ATLANTIC RESEARCH CORPORATION

ALEXANDRIA, VIRGINIA KING 9-7500

CHEMISTRY
PHYSICS
ENGINEERING
RESEARCH
DEVELOPMENT
CONSULTING

April 7, 1961

Dr. Krishna Bahadur
Chemistry Department
Allahabad University
Allahabad, India

Dear Dr. Bahadur:

In case you have not heard of a world's fair to be given in Seattle, Washington, U.S., in 1962, I am enclosing some printed material about it. Within the exposition, the U.S. Government is contributing a $9 million pavilion to "show the role of science in civilization." I have for some months past been developing exhibits for this science pavilion, in the general area of cell biology.

In Dr. Sidney W. Fox's papers on the proteinoid substance he has synthesized I found references to work of yours in synthesizing amino acids with sunlight. This seemed to me an admirably simple experiment and a good parallel experiment to show along with Dr. Stanley Miller's synthesis in a reducing atmosphere. The issue of these thoughts you will find enclosed: a rough sketch of the exhibit layout, and a short essay intended to brief the exhibit designer.

I thought you would like to see these, to know that we plan to show your work, and to catch us in any errors of fact that might have been included. Your response will be very much appreciated. Address me at Atlantic Research.

Sincerely,

David M. Paul, Jr.
Technical Communications
Specialist
Atlantic Research Corp.

Science Exhibit Developer
U.S. Science Exhibit
Century 21 Commission
U.S. Dept. of Commerce

ATLANTIC RESEARCH CORPORATION
ALEXANDRIA, VIRGINIA

David M. Paul, Jr.
April 6, 1961

Exhibit:
CAN WE CREATE LIFE SUBSTANCES?
Report

I REFERENCES

Please consult CE-3 form dated December 19, 1960, "How Did Life Substances Arise on Earth?" and enclosures; CE-3 form dated February 16, 1961, "How Can Amino Acids Be Combined into Protein-Like Materials? How Can These Materials Organize Themselves into Pre-Cell Models?" and enclosures, especially the Layout Sketch; and the Addenda Sketch dated February 28, 1961, "How Could Amino Acids Have Arisen on the Primitive Earth?" Note, however, that this report and the Layout Sketch provided in it supersede or include most information given in the earlier submissions, and where earlier work differs with this report, this report is to be followed.

II GENERAL BACKGROUND

Protein is the substance most characteristic of living things and amino acids are components of it. The question 'How did life arise on earth?' is therefore phrased in terms of the origin of amino acids and proteins.

For proteins to have arisen, amino acids probably had to exist; for amino acids to have arisen, simpler molecules must have been available, and in both cases some source of energy was required to assemble simpler substances into those more complex.

There is yet no general agreement on substances or sources. Thus, two different ways in which amino acids

✓ Dr. Bahadur

might have arisen, and a way in which proteins might have arisen from a third possible source of amino acids, are all to be shown.

Consult: Scientific American v. 191 August 1954 p. 44: G. Wald, "The Origin of Life."

II DISCUSSION OF THE DISPLAYS

A. How Did Amino Acids Arise on Earth? Can We Create Them?

The question of the origin of amino acids is phrased in terms of (1) what simpler substances and (2) what form of energy interacted to form them.

A direct approach to the question is to mix the likeliest substances together (making a miniature facsimile of primeval conditions), inject the likeliest kind of energy, and see what happens. Both Miller and Bahadur have taken this approach.

Miller found that circulating a mixture of methane, hydrogen, ammonia and water vapor (all gases thought to have been present in the primeval atmosphere) continuously through an electrical discharge (the energy of lightning) yielded, among other things, amino acids.

Bahadur found that a mixture of water, formaldehyde, potassium nitrate and ferric chloride (all substances which might have been present in the primeval sea) when exposed to strong sunlight would yield, among other things, amino acids. Both men detected the presence of these acids in the product by techniques of paper chromatography.

Thus, we can create amino acids, and we have at least two good ideas how those amino acids could have occurred on the primeval earth.

Consult: Science v. 117 May 15, 1953 p. 528: S.L. Miller, "A Production of Amino Acids Under Possible Primitive Conditions"
Consult: Nature v. 173, June 12, 1954 p. 1141: K. Bahadur, "Photosynthesis of Amino Acids from Paraformaldehyde and Potassium Nitrate."
Consult: Scientific American v. 184 March, 1951 p. 35: W.H. Stein & S. Moore, "Chromatography," espec. pp 39-41.

B. How Did Proteins Arise on Earth? Can We Create Them?

Again we must ask how simpler substances combined to form those more complex, and what furnished the energy required to combine them?

There are many amino acids in nature, a few of them not found in any living organism. Thus, one of the first questions to ask was 'Which amino acids might have combined to make the first protein?' Fox learned by chemical analysis what amino acids were common to all present forms of life, in what general proportions, and reasoned that these might also have been the original constituents.

The next question was 'What kind of energy might have made them combine?' Chemical know-how made heat energy a likely candidate, and Fox learned that the right amino acids in the right proportions, exposed to heat in a certain way, did indeed yield a substance very much like protein.

How much like protein? Certain laboratory tests have long been in use to detect protein; if Fox's artificial

substance gave similar reactions to these tests, its similarity with natural protein would be established.

Consult: Science v. 128 November 14, 1958, p. 1214: S.W. Fox, "Thermal Copolymerization of Amino Acids."
Consult: General Biochemistry, J.S. Fruton & S. Simmonds, Wiley 1953: biuret test p. 128 no. 3; xanthoproteic test p. 67; other color tests for protein p. 70.
Consult: Scientific American v. 189 October 1953 p. 42: B. Crawford, Jr., "Chemical Analysis by Infrared," espec. p. 43.

How could this synthesis, successful in a test tube, have taken place on the primeval earth? From his test tube synthesis Fox knew that one important condition must have been the near absence of water, for the presence of water in the test tube spoils the synthesis. Another important condition must have been considerable heat, and yet the temperatures involved in the synthesis seem rather high for protein or for life. However, Fox found in the work of Copeland that thermophilic algae, which show signs of being direct descendants of very primitive organisms, live in temperatures near boiling.

What geological location on the primeval earth might have provided this degree of heat, a supply of amino acids, and an essentially dry condition? Fox speculates that one such location might have been a pocket under the ocean floor, close enough to receive the right degree of heat from a volcanic 'chimney.'

All living things are largely composed of water, and for this and other reasons it is thought that the first truly living organisms probably appeared in the sea. Thus

Fox speculated on what might happen to the hot product of his theoretical undersea 'pressure cooker.' Like Miller and Bahadur, he was led to reconstruct the primeval situation in his laboratory. Proteinoid was made and immediately mixed with water. The exciting result is shown in Figure 1. These uniform, microscopic spherules exhibit many - though certainly not all - of the properties of cells.

Consult: Science v. 129 May 1, 1959 p. 1221: S.W. Fox, "Production of Spherules from Synthetic Proteinoid and Hot Water."

C. Unanswered Questions

How do molecules organize themselves 'spontaneously'? One problem in considering how life might have arisen spontaneously has always been that of the ordering mechanism. It was until relatively recently thought that the molecules which made up 'the primeval soup' were 'at loose ends,' just as it was thought that, within the visible structures of living cells, the organic substances were pretty much adrift. However "a change in view has come about because we now realize that it is not altogether necessary to <u>bring</u> order into this situation; a great deal of order is implicit in the molecules themselves...Lately it has become clear that very little of a living cell is truly fluid. Most of it consists of molecules which have taken up various degrees of orientation with regard to one another..given the right molecules, one does not have to do everything for them; they do a great deal for themselves,"* and scientists are only beginning to inquire how.

Note that Fox discovered that amino acids will combine to make proteinoid only when a larger proportion of two acids, glutamic and aspartic, is included. This seems to indicate that molecules of these two acids have implicit organizing ability - "they do a great deal for themselves."

What effect will the molecules of nucleic acid have on the synthesis of proteinoid? Dr. Fox has begun to inquire how this molecule, regarded as the master organizer, may interact with the amino acids. He and others will be asking, also, at what stage nucleic acid entered the primitive life picture?

Is life beginning now? "Although we can with certainty say only that life arose at least once, there is increasing reason to believe that life can, or even must, arise in many places at many times."** One reason to suspect this is the fact that identical floral patterns have been found in hot springs areas throughout the world. Do we "fail to recognize life beginning anew because it so resembles unevolved descendants of primitive forms already here," for example, thermophilic algae? "We have less reason to exclude this possibility than formerly. Perhaps we may evaluate this more precisely as we learn about the chemistry of the interior of the earth."**

---

* Scientific American v. 191 August, 1954 p. 44: G. Wald, "The Origin of Life."
** Science v. 132, July 22, 1960 pp 200-208: S.W. Fox, "How Did Life Begin?"

IV NOTES ON PRESENTATION AND SOURCES OF DISPLAY ITEMS

A. Miller Experiment

Audience interest can be heightened by conveying that (1) they are witnessing the continuous transformation of inorganic substances into organic substances, precursors of life; (2) the large flask contains a miniature facsimile of the earth's atmosphere before life began; (3) the original experiment was devised and carried out by a graduate student.

The three sets of apparatus are to be started at intervals of two days. The condensate will become noticeably pink the first day, and by the end of a week deep red and turbid; with three sets going in overlapping phases, one glance will convey the changes of a week. A live attendant should drain off samples of the condensate before the audience, and perform paper chromatography with a simple short explanation of the principle. The ingredients should be replaced each week; very little training will be required for this maintenance.

The apparatus is a closed system of glass except for the tungsten electrodes. A 500-milliliter flask and a 5-liter flask are connected by glass tubing in a boiling-condensation cycle with a trap for the condensate. Sources are listed in the CE-3 form of December 19, 1960.

B. Bahadur Experiment

Consult the Addenda Sketch dated February 28, 1961. Source for Miller apparatus can provide flasks required.

C. Fox Experiment

1. Amino acids to include: alanine, arginine, aspartic acid, cystine, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tryptophan, tyrosine, valine. As I have indicated on the Layout Sketch, the quantity of glutamic and aspartic acids must be obviously larger than that of the others. This company can supply these acids: California Biochemicals, 3625 Medford St., Los Angeles 63, Cal.

2. Tests for protein: Dr. Fox may have available for photocopying, by this time, some records of infrared absorption. He has expressed the willingness to perform the protein color tests for Century 21's camera; but these are very simple chem lab stuff and perhaps you can arrange to have them done in New York.

3. Thermophilic algae. My source for the following information is Dr. C.C. Copeland, Department of Biology, City College of New York. Dr. Copeland tells me that the idea of keeping a live culture of thermophilic algae in the exhibit for the length of the show is quite sound. He suggests Phormidium laminosum, one of the commonest, which is found in Mammoth Hot Springs at Yellowstone National Park. He suggests that you contact the Superintendent of the park, or the Ranger Naturalist Service, to procure the culture.

This algae has good temperature tolerance, from 40° to 60° Centigrade. Its liquid medium must be continuously agi-

tated or recirculated, and certain minerals must be supplied by it (for advice contact a scientist who is growing algae, e.g., Dr. Dean Burk, National Institutes of Health, Bethesda, Md.). These algae are a clear blue-green ordinarily, and turn buff or tawny at higher temperatures. Strong light and higher temperatures will bring out their most intense coloration. During the 6-month run of the show, the culture is likely to overgrow its container and should be broken up and placed in new liquid medium once or twice.

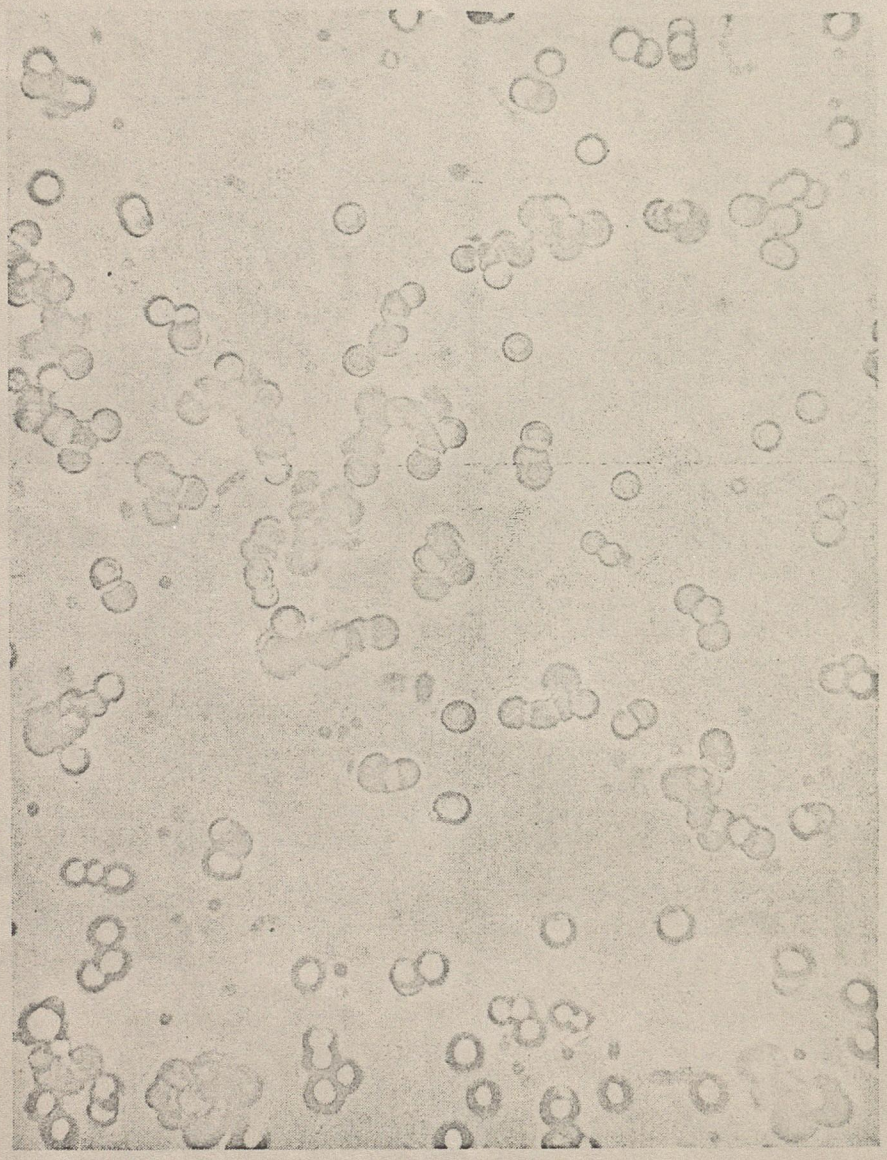
4. Wet vs dry. The stuff in the test tube marked "wet" is completely useless black tar or sludge. The tube marked "dry" contains proteinoid, off-white in color and powdery in texture. Either actual tubes or a photograph in color may be used.

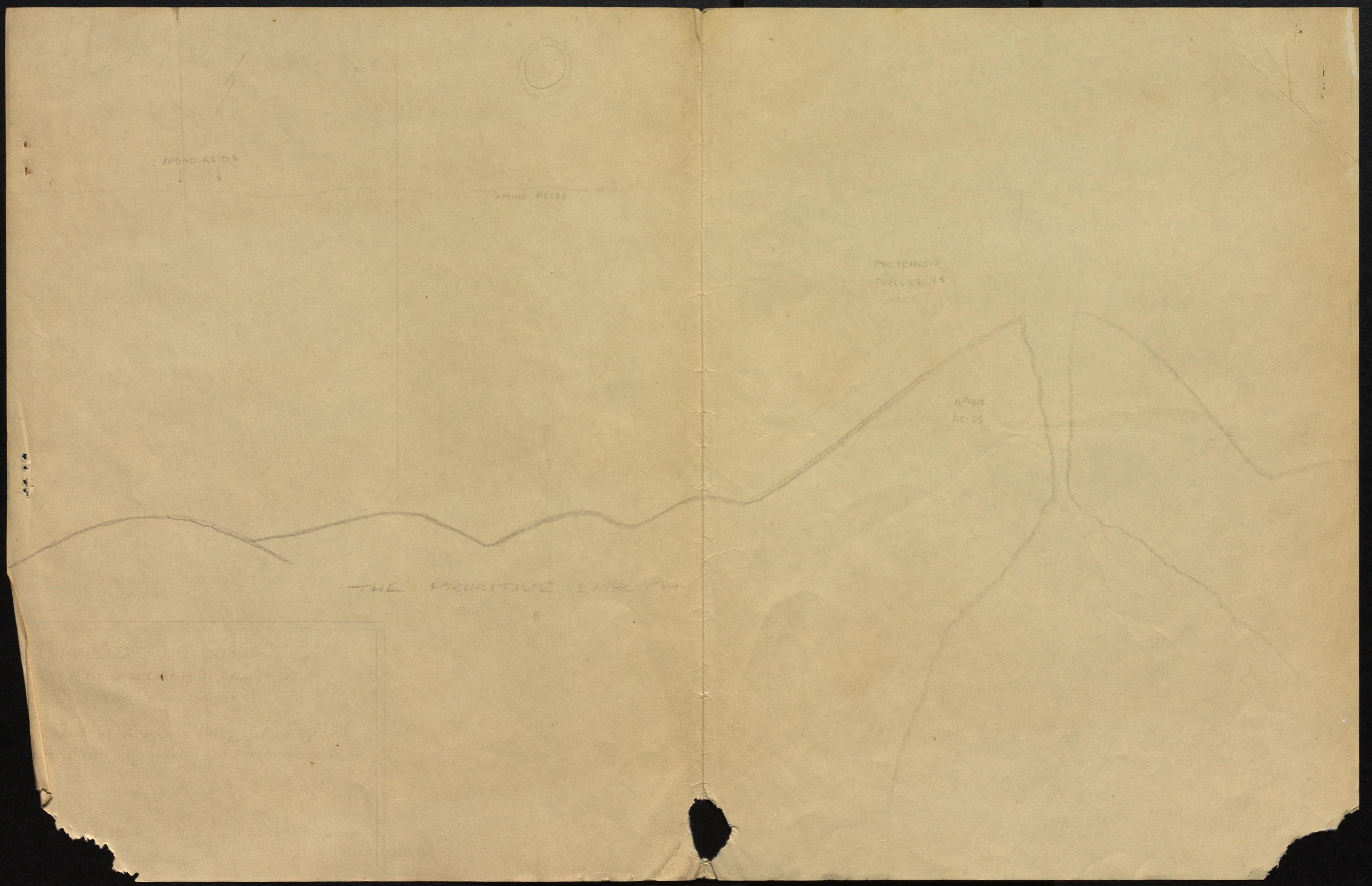
5. Geological background artwork. Please be guided by the glass-mounted slide enclosed in the CE-3 form. It was made from artwork supervised by Dr. Fox.

6. Films. Such films have already been made for inclusion in a movie for the National Aeronautics & Space Administration. Contact Mr. Byron Morgan in the Washington headquarters.

David M. Paul, Jr.

Figure 1
Individual & aggregated microspheres from hot potassium thiocyanate solution and proteinoid (x1550)




AMINO ACIDS
AMINO ACIDS
PROTEINOID
PRECURSORS
AMINO
ACIDS
THE PRIMITIVE EARTH

1.

Oparin

Bernal

Urey

Background on speculation concerning primeval conditions is artwork depicting theoretical environments of three leading theorizers, with short descriptive captions.

THIS ARTWORK TIES IN WITH ARTWORK SHOWING SIDNEY W. FOX'S THEORETICAL ENVIRONMENT FOR SPONTANEOUS GENERATION OF PRE CELL MODELS.

ADDENDA: "HOW COULD AMINO ACIDS HAVE ARISEN ON PRIMITIVE EARTH?"
amplifying the exhibit centered on apparatus of Stanley L. Miller

2/28/64 Exhibit Developer David M. Paul Jr.
Atlantic Research Corporation

2.

Miller Apparatus:

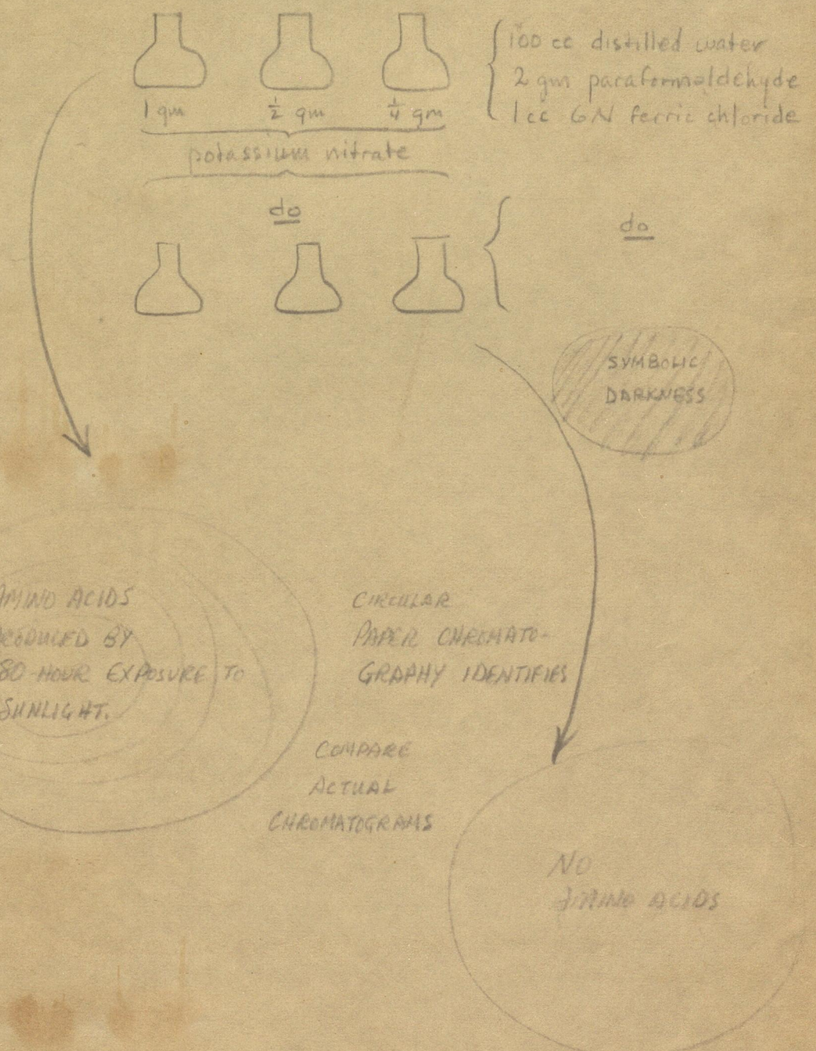
Use three setups, initiated at intervals of two days, to show color change.

Have provision in apparatus to draw off accumulation and perform chromatographic identifications etc.

3.

BAHADUR EXPERIMENT

Dr. Krishna Bahadur, Chemistry Dept., Allahabad University, Allahabad, has used sunlight to do the same job. In parallel with Miller apparatus, set up a simulation of Bahadur's experiment;



Reprinted from AIBS BULLETIN, June 1960

A request for suggestions toward making the Century 21 Exposition more scientifically meaningful

Harold F. Osborne

Director, Biology News Bureau, AIBS

Science and Century 21

BIOLOGY will have an unusual opportunity to serve the public, to display its own shining scutcheon and to advance the banners of all science during the summer of 1962 at the Century 21 Exposition in Seattle, Washington.

This world's fair—comparable in scope to the Brussels Exposition—has for its major purpose the depiction of the role of science in our civilization.

The federal government has appropriated $9,000,000 for a principal pavilion in which the world of science will display its esthetic treasures, its intellectual challenges and its tangible products.

This will be the first time that the U.S. Government has selected science to be the subject of its participation in an exhibition. It is, moreover, the first to ask scientists' assistance in determining content and focus of scientific displays. The emphasis of science in the exposition is to be a primary one. The Century 21 Exposition, of which the U.S. science exhibit will be a part, will differ from past fairs by not offering a review of man's progress, but, rather, an insight into his future; a portrait of his life in the 21st century. International exhibits of commerce, industry, arts and culture are proposed to demonstrate how men will live, work and play in the coming century. Shops and entertainment areas will augment these attractions. But the Science Exhibit in the federal pavilion will be dominant.

Herein appears to lie the possibility for bridging the gap between what the biological sciences are and what the public thinks they are, and perhaps a unique opportunity to impress youth with the significance of science.

The preliminary preparations have been underway for two years. The staff of the Century 21 Exposition, the Washington State Legislature, a National Science Planning Board of 23 distinguished scientists, and representatives of the Department of Commerce—the agency designated by the President to develop and make recommendations for federal participation—have contributed jointly and individually.

But ahead are problems of both a scientific and non-scientific character which must be solved if an authentic, integrated, challenging, informative and timely science exhibit is to be offered.

From consultation with representatives of the Exposition, there is no doubt in my mind that the principal need is to communicate method, meaning, background and significance to an audience which the planners estimate will move past a given point at a rate of one person per second.

This flow rate is predicated on an expected 8,000,000 visitors to the federal pavilion over a six-month period, and on an average time-per-visitior of about an hour in the entire U. S. Science Exhibit.

The sponsors are hopeful the exhibits will lure many patrons back for a longer, second visit after they have seen other parts of the 74-acre exposition grounds.

Specifications call for science displays which will make use of color, movement and spectator-involvement, to avoid the static and pedestrian conglomeration of a hobby show or a machinery exhibition.

It is perhaps conceivable that a push-button simulation of a Cape Canaveral launching can be arranged to be repeated at approximately the one-second interval. Perhaps Newton's Second Law of Motion or a cycloramic depiction of succeeding geological ages can be so presented. But can an ecological community, the principles of photosynthesis and energy transfer, the mystery of inheritance or the inter-relation of structure and function be condensed to flash-card form?

Still more to the point, can the complexity of living matter and life processes, the open-endedness of the biologists' approach and the question-asking nature of the scientific method be so compacted? These are important problems confronting the planners of the exhibit.

Philip M. Evans, Federal Commissioner, U.S. Science Exhibit, has selected Walter Dorwin Teague Associates as exhibit designers, and a team of architects—Minoru Yamasaki of Detroit, and Narramore, Bain, Brady and Johanson of Seattle—to handle the physical aspects of exhibit presentation, traffic-control and display housing.

He has called on scientific resources in government, private industry and the academic world to suggest both specific exhibit items and general ideas which can be put together with scientific integrity and within limits of budget and time.

At this writing, the planning is not frozen as to final scientific content. I am assured that exhibit ideas are welcomed from the world scientific community. I am hopeful that imaginative suggestions will be forthcoming in such quantity and scope that a reversal of the one-thought-per-second-is-enough tack will be automatic and inevitable.

The thematic framework, on which content, organization and architecture of the Science Exhibit are to be based, has been developed as a five-part demonstration of "the role of science in modern civilization." The concept is intended by the Exposition to reinforce the integrity of science as a force in history and contemporary life.

The Exposition framework is described:

In the introductory area (Area I) a multi-screen theater is being considered to introduce the messages of the exhibit and to enumerate problems to which science contributes solutions. In so doing, several concepts will be developed:

The nature, origin and growth of science; the values of science; the origin and impact of technology; and new problems and responsibilities in a changing world.

This section is intended also to delineate the propositions that knowledge is desirable for its own sake, that greater scientific activity will be required to solve problems of the future and the present, that support for scientific pursuits should be encouraged and that all citizens have responsibility for wise application of the findings of science.

The statement of plans continues:

"These basic concepts will be illustrated on several screens simultaneously to permit concurrent handling of this number of interrelated subjects in ten minutes. Film presentation will provide a controlled introduction before the audience moves into the main science exhibits.

"Area II, an area of 19,000 square feet will provide an introduction to science, its great men, great moments, unintentional discoveries, tools, method, breadth and scope.

"Area III may take the form of a 'spacearium,' or planetarium-once-removed, designed for audience orientation in space research and space perspectives, and for illustrations of time, distance and matter-energy relationships which require the cosmic scale. Here, again, the audience will have a ten-minute 'theatre' experience under a 75-foot dome, plus a close-up celestial education center.

"Area IV, the principal portion of the U. S. Science Exhibit, occupying space larger than a football field, will deal exclusively with scientific research. The American Institute of Biological Science and other scientific groups have been invited to help develop exhibitable concepts and ideas for areas where life sciences can be featured. Because of the breadth of research, timely items will be the most difficult to select and coordinate."

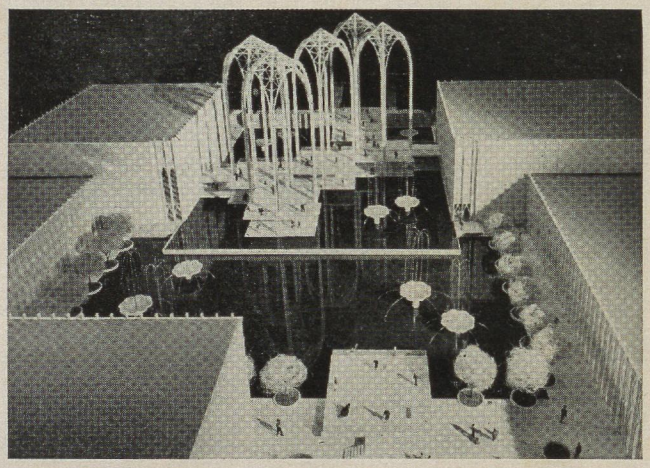
The opportunity to make an impact on 8,000,000 persons, with a dynamic exposition of the scientist's approach, and the results of his endeavor, is tempting.

How to present biology adequately and elegantly in a space-time continuum bounded by non-stop spectators is an even greater challenge.

Every effort will be made to avoid the natural tendency to emphasize technology, to confuse research with development and scientific end-results with gadgetry.

Hence, if science is to be faithfully depicted, it can logically be expected that the biological disciplines will do it, if for no other reason, perhaps, than that biology has less hardware to dramatize.

It can be observed, too, that the expected traffic rate is statistical only. Surely if biology is portrayed with sufficient quality and scope, the one-per-second average will be buried under an avalanche of delighted and stimulated spectators.



It remains only to provide the imagery, to capture in exhibits the zest of scholarly endeavor and the momentum and sweep of independent research, to unroll the panoramas of uncharted territories, to tune in the rhythms and harmonies of intellectual application, to unveil the mysteries and expose the satisfactions inherent in scientific literacy.

Biologists with ideas and, particularly, with specific, detailed and comprehensive proposals, should communicate them directly to Philip M. Evans, Federal Commissioner, U. S. Science Exhibit, U. S. Department of Commerce, Washington, 25, D. C., or to AIBS.

UNITED STATES DEPARTMENT OF
COMMERCE
Frederick H. Mueller, Secretary Washington 25, D. C.

Century 21
U.S. Science Exhibit

For Release Friday, November 18, 1960 EXH 60-9

Philip M. Evans, Commissioner for the U. S. Science Exhibit, announced today that Charles Eames, award winning designer of Venice, California, will produce a special multi-screen color film introduction to the Federal Science Pavilion, a major six-acre installation at the Century 21 International Exposition scheduled to open in Seattle, Washington, on April 21, 1962.

Recalling that Eames had written, filmed, and produced the successful seven-screen "Face of America" film presentation seen by two and a half million Russians at the American Exhibit at Moscow, Commissioner Evans said: "Many people either think science has all the answers, or that it will have the day after tomorrow. Actually science is a fascinating and continuous process of creative exploration which uncovers new questions as old ones are answered. In only ten film minutes Charles Eames successfully communicated the nature and spirit of America to the Russian people; he has the same amount of time to excite Americans about science. Frankly, we look forward to an unforgettable event. The Eames production will introduce the five-building United States Science Exhibit.

Since his work for the American Exhibition at Moscow, Eames has been designing another exhibit for use by USIA in Russia on the history of transportation in the United States. He recently produced film segments of the CBS award winning television presentation "The Fabulous Fifties."

Mr. Eames was born in St. Louis and attended public school there, also Washington University where he studied architecture. He has won numerous awards, not only in the field of architecture, but also for film presentations. Among these are the Edinburgh International Film Festival in 1957 and 1958, the American Film Festival trophy, 1959 and the Scholastic Teacher's 11th Annual National Film Award in 1960. He was awarded the Gold "Craftsmanship" Medal 100th Anniversary of the American Institute of Architecture in 1957, and the National Industrial Design Council of Canada award in 1959. This year he was given the Design Award by the Philadelphia Museum School of Art.

NEWS RELEASE

CENTURY 21 EXPOSITION SEATTLE, USA; APRIL 21 TO OCTOBER 21, 1962

EXPOSITION BUILDING; SEATTLE 9, WASHINGTON

FOR RELEASE 2 P.M. MONDAY, JUNE 6:

WASHINGTON, D.C. -- A spectacular pavilion to house the United States Government's $9,000,000 program of over-all participation in the 1962 Century 21 Exposition in Seattle, was unveiled in model form here today.

As a principal theme building for the international exposition, the pavilion will house the most extensive science exhibit ever assembled by the United States, depicting the role of science in modern civilization.

Participating in the ceremonies, held in the lobby of the Commerce Department were Under Secretary of Commerce Philip A. Ray, Senator Warren G. Magnuson (D-Wash) and Philip M. Evans, U. S. Commissioner for Century 21 Exposition.

Architects for the $3,500,000 five-part pavilion, which will cover approximately 110,000 square feet on a six-acre landscaped view site, are Minoru Yamasaki of Detroit and Naramore, Bain, Brady and Johanson of Seattle.

International displays from the world's outstanding scientific research organizations will be included in the integrated exhibit.

Built to tell the story of science's "esthetic treasures, intellectual challenges and tangible products," the complex of five structures will be joined around a courtyard pool and fountains, reflecting arching domes on the terrace.

As he enters, the spectator will be introduced to the broad science theme, with the story told on a multi-screen theater. The other buildings will house such unique concepts as a "spacearium," or planetarium from which the solar system is viewed as if from a point in space.

Century 21 Exposition will have on its 74 acre site international exhibits of commerce, industry, arts and culture, keyed to the theme of how man will live, work and play in the coming century.

But the Federal Science pavilion is expected to be the dominant exhibit, and the one which sets Century 21 aside as a truly unique exposition, according to government spokesmen.

It will be comparable in size and scope to the American Pavilion at the Brussels World Fair, as will the state of Washington's Coliseum Century 21, the exposition's second theme building.

The $9,000,000 program of participation represents the largest single appropriation ever made by the Congress for a domestic exposition. The event itself is the first of its kind to be held in the United States since the San Francisco and New York World Fairs of 1939.

Coordinating the program is the U. S. Department of Commerce, designated by President Eisenhower, under the direction of United States Commissioner Philip Evans and his staff.

Top scientists, educators and government research specialists for two years have been planning the exhibit, convinced that the story of science can have tremendous "box office" appeal for the 10,000,000 visitors expected at Century 21 Exposition. They have called on scientific resources of government, industry and education to insure an exhibition combining popular appeal with strict scientific integrity.

Creating the exhibit concepts has been a science advisory group, selected by Commissioner Evans, which has been meeting weekly under the direction of chairman Dr. Orr Reynolds, director of the office of science, Department of Defense. Basic themes were the product of the National Science Advisory Board, headed by Dr. Froelich Rianey, director of the University of Pennsylvania Museum. Many of the eminent scientists involved in these activities have served on both panels.

Walter Dorwin Teague Associates will be exhibit designers. Specifications for the display call for the use of color, movement, and spectator-involvement to a degree never before planned. Every effort will be made to determine exact content of the show on an up-to-the-minute basis of the latest scientific developments.

UNITED STATES DEPARTMENT OF
COMMERCE
Frederick H. Mueller, Secretary Washington 25, D. C.

Century 21
U.S. Science Exhibit

FOR IMMEDIATE RELEASE WEDNESDAY, OCTOBER 19, 1960 EXH 60-8

JOINT RELEASE OF THE UNITED STATES SCIENCE EXHIBIT, DEPARTMENT OF COMMERCE AND BOEING AIRPLANE COMPANY

Plans for a unique spacearium in which spectators will experience a simulated swift voyage to outerspace at the Century 21 Exposition in Seattle in 1962 were jointly announced today by the Office of the Commissioner, United States Science Exhibit, Century 21 Exposition, Department of Commerce, and the Boeing Airplane Company.

To be presented in a specially equipped unit of the United States Science Pavilion, the spectacular space voyage will be co-sponsored by the Federal Government and Boeing Airplane Company.

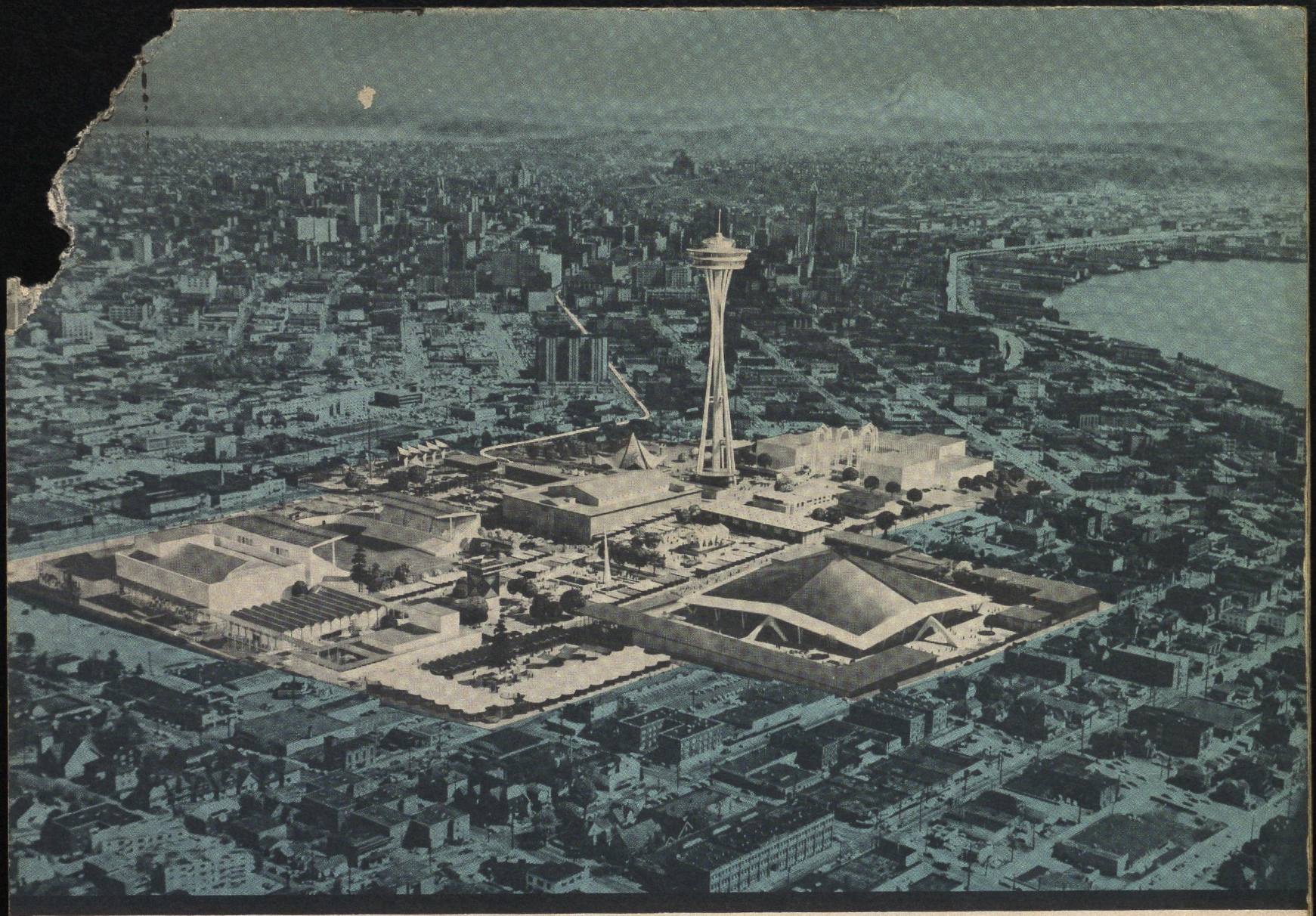
Philip M. Evans, Commissioner for the United States Science Exhibit, stated "Boeing's participation is a series of blue ribbon firsts--the first major American industry actually signed into the Federal Pavilion, the first production of an outerspace voyage among the moving heavens in the world's first spacearium."

Boeing's interdepartmental committee headed by Harold Mansfield, Special Assistant to the President, has been working for several months with Mr. Evans and Walter Dorwin Teague Associates, design consultants, in laying plans for the exposition.

"We decided to combine forces with the United States Science Exhibit in order that our joint budgets might be used to create a truly outstanding space experience as a major feature of the fair," Mr. Mansfield said. "The exhibition will be staged in a separate building in the Federal group. The possibility that the building may be obtained for community use as a permanent spacearium after the fair is being investigated, with the thought that it could be a valuable asset in preparing students and the public for space age achievements of the future."

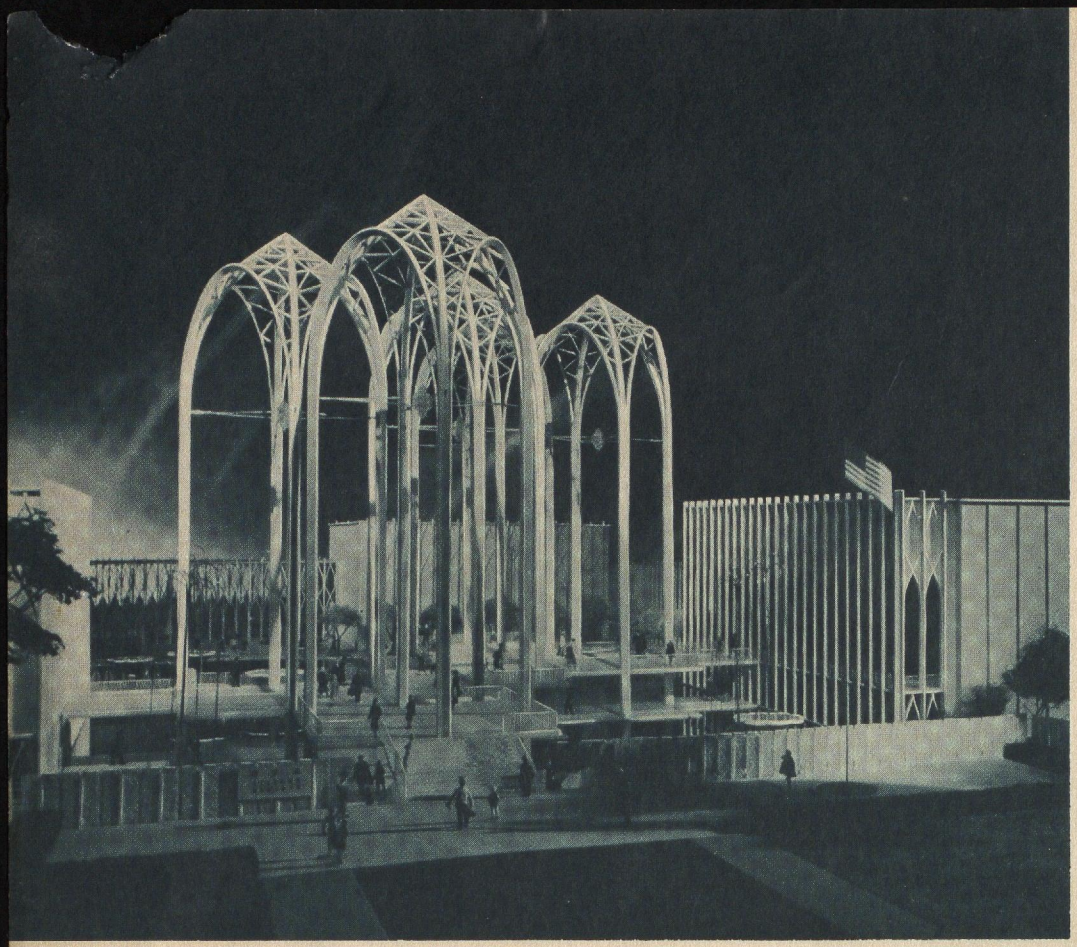
In their simulated space voyage, spectators at the Century 21 Exposition will travel at tremendous speeds through the heavens to give them a wider ranging space perspective with realistic closeup looks at Moon, Earth, planets and other heavenly bodies. A program will be developed under the supervision of Commissioner Evans with the aid of an advisory committee including representatives of Boeing, the national science community, Walter Dorwin Teague's organization and the technical producers. Mansfield and Dr. Walter Hiltner, Acting Space Section Head, Aero-Space Division, Engineering Department, will represent Boeing in the group.

Comm--DC--47218 - 0 -

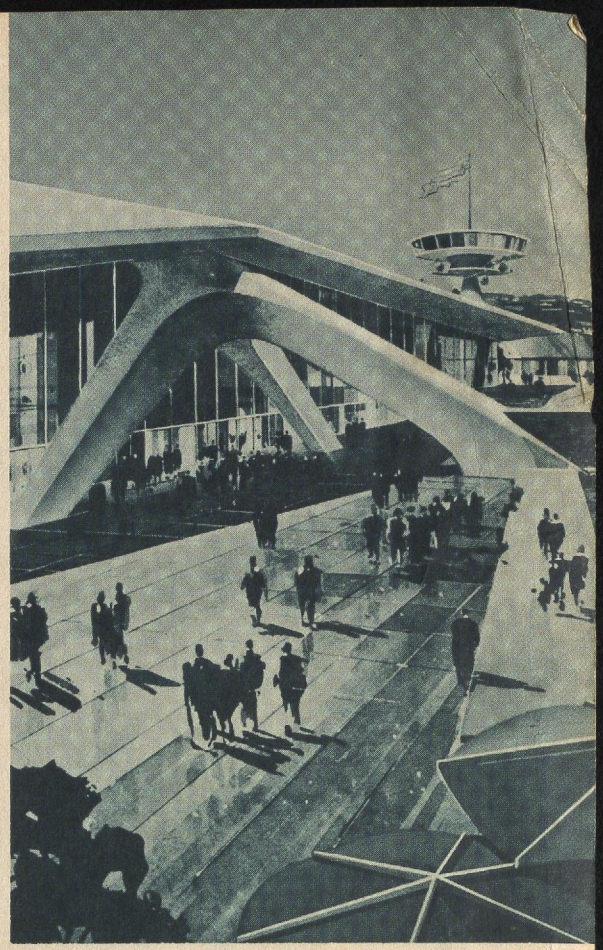


CENTURY 21 EXPOSITION

SEATTLE, U.S.A. 1962

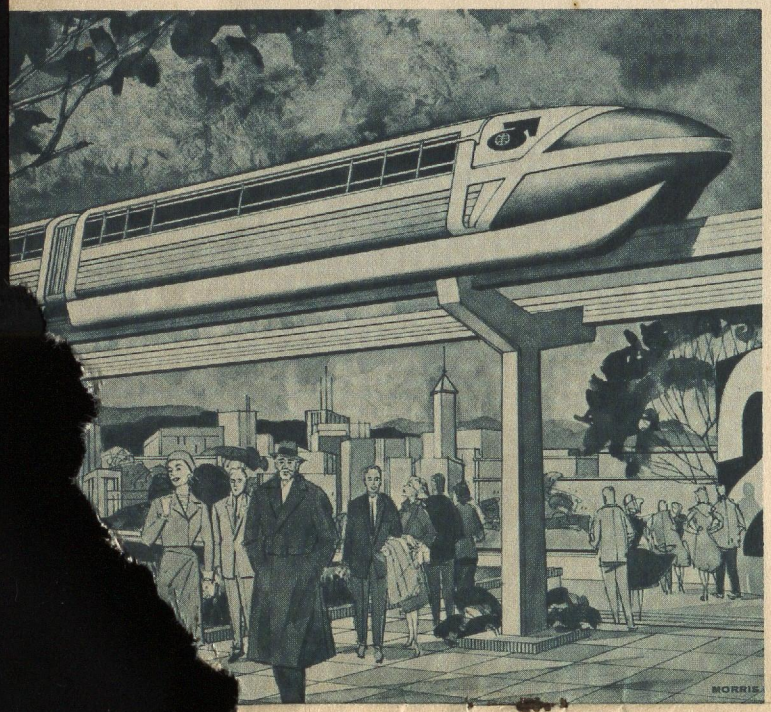


▲ *United States Science Pavilion*

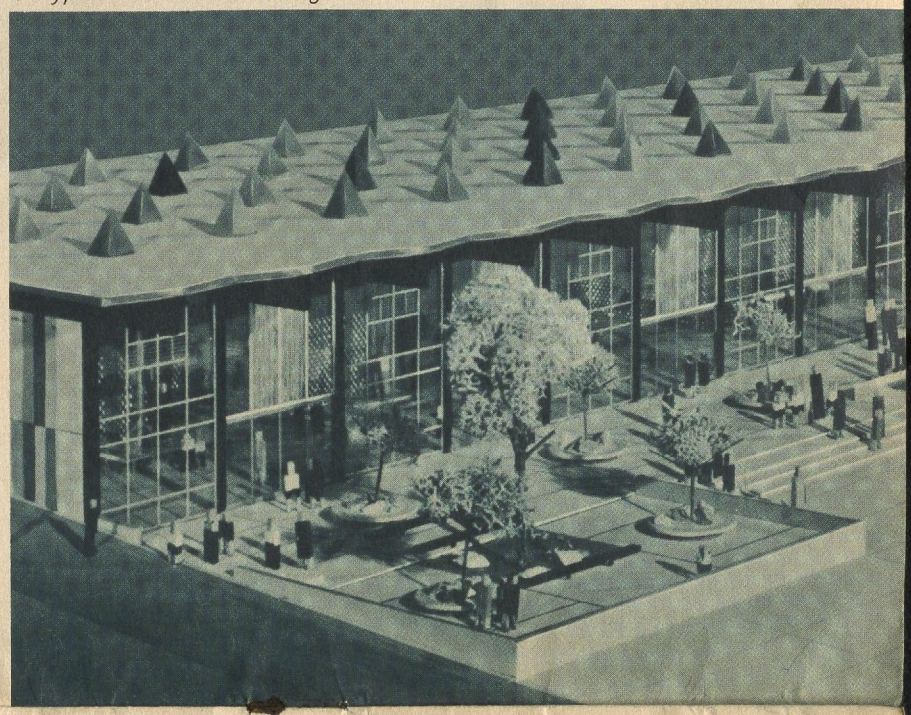


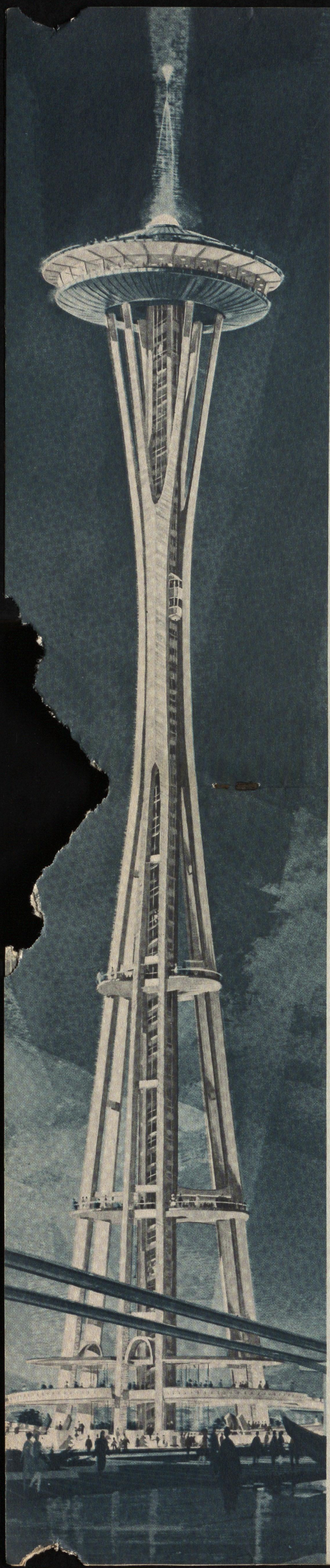
▲ *Coliseum Century 21 Theme Building*

Monorail ▼



▼ *Typical Exhibitor Building*





World of Science

The most extensive science exhibit ever assembled will be seen in the United States Science Pavilion, larger in size and scope than the U. S. Pavilion at the Brussels World's Fair in 1958. A simulated rocket journey into space in the world's first "spacearium" will be one of many features. The National Science Planning Board, representing 20 of the nation's leading scientists, is assisting the U. S. Department of Commerce in planning this $9,000,000 World of Science exhibit. Architects: Minoru Yamasaki of Detroit and Naramore, Bain, Brady & Johanson of Seattle. Designers: Walter Dorwin Teague and Associates of New York City, and Charles Eames of Los Angeles.

World of Century 21

Coliseum Century 21, the Washington State theme building covering almost four acres, is a $7,500,000 "World of Century 21" exhibit which will depict how man will live, work and play in the century ahead. Glass walls enclose 129,000 square feet of unobstructed exhibit space. Architect: Paul Thiry of Seattle. Exhibit designers: Donald Deskey Associates of New York City and Herb Rosenthal of Los Angeles.

World of Commerce and Industry

This important sector of the Exposition will present a picture of the world's latest industrial and commercial developments. Exhibitors, including industrial firms and foreign governments are building and leasing space.

World of Art

The 40,000 square foot Art Exhibition Hall will present a magnificent panorama of painting and sculpture from the Renaissance to the 20th Century. In the adjacent 800-seat theatre there will be lectures and films on both contemporary and historical masterpieces and the great artists of every epoch.

World of Entertainment

A continuous international parade of performing arts, sports and spectator events appealing to the tastes of young and old will take place at Century 21.

Staging of events will be in the 3,100-seat Concert Hall, 5,500-seat arena, 12,000-seat stadium, and 800-seat small theater.

A dramatic change of pace at Century 21 is a 7½ acre Gayway, which provides rides, games, music and refreshments reminiscent of "yesteryear."

Boulevards of the World

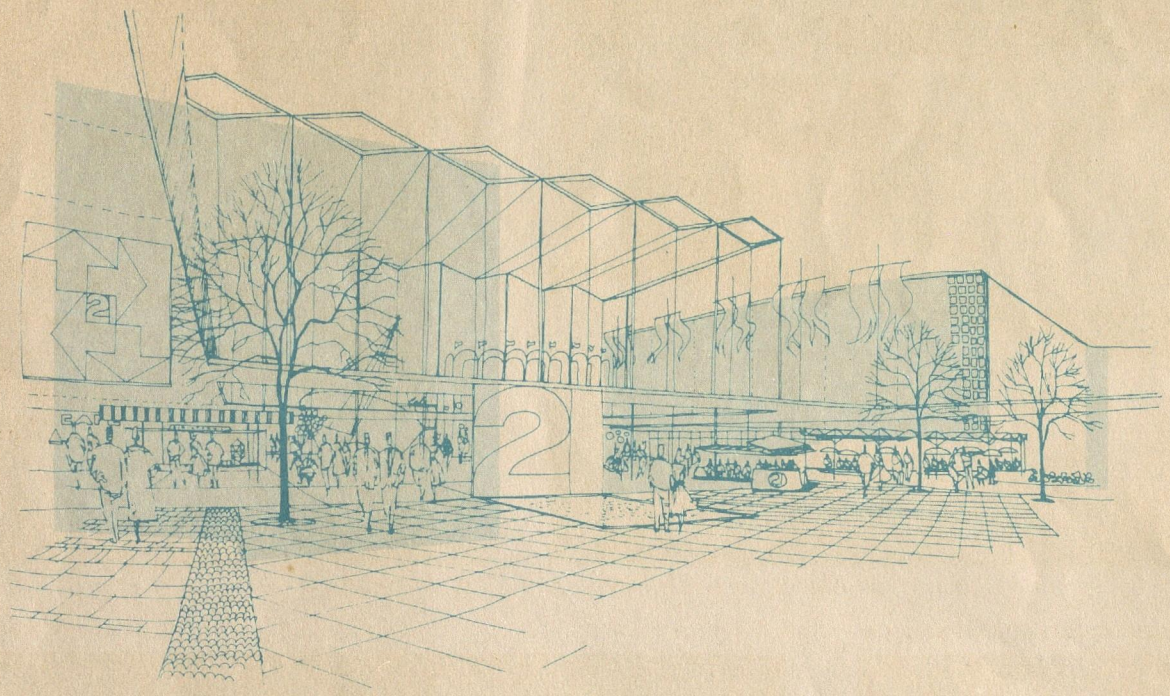
Exotic avenues joining together the five wondrous Worlds of Century 21, are lined with colorful shops, bazaars and restaurants representing a myriad of countries and cultures...a veritable tour of the world!

Monorail

The world's first high-speed monorail will whisk visitors to the exposition grounds from downtown Seattle—more than a mile—in just 96 seconds! This Swedish Alweg monorail will give the world its first look at a full-scale operation of a high-speed mass transportation system of the future.

Space Tower

550 feet in height, the unique space tower is crowned by a restaurant and observation deck which revolve 360 degrees each hour, affording a breath-taking panoramic view of Puget Sound, Mt. Rainier, the Cascade and Olympic mountain ranges. The structure will cost $2½ million and will contain the world's largest carillon. Design by John Graham & Co. of Seattle and New York City.



AMERICA'S first space-age world's fair will open its doors to the world in Seattle on April 21, 1962. Century 21 Exposition's "Man in Space" theme will unfold a glittering projection of life in the year 2000, against a backdrop of man's accomplishments today in the space age.

This will be the first international exposition to be held in the United States for 23 years.

The world-wide importance of Century 21 Exposition emerged dramatically in September of 1959, when the government of the United States appropriated $9,000,000 to become prime exhibitor. In Paris, the Bureau of International Expositions has given its sanction to Century 21 as the only exposition in the western hemisphere approved for participation by its 30 member nations. This is the second time a U. S. exposition has ever achieved this world recognition.

Century 21 Exposition is located at the heart of a metropolitan population of one million people...surrounded by mountains, lakes, salt water and tall timber. A vigorous, dynamic center of commerce on the West Coast of the United States, Seattle is only 12 hours from Europe, 9 hours from the Orient and 6½ hours from New York by jet.

Lodging and Transportation

By 1962, the opening of Century 21 Exposition, the Greater Seattle area will be able to provide lodging for 45,500 visitors each day, more hotel, motel and other accommodations than were developed for the Brussels World's Fair.

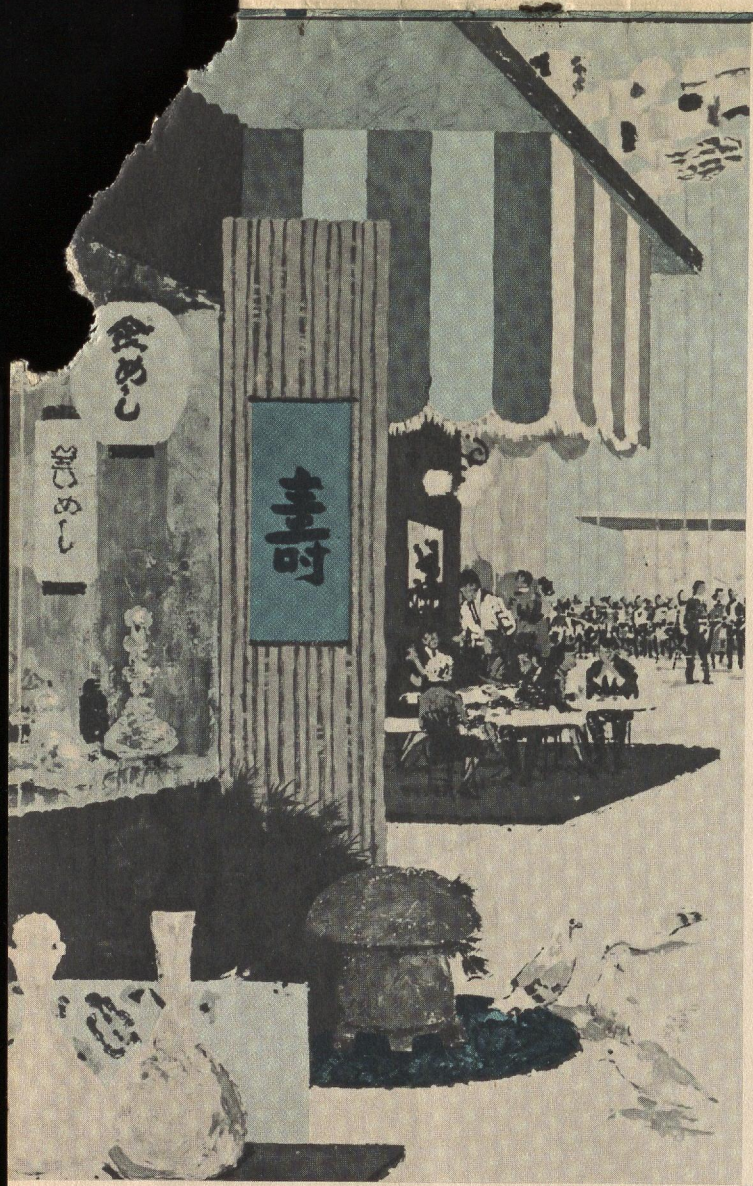
Leading hotel, motel and apartment owners' associations have formed Expo Lodging Service, a non-profit corporation, which will assist in placing reservations, guarantee convenient service and establish rates within a scale of price ranges suitable for all. As an additional service to the many guests visiting the Pacific Northwest, hotel, motel and trailer park operators in Washington, Oregon and British Columbia have joined this official housing bureau to guarantee accommodations throughout the Northwest. Please direct all housing and reservation requests to EXPO LODGING SERVICE, 312 First Avenue North, Seattle 9, Washington or phone CEntury 5-2121 for assistance.

Sponsors and Management

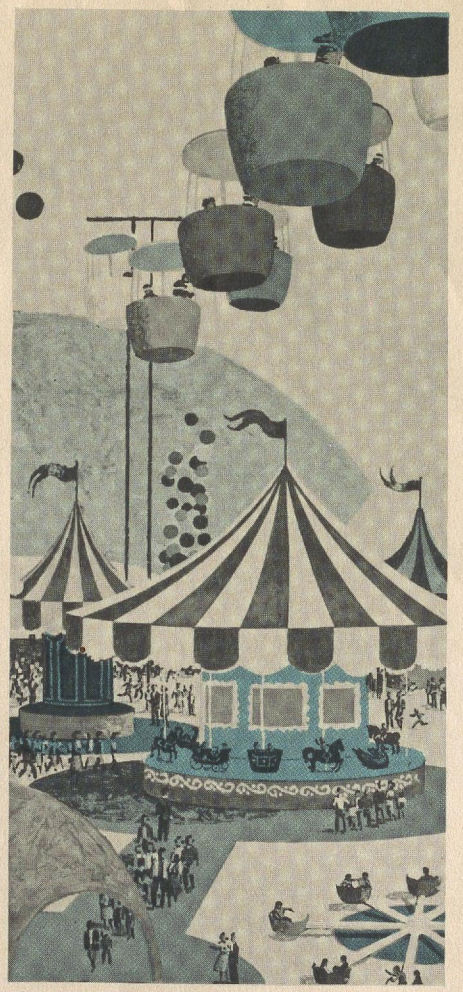
The sponsors of Century 21 Exposition are the State of Washington, City of Seattle and Century 21 Exposition corporation. Management is under the direction of the president and general director of the corporation.

Information is available regarding rules and regulations for participation as an exhibitor or concessionaire, from the Exhibitor Information Office. Requests for further information may be directed to:

Century 21 Exposition, Inc., Exposition Building, Seattle 9, Washington. Cable Address: CENTURY XXI. Telephone, CEntury 5-2121

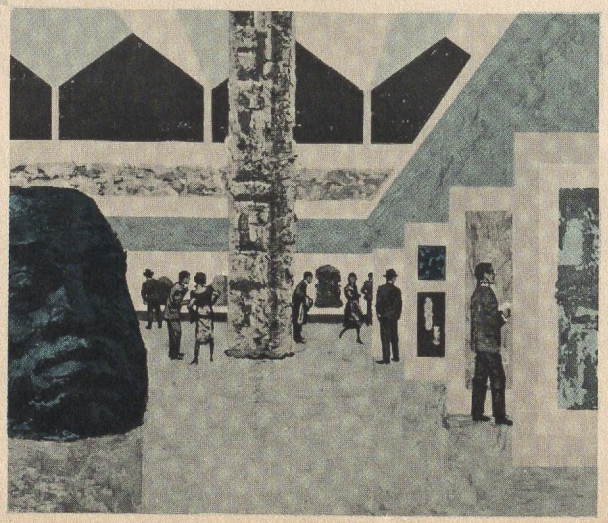


▲ *Boulevards of the World*



▲ *World of Entertainment*

▲ *Hydro-Electric Exhibit*

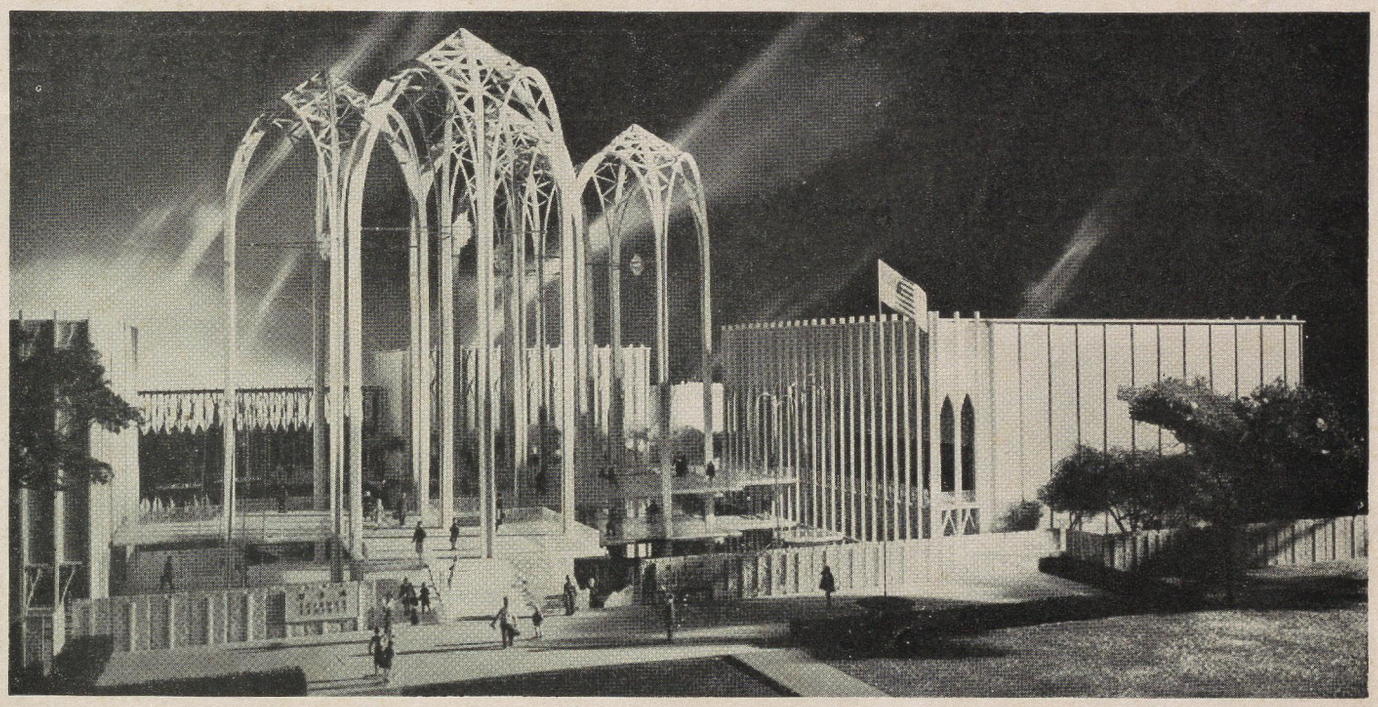


World of Art ▶

Offices in Seattle, New York City, Washington, D.C.,
San Francisco, Athens, Bangkok, Manila,
Mexico City, Paris and Tokyo

CENTURY 21 EXPOSITION

SEATTLE, U.S.A. 1962



"Vertical Gothic" Pavilion Designed for Century 21

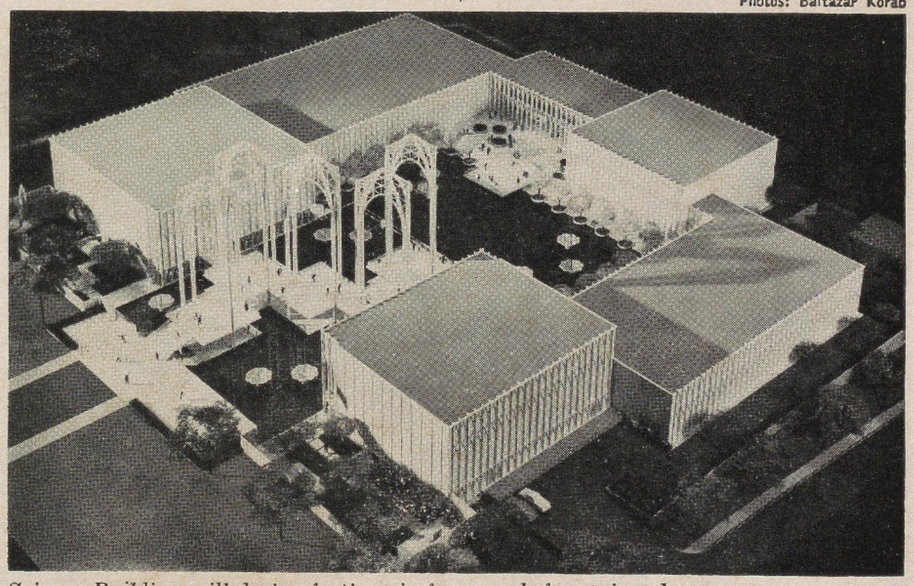
U. S. Science Building Will Set Fair's Theme

WASHINGTON, D. C. The model of the United States Science Pavilion Building scheduled for the Century 21 Exposition in Seattle, Washington, was recently unveiled in the lobby of the U. S. Department of Commerce here. Designed by Minoru Yamasaki & Associates, with Naramore, Bain, Brady & Johanson of Seattle associated, the project is expected to be one of the two "theme" buildings of the exposition (the other being Paul Thiry's Coliseum).

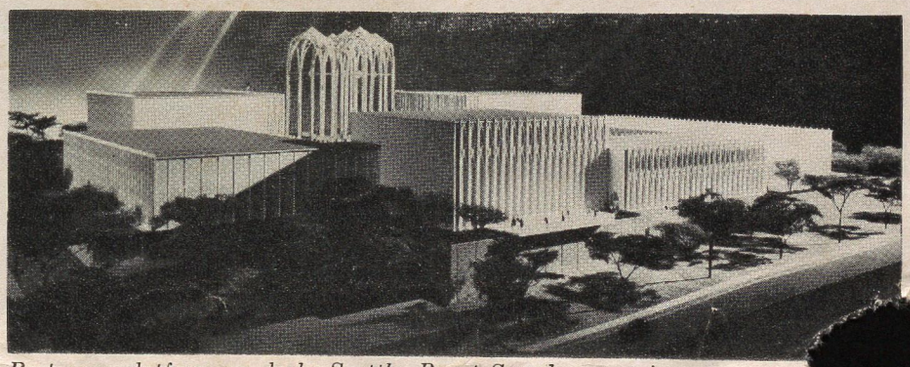
The pavilion—actually five connected buildings—will be approached over a bridge surmounted by five domes on 100-ft-high concrete columns. The domes will be studded with colored glass. Platforms over the courtyard pools will lead the visitor into the first building, whence he will follow a natural progression through the exhibits, to emerge at the other side of the pool. Exhibits will include a multiscreen theater for the showing of movies on the advances of science. and a planetarium showing the solar system as seen by a space traveler. Exhibits will be selected by the National Science Advisory Board, and designed by Walter Dorwin Teague Associates.

Structurally, the pavilion will be precast, prestressed concrete. Exterior walls will be faced with exposed [illegible]ite quartz. Vertical [illegible] of Yamasaki's [illegible] will embellish and lend structural support to walls facing the courtyard and major streets. This design will act as open grillwork around a rest area separating two of the units. The buildings will each have their own lighting and heating, and may be used separately after the Exposition.

Photos: Baltazar Korab



Science Building will derive festive air from pool, fountains, domes.



Rest area platform overlooks Seattle, Puget Sound, mountains.

PROGRESSIVE ARCHITECTURE JULY 1960

NEWS REPORT

Architecture's Monthly News Digest of Buildings and Projects, Personalities, New Products

Five 100-ft concrete lanterns soar over entrance to U.S. Science Pavilion, scheduled for Seattle's Century 21 Exposition.

Reprinted from the July, 1960 issue of PROGRESSIVE ARCHITECTURE