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DEPARTMENT OF REGISTRATION AND EDUCATION
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DIVISION OF THE
STATE GEOLOGICAL SURVEY
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URBANA

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ARCHITECTS CONTRIBUTE TO ILLINOIS DEVELOPMENT

By
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"Take interest, I implore you, in these sacred dwellings which one designates by the expressive term Laboratories. Demand that they be multiplied, that they be adorned. These are the temples of the future—temples of well-being and of happiness. There it is that humanity grows greater, stronger, better."

. . . . . *Pasteur.*

World War II has forcefully brought to our attention that it takes more than a "will to win" to bring the enemy to his knees. Germany is losing, not because of a lack of determination, but largely because it does not have sufficient natural resources to hold out and to compete with the allies, particularly the United States, which does have them, along with the necessary skill to develop them for use. A nation or state is as strong and as prosperous as her natural resources and her ability to use them.

Illinois is now well equipped to learn more about her resources. The Natural Resources Building, occupied by the State Geological and Natural History Surveys, on the campus of the University of Illinois, was completed in 1940. The completion of this structure concluded a vital period of planning and construction, important to the future growth and development of the State of Illinois. This period of planning began with the study of the purposes, aims and work of the two Surveys, an examination of their meager existing and scattered facilities, and their desire to unify their services on one plot and largely under one roof, and ended with the completed structure, a "tailor-made" plant, ready for action. In between is the record of the assembling of technical and scientific requirements and the solution of endless knotty problems, resulting in a modern plant for the adequate study of the potentiali-

Natural Resources Building, University of Illinois Campus, Urbana-Champaign. Completed 1940.

ties of our state's resources. This study is too little known generally, and is a fascinating story, part of which we are able to disclose at this time.

Today a trip through the building gives the impression of order, dignity, batteries of pipes, test tubes, machinery, instruments, files, cases, soft colors and pleasant working conditions. How was this order achieved? How were the many complex problems simplified and solved? What behind-the-scenes processes were employed in planning this complicated structure?

STARTED IN 1935

In 1935, Dr. M. M. Leighton and Dr. T. H. Frison, Chiefs of the Geological and Natural History Surveys, respectively, first presented their problems and aims to the Division of Architecture and Engineering. First we examined their existing facilities, scattered in eleven different locations about the University of Illinois campus. Rough requirements were determined and preliminary sketches started to establish the size of the building in a general way. At this time no site had been chosen. Establishing the approximate building size made it possible to begin negotiations with the University relative to the selection of a site.

The two Surveys date back to 1851 (Geological) and 1862 (Natural History) and are divisions of the Department of Registration and Education, a code department under the Governor of the state. The law creating these Surveys requires them to be located at the University of Illinois which furnishes light, heat, power, maintenance and janitor service. An agreement was consummated between the University of Illinois and the Department of Registration and Education, providing among other things, that the University approve the drawings and specifications before the award of contracts. A site was selected on the south campus, the front facing the Fine Arts Building on the north and the rear on Pennsylvania Avenue to the south. In 1937 an appropriation of $300,000 was made by the General Assembly for the erection of a portion of the group and the work of assembling exact requirements began in earnest. (Additional funds were provided by subsequent federal grants and state appropriations, making the grand total expended $768,363.00.)

PURPOSE OF BUILDING

Any building is a machine, in a sense, designed to do a certain piece of work. To fully understand the Natural Resources Building and how it was planned one should know its purpose—the job it is required to do. This job requirement relates back to the beginning of all things and continues through the ages when the natural resources of the state became what they are today. Illinois is rich. Most of its surface is fertile soil producing abundant crops. Underneath are extensive deposits of coal, oil, stone, clays, fluorspar, zinc and lead, silica sand, tripoli, fuller's earth, sand and gravel, ground water, brines, etc. But the mere existence of these is not enough. Dr. Leighton believes that instead of taking the viewpoint expressed by one writer, "Tell me what your resources are and I shall tell you what your *society is*," the thought should be: "Tell me what *can be done* with your resources and I will tell you what your society *can become*." Following this trend of thought, the building was to be a tool to make it possible for the two Surveys to carry on work leading to the discovery, development, and rational conservation of our state's resources and to present their findings to the public.

The two Surveys describe this work as dealing with resources which are renewable and non-renewable. When a lump of coal is burned, it is gone, as coal. There is no way to grow or produce more coal, for example, as we produce or grow apples, cereals, fish and game. The Natural History Survey, dealing with growing things, contends that with care, proper regulation and enlightenment, the renewable resources can be maintained or increased. The Geological Survey on the other hand, is constantly on the alert for new resources and new ways to use and conserve the old ones. How, then, is the average citizen served by these Surveys? A land-owner has an unusual deposit of clay on his acreage. What is it good for, is there a market for it, if so where? He is about to drill an oil well. How far must he go down to test the commercially potential oil sands? He wishes to sell his farm with coal beneath it. What is the coal worth? A blight has attacked his orchard. What shall he do? The chinch bugs may be out in force and he wishes to be instructed in the best methods and materials to combat them. Many written requests are made unnecessary by announcements over the radio, originated by the Natural History Survey, to the effect, for instance, that the following four or five days will be ideal for spraying orchards to combat some pest currently rampant.

How is industry served? An industrialist may wish to know the relative merits of coal from various sources for his purpose. Mineral producers inquire regarding preparation processes for their particular kind of resources to improve their competitive position. A railroad company seeks information on resources for a prospective industry. Inquiries of this sort pour in daily in a constant stream. How is the state as a whole benefited? Industry is served and can depend with assurance on the facts and data relating to Illinois resources and what they are capable of producing. New uses and methods of manufacturing are developed thereby increasing present industrial facilities and paving the way for new ones. Plant diseases and insects are kept under control, new disease resistant plants are developed, safeguarding the state's greatest industry—agriculture. We will describe this vital work, more in detail, as we go along.

ASSEMBLING REQUIREMENTS

All of the foregoing is designated as "routine" work. Answering inquiries and adding data to the ever growing foundation of accumulated knowledge calls for various sectional staffs, laboratory work and experiments. Therefore among our first requirements were offices and special laboratories. An example of the constant accumulation of knowledge and the building requirements to accommodate this phase of the work is the storage of well cutting samples. By law, the Geological Survey receives a log or record of every well drilled in the state and has the right to demand samples, if it desires, to learn more of a particular region. Special bags are furnished for the purpose and are sent to the driller. This practice results in the necessity for extensive storage areas. Many typical inquiries can be answered by special pamphlets and bulletins on related subjects and past experiments. They must be printed,

stored and ready for mailing. This also requires heavy storage areas. As developed in the finished building, every nook and corner, even the peak of the attic and a mezzanine in the garage, are devoted to the storage of the materials forming the basis of this vital and growing source of information.

In the life cycle of growing things, disease organisms and insects are a powerful and evil force. Since 1880 the Natural History Survey has accumulated the most extensive representive collection of insect fauna of any single state in the nation. The collection consists of over one and one-half million specimen insects. The housing of this and other research collections was a major consideration in the planning of the structure.

Illinois is a great agricultural state and therefore it is not surprising that the Section of Economic Entomology is the oldest section of the Survey and the most developed. Many new offices and laboratories were required to accommodate this important work. At one time in the state's history, about 40 per cent of its area was forested, but now this area has been reduced to about 3,000,000 acres or 9 per cent. The forestry staff required offices and laboratories to carry on its important work. The rivers and lakes present problems of Aquatic Biology. This study required the installation of the "last word" in aquatic tanks. Game must be studied, and policies formulated to prevent their extermination. Greenhouse concerns and growers look to the Natural History Survey to solve many of their problems. This requirement called for a modern greenhouse in which to experiment under actual commercial growing conditions.

Both Surveys are in constant communication with their field studies and fact-finding parties. Their fleet of trucks and cars must be housed and maintained, calling for a garage for 42 cars.

The Geological Survey divides its staff into various sections to devote individual study to coal, oil and gas, industrial minerals, etc., and in addition, a division of geochemistry to work with the entire survey from a chemical point of view. Therefore, in addition to the physical laboratories, a complete chemical section was required. Thus the inherent characteristics and potentialities of any material can be studied and determined from a factual point of view. The desire was to carry out these investigations in the light of possible use in commercial manufacturing, on a pilot plant scale. In this way "theory" would progress through "practice" and the solution passed on to the public to be used in a practical way. This called for the Applied Research Laboratory complete with huge stacks and traveling crane—a factory on a small scale.

The Surveys' routine work and requirements have been described in a general way, but in addition they are constantly at work on significant special projects—but we are getting ahead of our story. To summarize to this point, we had arranged a program calling for a group to house offices, laboratories, both physical and chemical, great storage areas, aquatic tanks, libraries for books and research collections, greenhouses, garage, parking areas and a small factory (applied research laboratory). Now we were ready to begin our architectural planning and strive for a solution. What steps were taken in reducing these generalized requirements to specific information so contract drawings for bidding could be prepared?

FUTURE DEVELOPMENT CONSIDERED

C. Herrick Hammond, Supervising Architect, at this stage suggested a list of general objectives be formulated. The two Surveys formed a joint committee to act in their interest, Dr. M. M. Leighton and Dr. T. H. Frison, Chiefs; Dr. Frank Reed, Chief Chemist, Geological Survey; Fred Squires, a former practicing Architect, and now Petroleum Engineer, Geological Survey; and Dr. Herbert Ross, Systematic Entomologist, Natural History Survey. Six general objectives were established to the effect that the finished building should (1) have an exterior in harmony with the buildings of the south campus, clothed in a style of Georgian architecture; (2) have an interior which would be businesslike—a work shop; (3) have an interior which would be cheerful, light and a comfortable place in which to work and think; (4) have a flexible plan, permitting alterations and future growth and a system of construction which would allow the movement of the equipment and partitions without structural difficulties; (5) have its mechanical service lines (cold and hot water, air, steam, distilled water, etc.) exposed to view for easy maintenance, extensions or cut-offs, from their points of origin in the building to the laboratory tables throughout their entire length; (6) have its corridors "off center" creating a larger side on the north for laboratories and a smaller one on the south for offices and conferences.

We then set about the establishment of a master plan—involving the *future development* of the entire plot 554 ft. x 343 ft. Future requirements were determined and the entire group was considered. An E shaped structure was chosen with the stem facing north and the three "stubs" reaching to the south. The central stub was to be the Applied Research Laboratory, but later on this unit was placed adjacent to the University Power House in an area near the Illinois Central Railroad because of anticipated smoke and fumes from fuel experiments. In later studies, this central wing to the rear, became the lecture room and additional chemical laboratories. The garage and greenhouse were to be separate units placed in the southern corners of the lot with suitable pedestrian walks, service roads, parking areas and screen walls, tying the buildings together and forming a complete working plant. Having this, how much of it could be erected as a first unit, considering the funds available?

Building costs (past, present and anticipated future) were taken into consideration. We obtained from the University, costs of some of their similar projects. The cost of our building appeared to be intermediate between one of their normal structures and their Chemical Laboratory building. Costs of many other similar projects were tabulated and analyzed. Original dates of erection were considered and corrected to the new date of construction, taking into account the rise and fall of construction prices during the years. This gave us anticipated future unit costs and we were then able to determine how large our first building could be—the size of our first bite. This proved to be most of the main stem of our letter "E" with the stub wings omitted for future construction.

We then roughed up a preliminary plan of the structure, establishing stairs, corridors, columns, elevators and most important of all, the available floor space. This was a renting plan, so to speak, similar to the diagrams office building managers furnish prospective

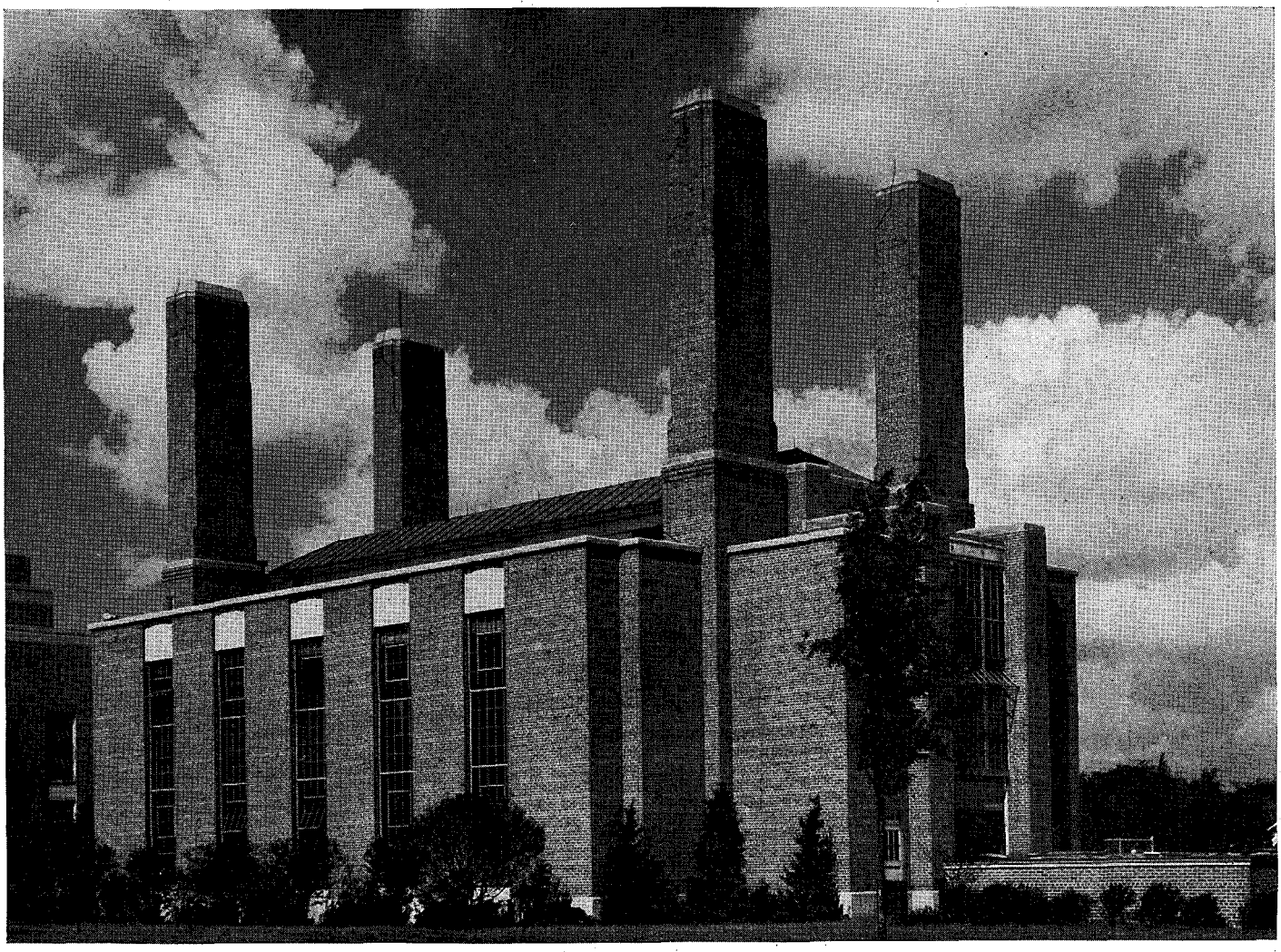
renters. The two Surveys then agreed on the major division of the building and set about allocating their various departments. This was largely a family affair, but we were able to assist them in a professional and technical capacity. The Chemical Laboratories were placed on the third floor so that fumes could be readily discharged through the roof; beyond this the Surveys were free to place their departments where they would serve their purposes best. At the completion of this process attention was focused on the individual department or research "set up".

Now we have arrived at one of the main considerations in the planning of this structure.

"TAILOR-MADE" LABORATORIES

Each unit is in charge of a special scientist and since research is largely a matter of personal approach, best results are obtained when the laboratory is planned to suit his own methods of approach and work. Therefore, each head was asked to arrange his allotted space as he believed it would serve him best. After consultations, he stated his requirements, steam, distilled water, electric current, fume hoods, laboratory tables, tables, chairs, bookcases, shelves and similar details. These diagrams were sent to us and we edited them, so to speak, calling attention to requirements difficult or costly to fulfill, fitting in columns, doors, windows, and considering them as portions of the whole plant. Drawings were prepared of each unit and returned for correction and approval. Finally after several months of collaborative study they were all complete and approved. We believe this to be an unusual approach, at least it is different from customary planning of most structures. It is different because, at this stage when the building was still in rough layout form, we knew exactly where every piece of equipment and furniture was to be located, where each plug was to be placed—in short, each unit was completely planned with reference to the job it was to do. Now the requirements were really established and it was up to us to integrate them, to fit the parts together and create one smooth working machine.

We made a supreme effort to fit these individual units into the proposed shell of the building without radically changing their layouts. This was difficult to do, taking into account that the exterior windows, ceiling heights and similar features were determined for us by the exterior architecture. How much simpler it would have been, had we been able to start from scratch and design the exterior to fit the interior. However, the finished result is a union of these exterior and interior problems and, we believe, have been worked out in such a fashion that no one, unless made aware of the problem, realizes that the problem even existed. To cite an example, the



Applied Research Laboratory—State Geological Survey

laboratory fumes are discharged through large Georgian brick chimneys, which in other campus buildings, serve as ornamental features or in some cases, ventilators.

The matter of piping twelve different laboratory services through the building was a problem in itself. Undoubtedly, the reader will be interested to know that the following twelve services are piped throughout the structure: high pressure, low pressure, and medium pressure steam, gas, hot water, cold water, distilled water, compressed air, vacuum, refrigeration (in some rooms), waste lines, and electrical outlets. It is interesting to compare our distribution system with other similar so-called "last word" buildings recently erected. In these structures invariably the lines run through "special spaces," through special floor trenches in connection with complete loops around the structure, both in basement and the attic with vertical risers rising up and down for the purpose of permitting great flexibility. We arrived at the same goal but our system is *utterly simple* and reduced to the bare minimum. Our two stair halls were designed with spaces for the main lines to rise in the open from basement to attic. At each floor, branches lead to the corridor ceiling adjacent, where they run the length of the structure. From this stem they branch at right angles to the room ceilings on each side of the corridor, thence up to the laboratory tables on the floor just above. Thus the pipes are a feature of the building, open to view for maintenance, extensions, additions and eliminations—not something to hide and run through trenches and inaccessible spaces.

PRACTICAL PURPOSE ACHIEVED

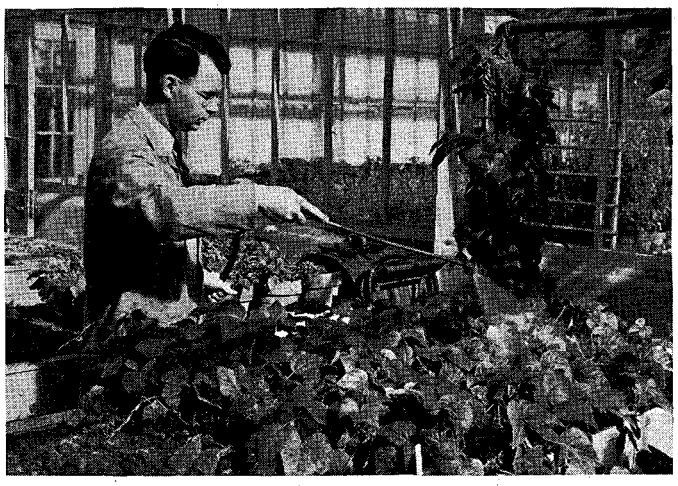
The reader will remember that one of the requirements was that the building be a workshop, a practical building. We believe this requirement has been accomplished in the completed structure. The pipes are exposed as described, there are no suspended plaster ceilings covering them. The reinforced concrete floor system, exposed to view, was given special consideration, the beams and joists were spaced with care and order, plywood forms were used and the completed smooth ceiling surfaces were painted. One piece metal door bucks were installed—no wood bucks and trim expensive to fabricate and install. The room bases are of painted concrete and the finished floor is asphalt tile and linoleum laid direct to the concrete floor; glazed terra cotta wall blocks were used in the chemical laboratories, otherwise the partitions are tile and plaster, easy to knock down and replace if changes are ever required. Utility was not the only factor, however, for the structure was to provide comfort, dignity and grace. Designed rooms were confined to the entrance lobby, the administrative rooms of the two Surveys on the first floor and the corridors connecting them. Color was an important consideration and was employed to offset any ordinary workshop character and to provide quiet and cheerful surroundings. Soft, grayish tones were chosen. The average visitor realizes the interiors are pleasing, but hardly believes there are about twenty-five separate and distinct colors in the finished building.

After the designing was completed and the goals established, complete contract documents were prepared, comprising drawings and specifications of the building and its numerous details, each piece of equipment and each item of furniture. This herculean task was finally completed, the work was advertised, bids received and contracts awarded.

The structure was built largely using Illinois products and resources. Rather than list the face-brick, wall tile, terra cotta, glass, cements, etc., originating in Illinois, it is easier to list the few materials which did not come from this state, such as the roof slate from Vermont and the iron ore from the Superior regions, raw copper from the west, etc. Many non-originating products were processed here so it can be safely stated that Illinois industry contributed the bulk of the labor and materials comprising the structure.

WAR SERVICE

Now after four years' service how have things worked out? "The proof of the pudding is in the eating" so a brief description of some of the "special projects" previously referred to, will serve to show how the building is serving both the state and nation, during these war years. In 1937, the oil boom in Illinois brought great activity to southeastern Illinois. Hundreds of new wells were drilled in the geologists' "virgin" territory. These wells passed through hitherto uncharted coal veins. After awhile wells cease to pay pumping and other costs—they must be rejuvenated by artificial water, air or gas pressures, which are termed secondary



Research for garden insect control is continuous throughout the year. Experimental Greenhouse—State Natural History Survey.

recovery methods. The Geological Survey numbers among its staff, experts on secondary recovery. There are large demands for domestic and industrial waters in Illinois. With the advent of great new war industries and munition plants, each well came to have geological as well as engineering interest. Geological and geophysical methods of a special sort, many of them drawn from oil field practice, gave the water well engineer new light. Great strides have been made in coal and its related fields. A study is now in process to utilize Illinois coal in the manufacture of metallurgical coke for the steel industry. This war project is seeking a way to reduce railroad transportation problems. Current progress is very encouraging. Active projects are under way to see if the normally wasted "fines" from Illinois mines can be manufactured into "smokeless" briquets. At present the processes of manufacturing are being studied in the Applied Research Laboratory. The aluminum industry requires a mineral known as cryolite, formerly imported from Greenland. Fluorspar, from Southern Illinois, is now used to produce synthetic cryolite. Research is being pursued to enlarge still

further the use of fluorine from fluorspar in the chemical field. Hydrofluoric acid has become important in the refining of high octane gas. New zinc mines have been opened in the old Galena district of northwestern Illinois and this one-time busy and prosperous city may be a Rip Van Winkle, waking up after a long sleep. Geological research has aided in the finding of new pools of oil, so much needed right now. Thus has the Geological Survey linked our building with the war effort.

The Natural History Survey likewise has been busy on many war and related projects. The large amount of grain in storage at the start of the war necessitated special studies in connection with the control of stored grain pests. Among rather recent newcomers to this country, the Japanese beetle has been moving in on Illinois and has now reached Chicago and East St. Louis. Control measures for it have been under investigation for some time because of the likelihood that it might become a serious pest. Advanced preparation for insect pests is a feature of the Survey's program, and, indirectly, through the studies of resistant corn hybrids the Survey has been preparing for 15 years for the time when the European corn borer would enter Illinois, something which has now occurred. The series of aquatic tanks planned for fisheries research have been used during the war in a cooperative investigation with the Federal Government to carry on secret experiments which could only be performed in a research laboratory so equipped. DDT (Dichloro-diphenyl-trichloroethane) the new revolutionary insecticide so successfully employed by the U. S. Army in Naples to prevent a typhus epidemic, is now being investigated so the citizens of Illinois can be safeguarded in its postwar use and to determine new uses for it. It will kill mosquitoes and flies and many other insects. How will it affect humans, fish, game, domesticated animals or other small forms of beneficial life which need to be increased or preserved? It may have many undesirable qualities as well—that remains to be determined. The scarcity of meat called for inventories of fish and game resources to determine if the restrictions now in force can be relaxed without a harmful long term effect to these resources.

As this is written, the Division of Architecture and Engineering is hard at work on contract drawings for the additions to the present building, virtually completing the group. After the war when labor and materials are available, Illinois will be ready to begin construction at once and when completed will have a plant second to none in this field. What its problems of the future will be no one really knows or can hardly guess. The horizon is limitless. Some day a new use for some material or plant will be discovered in one of these laboratories and a whole new industry will be born! Others are sure to follow. Our Division is extremely proud of its part in the development of this scientific group of buildings and feels it has had at least a small share in the development and future growth of our great state.

Entrance Lobby—Natural Resources Building.