, 32, and 33):

The building consisting practically of a single large hall; the cases are so constructed as to form partitions dividing the hall into seventeen halls of lesser extent.

1. The cases are all of one length, 8 feet 8 inches, which is the architectural unit of the Museum building, or are of such lengths that, combined together, they always conform to this unit, so that they are interchangeable.

2. The construction is such that, with very slight expenditure of labor, any one of them full of specimens can be transported from one part of the building to another, thus allowing great freedom in the matter of rearranging the museum.

3. All the smaller specimens are mounted in groups upon small tablets or in glass-covered boxes of uniform size, which can be handled with great facility and which afford great security to the specimens, and diminish immensely the labor properly caring for them.
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4. The objects are displayed against backgrounds which at the same time afford the greatest ease to the eye of the visitor and the greatest relief and effectiveness to the object displayed.

5. The objects being shown singly against a suitable background, and at the same time brought as close as possible to the glass front of the case, the sense of confusion, so often experienced in museums, is entirely avoided.

6. The labels are printed in large, heavy-face type and upon paper of soft tints, which are much less wearisome to the eye than the ordinary labels in black and white.62

Goode, fully engaged in the organization and installation of collections, regarded 1882 as the first year of occupation of the new building. His attention next turned to regulation and security, a persistent problem both at the SIB and at the U.S. Patent Office. A uniformed building staff included a superintendent of buildings, two assistant superintendents, one engineer and one assistant engineer, three firemen, three carpenters, two painters, one mason, twelve watchmen, four janitors, twenty laborers, four messengers, and two cleaners. Confronted by outright theft and the “mania of the relic hunter,” he increased security, closing the private doors in the SIB, stationing watchmen at all entrances, restricting removal of all packages from the building, and banning canes and umbrellas. The electrical room of the National Museum, in these early days of electrical building applications, included an extensive security system but little else of electrical utility:

One 50-drop telephone switch-board, with 34 connections, 14 of which are in the National Museum, 9 in the Smithsonian building, and 11 outside. There are 5 ordinary electric lamps, and 2 electric lamps for photographic purposes, with dynamo-electric Machine and resistance-box. There is also a 100-drop annunciator, to which are connected 300 windows and 85 doors throughout the Museum building; 1 large watch-lock for recording on paper dials the time signals which the watchman turns in from the 12 clock stations throughout the building as he makes his patrol; and one alarm box of the district Telegraph

Footnote 62: Goode, AR 1881, 94.
Company. In the Smithsonian building there are 9 clock stations, controlled in the same manner as those in the Museum building, and also a special telephone connection with the city.63

The number of visitors for 1882 totaled 167,455 at the National Museum building and 152,744 at the SIB. The Biological Society held its meetings in the new building and the museum initiated two lecture series under the auspices of the Biological and Anthropological Societies. These included eight Saturday afternoon lectures in March and April and twelve “young folks” lectures begun in December. The unexpectedly heavy attendance at these lectures made it necessary to abandon the planned use of the North West Range as a lecture room and instead to use the larger West North Range for lectures and public meetings. The National Academy of Sciences, the American Institute of Mining Engineers, and the National Dental Association also met in the lecture room of the National Museum during 1882 (See Figure 34).

Baird observed in his 1882 annual report, “The Museum building was received from the hands of the architects in so complete a state that but little remained to be done beyond the tinting of a portion of the walls and filling up of some of the alcoves with canvas frames, &c.”64 He noted many changes in the appearance of the interior as the museum program developed. These changes included enlargement of the library to accommodate the great volume of books required by curators and students associated with the museum. The original library room on the first floor, with its mezzanine level gallery, was connected to the room above on the second floor by a stair and now provided storage for as many as 10,000 books. Photographic enlargements of scenes and people from the transparencies of the exploring expeditions of Major Powell were produced for display in the windows of the museum, illustrating the contents of the rooms within (See Figure 35).

An Additional Museum Building Required As the organization of the working museum progressed, the size of the collections continued to increase enormously. The Smithsonian received additional items from the Centennial Exposition, various government expeditions, and the Ethnological Bureau. Baird anticipated much more from the industrial collections of the U. S. Census of 1880 and the collections of the U. S. Geological Survey. Baird commented, “Large and capacious as is the new Museum building, it has proved already inadequate to the existing requirements of the National Museum.” An additional museum would be necessary. On April 10, 1881, a bill providing for an appropriation of $200,000 for construction of a new museum building south of the SIB was introduced into Congress.65 The Regents recommended to Congress that, instead, $300,000 be appropriated for construction of a new museum building on the southwest corner of the Smithsonian Reservation similar in style to the existing museum. Baird suggested that, for the sake of expediency, one architecturally independent wing could be built now, and the building completed in the future as need and resources dictated. This wing would house the offices and laboratories of the National Museum and the Geological Survey.66 This request for funding was not granted.

Footnote 63: Goode, AR 1882, 125.

Footnote 64: Baird, AR 1882, 6. This comment apparently refers to initial partial enclosure of some of the spaces between the piers as a background for exhibits. The Cluss & Schulze interior perspective of June, 1878, shows low brick walls approximately 6'-8' high between some piers of the north hall. On March 10, 1879, Baird directed Cluss “Lay the concrete straight through. Add dividing walls between the piers as needed. This will reduce the original cost.” (Baird to Cluss, 10 March 1878, Outgoing Correspondence, Office of the Secretary, 1865-1891, 83; 88, RU 33, SIA.)

Footnote 65: Report of the Executive Committee, AR 1882, XII.

Footnote 66: Ibid, xi-xii. [H. R. 5781, 47th Cong., 1st sess.]
Originally, the great mass of unsorted stored materials, still in their crates, had occupied most of the exhibition halls. By the end of 1883, after two years of effort, only three of the seventeen halls were still in use for storage of unsorted materials. These included the South West, South East, and North East Courts. The carpenter shop was moved from the South East Court to a frame building east of the museum, freeing additional storage space within the building. The Armory building, now almost empty of stored materials, was turned over to the United States Fish Commission. An organizational plan for the museum was adopted, with 32 scientific departments grouped under the divisions of anthropology, zoology, botany, geology, and exploration and experiment. There were 11 executive departments grouped under a separate administrative division. Exhibition space had been provisionally assigned to each of the scientific departments. A large skylight was installed in the North West Annex roof to provide additional light needed after the addition of a second story and gallery.67

In the Annual Report for 1883, Secretary Baird notes that the Brush-Swan Electric Light Company had loaned the museum a powerful dynamo machine and a series of arc lights. Members of the National Museum staff took charge of this equipment and conducted experiments for lighting the building at night and for using electric light for photography. The Brush storage battery system was demonstrated in the lecture room by connecting a storage battery with 40 Swan incandescent lights and charging the battery with the dynamo. Invited government officials and private citizens witnessed the success of this system on several different occasions. The Brush-Swan Electric Light Company left this system in the lecture room, and installed 43 burners for the use of the museum.68 The building was lighted for the first time with electric lights on February 26, 1883, as the museum held a week-long public viewing of an exhibition prepared for the London International Fisheries Exhibition. Attendance averaged more than 2,000 visitors each day.69 During 1883, the electrical system was steadily expanded. By the end of the year, all of the exhibition halls had been wired for electric light and it was possible to light one or all simultaneously.70

The Smithsonian expanded the use of the museum by scientific societies, with the American Pharmaceutical Association holding its annual meeting there on April 17, 1883. A large floor area was cleared for their exhibits. The museum also shared some of its exhibits and cases for the occasion. The Philosophical Society held its annual meeting on December 8. In 1883, Congress also directed the museum to prepare a collection of duplicate specimens for the Southern International Exposition at Louisville, the Chicago Railway Exposition, and the Foreign Exhibition in Boston. The following year, Congress authorized participation in the World’s Industrial and Cotton Centennial Exposition at New Orleans and the Industrial Exposition at Cincinnati. Participation in these expositions allowed the National Museum to extend its educational program throughout the country.

Spencer Fullerton Baird died in 1887 and was succeeded as Secretary of the Smithsonian by Samuel Pierpont Langley (1834–1906). Baird had ardently supported the creation of the National Museum and had participated enthusiastically in...
the design and construction of the building. The collections had increased ten-fold under his direction. Congress had not appropriated funding for an additional museum and valuable accessions were stored in boxes without opportunity for exhibition. In looking toward the future, G. Brown Goode envisioned Washington as “the seat of one of the greatest museums in the world.” Located in close proximity to the Smithsonian Institution Building, new buildings of the museum would complement each other in resources and scope, “being directed mainly toward the exhibition of the geology and natural history of America, and its natural resources, to the preservation of memorials of its aboriginal inhabitants, and the exposition of the arts and industries of America.” With the completion in 1886 of the Army Medical Museum and Library building just east of the National Museum, Goode predicted that a group of specialized museums would eventually be established: “Every considerable nation has a museum or groups of museums in its capital city—centres of scientific and educational activity—the treasure-houses of the nation, filled with memorials of national triumphs in the fields of science, art, and industrial progress. They are legitimate objects of national pride, for upon the character of its museum and libraries intelligent persons visiting a country very properly base their judgment as to the nature and degree of the civilization of the people.”

With the organization of the collections in hand, the National Museum steadily advanced its commitment to public education. The museum distributed duplicate specimens to local museums and schools across the country. It furnished plans for museum cases to institutions both here and abroad and made its staff of scientists available to assist with problems of specimen identification and specialized information. The public lecture series begun in 1882 was continued. The museum kept records of the number of visitors each year. Between the opening of the museum in 1881 and June 30, 1890, 2,111,949 visitors were recorded. (See Figure 36)

In 1889, in response to repeated appeals from the Smithsonian for an additional building for the National Museum, Congress directed Architect of the Capitol Edward Clark, to investigate the possibility of constructing a basement beneath the National Museum Building. Clark reported to the House on March 3, 1890, that the cost would be prohibitive and the work excessively difficult in proportion to the advantage gained. A suitable brick storage and laboratory building could easily be erected on the Smithsonian grounds or in the neighborhood at much less cost. In 1890, Senator Justin S. Morrill reported from the Committee on Public Buildings and Grounds a bill (S. 2740) to provide for the erection of an additional fire-proof building for the National Museum. This bill failed on January 9, 1891. On January 21, 1892, another bill providing for a new 36: North Hall, already overcrowded, 1885-1890. SIA RU 95, B 42, F 13.
museum passed the Senate, but failed for the third time in the House on April 14.

In his 1893 report, Goode reported the heavy burden on the museum’s resources imposed by frequent participation in expositions as mandated by Congress. The work of preparing for these expositions engaged the efforts of almost the entire staff:

Many of our Museum halls have been closed, being needed for the work of mounting and packing the collections. Many of our employees have been transferred to the exhibition staff, and are absent in Chicago, while a considerable number of others have been detailed for special service at the fair, or have been given special leaves of absence to attend the congresses or to act as judges of awards.

A large number of specimens and cases have been withdrawn from the exhibition halls and sent to the expositions in Madrid and Chicago, and it has required the utmost ingenuity to fill the gaps thus caused, so that the collections may be presentable in the eyes of the visitors, who are quite as numerous this year, and among whom are many from foreign lands.

While he estimated that an additional year would be needed to re-adjust the collections after the return of the exhibits, he noted that the benefit for public education was too great to ignore: “The National Museum is a treasure-house filled with materials for the use of investigators, and it is also an agency for the instructions of the people of the whole country.”

By 1895, Secretary Langley observed that the size of the collections had increased so massively that they would now completely fill a new building as large as the present museum. In addition, there was no further space for storage in the SIB or rented buildings. To alleviate this situation, he proposed the erection of galleries in the South West Court and South East Range, asking Congress for an appropriation of $8,000. He noted, “Galleries were provided for in the original plans for the Museum building, and can be supported so as not to detract from the appearance of the halls or to interfere with the present system of installation.” A June 1878 interior perspective by Cluss & Schulze of the North Hall showed the intention of including visually light galleries in the museum. These galleries were similar in design to those that Cluss & Schulze designed for the reconstruction of the U. S. Patent Office. In 1883, already confronted with the lack of space in the new museum building, Spencer Baird had directed Cluss to “Prepare plans for the galleries originally contemplated in the four main halls of the museum building. Estimate also.”
Secretary Langley’s request for an appropriation to construct the galleries was rejected twice but finally approved for Fiscal Year (FY) 1897. Washington architects Hornblower & Marshall prepared drawings for the galleries in February 1896. Their design included light iron framing and rails with partially cantilevered glass floors designed to minimize obstruction of natural light to the floor below. A working drawing for one of the courts by consulting architect E. Schmitt, dated November 20, 1896, follows the Hornblower & Marshall design but substitutes wood floors for glass. A stair location plan by E. Schmitt dated March 10, 1897, shows the galleries then under contract for construction and those projected for the future. The drawings show the removal of Cluss & Schulze’s stairs and galleries in the four corners of the Rotunda and replacement with new stairs leading to the new galleries directly from the Rotunda. These are shown as being ready for bid. Secretary Langley reported in 1897 that, due to unusually low prices for iron, four galleries, instead of the expected two, were under construction. He requested another $6,000 and noted “While the galleries which can be erected with this amount ($16,000) will be of very great benefit, the need of another building is not in any degree lessened, since the additional space obtained will be necessary to relieve the overcrowded condition of the floors, which has given the exhibition halls almost the appearance of storerooms.”

Congress appropriated an additional $10,000 in FY 1999 “for furnishing railings, painting the galleries, connecting them with those in adjoining hall, placing a skylight in each court, and providing a ventilator in one of the ranges.” Architect Victor Mindeleff provided drawings for the iron balustrades in the spring of 1899. Secretary Langley reported in 1899 that ten galleries had been constructed in the three years since the project began. Two more galleries were erected in 1900. The new galleries in the courts and ranges unfortunately obstructed the natural light, requiring the addition of skylights at all four court roofs and at the ranges (See Figure 38). The glass-floored galleries originally designed by Hornblower & Marshall would have allowed more natural light to reach the first floor than the terrazzo-floored galleries that were built. A similar problem had occurred in 1882 when the construction of an additional floor and a gallery in the library had necessitated the addition of a skylight to the North West Annex roof. At the South East Range, a second floor extending over the first floor exhibition space was built. Building of galleries continued into 1902.

In 1900, Assistant Secretary Richard Rathbun (1852-1918) declared the museum in crisis, unable to do the work mandated by Congress due to the limited space available.
to the enormous growth of the collections and lack of space. He pleaded:

The demand for additional space and for new cases, always incessant, has reached a stage where the helplessness of the authorities to meet it is pathetic. Galleries have been built in some of the Museum halls. Their capacity has not sufficed to keep pace with the current demands of the years in which they were constructed, and collection after collection has been carted away to one of the outside buildings. These now are all practically filled, and next year a new one must be leased, or accessions turned away, or the exhibition halls transformed into storehouses.88

The educational program of the museum was impacted by the crowded conditions; the laboratories were insufficient for the needs of scientists here and abroad; and the shops for taxidermy, modeling, and other uses were scattered and inadequate. In 1902, Assistant Secretary Rathbun decried “conditions which are very deplorable for the National Museum of a great country. Its halls are overcrowded, the cases being generally placed so near together that two persons can scarcely pass between them and no effective view of their contents can be obtained.”89

After the design of the galleries, Hornblower & Marshall continued to work with the museum on minor remodeling projects designed to update and reconfigure existing space to relieve the congestion of the museum. These projects included permanently closing the south entrance to provide additional office and storage space, the addition of new toilet rooms, construction of a new chimney at the North West Pavilion, remodeling the Division of Photography third floor interior, constructing a large north-facing skylight for the Division of Photography on the roof of the South East Pavilion, remodeling the north entrance, and providing a new door between the stair hall of the North West Pavilion and the library in the North West Annex on the first floor. Congress, in the Sundry Civil Act of 1902, appropriated $5,000 for preliminary plans for a new museum. In anticipation of this work, Hornblower and Marshall traveled separately to Europe to study museum design. Their professional experience prior to this time was primarily residential and did not include design of museums or any large public projects.90 In the winter of 1902–1903, the firm prepared preliminary plans for the new museum in consultation with the Smithsonian and visiting scientists. These plans, together with a report by Assistant Secretary Rathbun explaining the needs of the Smithsonian, were transmitted to Congress on January 23, 1903.91 The bill passed in the Sundry Civil Act for 1904.92 The Regents selected Hornblower & Marshall as architects. A new building, reflecting 20 years of innovative developmental museum experience and increasingly urgent need, was underway.

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The Arts & Industries Building In 1903, Assistant Secretary Rathbun’s report to Congress suggested plans for future use of the existing 1881 building. He noted that the building had originally been constructed to receive the exhibits of the 1876 Centennial Exposition, which were primarily those of the department of arts and industries:

The department of arts and industries, the more practical side of the Museum, has perhaps suffered most from the lack of accommodations. Large exhibits have had to be removed to storage, and the...
growth of this most important and striking branch was necessarily stopped some time ago. It should be made here, as it has been in all the larger capitals of the world, one of the most important features of the national collections, and its increase, once stimulated, would go forward rapidly and at relatively small expense, as generous donations might be expected from all quarters\footnote{93}

Transferring to the new building the departments of ethnology, archeology, natural history, and geology would allow the 1881 building to be used exclusively for historical and industrial arts collections. The collection of fine arts would be exhibited in the original SIB. Rathbun argued that “with its collections thus distributed between the three buildings, all fireproof and of substantial construction, the National Museum may be expected to enter upon an era of renewed prosperity and usefulness.”\footnote{94} This was the beginning of the fulfillment of Goode’s vision of a group of specialized museums located on the Mall near each other and the Smithsonian Institution, sharing resources and together forming a great national museum unequalled elsewhere in the world.

While the new building was under construction, the Smithsonian began extensive renovation of the 1881 building. The work included repair and replacement of the roofs, construction of additional skylights, replacement of worn out floors, painting of walls and exterior woodwork, updating the electrical system, and many other items designed to repair and modernize the building. Unfortunately, the work also included filling in many of the original arches to create the small exhibition rooms then in style. In the 1906 Annual Report, Rathbun commented:

The halls, courts, and ranges in the Museum building are broken by so many large, arched openings, reaching nearly to the roofs, as to make of the exhibition space practically one large room, about two acres in extent. While the building itself was constructed of fireproof materials, yet the immense collection, now greatly crowded, contains much that is combustible. Every possible means of detecting the occurrence of a fire and of preventing its spread have been introduced, but as an additional and very necessary precaution it has been decided to isolate the different sections as far as possible. The only way to accomplish this effectively is to close all openings, except the few necessary passageways, with some fireproof material, and macite has been selected.\footnote{95}

Transfer of collections from the older buildings to the still unfinished new building began in 1909. With the removal of natural history and anthropological exhibits and with the substantial completion of the new building in 1912, the Annual Report noted that space was made available in the older buildings for the collections of the department of arts and industries. Secretary of the Smithsonian Charles D. Walcott\footnote{96} commented:

The very interesting series of objects commemorative of eminent Americans and of important events in the history of the United States; the collections illustrative of art textiles, graphic arts, and ceramics, as well as firearms, electrical inventions, and other technological material may now receive more attention and be more adequately displayed than has heretofore been practicable.\footnote{97}


Footnote 94: Rathbun, AR 1905, 5.

Footnote 95: AR II 1906, 13.

Footnote 96: Charles Doolittle Walcott (1850-1927) succeeded Samuel Pierpont Langley as Secretary of the Smithsonian Institution in 1907. Langley died in 1906.

Items stored away for decades were brought out, evaluated, restored, classified, and arranged for exhibition. The original idea, that exhibitions of industrial products would serve not only as a matter of record and education but actively contribute to industrial production, was revived. Looking first at textile and mineral technology, the Smithsonian planned both an exhibition series and a reference series of objects for each industry. The exhibition series would illustrate "the latest processes and products of the industry" as well as provide a historical display. Its intent would be the education of the general public. The reference series would provide carefully catalogued, easily accessed material to assist manufacturers and technical students in product research. Cooperation with new federal government departments promoting and regulating industrial interests was planned.

With the museum remaining open to the public, the museum staff developed plans, unpacked and refurbished old materials, acquired new materials to complete collections, and constructed often intricate models to illustrate manufacturing processes. One by one the newly renovated halls were ready for viewing. By the end of June, 1912, a provisional exhibit of 37 cases was opened on the gallery of the South Hall with "a series of the raw materials and of the successive stages of manufacture of all the important textile and cordage fibers." Donations of new materials were readily obtained from manufacturers and private collections. New England mills, among others, sent samples of their products. The renovated building was first officially referred to as The Arts & Industries Building in 1917, after being referred for a few years as the "old National Museum." The new National Museum Building was then officially called the Natural History Building. In 1918, Secretary Walcott explains that the National Museum includes the collections of the Smithsonian Institution Building, the Arts & Industries Building, and the Natural History Building.

The entry of the United States into World War I in 1917 curtailed the normal activities of the Smithsonian. Members of the scientific staff, using the collections and research laboratories, advised the War Department on various technical issues, including shipping, fertilizer, fuel, power, and weapons. Much of their work involved extensive travel. Secretary of the Smithsonian Institution Charles D. Walcott served on the Aircraft Board, which was created to advise the War Department concerning the production and purchase of aircraft and aircraft appliances. An experimental laboratory was created at Langley Field near Hampton, Virginia, named for former Secretary of the Smithsonian Samuel Pierpont Langley. Exhibits promoting domestic conservation of food and animal products were prepared for circulation across the country. Soldiers drilled on the Mall and the facilities of the museum were thrown open to them. The Bureau of War Risk Insurance occupied part of the new museum building, now the National Museum of Natural History (NMNH), as exhibits were relocated to make room. On July 16, 1918, the new NMNH was closed altogether to accommodate the bureau.

With war-time food shortages increasing, the staff of the AIB mounted popular exhibits to introduce little-known food products such as peanut, soy, grape seed, and cottonseed oils. It promoted use of Native American food sources like potatoes, peanuts, corn, and beans. An exhibit showing the classification, use,
and conservation of foods was placed in 20 upright floor cases arranged in a circle around the statue in the Rotunda. In cooperation with the Department of Agriculture, room 80 in the South East Pavilion of the AIB was furnished with a demonstration kitchen where classes and demonstrations of new products like powdered milk, pressure cookers, and electric washing machines were held. Knitting and weaving demonstrations were popular.¹⁰³

In the years following its designation as the Arts & Industries Building in 1917, educational, archival, and administration activities increasingly replaced the museum function and impacted the original fabric of the building. The museum complex on the Mall developed as Baird and Goode predicted and, today, includes the National Museum of Natural History, opened to the public in 1912; the Freer Gallery of Art, in 1923; the National Museum of American History, in 1964; the Hirshhorn Museum and Sculpture Garden, in 1972; the National Air and Space Museum, in 1976; the Arthur M. Sackler Gallery, the National Museum of African Art, and the Ripley Center, in 1987; and the National Museum of the American Indian, in 2006. The National Museum of African American History and Culture is now being planned for a site west of the National Museum of American History.

The Arts & Industries Building is now closed for renovation.

**The National Museum’s Architects, Engineers, and Builders**

*Adolf Cluss, FAIA, (1825–1905)* was born in Heilbronn, Württemburg, Germany, to a family of prosperous architects and builders. He apprenticed as a journeyman carpenter and worked as a draftsman on railroad construction. After involvement in the brief 1848 revolution in Germany, he immigrated to the United States, settling finally in Washington, D.C. His first employment was with the U.S. Coast Survey, and later he worked for the Office of the Supervising Architect of the Treasury and then the U.S. Navy Yard. In 1862, he ventured into private architectural practice with Joseph Wildrich von Kammerhueber, a fellow German émigré with whom he had worked at the Navy Yard. The firm of Cluss & Kammerhueber was immediately successful, designing a number of churches, the Department of Agriculture building, and the acclaimed Wallach School before their partnership was dissolved in 1866. He entered into a partnership with Frederick Daniel from 1875 to 1877 and with Paul Schulze from 1878 to 1889 when Cluss retired from private practice. During his career, Cluss designed more than 80 buildings, including prototypical schools and markets for the city, many single-family residences, Washington’s first apartment building, commercial and institutional buildings, and other projects. In addition to his work on the National Museum, his museum work included reconstruction of the SIB after the fire of 1865, reconstruction of the U. S. Patent Office after the fire of 1878, remodeling of the east wing of the SIB from 1883 to 1884 following Joseph Henry’s death, and the Army Medical Museum and Library (1883). He served as engineer member of the Board of Public Works from 1872 to 1874 and as Inspector of Public Buildings of the United States from 1890 to 1895. He was an active member and officer of the American Institute of Architects (AIA), presenting a number of papers at their national conventions. He was elected a Fellow of the AIA in 1867. He was an organizing member and the second president of the AIA’s Washington Chapter and served on the Board of Directors in 1890.

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Footnote 103: AR II, 1919, 15.
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Frederick Daniel (1843–1878) was born in Schwin Mecklinberg, Germany. He worked in Cluss’ office after the partnership with Kammerhueber ended, and as a partner from 1875 to 1878. Cluss & Daniel, architects & engineers, prepared early drawings for the National Museum. Many of the details of their early design survive in the completed building. Daniel died on March 26, 1878.

Paul Schulze (1828–1897) was born in Breslau, Prussian Silesia, Germany. He was educated in the technical high school of Breslau and trained in fine arts in Berlin and Vienna while working in the offices of prominent architects. Schulze participated in the 1848 uprisings in Vienna, emigrating to Boston, Massachusetts in 1849. He was the architect of Boylston Hall (1857) and Appleton Chapel (built 1856 to 1858) at Harvard. Boylston Hall was the first building at Harvard dedicated to the sciences. He moved to New York in 1857, practicing architecture with Charles Gildenmeister (1820-1869) who, with George Carstensen (1812-1857), designed the New York Crystal Palace in 1853. He was associated with Paul F. Schoen (d. 1887) in New York from 1865 to 1875 and with William G. Steinmetz (1838-1898) from 1875 to 1876. In 1877, he came to Washington, D.C. The partnership of Cluss & Schulze was formed in 1878 and continued until 1889 when Cluss retired from professional practice. Schulze formed a partnership with Albert Goenner (1860-1918) from 1891 to 1894. During the Civil War, Schulze served in the Union Army with the New York Volunteers as an engineer officer on the staff of General Blenther.104


Joseph Coerten Hornblower, FAIA, (1848–1908) was born in Paterson, New Jersey, the son of a prominent Presbyterian minister and theologian. Educated at Yale (class of 1869) in the Sheffield Scientific School, he pursued an architectural career in Washington. He studied at the Parisian atelier of Jean-Louis Pascal from 1875 to 1876, training in the methods of the Ecole des Beaux Arts. In 1877, returning to Washington, he entered first into a partnership with William Poindexter, AIA. In 1879, as work on the National Museum building began, he established his own practice in the same building where Cluss & Schulze had their offices. In 1883, he formed a...
partnership with James Rush Marshall. He was a founder of the AIA’s Washington Chapter and served as chapter president in 1897, 1898, 1905, and 1906.

James Rush Marshall, FAIA, (1851–1927) was born in Carlisle, Pennsylvania, the son of an educator and prominent official of the Grant administration. He attended first the Rutgers College Scientific School, leaving after his junior year to travel through Europe with his scholarly father. Like Cluss, he worked as a draftsman in the Office of the Supervising Architect of the Treasury from 1871 until 1883, when his partnership with Hornblower began. This partnership lasted until Hornblower’s death in 1908. The firm designed a series of notable Washington residences and the Baltimore Custom House. Hornblower & Marshall succeeded Cluss & Schulze at the Smithsonian Institution, advising the Smithsonian on architectural matters from 1896 forward. They designed the galleries and other projects at the AIB, and designed and superintended the construction of the National Museum of Natural History. Hornblower and Marshall were both active in the affairs of the AIA and were elected fellows of that organization. Marshall was a founder of the AIA’s Washington Chapter and served seven terms as chapter president between 1891 and 1910.

The AIB’s Relationship to Smithsonian History
The AIB was the first of a group of purpose-built museum buildings largely funded by the U. S. government and constructed and administered by the largely privately-funded Smithsonian Institution on the National Mall. It was the first building to be officially known as the National Museum, and was the beginning of what is now one of the greatest museum complexes in the world. In this building, the Smithsonian developed methods of museum administration, specimen preparation and preservation, classification and labeling, exhibition, and education outreach that are today standard practice in museums worldwide. Through the participation of the Smithsonian and the National Museum in the great international expositions of the 19th and early 20th centuries, the natural resources, arts, and industrial innovations of the United States were introduced to cities across the nation and worldwide. Sharing exhibits, plans, and publications with museums in other cities and countries, the National Museum served as a model institution assisting in the establishment of other museums. Through a series of both popular and professional lectures and publications, instituted as soon as the building opened to the public, the museum has been a vital cultural force in the nation’s capital. In the 20th century, popular demonstrations, classes, and publications have greatly extended the educational advantages provided through the Institution and the museums. Through preservation of the collections of the great U. S. government expeditions of exploration of the 19th century and of various government departments, the National Museum, operating out of the AIB, contributed immeasurably to knowledge of the cultural history of the country.

Architectural Precedents and Design Influences
The design of the National Museum Building was based in part upon the design of international exposition buildings after the success of the 1851 Crystal Palace in London, England. It specifically
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references architect James Windrim’s design for the Government Building at the 1876 Centennial Exposition with its octagonal rotunda, cupola, clerestories, and longitudinal halls. With a tight budget, short schedule, and constricted site, Cluss adapted this new temporary building type for use as a permanent museum structure. Exposition buildings were often cruciform in plan with a central rotunda approached from entrances at the termination of each arm. The interiors featured a single vast exhibition floor and soaring space to allow for exhibition of items of any size. Promenades, views, and vistas promoted the social functions of the exposition. The exhibition area was sometimes expanded through galleries and laid out like a market floor with individual booths and areas assigned to individual countries and/or industrial interests. Glass and iron modular structural units were used extensively. Exposition contracts generally required buildings that could be assembled quickly with an agreement to clear the site by a fixed date. Since there was no effective means of artificially lighting these halls, their design incorporated generous natural lighting through clerestories, skylights, and monitors.

Cluss commented:

On the whole, the one-story plan which has prevailed among experts ever since the Paris exhibition of 1867 has been adopted. But by the introduction of upper stories on those outlying sections reserved for offices, ample office-room has been secured without encroaching materially upon the floor space within the square of 300 feet, to which the building was primarily limited.106

Historical Background and Context 1.1

He described the style of the building as modernized Romanesque complementing the Norman Romanesque of the Smithsonian Building: “To modernize this style was found necessary on account of the different building material, and to do justice to the purposes of the building with its modern demands of perfect safety and elegance of construction, of greatest possible available floor space, of easy communications, efficient drainage, a well calculated and pleasing admission of light, free circulation of air, and all other hygienic dicta.”107

The “modernized Romanesque” style that Cluss cites is not a reminiscent historical style like that of the Norman Romanesque Smithsonian Building. His ideas were rooted in the Rundbogenstil aesthetic that developed in Germany after the 1828 publication by Heinrich Hubsch (1813-1863) of his controversial book, In What Style Should We Build? This was a truly modern style looking toward the future and using new materials and methods of construction for new building types with new technical requirements. It proposed that the structural system and function of a building should guide the design process and be clearly expressed in the completed building and that construction costs should be contained through use of modular, mass-produced component parts. The design, structural and economic advantages of highly versatile brick masonry construction was preferred. Rundbogenstil, literally round arch style, looked to early Christian and Byzantine as well as Romanesque architecture for rational design restraint and structural precedent. Decoration was integrated with structure through the use of recessed panels, corbelled cornices, decorative patterns of colored bricks and slate, and other such devices. Color was


often introduced through the deep, smooth dark red of factory-produced pressed brick laid up with a very fine joint. Cluss commented that “architecture itself constitutes the decoration of architecture.”

In his comments at the dedication of the Franklin School on October 2, 1869, Cluss traced his inspiration to the brick architecture of *cinque cento* Lombardy where the humble brick was formed and used with imagination and elegance to create great architecture. Washington was then a red brick city. Brick was manufactured here from the locally abundant red clay, burned at first near construction sites, and eventually manufactured and marketed by commercial firms using factory-like production methods. Cluss bought the 5,250,000 red face, common, and purpose-moulded arch bricks needed for the National Museum Building from the Washington Brick Machine Company, located in northeast Washington near the Baltimore & Ohio railroad tracks and the Anacostia River. Brick masonry construction was versatile, efficient, and cost-effective. It made effective use of manufactured materials of factory-determined dimensions such as rolled iron beams and terra cotta, cast iron, and galvanized elements.

There is a political and social aspect to Cluss’ adoption of the modernized Romanesque style. Like many other Germans, Cluss emigrated to the United States after his involvement in the failed 1848 Revolution. Early work on the construction of a new railroad between Manheim and Mainz exposed the young engineer to the dire living conditions of the workers building the railroad. He became passionately involved in liberal issues, writing and speaking in support of universal education, individual freedom, and other issues of the 1848 Revolution. The *Rundbogenstil* movement sought to define German architecture in the present and future rather than in the past. The 1848 Revolution pursued nationalism and democratic ideals, rejecting the feudalism of the past. Cluss, in both architecture and politics, worked in a transitional period as the industrial revolution and ideas of social reform were changing the world.

In addition to international exposition building precedents, the design exhibits the influence of the sketch prepared by General Montgomery Meigs showing a square plan with central rotunda and surrounding interconnected exhibition halls. Meigs’ sketch was based upon a well-known early museum plan popularized by J.N.L. Durand (1760–1834) in his 1805 *Précis des Leçons d’Architecture*. Durand’s rationalist architectural theory strongly influenced 19th century architectural practice. Entirely rejecting the structural mysticism and extreme façade plasticity of Baroque architecture, Durand advocated the simplicity and clarity of pure geometric form in

Footnote 108: Ibid.

architectural composition. Utility, economy, and regularity of plan and space were primary concerns. Durand’s career was interrupted by the French Revolution of 1789. Lecturing in Paris in 1794 at the newly established École Polytechnique, he expounded this rationalist theory and illustrated it through plans for proposed new public building types for a new egalitarian society. Published in 1805 as Précis des Leçons d’Architecture, his work was widely known. In 1813, he published Nouveau Précis des Leçons d’Architecture. His students at the École included Germans C.W. Coudray (1775-1845), Johann Frederich Christian Hess, and Leo von Klenze (1784-1864). In 1831, Durand’s two volumes were accurately translated into German. Through his students and publications his rationalist egalitarian theory influenced the German Rundbogenstil in architectural practice. Through the German émigrés of 1848, the style came to America and was commonly used in some variation throughout the 19th century (See Figure 39).

The AIB’s Relationship to the Development of the National Mall
In 1847, the President of the United States James K. Polk (1795-1849) designated a site for the construction of the Smithsonian Institution Building. The 47 acre site, known as the Smithsonian Reservation, extended from Seventh to Twelfth Streets, and from South B Street to the Washington Canal, now the location of Constitution Avenue. It was desolate and isolated, completely unimproved, separated from downtown Washington by the fetid canal. To the west, the Washington Monument (1848–88) would soon rise from the marshy shore of the Potomac River. In his 1791 Plan of the Federal City, Pierre L’Enfant (1754-1825) had envisioned a lushly planted green promenade, lined with beautiful buildings connecting the Capitol with the President’s park south of the White House. It would be the intellectual and artistic heart of the city. The canal was to have afforded pleasant and swift transportation from Georgetown through the downtown area, turning south at the base of Capitol Hill, then branching both toward the confluence of the Potomac and Anacostia Rivers and toward a hoped-for industrial site on the Anacostia River. Benjamin Henry Latrobe (1764-1820), planning the canal and the Mall, adopted George Washington’s idea for a great university to be constructed on the Mall. Locating the Smithsonian, an institution dedicated to the “increase and diffusion of knowledge among men,” on the Mall was the beginning of the fulfillment of this plan.

James Renwick, Jr., architect of the SIB, laid out the grounds as part of his work for the construction of that building. He recommended grading and indicated the location of paths, roads, trees, and shrubs. The plan intended to create a kind of museum of American trees with approximately 160 different specimens. “The climate of Washington is favorable to the growth of a very large number of the products of our forests, and an exhibition of this kind would serve to render better known our botanical wealth, and to improve the public taste. The preservation and cultivation of our native trees are objects of national importance.” The Smithsonian partially graded and fenced the area and planted trees at its own expense.

In 1851, Secretary Henry was instrumental in bringing the noted landscape designer and architect, Andrew Jackson Downing (1815-1852), to Washington to create a picturesque public park the entire length of the Mall from the foot of Capitol Hill to the


Footnote 112: Henry, AR 1856, 17.

Historic Structure Report & Conditions Assessment
Smithsonian Institution Arts & Industries Building
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Potomac. The Regents reported that the Mall would be “converted into a beautiful park adorned with evergreen and other ornamental trees, and traversed with carriage drives and gravel walks. In the midst of this variegated landscape the Smithsonian will occupy a prominent position, and with its picturesque style will produce a harmonious effect.” The Smithsonian removed their partition fence to assist in implementation of this unified plan for the Mall. The city built an iron foot bridge over the canal at 10th Street, N.W., and Downing laid a skillfully drained gravel walk to the main entrance of the SIB. After Downing’s death in a steamboat explosion during the summer of 1852, the project came to an end.

Initial plans for the National Museum proposed a large addition, south of the SIB, connecting through the south tower entrance or through a substantial east entrance addition. Congress, in the enabling legislation, directed a separate building “on the southeastern portion of the grounds of the Smithsonian Institution, said building to be placed east of the Smithsonian Institution, leaving a roadway between it and the latter of not less than fifty feet, with its north front on a line with the south face of the buildings of the Agricultural Department and of the Smithsonian Institution.” This action protected the view of the Smithsonian and Agriculture buildings from the U. S. Capitol, but limited the size of the museum site. It also protected the architectural integrity of the SIB.

The Washington Post, commenting on the progress of the museum construction in the summer of 1880 observed:

Located at the northeast corner of the institute, it is so adroitly placed as not to interfere with the imposing front of the irregular pile, which, with its varied architecture, has been such a source of pride to the visitor of the famed result of Smithson’s whim. The quaint curves, and turrets and towers and angles which in the aggregate make up the outside of the Smithsonian Institute, still stand in their bold outlines against the southern sky, while the new edifice, by a happy combination, is just near enough and just far enough to serve a dual purpose. It will

Footnote 113: Henry, AR 1851, 84.

Footnote 114: U.S. Statutes at Large 183 (1879) 417.
accommodate the exhibits for which it is intended, and will at the same time present, in marked contrast, the modern and mediaeval styles of architecture; for the annex is purely modern.115

As completion of the construction neared, the Post further observed:

The new building, when finished, will be a magnificent structure, creditable alike to the Government and to the cause of science to which it is dedicated. It is a matter of congratulation that it is to stand within the classic shades of the Smithsonian grounds. They have a special charm and individuality of their own, unlike anything else in Washington. The grounds are retired, and there is something in the approaches, in the perfect dead level of the park, full of evergreens, and in the semi-Gothic architecture of the somber-hued building that gives it a foreign look. It has not a touch of the newness that sometimes quite stares one out of countenance in our public buildings. Architecturally, the new museum is a model of beauty and convenience.116

In 1881, Congress, in order to improve public access to the National Museum, appropriated $1,500 for the construction of asphalt walks from Seventh and Twelfth Streets to the Smithsonian Institution Building.117 An 1882 aerial view of the city from the south shows the layout of the Mall as the museum opened. The Washington Monument, Department of Agriculture, and Smithsonian Institution, with their picturesquely landscaped grounds, are approached directly from the city by Fourteenth, Twelfth, and

Seventh Streets. The Baltimore & Ohio Railroad tracks, authorized in 1872, cut through the Mall in the right-of-way of Sixth Street. The Armory building is located on the south side of the Mall adjacent to the Smithsonian and the railroad tracks. The train station is on the north side of the Mall. The Center Market is located directly opposite the new museum building where the National Archives building now stands. These buildings were predominantly constructed with local red brick. Today, the AIB is the only red brick building and the last of those designed by Adolf Cluss and his partners that remains on the Mall (See Figures 40, 41, and 42).

The “White City,” created by Daniel Burnham FAIA (1846-1912), Charles McKim FAIA (1847-1909), Frederick Law Olmsted (1822-1903), and Augustus Saint-Gaudens (1848-1907) for the 1893 Columbian Exposition in Chicago, changed the direction of architecture and city planning in this country. These men, appointed to the Senate Park Commission of 1901 to 1902, planned a monumental redesign of the Mall. Beginning as a return to the intent of the L’Enfant Plan, they proposed a formal green lawn lined by two


Footnote 117: U.S. Statutes at Large, 1881, vol. 21, 444.
rows of elm trees extending on axis from the base of the Capitol to the Potomac. The existing picturesque landscaping would be removed. Public buildings designed in the Beaux Arts style and faced in light-colored stone would replace the existing red brick buildings. The Mall would be extended far beyond the Washington monument by land fill in the swampy Potomac shore. The Lincoln Memorial was planned as a terminus to the axis. Drawings showed the removal of all of the older buildings on and near the Mall including the SIB and AIB. Hornblower & Marshall supported the new aesthetic for the Mall and were selected in 1902 to design the new U. S. National Museum — now known as the National Museum of Natural History. This building conforms to the planning principles of the Senate Park Commission in every way, suggesting that implementation of the Commission’s plan may have spurred the Congress to finally appropriate funding for erection of the new building (See Figure 43).

Significant Contemporaneous Buildings and Technologies

International exposition halls and museum buildings developed together in the 19th century. The industrial revolution brought new construction materials and technologies, making new architectural design concepts possible. The architectural and engineering professions merged. Evolving egalitarian social ideals led to the founding of public institutions like museums, libraries, schools, and parks bringing advantages to ordinary people that had previously been reserved for a select few.

International Exposition buildings

Iron and glass structures created vast and wondrous exhibition spaces at the many international expositions following the 1851 Crystal Palace in London. In 1853, a Crystal Palace, designed by Danish architect Georg Carstensen (1812–1857) and German architect Karl Gildemeister (1820–1869), graced the Exhibition of the Industry of All Nations in New York City. Designed in the form of a Greek cross, a large central dome and clerestories defined the principal exhibition halls. The building was framed with modular, factory-manufactured iron structural units. Crowds came to watch the innovative construction process. Financially unsuccessful, the New York Crystal Palace remained on its site in present-day Bryant Park until October 5, 1858, when it burned to the ground in 25 minutes. In 1854, in Munich, the Glass Palace, a rectilinear iron and glass structure modeled after the 1851 Crystal Palace, housed the First General German Industrial Exhibition. The Glass Palace remained as a permanent building, the site of art exhibitions and international trade fairs until it burned in 1931 (See Figures 44, 45, and 46).

Cluss cited the one-story plan of the Paris exposition of 1867 as the standard for subsequent expositions and for his design for the National
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Museum. Exposition Commissioner Frédéric Le Play (1806–1882), educated as an engineer at the École Polytechnique, was concerned with social issues and the design of industrial buildings. He designed an enormous structure with dual oval exhibition galleries, one within the other, separated by courtyard gardens. He developed a classification system with which he hoped to encompass the whole of human experience in 10 groups and 95 classes. There were 52,000 exhibitors arranged in concentric aisles around a longitudinal axis. Intermediate connecting aisles confused rather than simplified circulation through the galleries. The distances to be traversed by visitors were daunting. Viewing galleries were provided for spectators. The direct light created by a curved iron and glass roof over the main exhibition area was merciless in intensity, adding to the discomfort of the visitors and creating an imperfect illumination of the exhibits (See Figures 47 and 48).

At the 1873 World Exposition in Vienna, chief architect Karl von Hasenauer (1833-1894) designed the first multiple building exposition. An industrial palace featured a central circular rotunda approached through longitudinal exhibition areas. Intersecting lateral transepts eased access, causing the design to be popularly known as the fishbone plan. Scottish engineer, inventor, and ship builder John Scott Russell (1808–1882) designed a phenomenal iron and glass dome to be placed over the rotunda. This dome was erected with great difficulty by architect Frederich Schmidt (1825–1891) with the assistance of the Johann Caspar Harkort, an iron and steel company of Duisburg, Germany. It was considered the largest dome in the world, 328’ wide and 279’ high, its structure exposed on the exterior for all to see. Two lanterns, one above the other, were surmounted by a jeweled replica of the imperial crown. Visitors could view the exposition from a platform at the first rotunda level or could even climb adventurously to the top. The Industrial Palace was a permanent building, used for trade fairs until it burned in 1937. Separate buildings housed a machine hall, two agricultural halls, and an art gallery. Sited in the Prater, a former imperial hunting park, the exposition included many individual pavilions of varied design, lavish entertainment, and exotic restaurants. The Danube River was diverted to bring exhibits and visitors to
the grounds. The theme of the fair was “Culture and Education.” An exhibit by the Washington D.C. public schools, including a scale model of Cluss’ Franklin School, won a gold medal for “Progress in Education.” (See Figures 49, 50, and 51)

Two of the buildings erected for the 1876 Centennial Exposition in Philadelphia were designed as permanent museum buildings. Horticultural Hall and Memorial Hall were both designed by German-American architect/engineer Herman J. Schwarzmann (1846–1891), chief engineer and architect of the Centennial. Horticultural Hall, designed in a 12th century Moorish style, was a large greenhouse-like structure built primarily of glass and iron like the Crystal Palace of 1851. It was demolished in 1955 after devastating damage caused by Hurricane Hazel. Memorial Hall still stands, used first as the Philadelphia Museum of Art. Converted into a recreation center with offices for the Philadelphia police and parks departments in the 1960s, it has now been restored and rehabilitated as the Please Touch Museum. Designed in a modernized Renaissance style, Memorial Hall is built of granite, brick, iron, and glass. It is a monumental building with full basement and clear frontal orientation. Since it was designed as an art gallery, lighting requirements differed from those in the AIB. A double central rotunda, framed in iron, ingeniously diffused lighting to illuminate yet protect the art within. This building design is close to the Beaux-Arts classicism of the 1893 Chicago exposition, and inspired the design of the Chicago Academy of Art, a permanent building at that fair (See Figures 52 and 53).

Commissioners planning the 1876 Centennial exposition visited the 1873 Vienna fair. They rejected the excessive monumentality of the Industrial Palace as inappropriate for the celebration of the Centennial of the American Revolution. They preferred a direct approach to design with clearly expressed construction details. They felt the design of an exhibition building should not be more important than the exhibits themselves. The Commissioners adopted the multi-building plan of Vienna and endorsed the importance of social interaction at fairs. They planned promenades, avenues, sculpture, fountains, and gardens. The system of classification and
arrangement adopted precluded national exhibits, prompting the U.S. government to erect its own building. Women were excluded from exhibiting, so, as a group, erected their own building.

Construction technologies rapidly advanced in the mid-19th century, introduced by inventors and manufacturers at these expositions. Elisha Otis (1811-1861) demonstrated the safety elevator at the New York Crystal Palace in 1854. Sir Henry Bessemer (1838–1888) patented his process for manufacturing cheap steel in 1855, introducing it to the public at the Great London Exposition of 1862. The hydraulic elevator and reinforced concrete were introduced at the Paris Exposition of 1867. The Rotunda of the Austrian Exposition of 1873 was a major engineering achievement, as were the Eiffel tower and Gallerie des Machines at the Paris Exposition of 1889, built shortly after the AIB was opened to the public. In 1884 through 1885, American architect William Le Baron Jenny (1832-1907) designed and built the Home Insurance Company building, considered the first steel frame skyscraper, in Chicago. A new era in building construction had arrived.

The design of the Museum of Comparative Zoology building was developed by Agassiz with architects Henry Greenough (1807-1883) and George Snell (1820-1893). The requirements were modest. The program required a fire-proof building with rooms for exhibition, working, and lectures. As little as possible should be spent on the building itself, so that the collections would not suffer financially. The museum was to be a teaching facility equal or better
than those in Europe. A rectangular building, 364’ by 64’ with wings 205’ by 64,’ would be built in stages as the needs of the museum increased. In 1859, the cornerstone was laid for a structure only two-fifths the full size of the north wing. Construction began on the second two-fifths after the Civil War, in 1868. The plain brick building contained four floors of museum space including a full basement and gambrel-roofed attic. The plan would eventually include four exhibition rooms two deep at either side of a minimal central entrance hall. There were no lateral halls. The rooms were entered from each other. There were galleries in the exhibition rooms on the first and second floors, expressed on the exterior by ranges of smaller windows with 3/2 sash above the principal windows with 6/6 sash. A large exhibition room on the second floor above the entrance hall was laid out the full depth of the building with light from two sides (See Figures 54 and 55).

The collections of the British Museum, opened to the public in 1759 in London, included zoological, geological, and botanical specimens in addition to rare manuscripts and objects of art. In 1860 the Trustees of the British Museum, confronting the problem of overcrowding, resolved to remove the Natural History Collection to a separate building. In 1863, the site of the London International Exposition of 1862 was selected for the new museum. Sir Richard Owen (1804-1892), Superintendent of the Natural History Collection, worked actively in the design and construction of the building. The commission was first awarded to Captain Francis Fowke (1823-1865), architect of the 1862 Exposition building, demolished to make way for the museum. After Fowke’s death in 1865, the work was awarded to architect Alfred Waterhouse (1830-1905). Plans were completed in 1868, ground was broken in 1873, and construction was completed in 1880. Described as a “true temple of nature” and “the animal’s Westminster Cathedral,” the museum was partially opened to the public in 1881 (See Figures 56 and 57). Planned returned fronts at either end of the museum were never built.118

The monumental terracotta, iron, and concrete building demonstrated the strength and versatility of modern, British-manufactured building materials.

Footnote 118: General Guide to the British Museum of Natural History, Cromwell Road, London, S.W., printed by order of the Trustees, 1906.
Owen and Waterhouse found inspiration for the museum’s cathedral-like design in the German *Rundbogenstil* and the brick masonry construction of the 10th to 12th centuries in Lombardy and the Rhineland. Although the construction of the British Museum of Natural History was vastly more expensive and lengthy, it had much in common with the construction of the United States National Museum. Sir Richard Owen and Spencer Baird both worked long and hard to establish national museums of natural history and both worked actively with the architects of their buildings. In both cases modern, manufactured building materials were used both structurally and decoratively. Both drew upon *Rundbogenstil* aesthetics. Baird consulted with the British Museum on the design of museum cases before deciding upon the custom design used in the U.S. National Museum. The monumental design of the British Museum expressed the power of the Victorian British Empire at its height, while the functional design of the U.S. National Museum, with its purposeful absence of monumentality, expressed the concept American openness and individual freedom. The design and construction of the National Museum also displayed typically American ingenuity in solving seemingly insurmountable problems of budget and schedule.

The American Museum of Natural History in New York was founded in 1869 as “an establishment that shall afford opportunity for popular instruction and amusement, and for the advancement of the Natural Sciences.”\(^\text{119}\) Albert Smith Bickmore (1839-1914) conceived the idea for the museum while studying with Louis Agassiz at the Museum of Comparative Zoology in Cambridge. Owned by the city and managed by a board of trustees, the planning and construction of the museum was attended by the political maneuvering and controversy surrounding the Tweed administration. Manhattan Square, west of Central Park between Seventy-fifth and Eighty-first Streets, was selected by the city as the site for the museum. Calvert Vaux (1824–1895) and Jacob Wrey Mould (1825–1886) were selected as architects.\(^\text{120}\) Calvert Vaux had been a partner of Andrew Downing. Both had collaborated with Frederick Law Olmsted in the design and development of the Greensward project for Central Park.
Vaux and Mould planned a monumental building based on the same J.L.F. Durand idea for a museum that would later inform the design of the Smithsonian’s National Museum Building. A Greek cross inscribed in a square with a central rotunda, the building would be erected in stages, eventually occupying the entire enormous square. The initial construction included the 200’ × 60’ southern arm of the Greek cross plan. Sited near the middle of Manhattan Square it would eventually be an interior wing. Vaux and Mould designed the building in a Ruskinian Gothic manner with facades of red brick accented by light-colored stone. The main facades are organized as a pointed-arch Gothic arcade with rhythmic narrow bays carried vertically the full height of the building. The museum plan included two lofty exhibition floors in addition to a full basement and an attic for workrooms and offices. Broad galleries extended the space of the halls. Narrow slit windows were provided in the piers of the arcaded facades to increase light within the halls. The planned rotunda would eventually adjoin the north end of this wing. President Ulysses S. Grant broke ground for the building in early 1873. Construction proceeded slowly and the museum was not opened to the public until 1877. Today, this original wing can only be viewed from inside the completed building (See Figures 58, 59, and 60).

In 1873, while the natural history museum building was under construction, Calvert Vaux (1824-1895) with engineer George K. Radford (1826- post 1900), entered the design competition for the main building and art gallery at the 1876 Centennial Exposition in Philadelphia. They based their unique design on a pavilion module that could be extended endlessly in all directions, easily and economically constructed, and provide optimum exhibition conditions. The pavilion module was cruciform in plan, reflecting Durand’s museum design. Colossal iron truss pointed and round arches defined each structurally independent module. Constructed in four rows of seven modules each, the design would have created a vast 20-acre open exhibition area with perfect light, unobstructed views and vistas, and myriad garden spaces with plants and fountains within the arms of each pavilion cross. Vaux and Radford won the competition, but, due to political wrangling, their design was not built.
The New York Times critiqued the 44 competition entries, finding only the Vaux and Radford design acceptable. Their comments laid out the requirements for an ideal exposition building appropriate for the celebration of the Centennial of American Independence. In designing the National Museum building, Cluss & Schultz clearly took note both of these comments and the Vaux and Radford design. Cluss' reports touch upon every point, including the preference for the one-story design of the Paris exposition, the creation of perfect light through side lights without the use of skylights, the construction of a vast open exhibition floor with views and vistas throughout, lofty spaces providing for adequate ventilation as well as visual effects, avoidance of long valleys in roof construction, and the use of arched modular design units (See Figures 61 and 62).

In 1869, at the invitation of Emperor Franz Josef I of Austria (1830-1916), German architect, educator, and theoretician Gottfried Semper (1803-1879) joined Austrian architect Karl von Hasenauer to design two museums — one for natural history and one for art history. The museums were part of the Ringstrasse urban renewal project in Vienna which also included the site and buildings of the 1873 International Exposition. Semper developed a plan for a monumental Imperial forum — never completed — which grouped a palace, government buildings, and theater with the museums along an axial, formally landscaped plaza. The two museums were mirror images of each other, facing across the plaza. They were rectangular in plan with courts on either side of a monumental central entrance hall. Semper provided elaborate iconography depicting the progressive history of nature and of art both inside and outside the buildings. The iconography was an integral architectural design element, so much so that the museum buildings themselves became the museum. Ground was broken in 1871, and construction progressed slowly. In 1889, both museums were opened to the public, although not completed until 1891.

Semper had participated in the 1849 uprisings in Dresden, fleeing to London in 1850. Here he designed several of the pavilions for the 1851 Crystal Palace. The much younger Hasenauer temporarily left the project in 1871 to design the buildings for the 1873 Vienna International Exposition (See Figures 63 and 64).
Architectural and Engineering Design Technologies

Exposition structures built of glass and iron demonstrated the aesthetic, economic, and structural advantages of these materials (See Figure 65). The fire at the New York Crystal Palace also demonstrated their vulnerability. Charged first and foremost with construction of a fireproof building, Adolf Cluss depended upon an interconnecting brick masonry arcade structural system for the open design of his permanent museum building. Light and airy exposed wrought iron trusses supported the individual roofs of each of the 17 halls. They span the lofty open spaces created by this system while clerestories and lanterns and monitors perfectly light each of the halls. The pavilions and towers function as buttresses for the arcades. The building envelop is rational and self-contained. Although inexpensive and rapidly constructed, the modern Romanesque design complements the adjacent Norman Romanesque design of the SIB.

Machine-made Brick

Twenty new machines for making bricks were exhibited at the 1876 Centennial Exposition in Philadelphia. Coal-burning steam engines, cast and wrought iron machine tools, rail transportation, and continuous belting of various widths made factory production of bricks possible. The clay-tempering brick-making machine of Chambers, Brother & Co. of Philadelphia was said to turn out 50 to 80 bricks per minute or 50,000 to 80,000 bricks a day.122 The Peerless Brick Company of Philadelphia, considered the foremost producer of fine brick, used this machine combining it with a hand press for face brick. An improved version of this press, the Peerless Brick Machine, was patented in 1882 by John Crabtree of Philadelphia.123

Gleason & Himber, the brickwork contractors on the AIB, described the face brick manufacturing process at the Washington Brick Machine Company as, “After the glutz came out of the steam presses, they were again pressed in a Philadelphia hand press, carefully selected and placed in the kiln to be burnt.”124 Bricks manufactured in this manner often contained undesirable striations, making them unsuitable for use as face bricks. The careful selection of only the best bricks was time-consuming and expensive as was the mason’s work in laying them. In 1879, as brick-making technology evolved, there was considerable

Footnote 122: Described in detail in J. S. Ingram’s account of the exposition. 200.


Footnote 124: Minutes of the U.S. National Museum Building Commission, 17 November 1879, 138, Box 7, RU 71, SIA.


65: Construction of the Crystal Palace (1853)
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confusion over the difference between a face brick and a pressed brick. Cluss had specified “Joints of exterior faces, soffits and reveals to be cleared out not less than 3/8" and filled with black pointing mortar compounded of paste of finely ground cement and clean, sharp silicious sand. 2 ½ sand/1 cement paste.”125 The joints were to be no more than ¼” wide. The contractors protested:

We took every care and laid them as press bricks. Instead of laying the bricks in common mortar, rake joints and point with black mortar, we buttered every brick separately with black mortar, and laid it carefully in its position; cutting off the superfluous mortar, which was caused to be forced out to bring the brick to its right place and position. And after eight or nine courses of these bricks as above described had been laid we pointed up every crevice that appeared and struck a flat regular joint, making the joints thicker or thinner as the thickness of the bricks required.126

The black mortar was stiff and difficult to spread. The polychromatic design of the brick work also was unfamiliar work for the masons. Cluss had ordered 13,000 buff brick from the Peerless Brick Company and 9,000 sand-blasted blue brick from the Enameled Brick Company — both in Philadelphia. These specialized bricks were rarely used in Washington. Both were difficult to lay with the black mortar. The blackened bricks required extra work. Those above the arches required hand-cutting on site, followed by hauling back and forth to the blackening shed. Red arch brick were ordered purpose moulded. The bricks above the arches required hand-cutting on site. Ornamental work included courses or patterns, pilasters, dentils and corbelled cornices. When the work was completed, The Washington Post commented, “The building is fire-proof and decorated, and not over-decorated, externally with ornamental brick-work, and a ‘master mason’ who was going through the grounds and inspecting the work one day last summer pronounced the masonry to be the best piece of work that he had ever seen.”127

Historical Background and Context 1.1

Rolled and Shaped Wrought Iron

The rolled and shaped wrought iron used in the National Museum building was supplied by the New Jersey Steel and Iron Company of Trenton, New Jersey, and the Phoenix Iron Works, of Phoenixville, Pennsylvania, northwest of Philadelphia. Both companies were leaders in the manufacture of rails and structural iron. The New Jersey Steel and Iron Company, organized in 1866, was the successor to the Trenton Iron Company. Founded in 1847 by industrialist Peter Cooper (1791–1883), his son Edward (1824-1905), and son-in-law Abram Hewitt (1822-1903), the Trenton Iron Company began production of wrought iron beams for floor joists in 1852. By 1856, the company was producing the first I beam with contracts for the U. S. Capitol extension, the U. S. Patent Office, and other federal government projects. The Cooper Union building (1859), between Seventh and Eighth Streets at the convergence of the Bowery and Third Avenue in New York City, was constructed with these early rolled iron beams.128 The Phoenix Iron Company was founded in 1855 by David Reeves (1735-1871) and his son Samuel (1818-1878). In the mid-1850s, this company also turned from the manufacture of rails to structural iron. In 1862, Samuel Reeves designed the Phoenix column, widely used in


Footnote 126: Ibid.


Footnote 128: In 1897 Abram Hewitt and his daughters founded the Cooper Union Museum of the Arts of Decoration in this building. The Museum became part of the Smithsonian Institution in 1967. In 1976, the museum, now known as the Cooper-Hewitt National Design Museum, moved to the former Andrew Carnegie residence at Fifth Avenue and 91st Street in New York City.
construction of bridges and tall buildings (See Figures 66, 67, and 68).

Cluss & Schulze designed a roofing system in which exposed iron trusses span each of the exhibit halls, resting upon the brick masonry bearing walls of the naves, square halls, and ranges. The system is complicated by large clerestories and monitors and double transitional roofs in the valleys between the main halls and the square halls. A light iron framing system rests upon the trusses, supporting slate and metal roofs. The floors of the towers, pavilions, and annexes are constructed with segmental brick arches sprung between rolled iron beams. This was a fireproofing technique frequently used by Adolf Cluss.

Slab on Grade
This new technology eliminated the enclosed joist spaces under floors where fires often originated. It also allowed for installation of extremely heavy new industrial exhibits such as locomotives. Cluss specified hydraulic cement concrete for the museum exhibition area and basement floors. This strong, fast-setting, waterproof material was also used in the foundations. It had been used in the caissons of the Brooklyn Bridge, the foundations of the Statue of Liberty, the Chesapeake & Ohio Canal, and the Washington Monument. Cluss recommended stone aggregate broken by the new machinery of Cranford, Hoffman, and Filbert: “The machinery furnishes a cleaner stone than any broken by hand; the sizes thus furnished are so graduated as to supply pieces sufficiently small to fill interstices to an advantage in the way of a saving in cement. Only costs a little more.”129 He intended that the concrete floors be left exposed and covered with asphalt. Senator James G. Blaine remarked in the Senate, June 10, 1880:

Footnote 129: Minutes of Meetings of the U.S. National Museum Building Commission, 16 April 1879, 53. Box 7, RU 71, SIA.
They are finishing it with a common concrete floor, just such as you have on the street to drive on. The floor that is now designed and that they must adopt if kept within the appropriation which is now granted will be a simple ordinary rough concrete floor on which they propose to put strips of boards for walking. I think that would be a great disfigurement to a building which will be greatly visited, which will be an object and center of interest to all the visitors to Washington and to the whole people of the country. I think the beauty of the building, the beautiful design for which it is intended, and all connected with it deserve at least that there should be a good floor in it.

The Congress appropriated an additional $26,000 “for flooring of marble and encaustic tiles in the large halls of the National Museum building.”

**Glass**

Designing a museum building that would provide the “perfect light” for exhibition purposes was challenging. In the museum, many of the exhibits would be small — presented as collections in glass-fronted wooden or metal cases. Most exhibits, large and small, would be subject to deterioration from ultra-violet light. In the Washington summers, heat and humidity could prove unbearable for both museum personnel and visitors and could damage collections. In winter, large expanses of glass could have equally disastrous effects through the transmission of cold. The glazing requirements for a permanent museum building differed somewhat from those of the temporary exposition buildings. At the conclusion of the project, Cluss noted that in the National Museum building:

90,000 sq. ft. of floor space are lit by 12,600 sq. ft. of glass, equal to 1/7 of the floorspace for glass. According to the best authorities 1/9 of floor space is required (under similar conditions for glass) to exhibit art matters properly. The great Rotunda of the Vienna Exhibition buildings had, for a floorspace of 140,000 sq. ft., a glass surface of 12,000 sq. ft. or less than 1/11 of floorspace for glass. This was considered an excellent light although the sills of the gigantic windows were 180’ above the floor.

In the design for the National Museum, a complex fenestration of clerestories and monitors was developed to bring indirect light into each of the 17 exhibition halls. Skylights were purposefully avoided both for the harmful effects of direct light and for the increased danger of leakage. All exterior windows were vertically installed. All were fitted with double-paned glass for insulation purposes and most were operable. Ground glass was used in the exterior panes of all exhibition hall windows to further diffuse the light entering the museum. The windows of the office and laboratory areas in the pavilions and towers were clear and shaded with awnings in the summer.

At the 1876 Centennial Exposition in Philadelphia, Belgian glass manufacturers exhibited “excellent samples of all kinds of window glass — white, colored, fluted, ground, engraved, enamelled and stained. The glass industry is an important one, and gives support to twelve thousand workmen, the annual value of the products amounting to at least a million dollars.” In 1879, the manufacture...
of window glass of good quality in large quantities was just beginning in the United States. France and Belgium led the world in both quantity and quality of this product. Gradual improvement in the manufacturing process and the construction of improved furnaces and other machines increased production 20% to 25% over a short period of time. In 1877, Belgium produced 18 million to 19 million square yards — nine-tenths of this was exported. In the United States, a heavy duty was laid upon importation of glass. William P. Blake, United States Commissioner at the Paris Universal Exposition in 1878, reported to Congress that the use of gas furnaces had increased production there. He suggested that petroleum, recently applied to the manufacture of iron in the oil region of Pennsylvania, should be used in the manufacture of glass.134

Systems
Building systems engineering technologies evolved quickly in the 1862 to 1890 period in which Adolf Cluss was practicing architecture. New methods of heating, ventilating, and plumbing became out-moded almost before the completion of each building’s construction. Cluss stayed abreast of changing technology, traveling to other cities before each major commission to see how others had solved the problems he was about to encounter. He often participated in AIA discussions, speaking on a variety of topics including acoustics, concretes and mortar, chimneys, and clean water supply. He was particularly concerned with the effective and economical heating and ventilation of the large new building types he was designing. The radiators used in the National Museum were not available when he designed the Franklin School. Insulation through use of cavity walls, mineral wool, and double pane glass were not in general use in 1860s. His early schools placed the imperfect water closets of the day in exterior structures connected to the buildings by covered passageways. In the National Museum, ladies’ and gentlemen’s retiring rooms with running water and modern water-closets were available at the Garfield inaugural reception before the completion of the building. The original electrical system in the National Museum building operated the telephone, telegraph, clocks, buzzers, and burglar alarms. Electric light was installed in the photographic studio for cloudy days or at night. Routine electric lighting for the building was not contemplated, but provision for gas-lighting was included. Spencer Baird observed of this state of the art electrical system, “Indeed it is believed that in no building in the world, with the exception, perhaps, of the Grand Opera House in Paris, is there so perfect and complete application of electricity to practical purposes.”135

In 1859, William C. Baker and John Jewell Smith established a business manufacturing and installing a patented improved low pressure, self-regulating steam warming and ventilating apparatus. A description of this system was published in 1860, revised and republished several times under varying titles as the business of Baker, Smith & Co. flourished. The 1872 version, Steam and Water Warming and Ventilating Apparatus: As Manufactured and Erected Solely by Baker, Smith & Co., listed addresses in New York, Buffalo, and Chicago. The proposal of Baker, Smith & Co. was the lowest feasible bid of nine offered for the installation of a complete steam heating system for the museum.


Footnote 135: Baird, AR 1881, 12.
Heating and ventilating the vast open space of the museum with its lofty ceilings, large areas of glass, slab on grade floor, and constant movement of visitors in and out of the building was a formidable task. Four steam boilers were placed in the basement below the South West Pavilion with steam supplied and water returned through underground piping to and from radiators placed along walls throughout the building. Vents in the spires of the towers assisted winter ventilation. Operable sash in the monitors, clerestories at the Rotunda, halls and courts, and the windows at the side walls assisted ventilation as needed. Insulation of exterior enclosure included cavity brick wall construction and double glazing of window sash. Cluss had designed an insulation system for the metal roofs that would have placed mineral wool or some other such material between the roof and a cramped iron ceiling. Meigs proposed a fireproof system of wooden lath attached to the slate and covered by plaster. He maintained that this would be as effective and would cost considerably less. This latter system was adopted. The plaster began to fall while the building was still under construction. Costly removal of the failed plaster caused great clouds of dust, creating a biohazard and threatening the safety of the collections. Another problem was encountered when it was found that the North East Pavilion, the area farthest from the boilers, was not adequately heated. Two additional boilers were added to correct this problem.

Adolf Cluss, serving as engineer member of the Board of Public Works from 1872 to 1874, had been instrumental in modernizing the water and sewer system of the city. In designing the sewer system for the National Museum, 12" glazed terracotta branch sewers, were run beneath the floor slab, which drained 60 conductors from the roof and the soil-pipes of water closets and basins, connecting to the city sewer at South B Street. Vertical conductors of rainwater and soil-pipes were constructed of heavy cast iron piping with air and water tight joints. Water and gas were supplied throughout the building. Cluss commented:

A 12-inch main pipe was tapped outside of the building and near its southeastern corner. Three parallel lines of 3-inch water-pipe running due north through the building were put in with supply for 16 fire-plugs, numerous street-washers, outlets for closets, basins, and bath-tubs, stop-cocks, &c.

The gas main was tapped on B Street, outside of the southwest corner of the building, and two 4-inch supply pipes were put in, one running due north and the other due east through the building, at an equal distance of about 20 feet from the outside walls of the building. Both pipes are continued, of reduced sizes, in a similar way until they meet at the northeast corner of the building.136

Cluss was aware of the potential problems with his multi-roof system for the building. He noted of the valleys between the naves and square halls, “These roofs are in part constructed double, for the purpose of so perfecting the drainage of the roofs that accumulations of ice and snow can nowhere obstruct it.”137 In addition, his system of monitors, clerestory, and dome lighting purposefully avoided flat skylights, “which for various reasons it was well to avoid.”138 As he ordered all slating halted until the iron dome structure was completed he warned, “Walking over slate causes breakage.”139 As the collections of the

Footnote 137: Ibid, 131
Footnote 139: Minutes of the Building Commission, 10 March 1880, 176. Box 7, RU 71, SIA.
National Museum increased, flat skylights would be added to bring light to interior spaces altered for their accommodation. There also would be much walking over the slate and metal roofs for maintenance, construction, and other purposes.

By 1883, the Brush-Swan system of electric lighting had been successfully demonstrated and installed throughout the National Museum building, replacing the original gas-lighting system installed just two years earlier. Charles Francis Brush (1849–1929) was one of the early pioneers and inventors of electric lighting. He completed his first arc light prior to 1869, first dynamo in 1875, and by 1880 invented a 16-hour double carbon arc lamp, an automatic regulator for multiple lamps, and introduced copper plated arc carbons, solving all of the major problems in arc lighting at the time. On April 29, 1879, Brush staged a public demonstration of his arc lights in Monumental Park in Cleveland, Ohio. In 1879, he also installed his arc lights in the John Wanamaker department store in Philadelphia. Brilliant arc lighting was soon replacing gas lighting in the streets of American cities. In 1860, Joseph W. Swan (1828–1914) obtained a patent in Great Britain for a partial vacuum, carbon filament incandescent lamp. In 1878, he patented an improved version and, in 1881, founded the Swan Electric Light Company. In 1882, he sold his American patent rights to the Brush Electric Company. Incandescent lighting was more suited to residential use than was arc lighting and the system demonstrated at the National Museum in 1883 included both. There was understandably fierce competition in the electric light field. The Brush-Swan system became, through mergers, part of the Westinghouse Electric Company. In 1884, Brush built a mansion in Cleveland that included a basement laboratory with a dynamo, which, powered by a windmill in the back yard, generated electricity for his use.140