

LESSON FOUR: Form and Function



IMAGE TWELVE: Louis I. Kahn. American, born Estonia. 1901–1974. Alfred Newton Richards Medical Research Building, University of Pennsylvania, Philadelphia, Pennsylvania. Overall building complex (final version). 1957–65. Model: basswood, $13\frac{1}{2} \times 22\frac{3}{4} \times 14\frac{3}{4}$ " ($34.3 \times 57.8 \times 37.5$ cm). The Museum of Modern Art, New York. Gift of the architect



IMAGE THIRTEEN: Louis I. Kahn. American, born Estonia. 1901–1974. Alfred Newton Richards Medical Research Building, University of Pennsylvania, Philadelphia, Pennsylvania. Structure of typical laboratory tower (final version). 1957–65. Model: wood, $28\frac{1}{2} \times 23\frac{1}{6} \times 23\frac{1}{6}$ " ($72.4 \times 60.8 \times 60.8$ cm). The Museum of Modern Art, New York. Gift of the architect



IMAGE FOURTEEN: Alfred Newton Richards Medical Research Laboratories, University of Pennsylvania, Philadelphia, Pennsylvania. Louis I. Kahn Collection, University of Pennsylvania, and the Pennsylvania Historical and Museum Commission. Photograph: Malcolm Smith



IMAGE FIFTEEN: Pre-cast beam during transport, Alfred Newton Richards Medical Research Laboratories, University of Pennsylvania, Philadelphia, Pennsylvania. The Louis I. Kahn Collection, University of Pennsylvania, and the Pennsylvania Historical and Museum Commission. Photograph: Ronald C. Binks



IMAGE SIXTEEN: Construction photo, Alfred Newton Richards Medical Research Laboratories, University of Pennsylvania, Philadelphia, Pennsylvania. The Architectural Archives, University of Pennsylvania. Photograph: Marshall D. Meyers



IMAGE SEVENTEEN: Construction photo, Alfred Newton Richards Medical Research Laboratories, University of Pennsylvania, Philadelphia, Pennsylvania. The Architectural Archives, University of Pennsylvania. Photograph: Marshall D. Meyers



IMAGE EIGHTEEN: Construction photo, Alfred Newton Richards Medical Research Laboratories, University of Pennsylvania, Philadelphia, Pennsylvania. The Architectural Archives, University of Pennsylvania. Photograph: Marshall D. Meyers



IMAGE NINETEEN: Louis I. Kahn. American, born Estonia. 1901–1974. Salk Institute for Biological Studies, La Jolla, California. c. 1962. Model. Louis I. Kahn Collection, University of Pennsylvania, and the Pennsylvania Historical and Museum Commission. Photograph: George Pohl



IMAGE TWENTY: Detail of laboratory tower wall, Salk Institute for Biological Studies, La Jolla, California, 2006. Photograph: Lisa Mazzola



IMAGE TWENTY-ONE: Detail of porch off library, Salk Institute for Biological Studies, La Jolla, California, 2006. Photograph: Lisa Mazzola



IMAGE TWENTY-TWO: Detail of laboratory, Salk Institute for Biological Studies, La Jolla, California, 2006. Photograph: Lisa Mazzola



IMAGE TWENTY-THREE: Detail of courtyard, Salk Institute for Biological Studies, La Jolla, California, 2006. Photograph: Lisa Mazzola



IMAGE TWENTY-FOUR: Detail of light wells, Salk Institute for Biological Studies, La Jolla, California, 2006. Photograph: Lisa Mazzola



IMAGE TWENTY-FIVE: Courtyard, Salk Institute for Biological Studies, La Jolla, California, 2006. Photograph: Lisa Mazzola



IMAGE TWENTY-SIX: View of study towers, looking west, Salk Institute for Biological Studies, La Jolla, California, 2006. Photograph: Lisa Mazzola



IMAGE TWENTY-SEVEN: View of study towers, looking east, Salk Institute for Biological Studies, La Jolla, California, 2006. Photograph: Lisa Mazzola

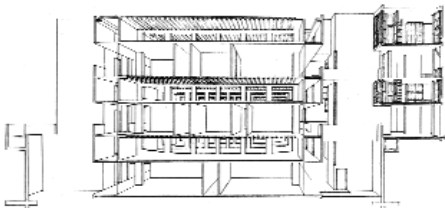


IMAGE TWENTY-EIGHT: Louis I. Kahn. American, born Estonia. 1901–1974. Salk Institute for Biological Studies, La Jolla, California. Section-perspective of laboratory. The Architectural Archives, University of Pennsylvania, August Komendant Collection

INTRODUCTION

In 1957, Kahn was commissioned to design a new laboratory and research facility for the University of Pennsylvania. Due to a rise in student enrollment at the university's medical school, more space was needed for teaching and research. The new building, which was completed in 1960, was named the Alfred Newton Richards Medical Research Building.

In 1955, scientist Jonas Salk was successful in trials for a new vaccine against the virus that caused polio. By 1956, polio had been almost completely eradicated. Salk's vaccine saved thousands of lives and turned the scientist into a celebrity. Fueled by his scientific achievements, he began planning a research facility dedicated to the search for medical advances. In 1959, Salk met with Kahn after touring the Richards Building. He decided that Kahn would be the architect with whom he would collaborate on his new research facility, which eventually became the Salk Institute for Biological Studies.

These buildings were crucial to the development of Kahn's work, as they allowed him to try out new techniques and new ideas in two different projects. Kahn brought what he learned from the Richards Building to the larger scope of the Salk Institute. Previous experience, coupled with a fruitful collaboration with Salk, allowed Kahn to create a highly successful building in form and function.

LESSON OBJECTIVES

- Students will explore the process of building construction through photographic documentation and architectural plans and elevations.
- Students will use primary source documentation to explore the history of a building.
- Students will learn the following vocabulary words: **design brief, model, plan, rendering, concept, and structural engineer.**
- Students will learn about different kinds of building structures and construction techniques.

INTRODUCTORY DISCUSSION

When Kahn was commissioned to design the Richards Building, a committee from the university gave him a design brief, or program. This brief specified that the building must include seventy-five thousand square feet of floor space and separate facilities to house research animals. Kahn's design also included two additional biology towers, which were built after the main structure. There were many rounds of revisions as a result of conflicts between Kahn and the university over space allotments and budget. Kahn created multiple sketches, renderings, and models of his many design iterations. On May 19, 1958, Kahn and his colleagues met to approve a final architectural plan.

- Split the class into two groups: one will represent an architecture firm and one will represent a client. Have the client group designate a design program for your classroom that addresses a need or a problem. This could be larger desks, more shelving, or larger storage spaces. Have the client group also include a budget for the project they have outlined. Have the architecture group make a series of recommendations for ways to address the problem, including sketches of possible ideas and an estimated budget. Ask your students to describe the process of working in groups to address a variety of needs. Did they find it difficult? Why or why not?

IMAGE-BASED DISCUSSION

- Give your students a few minutes to look at the models and photograph of the Richards Building (Images Twelve, Thirteen, and Fourteen). Have your students describe the design of the building.
- Ask your students what they can infer about the function of this building based on how it looks.

Inform your students that Kahn's final design for the site incorporated concrete laboratory towers and brick tower shafts to house all of the mechanical facilities. Kahn felt strongly that "the air we breathe and the air we throw away must be in different channels."¹¹ The concrete laboratory spaces were designed for scientists to conduct research in, and the gasses or by-products of experiments would be expelled from the building through the brick towers. Kahn called the laboratories the "served" spaces and the towers the "servant" spaces, and kept the two separate in his design. This was a new concept for the modern building of the time.

- Ask your students to look at the images again. Ask them to locate the served and servant spaces. Ask your students to explore the idea of a hierarchy of spaces in their school. What is a function of a classroom, versus a hallway or a stairwell? How do the hallways and stairwells serve the classrooms? How are these spaces organized? Are there any similarities between these spaces and spaces outside your school?
- Next, show your students the Richards Building construction photos (Images Fifteen, Sixteen, Seventeen, and Eighteen).

Kahn formed a team of people to collaborate on the construction of the Richards Building, including August Komendant, a structural engineer. Also a native of Estonia, Komendant was educated in Germany. After World War II, he worked in Germany on the reconstruction of bridges that had been destroyed during the Allied bombing. Due to the shortage of steel at that time, Komendant was forced to innovate new ways of building. He eventually developed a system of building with prestressed concrete structures that were prefabricated off-site and assembled onsite. He introduced this method of building to Kahn, and Kahn used it for the Richards Building.

- While your students are looking at the construction photographs, read the following statement by Kahn out loud:

A building is like a human, an architect has the opportunity of creating life. The way the knuckles and joints come together make each hand interesting and beautiful. In a building these details should not be put in a mitten and hidden. Space is architectural when the evidence of how it is made is seen and comprehended.¹²

- Ask your students to consider how a building is like a human body. What structures in buildings and bodies have a common design or purpose?

Eventually, the building skeleton was covered with a protective skin of brick, concrete, and glass.

- Ask your students to look at the construction photos and the images of the models again to see if they can see the seams or joints where building parts join together.

11. Louis I. Kahn, "The Institutions of Man."

12. Louis I. Kahn, quoted in Ronner, Jhaveri, and Vasella, *Louis I. Kahn*, 116.

With the Richards Building, Kahn was trying out a new process of building, using prefabricated pieces that were assembled at the building site. Cranes were used to put each piece in the right place, and workers secured the pieces to each other, ensuring the safety and stability of the building. Share the following quotation by Kahn with your students:

One day I visited the site during the erection of the prefabricated frame of the building. The crane's 200-foot boom picked up 25-ton members and swung them into place like matchsticks moved by the hand. I resented the garishly painted crane, this monster which humiliated my building to be out of scale. I watched the crane go through its many movements calculating how many more days this "thing" was to dominate the site and building before a flattering photograph of the building could be made. Now I am glad of this experience because it made me aware of the meaning of the crane in design, for it is merely the extension of the arm like a hammer.¹³

- **Ask your students to consider this idea. How is a crane like an extension of the arm? What do they have in common? What is different about the way they are structured and used? Encourage your students to consider how they look in order to understand how they are used.**

In 1961, the Richards Building was the subject of an exhibition at The Museum of Modern Art. The show's curator, Wilder Green, described it as "probably the single most consequential building constructed in the United States since the war."¹⁴ Kahn's design clearly demonstrated innovative structural concepts and new principles for the organization of space, and it created a lively dialogue with the older, more traditional architecture of the university campus.

In 1959, Jonas Salk met with Kahn and toured the Richards Building. The two discovered that they shared a common ancestry. Like Kahn, Salk was born to Russian-Jewish immigrant parents and had attended city public schools. An immediate bond was formed; Kahn would forever refer to Salk as his greatest client. In 1960, the two first went to visit the project site that the city of San Diego and the University of California were offering for Salk's research center, on top of a large mesa overlooking the Pacific Ocean to the west and La Jolla to the south. With this commission, Kahn was at last given the chance to establish the entire nature of a space, planning all of its elements alongside Salk. Kahn had a new opportunity to explore his ideas of served and servant spaces, working again with Komendant, who was a partner in the design program, along with Salk.

- **Ask your students if they have had the experience of testing out an idea or technique in different situations. This could include a new sports maneuver or a challenging dance move. Ask them if this idea or experience is the same each time they attempt it. Does the experience change the more times they try something?**

Salk told Kahn that he wanted a place he could invite Picasso to.¹⁵ With this in mind, Kahn immediately saw the need for a design program that would serve the technical and the human needs of the scientists who would use the space.

- **Ask your students to make a list of what they think constitute technical needs and humanistic needs for a space for scientific research. Can they see any similarities to the needs fulfilled in their place of research, their school? Ask your students to consider what Salk meant about inviting Picasso to the research center.**
- **Show your students the presentation model of the Salk Institute (Image Nineteen).**

13. Louis I. Kahn, quoted in Thomas Leslie, *Louis I. Kahn: Building Art, Building Science*, (New York: Braziller, 2005), 92.

14. Green, "Louis I. Kahn, Architect," 3.

15. Peter Reed paraphrases Salk in "Louis I. Kahn," in *Envisioning Architecture: Drawings from The Museum of Modern Art*, ed. Matilda McQuaid (New York: The Museum of Modern Art, 2002), 126.

Kahn and Salk developed a three-part design consisting of laboratories, a meetinghouse, and dormitories for visiting faculty. The laboratories were at the center of the design, and the meetinghouse and the dormitory sat on either side, to the north (left) and south (right) in the presentation model. The laboratories were realized, but the meetinghouse and dormitory have yet to be built.

- **Ask your students to locate all three structures in the presentation model, then ask them how these structures (laboratories, meetinghouse, and dormitories) address humanistic and technical needs. Can this question be answered by looking at this model?**
- **Next, show your students photographs of the built complex (Images Twenty to Twenty-seven).**

Each of the two laboratory structures is six stories tall, comprising three laboratory floors and three mechanical floors that house the utilities that the building needs to function. The selection of building materials was an integral part of the design process. Each material was carefully chosen for specific reasons, with respect to the aesthetic and functional needs of the building. For the laboratory structures, Kahn decided to use poured concrete, travertine marble, wood, steel, brick, and water. Kahn and Komendant designed wooden forms to serve as molds for the building, and concrete was then poured into the formwork. Once the concrete was cured, or hardened, the formwork was removed and the building was revealed. Kahn called concrete “liquid stone.” This process of construction was not entirely uncommon at that time, but what was uncommon was Kahn’s technique of leaving the exposed concrete free from any kind of added ornamentation. The pattern, seams, and joints of the formwork were left visible. In addition, Kahn also left visible the metal form ties (rods) that were used to hold the formwork in place. You can see part of an oval rod in Image Twenty.

- **Have your students look at the detail photographs of the Salk Institute (Images Twenty to Twenty-four). Ask them if they can identify the different building materials. Ask them to consider the nature of these materials and relate that to the function of the space.**
- **Have your students look at Image Twenty. Ask them describe the pattern they see.**

Another integral part of Kahn’s design was the incorporation of natural light. He believed that natural light was a basic human need that should be considered in the design of buildings.

- **In what ways has Kahn incorporated natural light into the building design? Are all of the ways the same? Different? Do the building materials or the environment allow him to do this? Is it a combination of the two? Ask your students to refer to the images to support their ideas.**

In his original design, Kahn included a garden space between the two main laboratories. The space, as built, can be seen in Images Twenty-three, Twenty-five, and Twenty-six.

- **Have your students compare the photograph of the presentation model to the photographs of the space as it exists today. How did the original concept change, as evidenced by these photographs?**

Kahn wanted to include a garden to add to the natural elements of light, water, and trees and to further address the human needs of those who would inhabit the space. “I separated the studies from the laboratory and placed them over gardens,” he said. “The garden became outdoor spaces where one can talk. Now one need not spend all the time in laboratories.”¹⁶

16. Louis I. Kahn, quoted in Ronner, Jhaveri, and Vasella, *Complete Works*, 158.