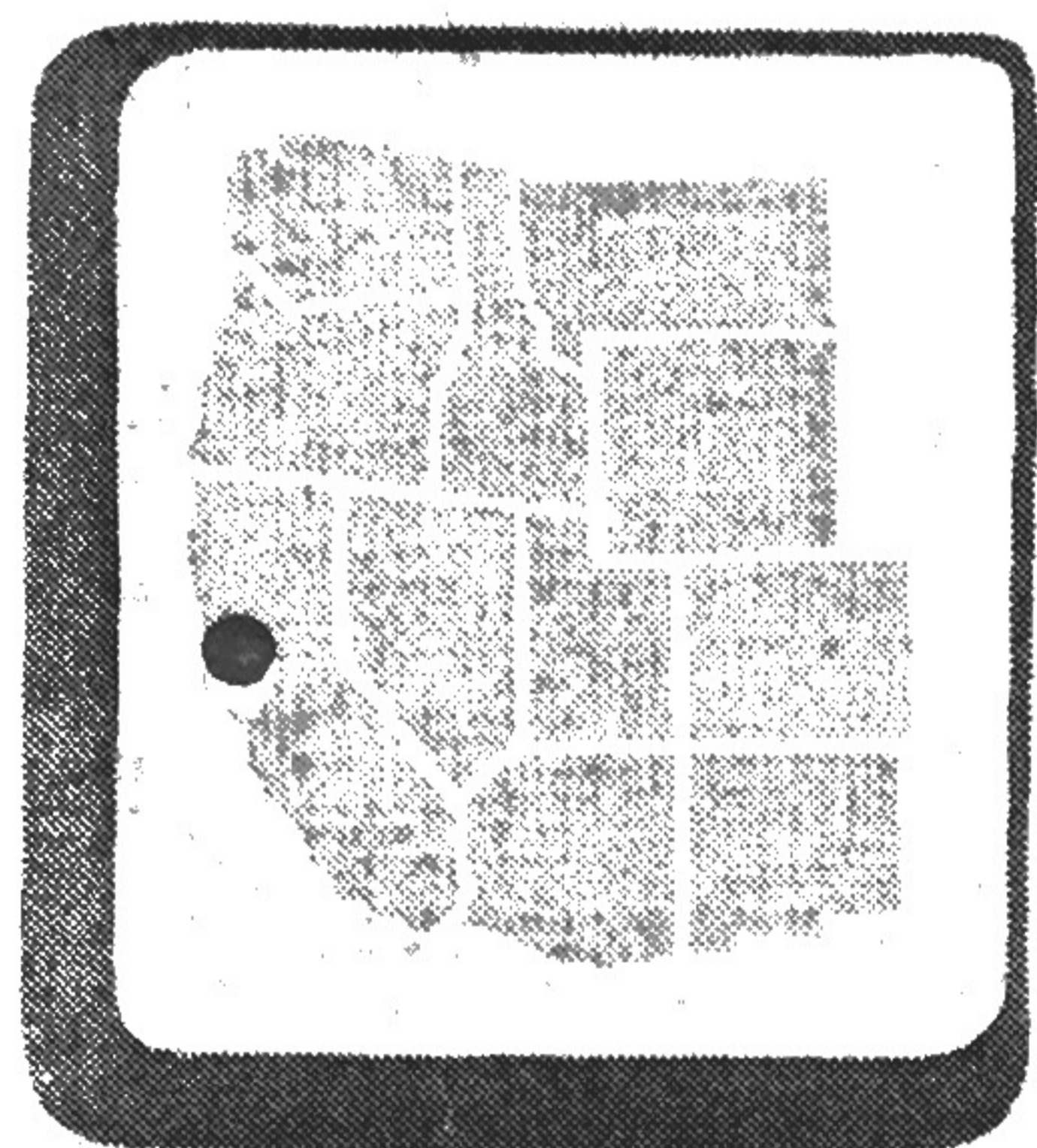


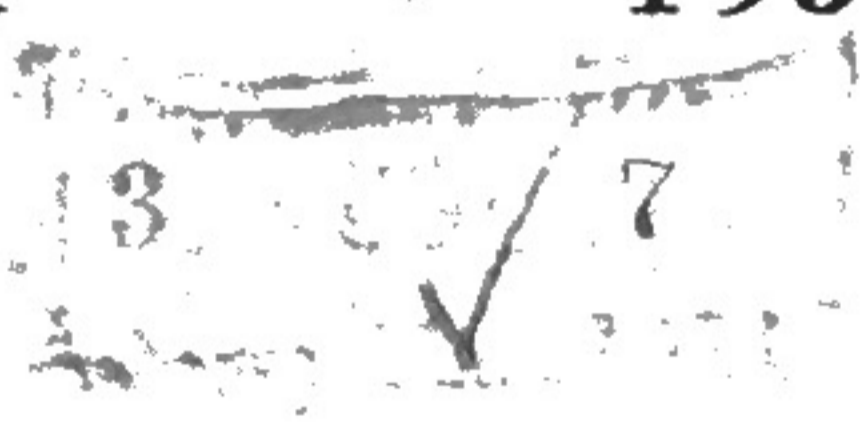
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STANFORD

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**STANFORD RESEARCH INSTITUTE** *Stanford University*  
**STANFORD, CALIFORNIA**

Why

## Institute Sponsored Research

**T**he prime responsibility of Stanford Research Institute is to serve Industry. This can best be done by a staff that approaches industrial problems with a fresh viewpoint backed by sound scientific reasoning and economic perception. The sharpening of these research senses can be accomplished through encouraging original research by Institute members.

This encouragement has been provided since 1949 by the Institute Sponsored Research program. Much of this has been made possible through funds contributed to the Institute by its Associates.

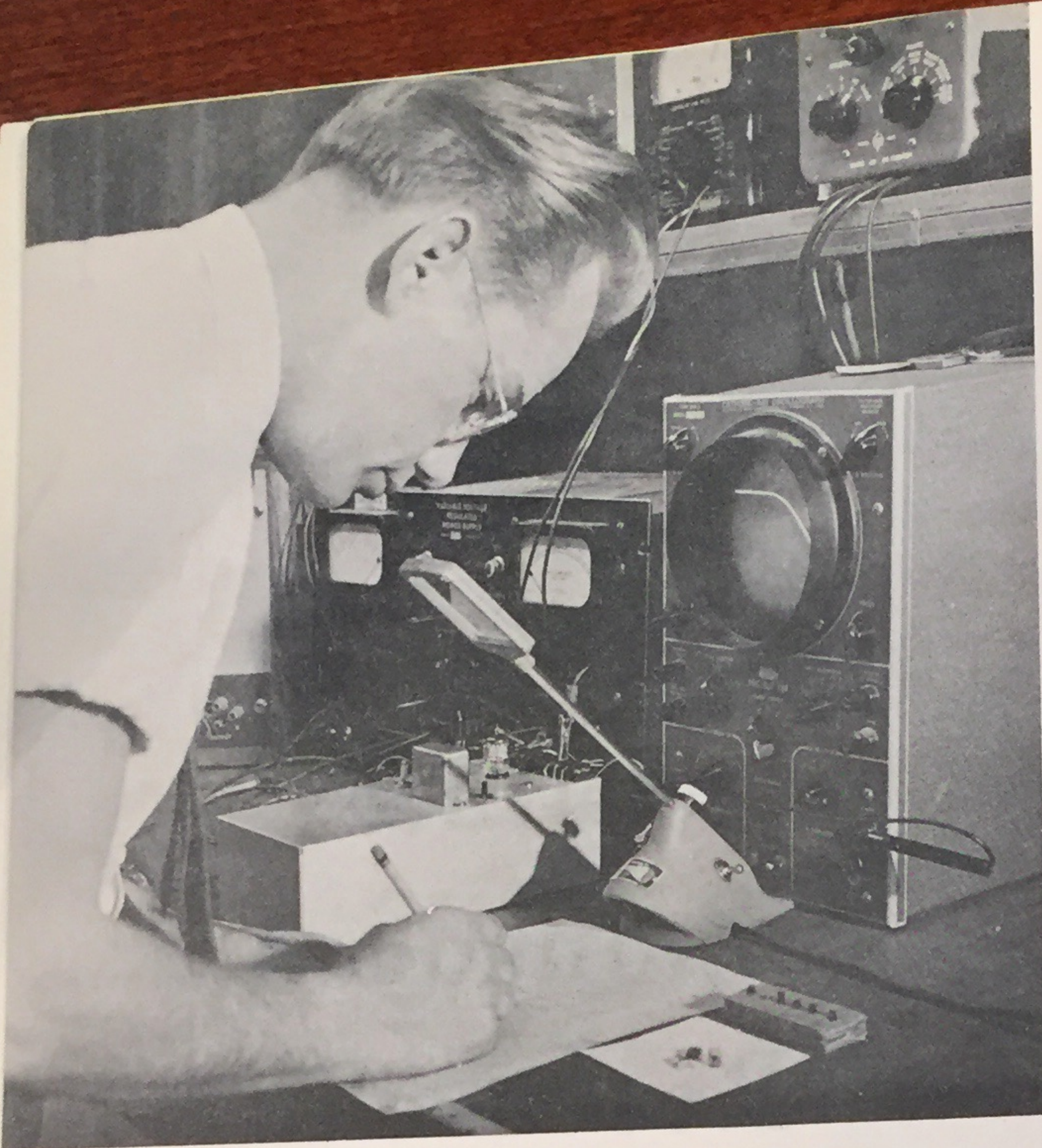
The over-all purpose of the program is to explore new fields that might later be developed by or for Industry. The plan allows the staff to do basic research in fields of special professional interest. In so doing, it offers the individual scientist incentive to conceive and develop new ideas

that might ultimately become part of the technical literature and thereby guide others in paths of industrial interest.

Specifically, the objectives of Institute Sponsored Research are:

To permit staff members to conduct basic work in the fields of their special professional interests, this work to be distinguished from the specific work normally done on projects undertaken for commercial sponsors.

To offer incentive to the staff to bring forth and develop sound scientific ideas. This is incentive not aimed at financial return, but rather to the enhancing of the professional reputation of the Institute and its staff members.



Transistor Study

To develop new fields of activity for the Institute. To provide a means of developing ideas generated within the staff for possible commercial application. Projects within this category serve both the Institute and the industry of the region.

To contribute to the growth and welfare of the West by conducting research and studies aimed at developing western natural resources, improving industrial and living conditions, and other problems of public service.

To provide a means for exploring research fields of particular interest to Associates of the Institute.

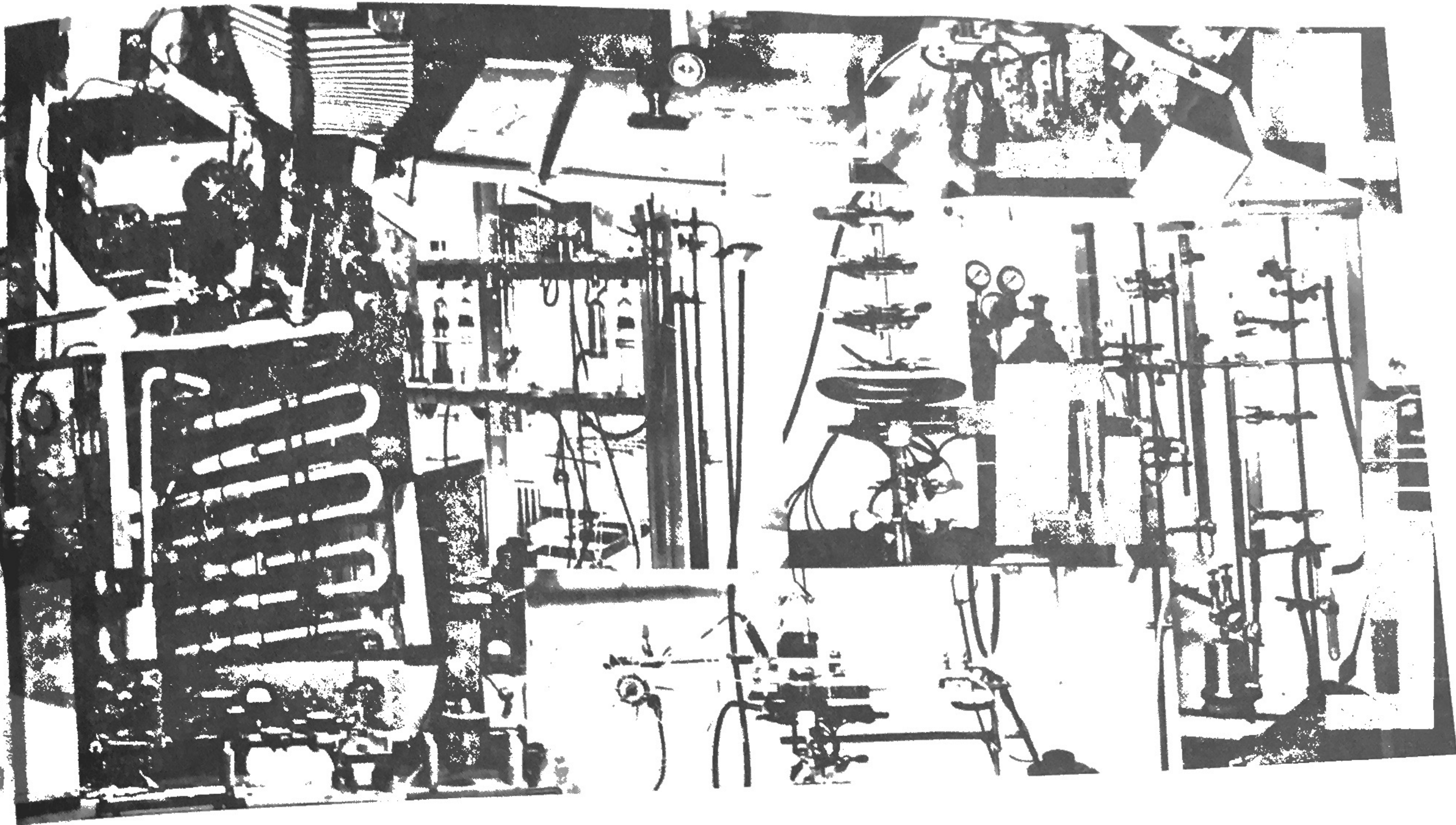
To encourage and assist in financing the preparation of scientific papers provided the

publication is of the type to enhance the position of SRI in the scientific field.

Work conducted under Institute Sponsored projects should be restricted to that which will enhance the reputation of the Institute and/or lead to development of a "research package" which can be taken over for development by an Associate. The projects must involve the achievement of specific research objectives, rather than the acquisition of equipment items. In those instances where specialized equipment is necessary as a part of carrying out such research, it may be purchased out of available funds.

The entire Institute Sponsored Research program is made possible through financial support provided by the Institute Associates.





CS-354

## CHEMICAL REACTIONS IN AEROSOL SYSTEMS

Richard D. Cadle

### THE PROBLEM

Los Angeles smog has been found to consist of a complicated system of aerosols. Essentially aqueous, acidic drops make up much of this system, which includes other particles or minerals (such as various silicates), soluble crystals (such as sulfates and chlorides), carbon, metal particles, and tarry droplets. A question arose as to the possibility of the co-existence of various particles which could react chemically, such as various carbonates and the acidic droplets. Examination of the scientific and technical literature failed to reveal studies of chemical reactions between particles in an aerosol system.

### ACTION

A study of chemical reactions which may occur in heterogeneous aerosol systems was undertaken to obtain fundamental information which could be helpful in many air pollution and related problems.

The first phase of the project involved a literature search which showed that although little work on this subject had been done, certain equations had been de-

veloped which, when slightly modified, could be used to estimate the rate at which chemical reactions might occur in aerosol systems provided that collision between potential reactants resulted in chemical interaction.

The second phase of the work involved preparing aerosols in settling chambers and examining the material that settled out on slides. In all of the systems studied, chemical reactions seemed to have taken place whenever contact was established between the reactants.

The third phase of the project involved the development of equipment which could be used to photograph individual particles *in situ* in aerosols.

The Los Angeles smog problem can be used as an example of the application of these results. Concentrations of particles of about 1 micron diameter in Los Angeles smog have been estimated to be about 2,000 particles per cubic centimeter of air. If half of these particles could react chemically with the other half, the rate of interaction of particles would not exceed 0.1% per hour. Thus the rate of interaction of the particles would be extremely slow.

CS-381 **LOW-PRESSURE FRACTIONATING COLUMN**

Robert M. Silverstein  
Robert Perthel, Jr.

**THE PROBLEM**

The objective of this project was to design a fractionating column which would combine a small pressure drop with adequate plate efficiency at operating pressure of 1 to 5 mm.

In general, the most efficient columns are the so-called "packed" columns. However, the pressure drop through these columns at a head pressure of 1 mm. may amount to as much as 25 mm. under operating conditions. The spinning band columns developed in recent years are generally satisfactory with regard to pressure drop, but are moderately efficient only at low through-put.

**ACTION**

The first column constructed on this project consisted of a series of propellers which were spun by the ascending vapors; the descending reflux was thrown out by the propellers against the column wall from which it was again returned to the next lower propeller. Pressure drop was satisfactory, efficiency fair, through-put low, and construction difficult.

The next column consisted of a series of inverted metal cones on a shaft which was spun by a magnetic couple. The descending reflux was thrown out from these spinning cones into a series of stationary inverted truncated cones made of wire gauze. These cones were fixed to the column wall and alternated with the spinning cones. The reflux descended the wire gauze as a thin film and returned to the next lower spinning cone. This design combined the solid truncated cones of Urey and the gauze effect as used by Lecky and Ewell, and by Stedman. In addition, small vanes on the spinning cones might be expected to produce vapor turbulence.

Initial results on this column looked quite promising in spite of several mechanical defects. A run with a test mixture at 1 mm. gave 8 plates in a 16-inch column at high through-put.

Further testing of this column will be necessary to evaluate its utility. If these performance tests are satisfactory, an engineering study of design and construction details will be made to determine the feasibility of the column for laboratory and/or industrial use.

CS-390 **PREPARATION OF TECHNICAL PAPER:  
AIR POLLUTION ASPECTS OF THE  
LOS ANGELES TEMPERATURE INVERSION**

Elmer Robinson

**THE PROBLEM**

Many basic climatological data on the Los Angeles temperature inversion have been obtained as a result of air research projects at the Institute. Since published data are meager and because there has been limited opportunity to present data of use to the technical meteorologist in the interim smog reports, a paper was planned for publication in the *Bulletin of the American Meteorological Society*.

**ACTION**

A paper was prepared and accepted by the *Bulletin of the American Meteorological Society*. The results presented in this paper are as follows:

During research on air pollution in Los Angeles, various meteorological phases of the study have been developed. One of these was the derivation of a mathematical formula which combines measures of the stabil-

ity height and thickness of the inversion layer to give an over-all value for its intensity. This formula has been useful in describing inversions and in various correlation studies.

A file of data on inversion conditions in the Los Angeles area has been accumulated in the course of the smog program. These data, which apply to mean inversion conditions from May through November, are interesting not only for the present study but also in evaluating the climate of the area. They should prove useful in other studies where an appreciation of the climatic nature of the inversion surface is required. The cycle of the inversion indicated that the base gradually lowered during the summer and early fall and that, as early as June, inversions were present 90 percent of the time. The "smog season" generally coincided with the latter part of the inversion cycle.

BS-417

## PAPER CHROMATOGRAPHIC TECHNIQUES

Luman F. Ney

### THE PROBLEM

Since the rediscovery of paper partition chromatography in 1944, this very useful tool has contributed essential information to many chemical and biochemical problems. Some of the more important applications of the method have been in studies of the chemistry and metabolism of amino acids, proteins, carbohydrates, and fats as well as in the separation of purines, pyrimidines, antibiotics, and several groups of natural pigments. In spite of the rapid development in so many diverse directions, the method is still far from being fully exploited. New applications, new ideas, and new developments of technique are still being introduced.

### ACTION

A study initiated at the Institute in 1951 had the following objectives: (a) to assemble the materials and equipment needed for carrying out studies in paper chromatography; (b) to develop experience in the various paper chromatographic techniques; (c) to conduct research in the development and the application of paper chromatography.

Using one of the recently developed techniques, 13 different amino acids were identified in *Chlorella*, including 4 which had not been found in a previously reported chromatographic analysis. Preliminary

studies were begun on separating and identifying sterols by paper chromatography. Attempts to apply these techniques to the separation and identification of cholesterol and sitosterols were partially successful, one of the principal problems being the development of a sensitive color reaction by which the rather unreactive sterols can be located on a developed chromatogram. It had been hoped to apply a sterol separation technique to the nonsaponifiable lipid fraction obtained from *Chlorella*. Recent developments in the *Chlorella* work at other laboratories made it appear unprofitable to pursue this study further.

As a result of the experience acquired in these studies, several applications of paper chromatography to other problems have been suggested. The method was applied to the study of pineal gland extracts in the course of a current project in the Applied Biology Department. Suggestions have also been made for inclusion in research proposals having to do with the separation and identification of insecticides, identification of a particular brand of frozen juice concentrate, the study of flavor constituents of raw sugar, and the determination of the structure and terminal groups of denatured milk proteins.

The study was concluded with the issuance of a final report in April 1952.

CS-426

## PREPARATION OF TECHNICAL PAPER: STUDY OF EYE IRRITATION CAUSED BY LOS ANGELES SMOG

Richard D. Cadle

### THE PROBLEM

Perhaps the most exasperating characteristic of Los Angeles smog is the eye irritation and lachrymation that it causes. This property of smog has been studied by the Air Research Laboratories for several years under sponsorship of the Western Oil and Gas Association.

Nation-wide interest has been shown in previous SRI publications on the Los Angeles smog problem. Accordingly, it was felt that a paper should be prepared for a scientific journal in order to present results of the Institute's latest eye irritation experiments.

### ACTION

Dr. R. D. Cadle and Mr. P. L. Magill prepared a paper which described the change in eye, nose, and

throat irritation caused by systematically changing the composition of artificial smog. This paper has appeared in the A.M.A. *Archives of Industrial Hygiene and Occupational Medicine*, July 1951.

Results obtained from this study were the following:

1. Removal of no single constituent of the artificial smog eliminated all of the irritating action.
2. Removal of all the particulate constituents had little effect on the irritating action of artificial smog.
3. Removal of all the gaseous constituents entirely eliminated the eye irritation.
4. An artificial smog containing the reaction products of gasoline vapor and ozone had an odor similar to that of natural smog.