

**Report of the Survey Committee  
on  
Scientific and Technological Education  
in  
Selected Institutions of Higher  
Education in Brazil**

APPENDICES

Prepared for the  
International Cooperation Administration

Washington, D. C.  
1960

**National Academy of Sciences—  
National Research Council**



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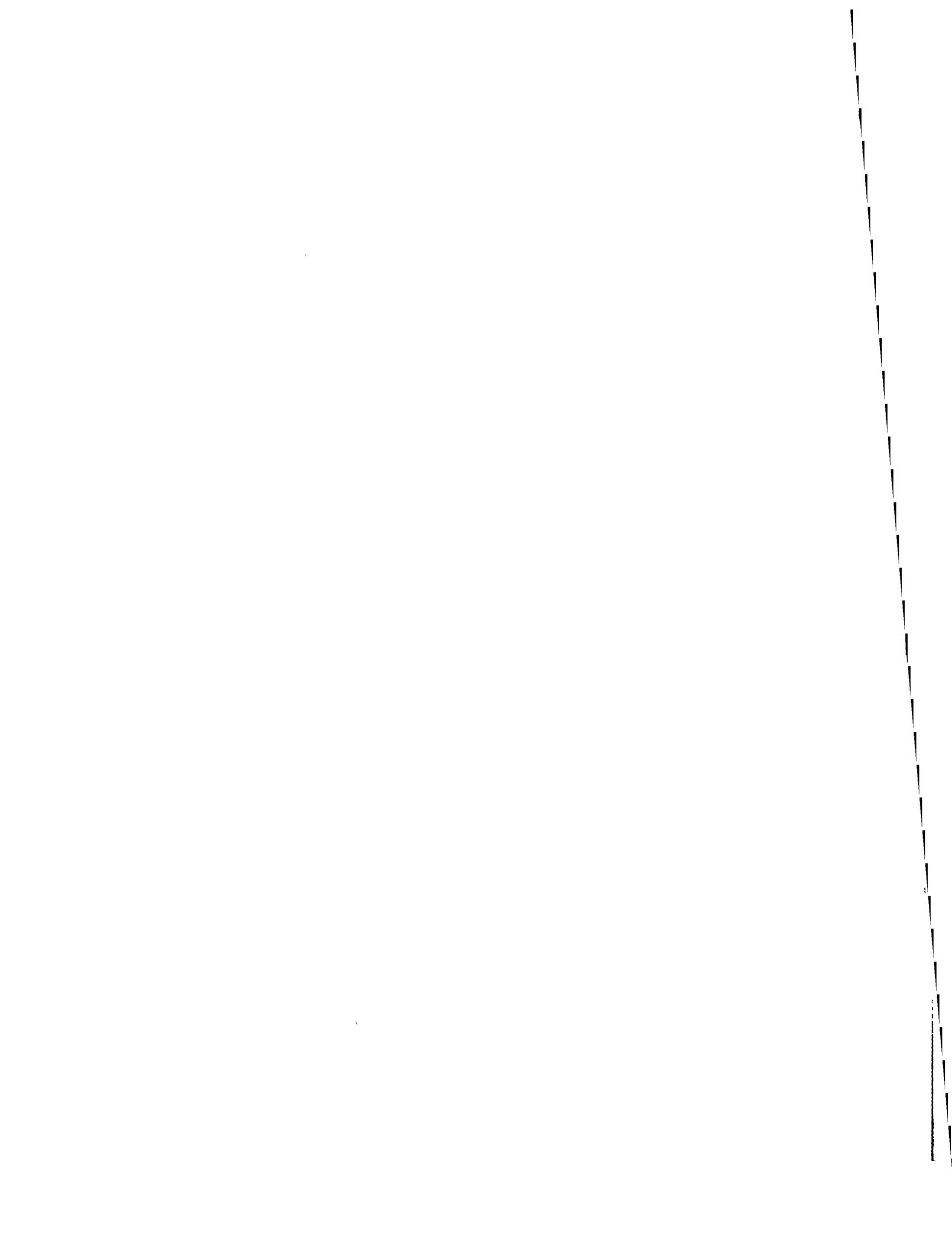
**Appendices**

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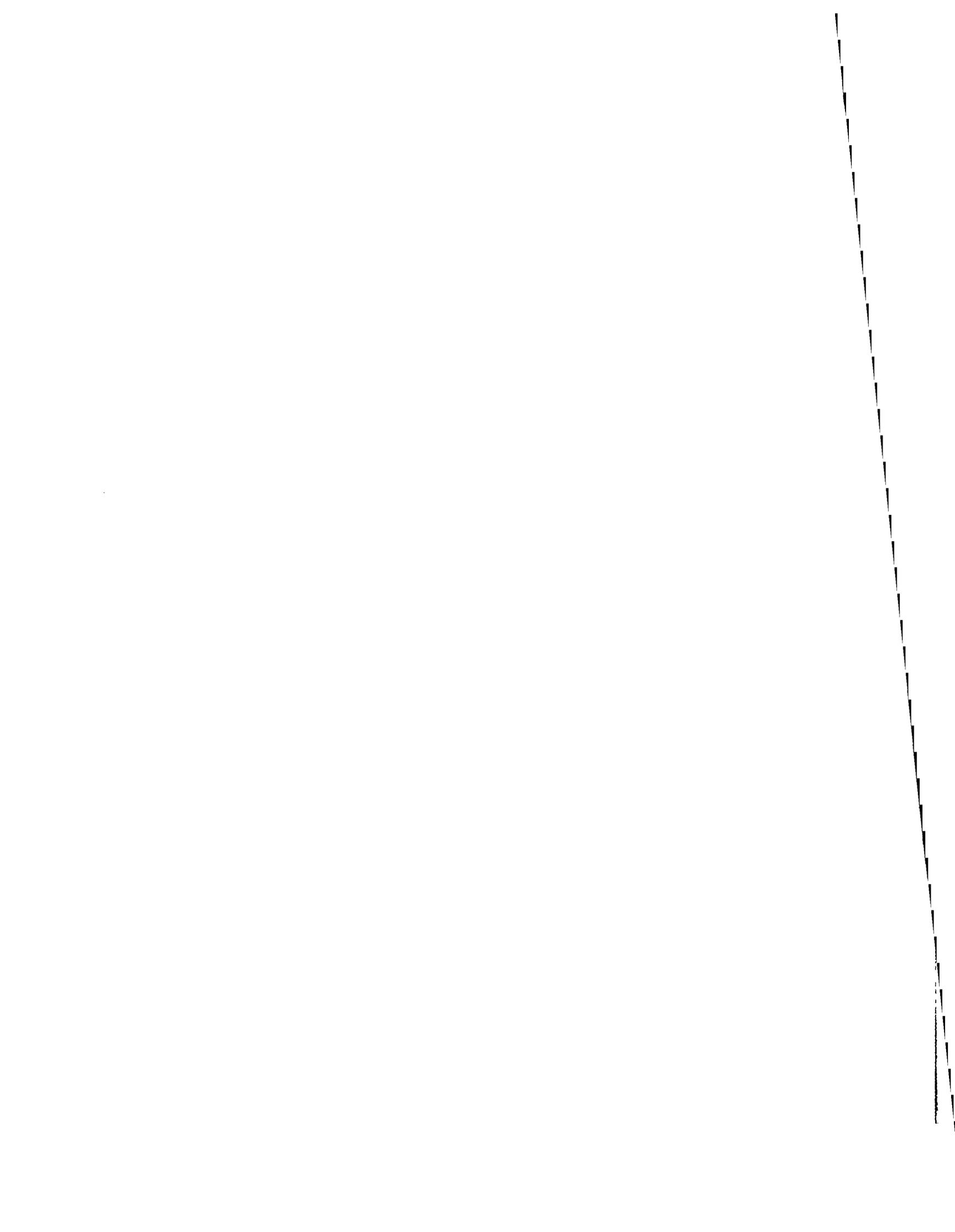
**1960**



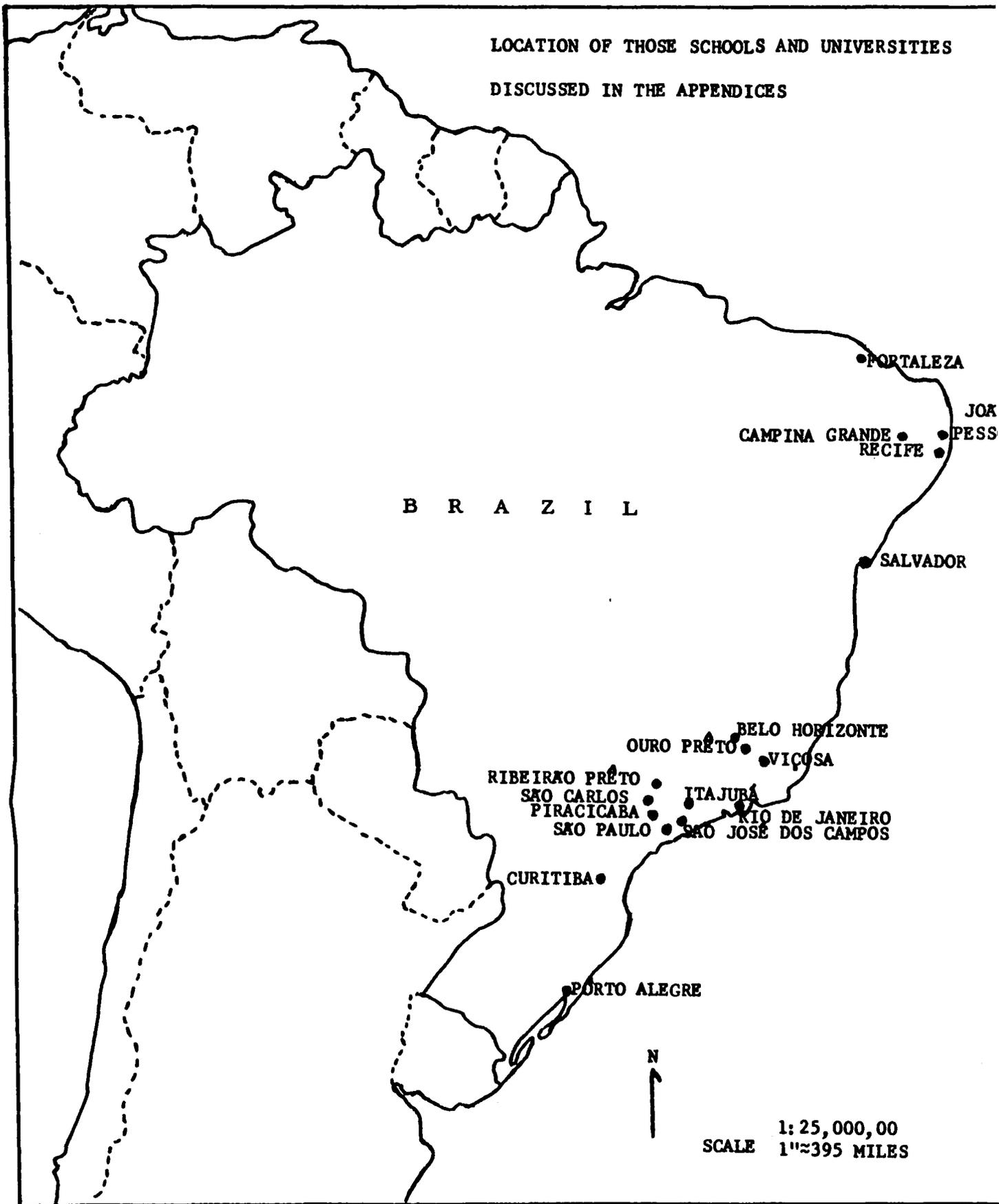
## C O N T E N T S

(Chronological Listing of Institutions of Higher Learning Visited)

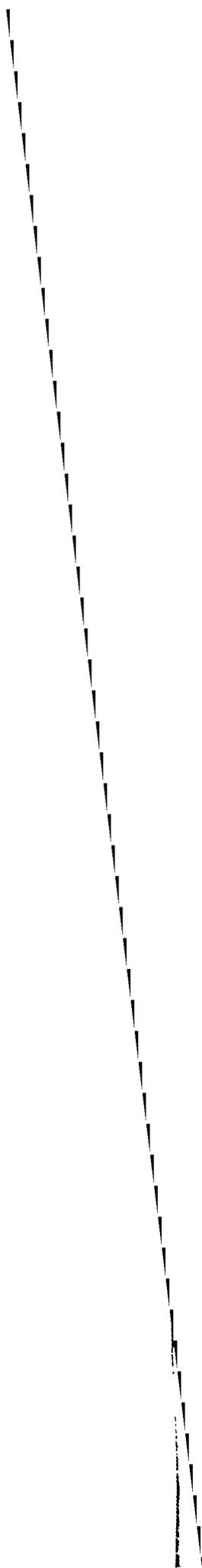
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LOCATION OF THOSE SCHOOLS AND UNIVERSITIES  
DISCUSSED IN THE APPENDICES



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SCALE 1"≈395 MILES



1. RURAL UNIVERSITY, RIO DE JANEIRO  
Universidade Rural (Km 47 Estrada Rio - São Paulo)

Physical Plant

This institution offers training at introductory and intermediate levels rather than most advanced stages in agriculture and agricultural economics, agronomy and veterinary science; "agronomic engineering". It is located on a splendid 1,000 acre tract of land, about 30 miles from Rio de Janeiro on the main highway to São Paulo. It consists of some 12 major building units of solid colonial style construction which are usable but generally not especially suitable for laboratory as well as classroom instruction. The buildings are lavishly proportioned two-story structures with large verandas which are too widely scattered to be readily accessible to students without transportation. A set of residence halls and attached student center provide for living quarters, eating facilities and minor social activities of the student body of approximately 500. There is an unusual arrangement of dormitory rooms in sets of two with three cots each, having a common study room between them with enough space for a table and six chairs. An excellent athletic field and other sport facilities are either available or under construction.

A considerable number of single dwelling faculty houses have been completed recently, possibly in response to the suggestion by Hilton A. Smith in his report on the veterinary school in 1953.

The physical plant with the exception of student housing, gives the general impression that with minor additions and alterations it might accommodate 3 to 5 times the current 500 enrollment. Facilities for research, however, are quite limited.

## Students

At the time of the visit, the Rector and most of the faculty and student body were away on business or vacation.

Entrance requirements are generally stipulated by government rules which provide for 11 years of prior schooling. The number of students is maintained at 500, of which 300 are in the school of agronomy and about 200 in the veterinary school.

## Faculty

The faculty is divided into some 41 departments, of which 18 are in the veterinary school and the rest in the agronomy school. Each department is under the direction of a professor, with 1 or 2 assistants. At present most professors commute from Rio de Janeiro, where they generally hold additional positions, and teach an average of 18 hours per week including laboratory instruction; some undoubtedly teach much less. Exceptions to this are the COSUPI-supported, full-time professors 2 in agricultural economics, 1 in anatomy and 1 in pharmacology, who have been appointed recently or who are about to start this year.

Approximately 50 assistants are employed on a yearly contract basis, except five who have tenure by virtue of having been employed five years prior to 1947, when the new law governing employment came into effect.

## Curriculum

The curriculum includes five years in either agronomy or veterinary subjects, two of which are basic preparation and three of a more specialized nature.

Instruction generally is limited to introductory and intermediate levels. No evidence of really advanced work was found.

## Research

Although research by individual professors is minimal, several may be engaged in research in connection with employment elsewhere. Junior members in some cases carry out research projects at their own cost.

Renewal of contract is a serious matter, subject to complications from delays in assignment of funds to professors, difficulties in keeping qualified personnel at the low rates of pay and short terms and uncertainties connected with the appointments. In spite of this, apparently there are a number of younger staff members carrying on research projects on the moderate scale permitted by the limited facilities and lack of research budgets.

In this connection our attention was called to the Ecological Institute where projects are in progress in soil microbiology by Joanne Doberimer and in genetics (plant breeding) by Professor Grossman. In the plant pathology department active work is being done by Assistant Professors Vendetti and Charles Robb. The Veterinary Institute under Professor P. Dacorso is highly considered by other institutions.

COSUPI funds are supporting Dr. Romulo Covina (vice rector), and others in an effort to stimulate agricultural marketing research.

## Laboratories, etc.

The quality of laboratories varied. Elementary instruction in chemistry including soil chemistry to be handled effectively with the available, mostly old to nearly obsolete equipment.

On the other hand, instruction in meat inspection, including microbiology, seemed to be on a primitive scale. Instruction in botany seemed to be limited to descriptive morphology, anatomy and taxonomy. Zoology probably was of similar nature. Physiology, nutrition and other aspects of functional biology

seemed to be practically absent, although these subjects must be considered as essential background for modern applied work in agriculture. A few field-plots for experiments are available in one area of the campus.

### Extension Work

An interesting new development in "agricultural" extension service is under Mauricio Cantalice de Medeiros, a young vigorous man trained in agronomy at Texas A & M and other southern universities in the United States. Seven stations, each with a "county agent" and "home economics adviser" have been established. Mr. Medeiros gave us an impression of competence and exceptional drive. From other sources we have heard that the program is far from realistic, and not comparable to its U. S. counterpart. Failure is due, in part, to improperly trained personnel, and in part, stems from attempts to apply current U. S. "propaganda content" to less developed situations in Brazil. In any case, an extension service would seem to be urgently needed in Brazil now, even if it is becoming obsolete in the United States.

### Library

The library has a collection of 25,000 books. It has a fairly large proportion of English texts, sparsely used. The list of journals was inadequate, both in scope and quality.

### Needs

Needs of the institution for advanced work and training are apparent.

These include:

1. research laboratories for staff and advanced trainees,
2. equipment for these laboratories and for routine class laboratories,
3. technical assistants and/or graduate students for significant programs,
4. full-time staff at all levels, especially of young active men.

This point was stressed by many persons.

## General Assessment

Rural University may have the land and physical plant to warrant serious consideration for large scale upgrading. In this respect, its location has some very favorable and some questionable features. Steps would be needed to provide attractive enough living conditions, salaries and professional facilities to maintain high quality staff in competition with attractions in the city of Rio de Janeiro.

This location may perhaps be important enough to warrant a major additional development in physical sciences and technology.

Humanities seem to be practically excluded at present and need to be stressed, regardless of new scientific developments.

II. NATIONAL SCHOOL OF ENGINEERING  
UNIVERSITY OF BRAZIL, RIO DE JANEIRO  
Escola Nacional de Engenharia

General Impressions

This school, originally a military school, has long since become civilian. It was organized in 1810 and the building was started about that time. A new extensive plant is being constructed at University City, the present plant being entirely obsolete and outmoded. The date for transfer to the new location has not been established, however.

The institution accepts 250 new students each year exclusively in engineering. Because of failures and course re-enrollments this results in each class numbering about 300 to 400. For example, about 700 second and third-year students are registered in subjects in physics. Formerly 90 percent of the students were in civil engineering, but this figure has now dropped to 40 percent.

It was stated that 95 percent of the students in the final year are employed, which agrees with the concept that this is really a 4-year engineering school, with the fifth year designed to give the students a feeling for engineering practice. It appears that the practical projects of the fifth year can be worked out in industrial jobs since class attendance is not required in Brazilian institutions. However, the Escola Nacional is somewhat unique in this regard because elsewhere it was found more usual for the fifth year to be more formally organized on a classroom-laboratory basis.

Faculty

The Director of the school is Rufino de Almeida Pizarro. Professor Ferruccio Fabriani is head of metallurgy. The professor of agricultural products is Oscar de Oliveira. Among others interviewed were Jeronimo Monteiro and Hugo Cardozo.

The full-time faculty seems limited to 4 persons, 2 professors and 2 associate professors. The full-time appointments are in rational mechanics, technical chemistry, mechanical technology and industrial technology.

### Curriculum

The curricula in order of enrollment are civil, mechanical, electrical, metallurgical and geographical engineering. There is no chemical engineering in this institution since it is covered in another faculty of the University of Brazil. The curriculum contains no time allowance for language or liberal studies. There also seems to be insufficient attention to basic science, no doubt due to the concept that all subjects in an engineering school must be taught by engineers rather than a faculty of engineers, scientists and humanists.

### Laboratories and Library

Basic science laboratories were considered to be completely inadequate and obsolete. The engineering laboratories are also generally discouraging. Equipment of an ancient vintage leads to retention of practices that went out of fashion in the United States about 1930. Metallurgy has been partially re-equipped by COSUPI at a cost of Cr\$ 3½ million.\* The director of this laboratory sees a future in his work and is the type of person who should be stimulating to students.

There were several persons giving attention to the library which has a fair number of volumes, but it was noted that non-Portuguese texts were receiving little use doubtless because of the students' inability to use a foreign language with facility. Portuguese translations showed greater use. Generally speaking, the library was out of date in regard to modern scientific and technical material.

### Administration and Assessment

This is a very conservative institution with a long, distinguished tradition which has now become a great handicap. The administration shows little enlighten-

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\*At the time of the survey, the exchange rate of the cruzeiro was 180 to \$1, U.S.

ment and seems to prefer things as they are except for new equipment. A few industrial gifts have been received in mechanical engineering, but the result is insignificant in relation to the need for modernization. There are a few young faculty members who seem to be possible stimulating agents for the future. The move to a new plant now under construction with COSUPI funds appears likely to prove stimulating unless the ruling groups, including the director, prove too reactionary. Evidently no real permanent improvement can be achieved until a strong nucleus of a full-time faculty is appointed.

### 3. MILITARY INSTITUTE OF ENGINEERING; RIO DE JANEIRO Instituto Militar de Engenharia

#### History

This institution was established as the engineering educational arm of the Brazilian Army. It graduated its first class in 1933. Very little, if any, change in curriculum or procedures has occurred since that time although changes are now being planned. It appeared that the reduction of military students due to reduced Army funds was the energizing factor in producing a plan to accept civilian students and in developing curricula with greater modern appeal. This plan still must obtain top-level approval before initiation.

#### Physical Plant

The present excellent but restricted building was completed in 1942. It is centrally located in Rio de Janeiro with a fine view over the bay. However, being hemmed in by the bay in front and the mountain in the rear, the Institute has no opportunity for expansion to provide for new laboratories. Perhaps this is not critical, however, since the number of military students has been reduced to such an extent that the plant is being used at no more than 50 percent of capacity. Although this facility is old in relation to the new construction seen everywhere in Brazil, it is quite serviceable and would be considered fully useable in the United States.

#### Students and Faculty

The present enrollment is about 300. The desired enrollment is 500, although more could be accommodated. There are 82 military professors and 30 civilian professors and assistants. The latter are usually part-time. Many of the military instructors (of engineering subjects) have been sent abroad for advanced education, a goodly number to the United States. There has been and now is a nucleus of foreign teachers which has doubtless been a useful influence.

## Curriculum

The present curriculum is of four years duration but the students have received a 3-year military education in place of the usual Colegio, thereby making their age at entrance approximately 18. The present curriculum has only science and technological subjects. The main study seems to have been civil engineering although other curricula are listed. The new plan is for a 5-year curriculum with two years of basic studies and three years of specialization which might include any of the more common areas of engineering plus geodesy. It is commendable that the new planned curricula will include language, humanities and social studies in the first two years as well as the usual mathematics, physics, chemistry and technical drawing.

## Laboratories

The laboratories were quite uninspired as well as being equipped poorly by modern standards. Much space was given to geodesy, surveying and mapping which now receives very little attention in U. S. curricula but may be of greater usefulness in Brazil. A large laboratory of electrical machines doubtless serves a useful purpose even though it is almost obsolete by U. S. standards. The most interesting laboratory was in hydraulics where there seemed to be great enthusiasm for project work in both hydropower and river hydraulics.

The library was found to be completely inadequate (fewer than 10,000 volumes) in both quality and quantity of books and periodicals. Much of the limited material available must be classed as obsolete. A much increased book fund is quite essential to any plan for revamping the institute.

## Assessment

This institute has no capacity for research and must be looked upon primarily as a teaching institution. Its emphasis upon science is also limited for the same reason. There seems to be no reason why the Army Military Institute

of Engineering should be short of laboratory equipment or why the United States should provide it. Since there is little likelihood of it becoming a significant contributor to either science or engineering except for military purposes it seems to be outside the purview of the Academy Committee.

4. CATHOLIC UNIVERSITY OF RIO DE JANEIRO  
Pontifícia Universidade Católica do Rio de Janeiro

The programs of this university in sciences, as described in a discussion under the enthusiastic chairmanship of Father Francis X. Roser, appeared to be, in general, rather promising with the exception of the field of biology, which they stated was a secondary goal to be achieved subsequent to the development of the physical sciences.

Physical Plant

The university, located on a 15-acre tract in Rio de Janeiro, was founded in 1940 and received official government recognition as a "university" in October, 1946. This can be considered a factor in their favor since they do not have any history or tradition to overturn when there is a need to "re-adjust" curricula to meet the needs of the student and university. Having only a small acreage available for construction should lead to an efficient operation and tend to unify the faculty, making them more aware of the interdependent roles of their disciplines.

Curriculum

As in the case of most of the Brazilian universities we have seen, PUC has an extensive building program underway on its new site. The partially completed building which is to house the classrooms and laboratories for the sciences and which was visited represents approximately 1/10 of their entire project.

At the present time, there are 11 different "faculdades" and "escolas". Of particular importance to this study are (1) the polytechnical school with courses in civil, electrical, and industrial engineering; (2) the institute of physics; and (3) the institutes of technology. Student enrollment in the university is approximately 2,000, with some 500 of these in the polytechnical school.

Laboratories

During our visit, the programs they had planned and which were listed in several pamphlets were discussed in very glowing and optimistic terms. However,

in our tour of the building we did not see any actual laboratories or major pieces of equipment for putting these courses into operation. The only exception was the new computer which had just been inaugurated. According to American standards, it is doubtful whether this will be used "full-time" in the foreseeable future. The faculty stated that at the moment, it was of more value in public relations as a possible means of attracting more capital for the university.

The institute of physics (solid state and nuclear) was discussed in detail, but all evidence leads to the conclusion that this was mostly "on paper." Prospects of equipment for the solid state physics branch did not seem too bright. Dr. Karl Joergensen from the Max Planck Institute is at the university to help them order equipment and initiate operations. He leaves in January, 1961, undoubtedly before any equipment will arrive.

#### Faculty

A big problem with the university is the lack of properly trained people to conduct the program both now and in the future. While several of the staff are undoubtedly capable as teachers, there are no staff members with "strong scientific incentive."

On the positive side, the university should be commended for having taken the initiative in establishing full-time professors. They anticipate having 8 or 9 full-time professors within the next 4 to 5 years.

#### Library

The library has a modest number of antiquated volumes and a very limited periodical list. The present library is entirely inadequate in terms of the emphasis on expanding the areas of science and technology.

#### Assessment

The general feeling is that the Catholic University of Rio de Janeiro lacks the competent scientific personnel which would be needed to make it into a creatively productive scientific center but that it would serve well within its

present plans, and with the necessary basic scientific equipment, as a center for instruction and student experimentation in preparing students in the basic sciences and with further development in engineering.

5. THE UNIVERSITY OF RIO GRANDE DO SUL, PÓRTO ALEGRE  
Universidade do Rio Grande do Sul

General Information

The Universidade do Rio Grande do Sul (URGS) is located in PóRto Alegre, the capital of the State of Rio Grande do Sul, a city of more than 500,000 people. In 1956, it is reported to have had an enrollment of 1,783 students, and to have graduated 620 in that year; the number of professors was reported to be 340.<sup>1</sup> During 1960, the students reportedly numbered between 6,000 and 8,000.

Schools and Institutes

In the PóRto Alegre area are located the faculties of medicine (including nursing and the institute of experimental physiology), law, economic science, philosophy, architecture, dentistry, pharmacy; the schools of engineering, and of agriculture and veterinary medicine; the institutes of hydraulic research, microbiology, natural science, philosophy, and of food technology (tecnologia alimentar); and the department of clinical psychology. There are also the COSUPI institutes of mathematics and applied mathematics, physics, and economic science.

In the city of Pelotas, 140 miles southwest of PóRto Alegre near the southern end of Lagoa dos Patos, are located separate faculties of law (including an institute of sociology and politics), and of dentistry. In the city of Santa María, almost

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<sup>1</sup> Figures drawn from Conselho Nacional de Estatística, Anuario Estatístico do Brasil - 1956 (Ano XVII) Rio de Janeiro, 1956. pp. 358-359. Reproduced in Brazil, Education in an Expanding Economy, A. F. Faust. U. S. Office of Education, Wash. Bulletin 1959 - 13.

200 miles west of Pôrto Alegre, are separate faculties of medicine and pharmacy. The university has its own press and maintains a radio station at its central campus.

By planned intent, the university has become the cultural center for the city of Pôrto Alegre.

### Budget

The total budget for 1960 is Cr\$974,714,510, of which the operating budget is Cr\$571,614,510 (59%) and the capital budget is Cr\$403,100,000 (41%). The greater part of the ordinary income of Cr\$932,551,570 (98%) comes from the Federal Government, while Cr\$4,120,000 (0.4%) is received from the State of Rio Grande do Sul, and Cr\$14,737,940 (1.5%) from miscellaneous sources, which includes student fees, Cr\$495,000 (0.05%), interest on investments (juros de depositos) Cr\$5,000,000 (0.5%), and services rendered (rendas industriais) Cr\$9,242,940 (1.0%). Extraordinary income of Cr\$23,305,000 is estimated primarily (86%) from Federal sources (including Point Four support), and Cr\$2,750,000 from the State Government and other sources.

The operating budget is allocated as follows: Office of the Rector (administration), 20.64%; school of engineering, 11.77%; faculty of medicine, Pôrto Alegre, 10.80% and Santa Maria, 3.50%; school of nursing, 2.33%; faculty of philosophy, 7.24%; faculty of economic science, 6.53%; school of agriculture and veterinary medicine, 7.61%; faculty of architecture, 4.02%; faculty of dentistry, Pôrto Alegre, 3.11% and Pelotas, 3.01%; faculty of law, Pôrto Alegre, 3.07% and Pelotas, 2.26%; faculty of pharmacy, Pôrto Alegre, 3.05% and Santa Maria, 1.96%; institute of hydraulic research, 2.14%; and each of the remaining institutes, 1.35% or less.

## Physical Plant

The physical plant in Pôrto Alegre varied from old but adequate (with some departments overcrowded and others not fully utilizing the space available), to new and modern. The new auditorium and student center buildings are excellently conceived, and by United States standards luxuriously built. These structures provide the activity center not only to integrate the various faculties and students of the university, but also the university with the city.

New buildings, of esthetically appealing contemporary architecture, are nearing completion for the engineering school and for the faculty of medicine. The latter, including a 1,600-bed hospital, is a short distance from the University Center. From 1950 to 1958, the available area of the university buildings increased 250 percent. The school of agriculture and veterinary medicine, and the institute for hydraulic research, are in the country east of the city on the road to Viamão, perhaps five miles away from the University Center. Long-range plans provide for moving other units of the university to this extensive outlying campus, and for moving the faculty of agriculture and veterinary medicine to another location in the farming area some distance from Porto Alegre.

## Students

From 1950, when URGS became a Federal University (Universidade no Sistema Federal de Ensino Superior), it has grown from 2,658 students and 328 professors, until in 1958 it had 4,670 students and 952 professors.<sup>2</sup> Students enter from a colegio by examination. Recently instituted scholarships for students of Cr\$4,000 and Cr\$5,000 per month, have encouraged full-time attendance. As of July, 1960, the legal minimum wage in Brazil was Cr\$5,000 per month, and skilled workers earned Cr\$10,000 to Cr\$16,000 per month. These scholarships appear generous until it

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<sup>2</sup> See footnote 1, page 15.

is realized that to purchase a single technical book requires one-half of a student's monthly stipend. The 1960 budget provides Cr\$1,000,000 from Federal funds for scholarships. (This appears to provide for 20 scholarships, presumably all in physics and mathematics, annually for a student body of several thousand; fees, however, are negligible).

Data on the apportionment of students among the various faculties, schools, and institutes was not obtained in its entirety; such as was obtained will be presented as the various units are discussed. In general, the faculty of philosophy seems primarily concerned in teacher training of personnel for the faculties of the "colegios" and "ginasios," and has not many students. Law is an overcrowded profession, and many students study under the faculty of law. The medical faculty admits 50-60 students each year (directly from the colegio) and in expanding will not admit more than 100. The medical course requires six years.

### Faculty

The professors of the several units are believed for the most part to be part-time. (They would be called "full-time," but not "tempo integral;" many simultaneously hold other positions, or practice their professions.) The value of full-time (tempo integral) professors is realized, and the more progressive units have several such, as will be noted below. The first faculty of philosophy was organized in 1939.

Faculty ranks are not known as in the United States system, but are approximated by Professor Catedratico (appointed by the President of the Republic according to Federal Law), Assistente, Instrutor, and Trabalhos de Pesquisa. New titles are being introduced.

## Curriculum

The various specialized schools and faculties provide professional training as may be surmised. However, all students enter the professional curricula directly from the colegio, at age 16-18, and the program is narrow and specialized. Instruction in humanities, social studies, or languages will not, or at most rarely, be found, except in the faculty of philosophy. As indicated above, students under this faculty are for the most part training to be medium-level (secondary school) teachers.

As an example, in the school of engineering (Escola de Engenharia), all programs have a common first year, which is comprised of calculus, analytic geometry, nomography, descriptive geometry, physics, free-hand drawing (desenho a mão livre), and introduction to engineering. The third, fourth and fifth years vary for the different engineering programs, but are equally technical. The most liberal courses required are those such as business economics, administration, etc.

Each school or faculty in general provides instruction in the basic sciences by members of its own staff. For example, in the medical school the basic sciences are taught by the medical school faculty. Through the COSUPI plan it is hoped that this will be corrected.

### INDIVIDUAL FACULTIES, SCHOOLS AND INSTITUTES

#### School of Engineering

In 1960, the school of engineering had 782 students; first year, 202; second year, 192; third year, 158; fourth year, 101; fifth year, 101; and sixth year, 28. (Five years of study lead to the diploma in engineering, and the sixth year is postgraduate). Of these, from 25 percent for the second year up to 56 percent for the fifth are in the civil engineering program. The 192 second-year students have elected engineering options as follows: civil, 55; mechanical, 41; electrical, 20; mining, 3; metallurgical, 3; chemical, 13; civil electrical, 12; mechanical-electrical, 28; mining-metallurgical, 3; and mechanical-metallurgical, 14. (The course in M. E. was introduced but five years ago; formerly, emphasis was all C. E.)

In the engineering laboratories, the equipment was for the most part antiquated and obsolete, or lacking. One exception noted was the equipment for the calibration of watt-hour meters, purchased with COSUPI funds. In the new engineering building, however, provision is being made for adequate laboratories, often with generous space. For example, the student practice shop in mechanical engineering will have sufficient machine tools to provide good laboratory practice.

### Research

No research in engineering was in evidence, based on U. S. standards.

### Institute of Chemistry

The institute of chemistry in the school of engineering provides for the training of chemical engineers, and has more than enough space for the 13 second-year students, the 5 third-year, 1 fourth-year, and 4 fifth-year students; 23 in all. The laboratories could easily handle a total of from 500 to 1,000 students. (A question was raised as to whether students from other courses are not receiving instruction, in spite of being assured they were not.) Equipment was quite inadequate, and usually old. The one exception was in the physical chemistry laboratory. Here the specialized radio chemistry equipment bought by COSUPI funds through the institute of physics (to be discussed below) stood out. This equipment included counters, scalers and associated items, a modern high vacuum gas train constructed locally, and good neutron and x-ray sources for irradiation of samples, and properly set up for shielding and safe handling. Much of the effort of this laboratory seemed directed at routine fall-out measurements. Aside from this, there was no evidence of any research in chemistry.

The instructional program in chemistry seemed ordinary. An entire year appears devoted to inorganic qualitative analysis. This course is rarely more than one-half year in the United States, and in more progressive programs has been dropped altogether. Organic chemistry requires two years; the first concerned with aliphatic compounds, and the second with aromatic and heterocyclic.

Ordinarily this would be a one-year course. The year of quantitative analysis included some instrumental analysis, and seemed comparable to the usual course. The unit operations laboratory had ample space, but the equipment for the various experiments was in some cases old or lacking, with the exception of paper technology. There were some pieces of apparatus under construction, however.

Many more students could be taught without expansion of the plant or staff. Each of the two years of organic is taught by a different professor, each with his own assistants, to a mere handful of students, for example. Similarly, the unit operations laboratory was of the size which would be used for 30-50 students in a U. S. university.

#### Institute of Physics

The COSUPI-supported institute of physics was well equipped with modern apparatus, and the professors and staff were alert and knowledgeable. An active research program is in progress, and several significant papers in nuclear physics have already been published in recognized journals. In addition to the neutron and gamma sources previously mentioned, there is in prospect a synchro-cyclotron which is to be obtained, unused, from Niteroi, after its acquisition from the National Research Council (Conselho Nacional de Pesquisas, CNP). Other equipment for research in electronics is being sought. The active men in this program are Professor Gerhard Jacob and Professor Darcy Dillenberg.

The institute of physics now has 4 full-time professors and 12 full-time assistants. Plans have been made for increasing the number of full-time personnel. The institute can make good use of visiting professors.

The existence with the institute of an active division of instruction under the supervision of Professor Jacob promises an effective instructional program at the undergraduate level. Not only is equipment for student use being contrived and built, but an active program of student recruitment has, during its first year,

increased the number of entering students from 8 to 15. Proposals have been made for 45 scholarship students, and 10 "internos" (estagios). Plans are under-way to bring all instruction in physics at URGs to the institute of physics.

The support for the institute, from the time of its creation in 1958 has come from the following sources:

<u>Year</u>	<u>COSUPI</u>	<u>CNP</u>	<u>CNEN*</u>
1958	Cr\$ 8,600,000	----	----
1959	Cr\$30,000,000	Cr\$ 812,000	Cr\$74,190
1960	<u>Cr\$30,000,000</u>	<u>Cr\$1,032,000</u>	<u>----</u>
TOTAL:	Cr\$68,600,000	Cr\$1,844,000	Cr\$74,190

(About 97% COSUPI)

#### Institute of Mathematics

The institute of mathematics, established under COSUPI sponsorship, is comprised of the division of pure mathematics and the division of applied mathematics. A modern analog computer is operating within the institute. An active program of research is underway, and almost a score of publications has come from the institute, although none in recognized journals. Many are books for use in the instructional programs. Research topics in applied mathematics include thermodynamics, chemical kinetics, elasticity, the statistical correlation and filtering of information from agricultural experiments, and applied chemistry. Special courses are offered within the institute in the teaching of mathematics. There are 23 students in pure mathematics, and 21 in applied. There are 10 full-time professors.

#### Institute of Economic Science

The third COSUPI institute at URGs is that for economic science. This appeared to be well organized and well staffed, with a projected program of research and instruction. The institute of economic science has the support of COSUPI to the extent of some \$25,000 to \$35,000 per year which would have a purchasing power of three or more times this amount in relation to U. S. standards. This is quite adequate support for such a limited institute in its early stage of development.

\*Comissão Nacional de Energia Nuclear

The budget supports about a dozen full-time staff members, several being professors. There was some discussion of research but no evidence was presented comparable to that in the institutes of physics and mathematics which are quite active in research. There was some discussion of advanced training but no program of graduate study has been formally developed as yet.

#### Institute for Hydraulic Research (Instituto de Pesquisas Hidráulicas-IPH)

This institute, established in 1956 by the Federal Government as the national center for hydraulic research, opened its first building two years ago, and now has a well-conceived, well-planned, and well-built extensive plant of several large buildings, east of the city of Pôrto Alegre. Few, if any, U. S. laboratories are better. Under the able leadership of Professor Arcy Cattani da Rosa, active research in pure and applied hydraulics is underway, and a program of instruction is being set up with 150 students per year already participating. Research projects are undertaken for business or non-Federal Government units on a reimbursement of total costs basis. Fifty men are now on the staff of IPH, including 8 engineers, and 2 on the faculty of the school of engineering.

Professor Rosa is very anxious to have, for a 2-year stay, a visiting coastal hydraulics engineer from the U. S. Army Corps of Engineers Laboratory at Vicksburg, who would be familiar with material transport problems as opposed to agitation problems. It is believed that worthwhile use would be made by IPH of such a person.

#### Institute of Natural Sciences

This institute is long standing within the URGS, and comprises several departments. Particularly noteworthy are: (1) The work in botany under Professor Schulze, author of "Flora do Brasil," with effective teaching and research in systematic morphology and other aspects of botany. A number of able junior men work with him. (2) Genetics, under Professors Cordeiro and Tondo, and in human genetics under Professor Sazano, who has been investigating three different aspects of hemoglobin change, and has isolated a new hemoglobin component. This work in

genetics has been supported by the Rockefeller Foundation. Effects of in-breeding have been studied, as well as radiation effects in drosophila. (3) The department of geology and paleontology has been built up during the past five years under direct grants from the Federal Government, as part of a program to overcome the shortage of Brazilian geologists, and to exploit more effectively Brazil's mineral resources. Here Professor Iraja Damiani Pinto and his associates have accomplished a most remarkable task in inaugurating active programs of investigation, and inspiring great student interest by an effective instructional program, involving lectures, laboratory, and field work. The staff, equipment, and collections of the department would do credit to any U. S. university,

There is no effective program in physiology, or in functional biology, except for genetics.

#### School of Agriculture and Veterinary Medicine (Escola de Agronomia e Veterinária)

The head of this school, Dr. Correio, a veterinary doctor, runs an excellent school with a good veterinary hospital, staffed by two German veterinarians, and has a very adequate faculty for the work in veterinary medicine. In agriculture, the plant section, headed by Professor A. T. Quintas, is moderately equipped. Instruction in cytology and anatomy is offered but none in plant physiology. Small but adequate greenhouses are available for plant breeding experiments. Professor Rulin Markus (trained at Iowa State University) is very good, and in his Instituto de Estudos Forrageiros, he has some sound work on legumes going on. Dr. Karl H. Morkdick (trained at the University of California at Davis) is developing new grasses, and studies in progress since 1954 promise new climatically suited strains. These men receive nothing from COSUPI, and need support. Though working full-time, they are underpaid. Plot tests cover a considerable area. New dormitories are needed for students. All in all, the school is adequate.

## Libraries

The libraries are essentially divisional, by faculties, schools, institutes or departments. (The central library is essentially a comprehensive card catalog). They are adequately staffed, and the librarians have sufficient training. The catalogs appear comparable to those in the United States. In general, they have sufficient books, predominantly from the United States, for undergraduate work, but with one or two exceptions, are not adequate for graduate work or faculty research. Periodicals, serial and current, are weak.

The collection totals only 11,995 volumes. There are 293 titles (registrados) in the periodical section and 4,430 reprints. Purchases since 1956 comprise 2,235 publications, and gifts, 154.

Four trained librarians are on the staff, plus one library science student and one clerk. Brazil has taken steps to provide for the training of librarians, by organizing courses in library science. Many of the teachers of library science in Brazil have been trained in the United States.

## Assessment

URGS is well administered under the able and imaginative leadership of the Rector, Professor E. Paglioli. It is an alive and vibrant institution, with a knowledge of its mission in the Rio Grande do Sul area. It cannot help but grow in stature and recognition. However, by U. S. standards, it is no better equipped or staffed (with full-time teachers) than some of the poorest urban universities that live largely from tuition. Nearly all state universities in the United States would have better undergraduate programs than the University of Rio Grande do Sul.

LIST OF SOME KEY STAFF MEMBERS

- Prof. Pery Pinto Diniz da Silva**  
Vice Reitor da Universidade do Rio Grande do Sul,  
Diretor da Faculdade de Ciências Economicas e  
Professor da mesma Faculdade.
- Prof. Ernesto de Mello Mattos Lassance**  
Diretor Substituto da Escola de Engenharia  
Diretor do Instituto de Física da Escola de Engenharia e  
Professor da mesma Escola.
- Prof. Saviniano de Castro Marques**  
Diretor do Instituto de Física da Universidade do Rio Grande do sul,  
Professor da Escola de Engenharia.
- Prof. Ary Nunes Tietbohl**  
Diretor do Instituto de Matematica de Universidade do Rio Grande do Sul,  
Faculdade de Filosofia e da Faculdade de Arquitetura
- Prof. Ernesto Bruno Cossi**  
Chefe da Divisão de Ensino e Divulgação do Instituto de Matemática,  
Professor da Faculdade de Agronomia e Veterinaria e da Escola de Geologia.
- Prof. Arcy Cattani da Rosa**  
Diretor do Instituto de Pesquisas Hidráulicas da Universidade do Rio  
Grande do Sul,  
Professor da Escola de Engenharia.
- Prof. Oscar Maximiliano Homrich**  
Diretor do Instituto de Tecnologia Alimental da Universidade do Rio Grande  
do Sul,  
Professor da Escola de Engenharia.
- Prof. Manuel Luiz Leão**  
Diretor do Instituto de Química da Escola de Engenharia,  
Professor da Escola de Engenharia.
- Prof. Rubem Penha Rodrigues**  
Diretor do Instituto de Eletro-Técnica da Escola de Engenharia,  
Professor da Escola de Engenharia.
- Prof. Renato Gomes Perrone**  
Professor da Escola de Engenharia.

6. CATHOLIC UNIVERSITY OF RIO GRANDE DO SUL, PORTO ALEGRE  
Pontificia Universidade Catolica do Rio Grande do Sul

General

The general impression was of an institution operated by the Marist Order located in inadequate quarters that is struggling successfully to relocate itself on a suburban campus with excellent highway access and adequate acreage. The Rector, Irmão Jose Otão, seemed quite an able administrator whose attention is directed toward physically rebuilding the university. His new dean of engineering is Professor Wolff who is also a professor of civil engineering at Rio Grande do Sul. Dean Wolff is establishing a civil engineering curriculum first although he also hopes in due time to establish a mechanical engineering curriculum. It seems that this is due to expediency and availability of part-time teachers since electrical and mechanical engineers are in greater demand than civil engineers. Any further curriculum extensions are considered to be for the fairly distant future. The engineering school is only one year old, so its present quarters are not very significant. The planned engineering plant, which is now under construction, will be fully adequate for the foreseeable future.

Registration in engineering is not as yet determinable, but it might be expected to run from 10 to 20 percent of the total. The current registration in the university is 2,000 students, with 400 to 500 graduates yearly. The scientific side of the institution seems both underdeveloped and not well projected. In this area, the university compares unfavorably with the Catholic University of Rio de Janeiro.

Faculty

The faculty of over 300 is quite large for an institution of 2,000 students. However, it is wholly part-time and appears to be largely drawn from the faculty

of the University of Rio Grande do Sul. It was mentioned that this faculty duplication would also occur in medicine, which is a planned expansion. It seems clear that the development of a faculty is not taken very seriously, but is a casual process of appointment of available part-time personnel. However, there are about 20 members of the order who are full-time.

#### Laboratories and Library

The science laboratories visited showed evidence of use but were not modern in any sense. Engineering laboratories were essentially nonexistent since the engineering curriculum is only one year old. The school of dentistry was recently opened at the new campus in a large building, well equipped with new apparatus. Hence one may assume that some new equipment will be obtained for engineering and science when they are moved into the new building.

The library was reasonably well equipped in terms of historical, philosophical and religious material. However, little material was observed of a modern nature and even less of significance to science or engineering. The periodical room was quite impressive although again the emphasis was not strongly in either science or engineering. There was evidence, however, that the judgment or talent to build a library does exist in the institution, but that funds are not being used.

#### Administration and Assessment

No evidence of research was observed in the institution. Science and technology, therefore, will have a slow start. It is doubtful that a part-time dean can produce a modern engineering school of significance. Although the top administration is alert and aggressive, it appears that the administrative energy of the institution over the next decade is certain to be consumed by the task of building the buildings on the new campus. When completed, this will be a civic monument, but it may not have moved the institution ahead intellectually. Under different circumstances the rector's energy could produce an intellectual development of significance. However, the convenient dependence upon the adjacent Federal institution for part-time faculty is an extremely unfortunate limiting factor.

7. UNIVERSITY OF PARANÁ, CURITIBA  
Universidade do Paraná

Physical Plant

This institution has a group of buildings almost in the center of Curitiba, a city of 400,000, that houses the administration and the faculties of philosophy, medicine, dentistry and pharmacy. The faculties of botany, zoology, and chemistry are also located in the city and the suburban area but at some distance from the main cluster of university buildings. A new campus for engineering is under construction on a site located several kilometers away on the edge of the city. This new group of buildings is being financed entirely by COSUPI money. Other buildings are already planned for botany, zoology and chemistry. The physical plant now in use and projected, seems adequate for the program contemplated but unfortunately is badly scattered geographically. The efficiency of the institution will suffer from its lack of geographical unity.

Students

Apparently the student body is of good quality, above average for a small university, as judged by the relatively large number who select undergraduate study in the sciences. There is no study for advanced degrees, the fifth year in science and engineering being of a practical nature.

Faculty

Nearly all of the faculty is part-time, but in a few departments the principle of full-time has been established. Since COSUPI is providing buildings for engineering it is assumed that its faculty will be chiefly if not wholly full-time as they move into the new quarters.

The faculty has some outstanding members. Antenor Pamphilo dos Santos, Dean of Medicine, has served as dean for a number of years and appears to be effective as an administrator. Arnaldo Isidoro Beckert, Dean of Engineering and Samuel Chamecki, civil engineering, are obviously competent as judged by the economical design and standardized units planned for civil engineering courses now being given, and the projected program in mechanical and electrical engineering. In structural engineering, Professor Chamecki is highly qualified and has a very

good laboratory of structural models, both static and dynamic.

Professor Bacila of the Institute of Biology and Technological Research is outstanding. New quarters for the institute being built under his guidance will be modern and well planned for postgraduate and senior investigators. The institute for agricultural entomology and agronomy is housed in nearby buildings. Dr. Bacila's laboratories are well equipped for biochemical analysis and enzyme research. He has advanced students working on basic problems of metabolism and on the biochemistry of pathological and parasitic organisms. Professor Jesus Moura is a world authority on bees and is engaged in a detailed study of their social organization and behavior. He is extremely capable in the classical aspects of zoology. His assistant, Hans Jacoby, is working on physiology. He believes he has discovered an effective diagnostic test for cancer of the intestine. The botanist appears to give only routine old style botany.

Professor Nilton Emilio Buhner, Director of the Institute of Chemistry, is a full-time professor who appears thoroughly competent though not an outstanding scientist. He has a competent teaching faculty. The exhibit for the 14th Brazilian Congress of Chemistry was well organized and impressive.

### Curricula

In the above account of the faculty and the physical plant various curricula have been referred to, hence little more needs to be recorded. A total of 29 curricula are in force or projected. Only civil engineering is now given but mechanical and electrical engineering are provided for in the new buildings under construction. A full-time professor of mechanical engineering is being sought in France. The new quarters for biochemistry contemplate instruction for some 300 students serving medicine, pharmacy, and other divisions requiring this subject. In the school of chemistry, ceramics, wood utilization, glass technology, and electrochemistry are included as applied studies.

## Research

The most vital research seems to be found in the institutes of biology and technological research and of agricultural entomology and agronomy. The biochemistry research is particularly outstanding.

## Equipment

The equipment needs are very great. None has been provided for mechanical and electrical engineering and very little up-to-date equipment is found in civil engineering. In the school of chemistry there is no basic research in progress and no equipment for it.

The libraries are, in most of the units, far from adequate. The periodical list is extremely limited and there is no central library although there is a central catalog of library holdings of the several institutes, faculties and schools.

## Administration

Educational leadership is lacking in the central administration of the university. The rector, originally a construction engineer, is energetic and probably efficient as an administrator but appears to lack a genuine interest in the educational program. He showed great pride and enthusiasm in the building program. He is one of the three members of the COSUPI Central Committee and it is of interest to note that practically the only funds received by this institution are for building the new engineering plant.

## Assessment

The University of Paraná has the foundation for a strong university. In spots it is already strong but it is doubtful whether it will live up to its promise fully under present leadership. Personnel and equipment to improve the quality of instruction and research are paramount needs. They will not likely be met adequately unless and until the central leadership makes that its primary objective. A realization that separated campuses are inefficient and fail to unify a faculty could still make a great contribution to the ultimate development of the University of Paraná.

8. ELECTRICAL - MECHANICAL ENGINEERING INSTITUTE OF ITAJUBÁ  
Instituto Eletrotécnico de Itajubá

The general impression gained from the inspection of this institution was that of a small, highly specialized engineering school dedicated to training engineers for the power industry of Brazil. The isolation and limited curricula of the institution might have a near parallel in the United States in Clarkson College, for example.

Physical Plant

The plant has existed in one building that had become obsolete by 1957. COSUPI funds have been used to refinish the inside which is now in excellent condition, and to add new wings as needed to meet reasonably predictable demands. In general, it may be said that the revamped physical plant will be all that could be desired for the small faculty and student body involved. The plant is being planned to increase admissions from 60 to 100 annually.

Students

Sixty students are admitted annually from some 250 applicants. At present the total student body numbers 230. About 90 percent of the students pass into the second year and 65 percent finally graduate. The students are said to be highly cooperative in attending classes on a full-time basis. The fact that the town of Itajubá is small (40,000) provides students with very little social outlet or employment. Hence students are all, or nearly all, on scholarships. Nevertheless, 30 percent are drawn from the town of Itajubá and the surrounding area. It was noted that 4 students came from Paraguay, 12 from Peru, 1 from Bolivia and 2 from Nicaragua. These students are subsidized through the technical Assistance Board of the United Nations. Student tuition has been only 300 cruzeiros per year, since the institution was federalized in 1956. Housing for 100 students is now being constructed. The students raised funds for the presently adequate student union.

## Faculty

The present faculty consists of 7 full-time professors, 1 full-time assistant, 18 part-time professors and 20 senior student monitors. It was noted that only 4 of 26 full and part-time professors graduated from other institutions. None have recently studied for advanced degrees although 3 or 4 have such degrees from Europe. The last professor appointed is the teacher of English whose services are in very great demand. The plan is soon to have all students studying English. However, language is an extra subject since it cannot, by law, be required in an engineering curriculum.

## Curriculum

The objective of the institution is limited to the training of engineers for the power industry with the objective of increasing the power production of Brazil. Hence studies culminate in the study of hydroelectric power, steam generation and steam-electric power generation and transmission. The single degree given at the end of five years is designated as a mechanical-electrical degree or advanced certificate. This follows two years of basic study as specified by law and three years of advanced technical study. The final year culminates with completion by the 5th-year class of a project, which in 1958 was the layout and functional design of a hydroelectric power plant.

## Laboratories

The laboratories were found to be disrupted by the reconstruction program. However, the physics laboratory showed a reasonable number of new electronic instruments purchased by COSUPI. Excellent drafting rooms were observed. The electrical power laboratory, although old in terms of equipment, is adequate for the purpose of study of electric power generation. There was no electronic laboratory since electronics is not a basic objective of the curriculum. There was neither an electronic computer nor an electric power distribution analogue computer, either of which would be most useful in studying power distribution systems. A simple analogue computer could be student constructed. The hydraulic

laboratory was found to be adequate for the practical study of hydraulic power development, but is not fully adaptable to demonstration of the theory of various types of fluid flow. The mechanical power equipment was largely also of a practical demonstration type.

The new laboratories being developed were indicated to be of a more scientific nature, i.e., heat transfer and vibration, for example. When completed, the revamped and newly constructed laboratories appear likely to be adequate for the practical objectives of the electrical-mechanical hydropower curriculum. The only research being planned in the laboratories is to study the magnetic properties of materials. This work will be supported by a grant of Cr\$ 10 million from the Brazilian National Research Council.

#### Administration and Assessment

The operating budget for the current year is Cr\$ 40 million of which Cr\$12 million came from COSUPI and Cr\$28 million from the Federal Government. It is expected that in the coming year COSUPI will increase its support to Cr\$20 million and that there will also be the Cr\$10 million available, as mentioned previously, from the National Research Council. Last year, Cr\$3 million were expended for equipment. This year Cr\$8 million should be available for the purchase of equipment. The need expressed by the dean is for additional full-time staff and for scientific equipment. The staff considers the advantage of the smallness and isolation of the Itajubá engineering school to be (1) that the students are serious and give full-time attention to their studies (It is impossible for them to be employed except during vacations which amount to four months per year), (2) that there is close association between students and faculty. The disadvantages of location are (1) holding the best full-time staff in such a small community and (2) the difficulty of obtaining part-time staff who must commute some 150 miles from São Paulo.

9. TECHNICAL INSTITUTE OF AERONAUTICS, SAO JOSÉ DOS CAMPOS  
Instituto Tecnológico de Aeronáutica (ITA)

Concept

This is a civilian institution, established in 1948, operated and financed by the Ministry of Aeronautics. Operations are handled by Air Force personnel under the command of Brigadier Montenegro, actually a Major General. The educational policy and budget allotment for educational activities are handled by the rector who is currently Samuel S. Steinberg, former Dean of Engineering of the University of Maryland. Structured on the American pattern by a series of American rectors, aided by numerous consultants from the United States, the institution shows many characteristics of an American institute of technology but with necessarily extensive adaptations to local conditions. For example, the student body is not only highly selected but is given a small stipend in addition to all living expenses. Also, the faculty represents 20 countries which presents a very great problem of amalgamation not wholly solved as yet.

Physical Plant

The campus and plant at São José dos Campos is about 10 years old. It is being extended at this time by the addition of a building for physics and chemistry that is approaching completion. Although the original plant was designed primarily for instruction in aeronautical engineering it has been adapted to increased emphasis upon, for example, electronics, in a fully acceptable manner. The available buildings serve and should continue to serve the needs of the institution for some time in the future. The very recent addition of a cafeteria building has been a great asset. The construction of new dormitories (with COSUPI funds) will make the institution even more attractive to students. The only noticeable lack in regard to plant is that individual houses originally planned for professors have not been constructed. The row houses planned for associate professors serve this purpose to a reasonable degree but the need for staff, particularly visiting professors, is such that improved living quarters would be a great asset.

## Students

In the past year the institute examined 1,665 applicants for admission. Of these applicants 174 passed written examinations and 100 were admitted. These students are very fortunate in that they not only are admitted to the best equipped and staffed technical institute in Brazil, but they have all expenses paid including transportation and are given a small monthly allowance. Upon graduation they are free to seek any employment without obligation to the Federal Government. It was noted that all students must live on campus and that they are given considerable responsibility and operate under a student honor system. The use of a full-time faculty leads to close student-faculty relations in contrast to Brazilian metropolitan institutions. This relationship is being cultivated through a faculty advisory system. This is the only Brazilian institution in which class attendance is said to be compulsory. It was said that there had been little evidence at São José dos Campos of the student unrest that has resulted in prolonged strikes in many Brazilian institutions. In the one instance of student dissention caused by severe grading, prompt action by the rector apparently set a precedent that should avoid the possibility of future strikes. Of course, military authority gives the rector full support.

## Faculty

The faculty of ITA numbers 120 academic persons, including 10 North Americans. There are 12 full professors, 18 associates, 20 assistant professors and 70 assistants. In addition, the associated Air Force Research and Development Institute (IPD) employs 45 engineers and scientists. Thus the total group of academic personnel approaches one half of the number of students. Essentially all of these personnel are employed on a full-time basis, which is a policy of the institution. The quality of the faculty is indicated by the fact that 20 have earned doctorate degrees and 12 are now on leave completing Ph. D. degrees.

Visiting professors have been used consistently to bring unique competency to the institution. At present several North American professors are being brought to the campus through the Point Four program with the particular objective of training new teachers. For example, Professor Helander of Kansas State College, is spending 2 years at São José dos Campos to train a few possible teachers to conduct undergraduate courses in heat transfer. Other young professors are being sent to the United States through the Point Four program. There is also \$15,000 per year for purchase of laboratory equipment not available in Brazil. Hence at ITA there is in operation a model of the program being requested by COSUPI through ICA for all Brazil.

### Curriculum

This institution was established for the teaching of aeronautical engineering. Hence it is not surprising that several subdivisions were initiated of which aeronautical design and air transport have been retained. However, it is now planned to merge these curricula into a single aeronautical engineering curriculum. The other fully developed curriculum is electronics, with mechanical engineering less effectively developed as yet.

The standard concept of two preliminary years of basic science and mathematics is employed. There is evidence that the work in mathematics and the theoretical side of physics is strong. Less dependence can be placed upon the experimental or laboratory side of physics while chemistry has not received sufficient emphasis. This is evident from the fact that there has been a single department of physics and chemistry. However, this imbalance may be adjusted when the building for basic science is completed and the objective of developing curricula for degrees in the basic sciences progresses. It is encouraging to know that English is required for four semesters, and that humanistic electives are being planned. The first three years gives a strong emphasis to practical engineering but with desirable attention to the engineering sciences. In the fifth year the student is expected to complete a project which seems to carry

forward the best tradition of the undergraduate thesis. At this stage the facilities of the Institute of Research and Development are a valuable adjunct to ITA and are used in at least a few theses. Otherwise there was no more evidence of effective integration between ITA and IPD than there is in similar associated institutions in the United States which is usually negligible. Throughout the five years classes are small. Even individual instruction is feasible because of the high teacher-student ratio.

In general the curricula as planned, rather than those listed in the 1959 catalog, seem to reflect a progressive view in engineering education. If the intent to increase the social-humanistic content to 20 percent of the curriculum is actually put into effect, it is believed that the resulting product will provide more effective leadership for Brazil in the broad socio-technological field in which engineers inevitably must work.

#### Library

An excellent small library of 40,000 to 50,000 volumes exists. So far as could be determined from a brief visit, the books are well selected and are modern. A broad selection of current periodicals also is available. Current abstracts were also observed for the critical fields of science and engineering. There was evidence that English books were being used by the students far more frequently than in the other institutions visited. Hence the required course in English seems to be relatively effective. This course can be required only at São José dos Campos since other educational institutions come under the Ministry of Education and curricula are fixed by law.

#### Laboratories

The laboratories seen at São José dos Campos were the best equipped of those inspected in Brazil. For example, the aircraft structures laboratory was exceptional. As support for the laboratory there is a materials testing laboratory and a metallurgy laboratory that are well equipped. Fatigue testing and heat treating facilities are fully adequate and are backed up by good machine shops both for research and for student instruction. X-ray equipment of 200 KV capacity is available.

There are two wind tunnels; one of about 300 hp and 140 mph is quite adequate for undergraduate instruction. A large concrete tunnel of 1,500 hp and 300 mph across a large throat is being completed for commercial and military testing. It will be the largest wind tunnel in Brazil and can only be justified as a national tool for development work. It is of no great value to the educational program.

The mechanical laboratories attempt to combine semi-commercial testing with undergraduate instruction in dual purpose space. Such combined laboratories include engine testing, combustion, heat power, etc. This arrangement is not an obvious success. It may work reasonably well for the fifth-year projects, but lower-level instruction should be conducted in instructional laboratories set up for the single purpose of demonstrating the basic principles of mechanical power. This concept was not violated as obviously in electronics or in other laboratories.

#### Research

The center includes a research and development division termed IPD that compares favorably in equipment with such research institutes as Midwest in Kansas City, and Southwest in San Antonio, Texas. The military administration employs 45 scientists and engineers in this division. Most of the laboratories except mechanical power and aircraft structures are separate from the teaching laboratories. There is no evidence that these excellently equipped basic laboratories serve the teaching program except in a minor way. In this regard IPD may be compared with the Armour Research Foundation of the Illinois Institute of Technology and the Stanford Research Institute in which student activities are limited to occasional employment as assistants or an occasional thesis project.

Aside from the IPD activities there was no great evidence of faculty research although some papers have been published. Also two research contracts with the U. S. Air Force, totalling \$38,000 exist. Some complaint was noted

that professors were unable to hold assistants at the civil service salaries permitted. Later it was determined that assistants in the Polytechnic Institute of São Paulo are paid double the Air Force salaries of assistants at São José dos Campos. This discrepancy cannot continue very long without disastrous results.

#### American Professors

Two members of the Committee made a second visit to São José dos Campos to visit four American professors who were away during the first visit. There are five in residence currently. These are: Linn Helander, heat transfer, formerly of Kansas State University; L. C. Price, machine design, formerly of Michigan State University; A. J. Allen, nuclear physics, formerly of the University of Pittsburgh; C. C. Flora, aircraft design, formerly of Boeing Aircraft Company; and E. L. Page, production engineering, formerly of the University of Michigan.

For different reasons each of these individuals indicated considerable frustration except E. L. Page, who had been in residence for only one month. Problems often centered around finances, but not large sums of money. One man had found only a few dollars, literally, available for expense and supplies. Another had been allotted \$15,000 of Point Four money but had no expectation of receiving equipment during his first year of tenure. Complete lack of control over their destinies, with accomplishment more a matter of luck than work, seemed to summarize the sense of frustration. It was pointed out that an American should not be sent to Brazil without a specific written statement of exact duties, budget available and assistants with their qualifications listed. Equipment funds should be assigned six months or more before departure from the United States to assure early delivery after arrival. The morale of this group is not uniformly low but it cannot be listed as sufficiently high.

#### Administration and Budget

In the institute all salaries are paid by the Air Force and do not appear on the rector's budget.

Budget items of significance are Cr\$3 million for library or \$15,000 per year. There is \$80,000 for departmental equipment and services per year. The salary budget was estimated at \$300,000 annually.

There is strong evidence that the salary scale at São José dos Campos must be radically adjusted upward or the faculty will be lost. A full professor receives Cr\$52,000 per month plus his house while a laboratory assistant in the University of São Paulo receives the same salary without the house. At São José dos Campos each professor interviewed complained that the number of good assistants available to him had reduced and replacements at the standardized salary of about Cr\$20,000 per month were not available.

Another factor that is weakening the institute is the dictatorial attitude of the rector, Samuel Steinberg. This individual is so ego-centered that faculty members indicated unwillingness to offer suggestions for improvement. He may become an unfortunate advertisement for American educational administration. The Air Force seems to be satisfied with his overly forceful methods and some faculty members were found to be impressed with his complete acceptance of credit for all outside aid that has come to the institution. His contract is being extended for three years. However, since the rector expects to spend a limited amount of time in Brazil over the next three years, it is questionable how effective the administration may be during this period. In general, it seems agreed that a Brazilian rector would not have sufficient contacts outside of Brazil to maintain São José dos Campos against the forces that continuously attempt to change its pattern of education into the traditional Brazilian form of the *catedrático* system.

#### Summary

Unless there is a successful readjustment of salaries of a major nature and some improvement of the faculty-administration morale, the head start in

engineering education that is so evident on this campus may quickly be lost. Probably the key factor in obtaining recognition of the adjustments that are necessary is Dr. Ernesto Luiz de Oliveira, Jr., who has had a continuous association with São José dos Campos and was one of its founders. The fact that a Brazilian administration can be aggressive in recruitment of a strong staff of mixed Brazilian and foreign nationals was observed later at the engineering school of São Carlos. A similar solution would seem feasible at São José dos Campos.

10. THE UNIVERSITY OF SAO PAULO  
Universidade de São Paulo (USP)

INTRODUCTION

General Information

The University of São Paulo is a state university, the only one in Brazil. While it receives some federal aid its chief source of support is the State of São Paulo. All other tax-supported institutions in Brazil are supported chiefly by the Federal Government. It has the largest enrollment of all Brazilian universities; approximately 12,000 students. For the past six years its average growth has been 400 to 600 students each year. Some 1,200 graduate each year. According to estimates of the university authorities this number will increase to 3,600 by the end of the century.

Faculties

The university has the following faculties and institutes: philosophy, medicine, dentistry, pharmacy, veterinary medicine, architecture and city planning, polytechnical institute which includes the electro-technical institute, oceanography, and business administration. In addition to these, there are other units which need not be listed in detail. Altogether, the university has a total of 36 units described as follows: 12 institutos universitarios; 11 institutos anexos, and 13 institutos complementares. These institutes are widely scattered throughout the city. The university is in the midst of the gigantic task of locating not all but most of its units in a single campus referred to as "University City," an area of land containing approximately 1,000 acres.

University City

The transfer of the various units has been in process for several years, and its completion will require several years more. The Committee estimated that only about one-fourth of the plant has been completed to date, although one of the university's planning committee members considered it 30 percent complete. A total of Cr\$1.5 billion is in hand or has been appropriated

for the building program, and it is estimated that an additional Cr\$1.5 billion will be required for the completion of the University City plant. Dean Grinter estimated that when completed some 2 million square feet of space would be added to that now provided in the buildings already completed. The basis of the estimate is the reported cost of approximately Cr\$750 per square foot which is only 20 to 25 percent of current building costs in the United States.

Based on American experience, 2 million square feet should house the activities of some 20 medium-large schools or institutes. This, together with buildings already completed, should be ample to care for the program as now envisaged since the medical and dental schools, which are located fairly near the campus, will not be moved, and no provision is made for the law school which has not decided as yet to move to the new location, although it has recently expressed some interest in doing so.

The building program is moving forward on a broad front, several buildings being in various stages of development. The Cr\$1.5 billion allocated for buildings must be utilized by September, 1962. This probably accounts for the number of buildings under construction simultaneously.

The biological institute has already been moved. The framework of the faculty of philosophy building is already constructed. Plans for the chemistry building are now completed, and building is to begin in early 1961. Mathematics and architecture will be provided for in the next two years, according to present plans. Provision for the first two years of engineering has been completed, and the move of equipment is already in progress.

#### Organization

The University Council, a body of 24 members of the teaching and administrative staff, determines upon plans for the buildings, their location and the priority of construction. The faculty has, however, been freely consulted by the building

committee. Apparently the relationship between the faculty and administration is good although there is not always agreement between members of the teaching staff in matters involving the curriculum. A case in point is that of merging the work of the physics faculty with that of engineering physics. To meet this situation, buildings for the two departments will be adjacent to each other.

The Committee was well impressed with the type of construction. It is economical, suited to the needs of instruction and research, and generally well planned. The faculty members seemed alert, progressive and courageous. They are facing their task of reorganization and transfer to the new site with confidence. The rector, who assumed his duties only two months before the Committee's arrival, has not had time to prove himself, but he made an excellent impression. He has studied in the United States at three different periods. He is a medical man, still a professor of medicine and continues to do some practice. Despite the recency of his appointment and the fact that he is not completely full-time, he exhibited an unusual grasp of educational problems and the plans for the future development of the university.

#### General Assessment

In many of the divisions a larger proportion of the teaching staff and of the student body is full-time than in other universities visited. Likewise, the acceptance of the need for combining departments such as mathematics, physics, and chemistry of the several institutes and faculties is more clearly recognized and incorporated in plans than elsewhere. Moreover, the staff showed unusual competence and the research program, great vitality. This assessment was re-confirmed by a second visit after one month by two members of the Committee.

## THE PHYSICAL SCIENCES AT THE UNIVERSITY OF SÃO PAULO

### General

Because of the death of Professor H. Hauptman, Head of the Department of Chemistry in the Faculty of Philosophy, Science and Letters, on the first day of the visit to the University of São Paulo, and the resulting closing of the faculty in mourning, it was not possible to see as many members of the faculty as desired. In general, there are active research programs in the physical sciences and laboratory equipment for research and instruction seemed adequate. The USP, as a state university, can import equipment and materials duty-free. Students have the opportunity to work in the research laboratory or with research equipment. New ample laboratories were either already occupied or about to be constructed at University City (UC). Departments, while not yet integrated among the several faculties or schools, seemed destined for integration through the prevalent attitudes of individual members of the faculty, and because of their coming into close physical association coincident with the new UC plant.

Past reluctance against consolidation of several separate departments of the same discipline in some respects seemed centered among the older professors of the Escola Politécnica, who were said to be more conservative, and somewhat wary of their confreres of the Faculdade de Filosofia, Ciências e Letras, who for some time had been associated with active research programs.

The Faculdade de Filosofia, Ciências e Letras is perhaps unique among the universities of Brazil in offering high quality instruction in the basic sciences themselves, not concerning itself almost exclusively with the training of secondary school teachers. Encouraging, also, was the high quality research in the sciences by members of this faculty which was so frequently evident. The majority of the science faculty has had experience in foreign universities.

Departmental and divisional libraries appeared to be excellent, with much emphasis upon current periodicals, and with long runs for past years. Lesser emphasis has been given to the purchase of books, although in general these appeared to be adequate; with limited funds, no quarrel can be had with this choice.

### Physics

The major work in physics is in the departments of physics of the Escola Politécnica and the Faculdade de Filosofia, Ciências e Letras. The latter department is under the chairman of the department, Professor Mario Schemberg. (Schemberg was openly a communist, and as such was elected a deputy to the State Assembly of the State of São Paulo.) His own work is in field theory.

The department has a betatron in operation (under Goldenberg), and is an active research group.

The work of Professor Oscar Sala and his associates is impressive. A 3 million volt Van der Graaff machine has been constructed locally, and several investigations are underway. In the group working with him are Professor Ross Douglas, a Canadian from the University of Saskatchewan, and an impressive young Brazilian, Dr. Ernesto Hamburger (German born) who graduated from USP (filos.) and has just taken his Ph.D. at Pittsburgh.

During the first visit, it was not possible to see Lattes who divides his time between the USP and Rio, Gomes, Goldenberg, or Buttenger, to discuss their work. The latter was later interviewed by two members of the Committee.

Professor Walter Shutzer, department of physics in the faculty of philosophy, and Professor of Mathematics in the polytechnic school, spent some time outlining the undergraduate and graduate work of the department. His own research in many-bodied problems has just won for him a year's fellowship for study at Copenhagen from the International Atomic Energy Agency, W. Sterling Cole, Director.

The undergraduate program in physics is exclusively concerned with physics and mathematics, except in the fourth year, when for students desiring the Licenciado in addition to the Bacharel, courses in psychology and education (ensino) are elected. The courses are rotated among the different professors, and texts comparable to those of similar courses in the United States are used. Professor Sala stated he found the students lacking in manual dexterity since they received little pre-university experience in use of their hands; therefore, he took students into his laboratory in their first year so that by the time they graduated they could do competent experimental work. The number of students is still limited, however, owing to lack of interest at the secondary level. It is Dr. Coles' impression that graduates in physics recommended by this faculty could do good work in any U. S. graduate department. USP could grant creditable Ph.D.'s in physics itself.

The department of physics of the Escola Politécica in July, 1960 was in the middle of moving into new buildings at University City. Like the city as a whole they were not only aesthetically appealing, but were practical in conception and execution. Dr. Luiz Orsini, Professor of Physics of the Escola Politécica and the Faculdade de Filosofia, Ciências e Letras, is active in ionospheric probing, and has a probe operating. Other research programs were not in evidence. The new laboratories will be quite adequate for effective undergraduate instruction.

An interesting development which will facilitate research is the establishment, by two former staff members of USP, of a new factory to produce electronic equipment for research and industry.

Several years ago the Instituto de Física Teorética was opened in São Paulo. While not university-connected, it has several former university personnel on its staff of 10 full-time persons. Previously primarily made up of Germans, it now

employs many Japanese, including Pakitani and Marisima. Support is from the Ministry of War. It is working on many-bodied problems. It does no experimental work.

### Chemistry

Although there are departments of chemistry in several parts of U.S.P., only that of the Faculdade de Filosofia, Ciências e Letras was reviewed in detail. This is said to be the most active department in Brazil, both in teaching and in research. Visitations to date confirm this; the only competition may be from the National Institute for Chemical Research in Rio de Janeiro.

The stature of the department is the result of its organization and direction by two German chemists over the last quarter century. The first of these died several years ago, and the second, Professor H. Hauptmann, died on the day the visitation was initiated. It was later possible to spend some time with Dr. Mathias, Professor of Physical Chemistry, who is assuming the chairmanship of the department. He has an active research program in the physical chemistry of sulfur compounds; presently involved with routine dielectric measurements. He studied under Dr. Farrington Daniels at Wisconsin and was the first person to receive a Ph.D. in chemistry at U.S.P.

Organic chemistry was under the late Professor Hauptmann, and members of his group are continuing the research program and will take up his lectures for the remainder of the year. It is presently thought wise to seek a visiting professor for a few years rather than fill the professorship vacated by Hauptmann's death.

Biochemistry is a part of organic chemistry within the department, and Dr. Giuseppe Cilento heads this work. He has an active program of research in enzyme chemistry. The department hopes to establish a chair of biochemistry, and it is likely that Cilento will fill that rather than the now vacant chair of organic chemistry.

Analytical chemistry is under Senise, and inorganic, Gisbrecht. Both have research in progress.

The department is presently poorly housed in old, inadequate and crowded quarters. Plans for the new laboratories at University City are complete, and construction, scheduled to begin in January, 1961, should be completed in 2 to 3 years. These laboratories, at the request of the rector, will be large enough to house the chemistry of the Escola Politécnica, and possibly other departments. While there is no integration of the several chemistry departments now, most of those interviewed expressed hopes that this integration would be forthcoming after the new construction brings them into physical proximity.

The equipment of the department appeared modern and adequate for the work being done. A more imaginative and abler program would require updating of equipment. A modern infrared recording spectrograph given by the Rockefeller Foundation had just been received.

The library was small and minimal in books, but was excellent in periodicals.

The curriculum for undergraduate work is classical in concept, and as for physics, restricted to chemistry and supporting work in physics and mathematics. The first year requires both general and inorganic, and qualitative analysis. The latter uses the standard texts, and is rationalized as by the conservatives teaching qualitative in the United States. Organic chemistry and quantitative analysis are taken in the second year, and physical chemistry and instrumental analysis in the third; advanced courses come in the fourth, together with opportunities for independent work. No course in qualitative organic analysis is given, although Hauptmann required some work of this kind in his course in advanced organic chemistry. Staffing of the department appeared adequate, or even generous by United States standards relative to the number of students.

Twenty to thirty students enter the program each year, with perhaps 8 to 10 graduating - high mortality relative to engineers. Demand for chemists by industry is great, and 4-year graduates go out into jobs at salaries exceeding those of the professors. Until recently, Brazilian industry failed to distinguish between a graduate chemist and a mere technician; this situation is being corrected presently.

The department has offered graduate work for many years; the first Ph.D. was awarded in 1941, and a score since that time. Qualitywise, the degree is probably as good as those of many U. S. universities, but undoubtedly below that of the institutions generally represented in the American Association of Universities (AAU).

#### Mathematics

Little specifically can be said of mathematics because of lack of contact or communication. The Escola Politécnica and the Faculdade de Filosofia, Ciências e Letras have separate departments, but hope was expressed for integration. There are able younger men, e.g., Alexandre Martins Rodrigues, who studied under Chern at Chicago. Others are Professor Candido da Silva Dias, Professor Walter Schutger (in the Escola Politécnica), and Professor Abrão Morais. Judging from general conversations and impressions, the work in mathematics would be good; on the basis of all other science libraries inspected, it would be surprising if that for mathematics is not excellent.

#### Oceanography

The Instituto Oceanografico, an affiliated institute of the U.S.P., is one of two oceanographic laboratories in Brazil. The Director, Dr. I. Emilsson, was absent during the visit; Dr. J. Paiva Carvalho discussed the work of the institute.

The institute is located in the city of São Paulo, about 50 miles from the nearest ocean port, Santos. Bases on the sea have been established at Cananea,

and a smaller one at Ubatuba. (The latter was visited, and is primarily devoted to ecological studies, under the direction of Dr. Edmundo Ferraz Nonato.)

Direct radio communication is maintained between the main institute in São Paulo and the two ocean bases, as well as with ships of the institute at sea.

The work of the institute seemed primarily concerned with marine biology, with almost exclusive emphasis upon description, identification, and classification. No functional biological work was in evidence at São Paulo or Ubatuba. Physical and chemical oceanography seemed limited to collection and analysis of sea water samples collected by Wansen bottles, together with temperature data from reversing thermometers. The bathy-thermograph (now obsolescent) has been used, but no extensive data thus obtained was noted. Emilsson is said to be doing some work in circulation of the South Atlantic.

In submarine geology, a program of analysis of sediments on the ocean bottom is underway. Coring techniques are not used because of lack of equipment.

In meteorology, the principal effort is presently directed toward sea productivity measurements, relative to solar radiation. Surface meteorological data is also collected routinely at the shore stations.

Present laboratory quarters in São Paulo are cramped and inadequate. The shop for instrumentation is hopelessly deficient. Plans for the construction of new laboratories at University City are being developed. This will ultimately bring the institute into close proximity with the basic science departments as well as with engineering, and provide adequate research facilities.

Presently, the institute has two smaller boats for work at sea. The use of ships of the Brazilian Navy for oceanographic work is no longer possible, owing to the restricted Navy budget.

The construction of a 48.5 m. research vessel is projected for the near future (Draft 5 m, crew of 22 plus 10 scientists). Plans have been completed with the help of naval architects of the Navy and at U.S.P. Towing tank tests on a model of the vessel have been run in the Instituto de Pesquisas Tecnológicas of U.S.P., and a tender is pending from a shipbuilder in Norway, expected in at

between \$500,000 and \$1 million U. S. (Brazil has a capability for construction of the hull, but not of the specialized machinery required.) The general principles of the design do not conform to the latest U. S. concepts, and might profitably be studied and discussed in detail with men more familiar with the matter.

Students are very limited, and no course or degree work is offered. Junior staff is recruited from U.S.P. students in science, primarily through job programs. The senior staff has a definite international character as a result of the foreign training of the permanent staff combined with the presence of a number of visiting foreign scientists over the past years.

Brazil, with its 4,889 miles of coastline, should give greater emphasis to oceanography, in terms of food production, communication and transport, and national defense.

For study of oceanography as a pure science, Brazil has the most advantageous position of any South American country. Work in physical oceanography and meteorology, water-air circulation and transport, marine geology (including beach studies), and functional biology should have much greater emphasis.

#### Laboratorio de Biologia - Marinha (L.B.M.)

The L.B.M., organized and directed by Professor Paulo Sawaya of the Department of Physiology of the Faculdade de Filosofia Ciências e Letras, is located on the Atlantic coast at São Sebastião, about four hours from São Paulo by car. Sawaya introduced work in marine biology in 1935 at Santos. Later he personally purchased the facilities at Sebastião; recently support from the State of São Paulo has made possible extension of facilities, and the enlargement of the small laboratory building, which is being equipped with electricity and running sea water. Except for its remoteness, the L.B.M. is well located. Sawaya has an enthusiastic and able group working with him, and good research and instruction will result from this unit.

FACULTY OF ARCHITECTURE AND CITY PLANNING OF  
THE UNIVERSITY OF SÃO PAULO  
(Faculdade de Arquitetura e Urbanismo da Universidade  
de São Paulo)

(Interview with Professor Aubaia Melo, Director of the city planning course)

This faculty was organized in 1948 and provides two curricula, architecture and city planning (urbanismo). Twenty-four full professors and 10 assistants make up the teaching and research staff. None of them are full-time. It would be of great help if the teachers of design were full-time, but from the standpoint of Professor Melo, who has charge of city planning, it is not a handicap for the other professors to serve on a part-time basis.

Five professors and several assistants make up the city planning staff but students and others assist in gathering data required in the studies of municípios. A total of 60 were employed in one of the recent studies, 34 of whom were students. All fifth year students in architecture must do field work two days each week for a semester (or a year). If they wish to become city planners they must spend an additional two years of study in this specialty. Studies of 39 municípios are now in different stages of progress. They are financed largely by the municípios themselves except for the salaries of the faculty members who plan and direct the work.

Several departments of the university collaborate in developing plans for studies. Sociology, geography, history, economic and administrative science, and engineering are among the divisions that participate. This is the only such planning center in Brazil. Other universities have professors of town planning but none have developed a center for research such as exists in the University of São Paulo.

Basic studies are not included in the architectural and planning courses, only those of a professional character - mathematics, engineering, architecture and

specialized planning subjects make up the curriculum. These professional courses, however, include such subjects as history of art, theory of architecture, artistic design, architecture of Brazil, political economy, which includes applied statistics and administrative organization. Of the total of 29 chairs provided for by the law establishing the program, 22 are chiefly architectural and 7 deal specifically with planning.

In order to understand the significance of the planning program, it is necessary to comprehend the peculiarities of the Brazilian political organization and the nature of the município. It has no counterpart in American political organization. It is not like the county or the municipality. For example, the city of São Paulo is not a single city with one mayor, one police force and one city hall but a collection of five municípios each with a separate mayor, police force and organization. Each is independent of the other and each represents a section of the large whole. There are no city limits which comprehend them. They appear to have some of the features of the boroughs of New York City, but they do not form an administrative unit such as New York City represents. They are independent autonomous units.

The State of São Paulo comprises 507 municípios while in Brazil as a whole there are some 2,500. The problems of administration and planning, particularly for the larger centers, are multiplied by reason of the fractionization of the population of the community administratively.

The faculty of architecture and city planning has apparently accomplished quite remarkable results on a very slender budget. Funds are not available, however, to publish results which might be widely used by communities in other states and areas. The director feels that in time all the 507 municípios of São Paulo State should be studied. Professor Melo feels that he could move much more rapidly if he had funds to provide full-time work for the five professors of design and some other additional staff which would be required.

At present the center is in very crowded quarters. An impressive library, with a large collection of periodicals as well as many books on planning, has very little space in which students can work. The reading space is pitifully small for a student body of 250. The present housing is an old mansion built by a coffee baron who obviously spent vast sums on it, but it is wholly unsuited as quarters for a city planning center.

Fortunately, relief is in sight since it is planned to move into the university city in two years. Adequate quarters for this phase of the university program are to be provided there.

The director of the center is an outgoing personality, full of energy and good humor. He is national director of the city planning center and professor in both the faculty of architecture and the polytechnic institute, but is an active member of a firm of architects in the city. Despite the variety of posts which he holds, his real interest is the city planning program.

POLYTECHNIC INSTITUTE OF THE UNIVERSITY OF SAO PAULO  
(Instituto Politécnico)

This is one of the many divisions or faculties of the University of São Paulo. In general, the impression gained of the polytechnic institute as well as that of the other divisions inspected was of a rather progressive and active institution. The university is facing with considerable assurance the terrific task of moving all colleges except medicine, law and public health, to a new suburban campus where a dozen large buildings have already been erected. The guaranteed building fund of Cr\$1.5 billion over the next 2 1/2 years should complete perhaps one-half of the remaining task of construction. This is equivalent to \$8 million, but it will construct 2 million sq. ft. of floor space which would cost \$40 million in the United States. The polytechnic institute is currently moving its laboratories of physics and chemistry to the new campus so that the first two years of study for engineers will be at that location from now on. Other departments or chairs will be moved as space becomes available with the final transfer to be completed in five years.

Physical Plant for Engineering

The old polytechnic buildings are about as would be anticipated for an institution founded in 1894 and whose main buildings date to the early part of the century. They are crowded and in many parts antiquated although still useful. Also, some departments such as chemical engineering, are located in temporary buildings that are now a generation old. Nevertheless, good use has been made of the space available. The new buildings that were inspected at the Cidade Universitaria were functional, attractive and quite inexpensive in contrast to more elaborate educational structures observed in Rio de Janeiro and Porto Alegre. The intense use of the old plant and the common-sense design of the new buildings leave one with the impression that the institution will progress very far in the future. At the Cidade Universitaria three polytechnic institute functions were observed, part of which will now become functions of the faculty

of philosophy. The new laboratories of physics and chemistry (combined in one building) were completed in large part and should serve both engineering and science adequately. Several special purpose research buildings, i.e., betatron, Van der Graaff, centrifuge and reactor were found to be well established and in operation. They form a part of a research institute which also includes a laboratory of engineering materials. A large hydraulic laboratory that is to be completed shortly was also inspected. The hydraulic laboratory appears to be an arm of the State Government to be located on the new campus and to solve problems for the Government. However, it will also serve the polytechnic institute for advanced or professional training. The building program is not divorced from the questionable concept that laboratories can serve two purposes, i.e., development or testing work for industry and government, plus undergraduate instruction. No institution inspected seemed entirely free from this approach although it seems to be decreasing somewhat. Actually such dual purpose laboratories are not efficient or effective for undergraduate instruction.

### Students

It was said that the university has 12,000 students. On this basis the number of engineers, which is 1,200, is 10 percent. For example, the civil engineering curriculum is graduating about 60 and chemical engineering, 15 to 20 students each year. Metallurgy and electrical engineering fall in between. Shipbuilding and mining have smaller enrollments. Mechanical engineering is just being divorced from electrical-mechanical power. Students appear to be carefully selected since the number of applicants is relatively large. The percentage graduating is also relatively large, well above 60 percent, so one may judge that the students are serious. This is the description given of their students by the faculty interviewed. An unusual characteristic of the students of the polytechnic had been demonstrated by their successful campaign to raise money and build a multi-story dormitory and restaurant for student use. It was stated that this building could easily be sold to pay for another to be built when the polytechnic institute is removed to University City.

## Faculty

Since the inspection was made during the vacation period, only a few faculty members were available for interview. The Vice Dean, Professor O. Bergstrom, a chemical engineer, seemed like a capable administrator and counselor. He is one of the 6-man council that decides major issues for the polytechnic. Professor L. Orsini, a young professor of 35, serves in both electrical engineering and physics. His specialty is research in the ionosphere, but he teaches courses in electronics as well. He is clearly a very able teacher and researcher. Professor W. Borzani handles chemical engineering from the biochemical viewpoint. He was trained at São José dos Campos and is a person of high ability. Professor Y. T. de Britto Guerra is a naval officer in charge of the curriculum in ship design. He too proved to be a person of high competence who had spent two years at M.I.T. Based upon this sample, the faculty of the Polytechnic Institute of São Paulo appears to be of strong abilities. However, it is noted that only a few could be classed as full-time by U. S. standards. Most appear to hold several teaching assignments as catedráticos. Salaries were found to be low for full professors but high for assistants. The latter are paid Cr\$ 50,000 per month which is nearly a professor's salary. Hence, there is the peculiar situation that young men can be readily obtained to start teaching, but advancement is so restricted that the better ones quickly go to industry after a short period of apprenticeship training which is the current substitute for true graduate work. For example, only the equivalent of six credit hours plus a dissertation is required for the doctorate in electrical or chemical engineering where it has been given. Two years while fully employed can suffice for this achievement although more may be normal. It is clear that standards for the doctorate have not really been worked out since only a few applicants have been found, and the doctorate is almost a new concept in Brazilian education. Instead, the title "doctor" is carelessly applied to almost anyone who completes a first professional degree. Doubtless this will be changed when graduate work develops full stature which seems likely to occur first at the University of São Paulo.

## Curricula in Engineering

The catalog curricula are mechanical engineering, shipbuilding, electrical engineering (including an electronics option), civil engineering (with several options), chemical engineering, metallurgy and mining. There is a strong background required in mathematics and physics with less in chemistry. The theoretical work of the upper three years seems quite good, but it is evident that the laboratories do not adequately support this rather strong preparation. This explains the emphasis placed upon a practical problem or undergraduate thesis of the fifth year. This is also explained by the fact that the graduates are not assured of any competent technical supervision when they are employed. Hence, the professors feel that the students must know practice and be more competent to meet practical situations than United States engineering graduates. This may be true, but the necessity for teaching so much practical work vitiates any concept that the 5-year Brazilian curriculum serves the same purpose as a master's degree in the United States. It is unfortunate that the master's degree is unknown and has no status in Brazil. It should be the first step in instituting graduate work in place of the cheap doctorate that is now contemplated.

## Laboratories

So many laboratories were torn up and being moved, while others were closed for vacation, that an inadequate picture may have been obtained. However, the indication is that physics has had reasonably new equipment but that engineering has had little replacement of equipment for many years. The best equipment seen was in dual purpose laboratories where one had to wonder how well the students were handled. In many areas, it seems that the Professor Catedrático seldom enters a laboratory. His assistant (not an assistant in the American sense) is assigned this duty which is thus often inadequately dignified. As the polytechnic moves to the University City, good laboratory space will be available. However, it would seem a shame to transfer about one-half of the equipment observed in

the old buildings. Hence with appropriate additions to meet new and expanding needs it would be necessary to purchase three-fourths of the equipment for the laboratories planned at University City for engineering instruction. Since the present student body is 1,500 the need in equipment will be quite large.

#### Research in the Polytechnic

Since the polytechnic is probably losing its faculties in mathematics, physics and chemistry to the faculty of philosophy much of the research observed can no longer be classed as a part of the polytechnic. No research strictly of a fundamental engineering nature was observed except some indication of use of the hydraulic laboratory which is still under construction at University City. Apparently a towing tank is also constructed there and used by the shipbuilding department. From the quality of the personnel interviewed it seems reasonable to expect that the polytechnic will develop its own brand of engineering research to replace the loss that it suffers in the divorcement of physics. As a practical matter physics and engineering have not been very clearly differentiated which may well continue in practice at the new location.

The organizational pattern of the research already transferred to the University City campus was not entirely clarified. A nuclear reactor installation exists, but its relationship to the training of nuclear engineers or to nuclear engineering research was not made clear. Also a well-equipped laboratory of metallurgy and testing materials exists at University City as a part of the research complex in science and engineering. It does much work for industry but of a higher level than the testing work of the electro-technical institute. Again, however, it was not a simple matter to clarify its interrelationships to other branches of the university. Probably these relationships will not be fully clarified until the entire university is situated on one campus.

## Development and Testing

The electro-technical institute associated with the polytechnic was visited. It is clear that this institution is a testing laboratory without research objective and even without much experience in development work. It is not a very favorable atmosphere, therefore, for the electrical and mechanical engineering students who obtain their main machine experience in the laboratories of the electro-technical institute. It is fortunate that this arrangement will have to be reconsidered when the polytechnic is moved.

## INSTITUTO DE PESQUISAS TECNOLÓGICAS (IPT)

The IPT is an institute of U.S.P., closely associated with the Escola Politécnica through program and staff. The principal officer is the Superintendent, Professor Francisco João Maffei. (He is also Dean of the Escola Politécnica, and his salary in the latter position is supplemented by a salary in the former.)

Assistant Superintendent is Professor Oscar Bergstrom Lourenço. Professor Tharcisio D. Souza Santos (brother of the Director of the Nuclear Reactor Laboratory) is very active in IPT, as Head of the Section of Extractive Metallurgy and member of the Junta de Planejamento e Controle de Pesquisas. The IPT does work on contract for business and government, and in addition, supports a research and development program from university funds. It is thus similar in some respects to the Armour Institute of the Mellon Institute.

Included among its 18 divisions are; concrete; ceramics; refractories; rubber and plastics technology; cellulose, paper and fiber technology; forestry products; paints; varnishes and pigments; ores, minerals and industrial waters; soil mechanics; structures; applied geology; foundation engineering; petroleum; physical and analytical properties of petroleum products; analytical methods of industrial processes; spectroscopy; electrochemistry; general physical chemistry; analysis of alloys, metals and slags; essential oils; experimental towing tank (now being doubled in length); metallurgy, including mechanical testing, smelting, refining, metallography, heat treatment and physical metallurgy, foundry sands, alloyed cast irons, non-ferrous alloys, alloy steels, non-ferrous extractive metallurgy, mechanical transformation (rolling, pressing, forging, shaping, etc.), powder metallurgy, high tension testing, isotope separation by ultra-centrifugation.

The students of the Escola Politécnica do laboratory work in some of the IPT laboratories. In metallurgy, for example, they have the opportunity to work in the extensive foundry and metal processing and testing plant (which is engaged in considerable commercial production), as well as in the metallurgy and metallographical laboratories.

Also at IPT is a bureau of standards for the State of São Paulo.

The library, buildings and equipment of IPT at University City were excellent. It is expected within a few years that all divisions will have laboratories there. These are still in the planning stage for chemistry.

#### Libraries

A good electrical library was observed under the guidance of an able librarian. It is clear, therefore, that the library concept would be described in the United States as departmental libraries. If others are as well handled as the electrical library, the results would be generally good.

#### Assessment

Administratively the polytechnic is clearly handled by the dean under the direction of an administrative council of six full professors. The force seems to be lacking for rapid progress. However, a good job of education does result even though much of the plant and equipment must be classed as obsolete. The over-all assessment is that this is the largest scale engineering educational program inspected and is said to be the most extensive in Brazil. The quality is good but not distinguished. However, it appears that the only better quality in Brazil has been that of São José dos Campos which has been a small-scale personal operation not subject to ready expansion. Another promising development on a small scale was observed at São Carlos. If the concept of full-time professors and full-time students were fully accepted by the Polytechnic Institute of São Paulo it could become the MIT of Brazil. Perhaps, however, it would be better to compare its possible future with that of the engineering college at

the University of Illinois or Wisconsin since São Paulo is the only state university in Brazil and can be expected to develop in that pattern at University City in the future.

LIFE SCIENCES  
UNIVERSITY OF SÃO PAULO

Teaching and research in the life sciences at the University of São Paulo is carried on in several faculties, divisions, schools and institutes. Some of these are closely coordinated and have integrated teaching programs but most are separate, practically independent units, except for their common responsibility to the rector of the university.

The following are some principal organizations:

1. Division of Natural Sciences in the Faculty of Philosophy, Sciences and Letters, University City, São Paulo;
2. Medical School, São Paulo;
3. Medical School, Ribeirão Preto;
4. Institute of Biology, São Paulo;
5. School of Agronomy, Piracicaba;
6. Agricultural Experiment Station, Campinas;
7. Veterinary School, São Paulo;
8. Butantan Institute, São Paulo.

The first six will be reported below. The last two, although well known for their high quality teaching and/or research in animal husbandry and diseases, and on snake venoms and in basic biological research, respectively, were not surveyed by our group.

MEDICAL SCHOOL  
UNIVERSITY OF SAO PAULO

This institution was started in 1913 and received a great impetus toward its present state of development from a Rockefeller Foundation grant in 1926. Present quarters, consisting of three large, not modern but quite useful units of buildings, were erected in 1929 and accommodate 10 departments. Only the basic sciences departments such as biochemistry, physiology and histology, which are of interest here, were visited. The hospital, built in 1944, has about 1,200 beds for patient use for teaching purposes and also houses the orthopedic and psychiatric departments.

Budget

The budget, largely from São Paulo state funds, is about Cr\$5 million per year for the hospital and around Cr\$200 million for the faculty of medicine. The Rockefeller Foundation, evidently, still supports some areas of work.

Staff

The teaching and research staff (professors and assistants) includes about 50 persons with advanced professional training in medicine and some 80 technicians. In addition to the legal medical staff there are some 10 permanent professional specialists, chemists and biologists, who cannot hold regular staff appointments for lack of M.D. degrees. Staff members, other than professors, must present a Docent thesis within the first three years of residence. Laboratory and other assistants ordinarily are employed on a contract basis. A few are permanent by virtue of long service. Tenure is now acquired after 10 years of employment. Technicians' pay rates are from Cr\$10,000 to Cr\$15,000 per month, depending on skill and experience, for a 6-hour day. Additional pay may be provided from funds for individual research grants.

Research

Active work in the basic sciences include:

(I) Biochemistry by Dr. Cavalcanti. Enzyme chemistry, isolation and other work on cytochromes by Dr. Raw. This young, intellectually vigorous investigator also

has intense, effective interests in the laboratory aspects of secondary science education (IBECC). His role in this nationally critical area will be reported by Dr. Coles.

(2) Physiology: well known, important work is being done by Professor C. Silva on the nutrition of rats. He is currently in the United States at MIT. Dr. C. Malnic, soon to visit the United States for advanced training, is active in renal physiology; and Dr. A. Fajer heads a group working in clinical aspects of endocrinology.

(3) Histology: Dr. Junqueira and collaborators have a well-established reputation in the areas of chemical cytology, cell physiology, including tissue cultures, and microbiology. Dr. T. Fernandez, trained at the University of Wisconsin, is studying enzymes concerned in protein biosynthesis from nucleotide-coupled amino acids. M. Rabinovitch, trained in cytology at the University of California, is studying DNA bio-synthesis. Next year, he is to do research at the University of Wisconsin and then in Europe.

(4) Other research in progress includes projects on growth, metabolism, nutrition and specific aspects of host-parasite relationships of trypanosomes and of various other organisms of health interest and several other projects of medical interest in the region or country (by Franco Amarão and J. Hildebrando) and work on snake venoms (Ferri). The strictly clinical departments were not visited.

#### General Impressions

The reaction from limited observation was that this is a thoroughly sound and productive teaching and research institution.

#### Needs

In a long discussion with a group of young investigators the following needs were expressed:

(1) Contact with outside, to be achieved in different ways:

a. visiting professors;

- b. scholarships to young people (only after home opportunities for study have been exhausted), selected on a more careful basis than has sometimes been used in the past;
- c. access to recent literature in the field (periodicals);

(2) Equipment and materials are needed:

A genuine appreciation of the Rockefeller Foundation was evident, for having been a "Godsend" to the school in providing needed items of equipment and supplies, and also for travel funds for many persons.

It would seem that this medical school will continue to grow soundly. Its location, in the vicinity of an explosively developing business district and yet close enough to the new University City to permit integration with the physical and natural sciences departments, may be highly advantageous. It should be considered, however, that it must continue to grow in faculty and equipment to compete on even terms with the rapidly growing, excellent second medical school in Ribeirão Preto.

SECOND MEDICAL SCHOOL, RIBEIRÃO PRÊTO  
UNIVERSITY OF SÃO PAULO

This institution for medical training and research is located on a 1,250 acre (500 hectare) tract in the gently sloping hills surrounding a small lake in the fertile, beautiful valley, about 5 km. from the city of Ribeirão Preto and about 350 km. northwest of the city of São Paulo. Eighteen departments are housed in four main building units both tasteful and utilitarian in design, well-arranged and solidly constructed. The same architect and type of architecture were employed as for Rural University at km. 47 near Rio de Janeiro, but internal planning has been much more effective for research and teaching usage of the space. In addition, there are; a separate library building; a school of nursing; an animal breeding plant producing from 20,000 to 30,000 animals, rats, guinea pigs, and rabbits per year for experiments; certain student athletic facilities; and two large areas of excellent, spacious, single-family garden homes for the entire faculty (150) and certain service staff. Dormitories to accommodate 200 students are under construction, and a 400-bed hospital, exclusively for teaching and research, will be completed in three years, with funds now available. At present a 300-bed hospital is located in Ribeirão Preto, and the students also live in the city.

The areas of the campus still unused are under intensive cultivation. For example, coffee is grown.

The city is a rapidly growing center of about 120,000 inhabitants and serves as the capital for the surrounding farming region with deep, fertile soil, technically well-developed and diversified agriculture. The region has a total population of between 1.5 and 2 million people.

The school was started in 1951 as a "decentralized" unit of the university planned to permit rapid new development under the leadership of Professor Zeferino Vaz, who still is its director. His continued, intelligent efforts together with long-term, generous support from the Rockefeller Foundation, have resulted in a

truly outstanding campus. However, Dr. Vaz stated that his main emphasis always has been on the right man and to fit the facilities to the needs of his program of work rather than vice versa.

### Curriculum

At present there is a complete medical curriculum. There are 18 professors who are heads of departments with a total staff of 150 persons including 50 technicians. All persons are employed and engaged full-time. In addition, there is a staff of about 200 service personnel in the teaching and research laboratories and for other functions on the campus. The hospital, with possible exceptions in some clinical areas, was not included.

### Budget

The budget, again excluding the hospital, in 1960 was about Cr\$120 million which, according to Dr. Vaz, corresponds to about \$1.5 million in purchasing power. The hospital budget for 1961 is over Cr\$150 million.

### Students

Eighty students are selected for admittance each year to a 6-year course, and the total enrollment has been kept to about 480.

### Research

The school already enjoys a wide reputation as an outstanding center of medical research in Latin America due mainly to its collection of talented, productive, investigators in several fields.

Only the laboratories in biochemistry and pharmacology were inspected. Both departments have considerable space and facilities with modern equipment, efficiently in use for teaching and for investigations in protein chemistry, enzyme isolation, kinetics, etc. by M. Gonçalves and his group and in biophysics and biochemistry of drug action (bradykinin, etc.), by M. Rocha e Silva and collaborators. Both men are internationally recognized authorities in their specialties and are in close contact with pertinent basic science developments

both in the United States and in Europe. Each has a number of competent young collaborators, several with advanced training in the United States; Gonçalves and three others in organic chemistry or physiological chemistry, at the University of Wisconsin.

Dr. Rocha e Silva was fairly recently engaged under contract. He has done pioneering work in the isolation, identification and mode of action of biologically active components of snake venoms. Some of these are polypeptides which are now being synthesized by Hoffmann-La Roche Co. in Switzerland. They should prove of great interest in medical physiology. He has trained a number of students, and his influence is felt in various physiology departments throughout the country including Instituto Biológico de São Paulo, where he formerly worked. His present group is growing rapidly.

It was stated that active research is in progress in nearly all departments, for example, anatomy, histology, embryology, etc. A program in human genetics will be started in 1961 provided that the appointee now at Curitiba receives the blessings of the Rockefeller Foundation, as expected, for the transfer of his activities.

The most urgent needs for this institution as usual and in spite of their relative opulence, are:

1. ready access to current literature;
2. specialized equipment (Stein-Moore automatic Amino Acid Analyzer, for example);
3. assistance (salaries for technicians);
4. outside contacts (last but not least), exchange of personnel.

In detailed discussions of these points several positive suggestions and frank evaluations of recent and current status of organization and financial support of sciences were received. Some of these will be considered here, and others will be treated in detail elsewhere.

Professor Vaz stated that the cost of the library is increasing at an alarming rate, too fast to be met with Brazilian currency. Steps are needed to assure continued availability of current literature.

During its nine years of existence, the school has acquired an exceptional medical library at a total cost of over Cr\$30 million. It carries an active list of 900 journals and has complete sets of about 300 of these. This year's cost of journal subscriptions is between Cr\$3 million and Cr\$4 million.

Dr. Vaz suggested that a U. S. Government scientific organization or like corresponding organizations in some European countries might be able to provide cheaper publications and subscription costs of the most essential high-cost items, such as Chemical Abstracts, Biological Abstracts, etc. which are getting out of reach.

Dr. Gonçalves cited specific cases in which, due to curtailment of funds available to the Brazilian National Research Council, requests by him and by other highly competent scientists for continuation of small grants for assistants could no longer be granted. As a result of this, some talented young people were going without financial support. In this connection, he, as so many others have done earlier, stressed the need for support of basic sciences and the individual investigator rather than of technology alone.

#### General Conclusions

This is an excellent institution for basic biological as well as medical teaching and research - not equal to the best in the United States but better than the average and far superior to many. Its position has been attained by enlightened leadership in selection of and provision for effective operation by key personnel, distribution of responsibilities and freedom of action by departments. Much credit should go to the State of São Paulo and perhaps especially to the Rockefeller Foundation for financial support. Generous,

continued grants for visiting scientists, travel fellowships and equipment have been a decisive factor in achieving the present status. This year's Rockefeller grant is expected to be \$350,000.

This school, together with the medical school of São Paulo, certainly, or perhaps each by itself, represents the most advanced and effective center of medical teaching and research in this country. Financial support certainly would be effectively used, but perhaps should be considered only in association with the Rockefeller Foundation.

INSTITUTE OF BIOLOGY (INSTITUTO BIOLOGICO)  
UNIVERSITY OF SÃO PAULO

(Departamento de Defesa Sanitaria de Agricultura, São Paulo)

This is a well-established institution with an enviable record of achievements in research on animal and plant diseases, the purpose for which it was originally designed some 25 or more years ago. It is operated as an independent unit administratively, responsible directly to the rector of the university.

It is housed in a main 6-7 story building surrounded by a variety of smaller, more temporary structures and facilities, animal quarters, greenhouses, field plots, including a small coffee plantation, all within the city of São Paulo. Additional facilities for field work, etc., are located at Campinas, São Paulo.

Staff

A total staff of approximately 70 scientists is divided into six divisions each with a director and with several subsections and all under a general director (Diretor Geral, Professor Paulo Nobrega). The divisions are: plant biology, plant protection, experimental agriculture, animal biology, animal protection and science.

The visit was restricted largely to the division of plant biology (division de biologia vegetal) under the direction of Professor A. A. Bitancourt, one of the outstanding botanists in Brazil. His own research group, including Dr. Kate Schwartz (chemist) is best known perhaps for its work on the physiology of growth and growth substances in plants. One principal interest of this laboratory has been the study of plant disease by tissue culture techniques, and recently there have been several contributions on the metabolism of indoleacetic acid, the auxin (the most common plant growth hormone).

Dr. Bitancourt has developed interesting concepts of the mode of action of this substance in terms of its molecular structure and the configuration of its possible polymers.

Dr. K. M. Silberschmidt, Head of the Plant Physiology Section, actually is studying plant viruses. Much work was observed in progress on the isolation, characterization and interactions of various species and types in different hosts. Some work was also being done on the nature of the striking morphogenetic effects of certain viruses.

The institute is perhaps best known for its pharmacological research, formerly under direction of M. Rocha e Silva, for the production of vaccines.

The institute is still an important center of biological research, especially in plant and animal pathology. However, it does not train many people; it draws largely on the faculty of philosophy's natural sciences division for professional and technical assistants.

Apparently this institute has been an important instrument in the development of plant and animal husbandry throughout the state and country, and it still maintains quarantine services. It would seem, however, that a considerably expanded activity must be required for agricultural purposes in basic research on the nature and control of plant and animal diseases and that the initiative and center of activity may be passing elsewhere.

The impressions gained during a brief interview may be a serious underestimate of the depth and breadth of the institute's activities, and this report, therefore, may be subject to serious errors.

AGRONOMY SCHOOL, PIRACICABA  
UNIVERSITY OF SAO PAULO

This is one of the oldest and largest agricultural schools in Brazil. Up to 1957, it has produced a total of 1,742 agronomic engineers. In 1958, the enrollment was 330, and this (1960) it was 353. This is an estimated 75 percent of capacity. Actually, the excellent physical plant ought to accommodate at least twice this number.

The Committee made a general tour of the building and was shown a film used for student recruitment. This film purportedly represented the typical student life and instruction in the college. As most such documents, however, it stressed social and recreative aspects and failed to convey an impression of intellectual purposefulness or depth in agricultural science, instruction or research. There is a total staff of about 85, with 24 professors in 20 departments, of which only the following were observed in some detail.

The department of microbiology has new laboratories with much room and some equipment also for large-scale culture work. It was felt, however, that only a start was being made, and that, indeed, staff would be needed for effective work in this area.

The departments of agricultural chemistry and organic and biological chemistry have programs underway in mineral nutrition and fertilizer usage. Much analytic work was in progress, and it is reported that results obtained by this group have already been put to good practical use on the farms.

The institute of genetics under the distinguished leadership of Dr. Friedrich Gustavo Brieger is well known for the contribution of this group to both basic problems in plant cytogenetics (origin of domestic corn races, etc.) and the application in practical breeding projects. Most time was devoted to a discussion with Dr. Brieger on general agricultural sciences problems in Brazil. His world

famous orchid collection (6,000 species) and the extensive experimental plots were not seen. The genetics program is being provided with a new building and is also otherwise receiving COSUPI support.

The general impression is that the agricultural school is probably the best in the country. It should be utilized more for training and might succeed in this by more emphasis or development in the basic sciences departments.

AGRICULTURE EXPERIMENTAL STATION, CAMPINAS  
UNIVERSITY OF SAO PAULO

A brief stop was made at the agriculture experimental station at Campinas, São Paulo. This is said to be one of the best agricultural research centers in the country, and it has worked effectively for improvement of agriculture practices in the state.

We were shown the greenhouse facilities and some of the testing laboratories for the program of improving textile fibers. This laboratory was adequately equipped with instruments and under environmentally controlled conditions needed for this program. It is on a par with some of the textile research laboratories in large textile plants in the United States, but it was far from an advanced research institute in textiles fibers like some in Germany or in Gothenburg, Sweden.

Dr. Franco, a physiologist with expert training in mineral nutrition at the University of California, showed us the physical facilities for large-scale water culture of coffee trees. He stated that so far, trees have been successfully grown in water culture only to the 4th-year stage. After this time unknown difficulties set in. A generally satisfactory impression was gained. Much work had been accomplished and had been applied to practice on the farms and plantations of the region.

This station ought to serve as a source of experienced help for developments elsewhere in Brazil.

11. MACKENZIE INSTITUTE AND MACKENZIE UNIVERSITY, SÃO PAULO  
Instituto Mackenzie e Universidade Mackenzie

Scope

The Mackenzie University is one unit of the Mackenzie Institute which covers all levels of education. The university is subdivided into faculties of engineering, architecture, philosophy and science, economic science and law. Engineering is subdivided into civil, electrical, industrial-chemical and industrial-mechanical. The latter is to be increased in emphasis to become mechanical engineering, but the current shortage of mechanical engineering competency in the faculty is a great handicap. Emphasis was placed upon the need for help in obtaining an American mechanical engineer for Mackenzie for 2 or 3 years to initiate this important development. Although the Mackenzie Institute is legally a corporation of the State of New York, its main governing body is now a board of trustees in São Paulo. Of the 15 board members, only four are North Americans. The current director, termed Presidente do Instituto Mackenzie, is Peter J. Baker, who has been in Brazil over 30 years and is an able administrator. The academic president of the university is Professor Doutor Antonio Louis Ippolito. The director of the school of engineering is Antonio Valente do Couto, and the director of the faculty of philosophy, sciences and letters is Willie Alfredo Maurer.

Physical Plant

The plant consists of 12 or more buildings in a residential area of São Paulo located on a 3-acre plot. The constructed area leads to demolition of old buildings and their replacement as need for space increases. Step by step it is the plan to rebuild the campus by replacing most of the older buildings. Several buildings have either been completed or are presently under construction. Without going into detail it may be said that the plant of Mackenzie is reasonably adequate for its current objectives and seems likely to be kept ahead of all critical needs.

Inflation and the relatively low cost of construction has led here, as elsewhere in Brazil, to an urge to invest available funds in plant expansion or replacement.

### Students

About 7,000 students use the over-all Mackenzie plant on a part-time basis. Mackenzie University has 2,400 students, largely full-time. The school of engineering takes 200 new students each year and has a total enrollment of about 900 in its four curricula. The Federal Government supports 120 students on fellowships. Other new students now pay Cr\$30,000 tuition. Students are selected from a large number of applicants from all parts of Brazil by use of written examinations. It is surprising to find as elsewhere in Brazil that more than 90 percent of those accepted for the study of engineering graduate and usually within the normal 5-year period. One has to wonder whether student drive in an underprivileged group explains this high degree of success or whether standards and grades may be rather casual. Incentives to complete the course begun are social status and earning capacity versus the penalty of withdrawal which is to take an admission exam for another college and begin completely anew the 5-year program. No transfer from engineering to law or philosophy, for example, is permitted and no credits are exchanged.

### Faculty

Except for 10 or 12 persons supported full-time by COSUPI, the faculty is part-time. The typical salary is Cr\$22,000 or \$125 per month for 10 hours' teaching. The total teaching staff at the university level is 175 persons. Of these, 76 are on the engineering faculty. Mackenzie has no catedrático professors in the faculty of philosophy and only a few in engineering. However, under the law Mackenzie will soon be forced to advertise its professorships for competition and appointment of catedráticos unless, as is believed, the law will soon be changed.

## Curriculum

Although persons admitted to the faculty of philosophy might study for a major in physics or chemistry the number appears to be small. A large part of the activity is directed toward training teachers for primary and secondary education. In engineering it appears that 40 percent of the students study the civil engineering curriculum, 30 percent electrical engineering and about 10 percent study chemical-industrial. The mechanical engineering is just being initiated. It was stated that a student in the faculty of philosophy could not take a course in physical chemistry taught by the engineering faculty. This is typical of the restraints, largely imposed by law, upon Brazilian higher education. For the same reason, even at Mackenzie there are no humanities, social sciences, or languages taught to engineering students. The Federal laws and the Ministry of Education specify all subjects to be taught to engineers.

## Finance

Mackenzie is solvent or paid up-to-date with no debts, but has no endowment. It must raise money each year to balance its budget. The budget comes 70 percent from tuition, 20 percent from subsidies that were not defined and 10 percent from annual solicited gifts. The budget is Cr\$180 million for the entire operation, of which Cr\$80 million is in the university budget. The institution has clearly been operated in a sound financial manner. However, the excess of income over expense needed to build quality has not been available, apparently, for some period of time.

## Research

There has been no appreciable development of research since the faculty is employed part-time merely to teach. Funds would not have been available for support of research. However, with the use of COSUPI funds for the employment of some full-time faculty it is reasonable to assume that research will develop. There is some recognition of the need for practical research in engineering and

and science for the aid of industry. It is thought that the more practical type of project research can be self-supporting. It seems doubtful that this is really a profitable direction educationally for Mackenzie to take. Instead Mackenzie could develop a high quality analytical engineer that would be a greater long-term asset to Brazil and leave immediate practical problems to the State University.

### Library

This is the first institution visited that had the early concept of a central library. It consists now of some 50,000 volumes reasonably well housed and catalogued. In addition, there are specialized libraries in the colleges, i.e., for electrical engineering, law, architecture, etc. There seems to be more understanding administratively at Mackenzie than elsewhere regarding the importance of the central library concept.

### Laboratories

The laboratories are quite adequate from the space provided but are extremely short of equipment. Much equipment observed seemed so old as to be of limited usefulness. The most effectively equipped laboratories observed were in electrical engineering, in particular electrical power. The electronics laboratories had some modern equipment, but it represented no more than a quarter of the minimum essential as defined in the United States. Mechanical engineering laboratories must be developed from scratch.

### Assessment

Mackenzie University has performed and is still performing a very useful function. However, when the University of São Paulo has successfully readjusted itself onto the University City campus it is difficult to visualize a competing objective for Mackenzie since there are already many points on which the University of São Paulo exceeds Mackenzie, i.e., use of more full-time professors, more research,

better professors, and more generous accommodations for students. However, Mackenzie has a great tradition, and the Protestant background that may be considered important by a limited group of possible clientele. It seems likely to continue as a second-rate institution with part-time professors unless it is endowed privately or becomes federalized either legally or less formally by large-scale support from the COSUPI budget. Mackenzie should appeal as a place for limited support by individuals but only a very large donation covering all areas of the university could be expected to change its status into that of a research-type institution. As a small-scale research-type institution it could have a permanent position even in juxtaposition to the University of São Paulo.

12. SCHOOL OF ENGINEERING, SÃO CARLOS  
Escola de Engenharia de São Carlos

(Branch of the University of São Paulo)

Scope

The general impression of this institution was of a small vigorous growing college with quite definite objectives and the energy to make a successful contribution to the solution of its many problems. It is fortunately small in number of students but is growing rapidly. Since it has been organized only eight years and has graduated but three classes, much of its development is still in the future. However, the youth and enthusiasm of the faculty gives strong promise that São Carlos will continue to grow in importance as a factor in engineering education in Brazil.

Physical Plant

The institution was started in an old mansion which was loaned to the State in 1953 for 10 years; hence it is to be vacated by 1963. The first major building on the new campus is essentially completed. Two laboratory buildings are also ready for use, one being temporary and the other permanent. By U. S. standards the present plant would be nearly adequate for the small student body of some 200. However, other buildings are to be constructed before 1963 since the student body will be rapidly expanded to over 500. Sufficient applicants already exist to produce an institution of 500 or more students. The campus of 10 acres is to be expanded to about 15 acres. Hence it is clear that the originators of the plan visualized no extension of São Carlos into science and other fields to form a limited university. It is planned for this institution to remain an Escola de Engenharia.

## Students

The student body of the São Carlos School of Engineering now numbers 210. This year 50 students were accepted by entrance examination from 200 applicants. Hence, the plan to expand the student body to 520 by gradual increases, as soon as the new campus is opened, seems reasonable. It is planned to have all students and faculty reside on the new campus, largely on a full-time basis, but a large construction program will be involved. However, the Governor of São Paulo has approved a plan for academic buildings that will permit admission of a class of 100 each year. In the first class (graduated in 1958) there were 15 civil and 3 mechanical engineers. However, somewhat over 50 percent of the 1960 entering class are studying mechanical engineering. The students are being influenced by industrial offers to the graduates which are larger for mechanical than for civil engineers.

## Faculty

It was the judgment of the two inspectors, confirmed by later discussions with others who have visited the São Carlos School of Engineering that the faculty is extremely lively and competent. This is the most cosmopolitan faculty so far seen in Brazil even including São José dos Campos. It is clear that the rector who was hospitalized and could not be seen must be a man both of vision and of action because he has recruited an exceptional faculty of young persons in only eight years. There are 20 professors, 7 full-time and 13 part-time, 5 associate professors, of which 2 are full-time, and 47 assistants of which 14 are full-time. Hence the full-time staff numbers 23 which is as large as an American staff would be for 200 students. With 49 part-time faculty in addition, the institution has been able to initiate many projects, to publish papers and to plan the new laboratories and buildings. The department heads are as follows:

Mathematics	--	Prof. Achille Bassi
Physics	--	Prof. Sergio Mascarenhas Oliveira
Chemistry	--	Prof. Horacio Monteiro Pinheiro
Structures & Architecture	--	Prof. Frederico Schiel
Hydraulics & Sanitation	--	Prof. Alfredo Sacramento
Mechanics & Metallurgy	--	Prof. Rubens Lima Pereira
Statistics & Economics	--	Prof. Ruy A. da Silva Leme
Transportation	--	Prof. Serafim Orlandi

The publications of the faculty, listed in the catalog, indicate clearly that the major group had been selected for intellectual and research interests.

### Curriculum

There are only two curricula currently taught by the faculty of the São Carlos School of Engineering, i.e., civil and mechanical engineering. However, civil engineering is subdivided in the upper years into structural, transportation and hydraulic engineering. The curricula are subdivided into fundamental, intermediate, and application courses. The fundamental courses cover the first two years and include mathematics, physics, chemistry, geology, drawing and introductory mechanics. The third or intermediate year is devoted to the engineering sciences of applied mathematics, mechanics of materials, fluid flow, metallurgy, and construction materials. The final two years are devoted to practical courses in engineering analysis and design including a thesis problem or project. The curriculum, in comparison with U. S. colleges of engineering, has an opportunity to go more deeply both into basic science and into practice. However, the latter advantage is fully equalized by our industrial training programs for young engineers, and the former does not reach the depth we would require for the master's degree. Hence the program of the São Carlos School of Engineering, like similar institutions in Brazil, may be considered to give perhaps a semester more than typical 4-year North American institutions or perhaps a year more since no time is used for social or humanistic studies. Still, however, the product would compare unfavorably with the typical master's degree engineer from the United States. There is no current plan for new curricula although some interest was shown in industrial management.

## Laboratories

The laboratories in the old plant were inadequate to the point of absurdity. However, the new laboratories are rapidly approaching completion. These include hydraulics, electric power, soil mechanics, structural models, metallurgy and heat treatment, materials testing and some indications of a future development of mechanical engineering laboratories. The basic laboratories include physics for 'two years' instruction, chemistry and geology for one year of instruction each. Equipment is quite limited, but that available is satisfactory and shows evidence of use. Some equipment is made locally. COSUPI funds are being used to increase the laboratory equipment. The evidence is that good laboratories will be available to cover all undergraduate needs in 2 to 4 years. In many cases these laboratories are also being used for faculty research.

## Library

The library is subdivided into a basic part in the old building and an applied or engineering part in the new building. These will soon be brought together on one campus. The basic library was inspected and found to be quite good in mathematics. It is also adequate in physics and chemistry. For example, it has a full set of Chemical Abstracts and essentially all important bound copies of the mathematical journals. The holdings of the basic library were estimated at 30,000 volumes which represents about one half of the total library holdings.

## Research

Some 120 papers were published by the staff during the first 5 to 6 years. Currently about this number of research projects are said to be underway. This is an average of at least one current project or study per faculty member which is an indication of the spirit of the institution. Some of the publications were merely lithoprinted and did not appear to be very significant, but others were printed in standard journals and showed active participation in international research.

Generally speaking the research interests of the faculty were found to be high by any standard in use in the United States although perhaps not for Europe.

#### Assessment

It is to be regretted that because of his hospitalization, the Director of the São Carlos School of Engineering was not available for interview. The administration has accomplished a great deal in the first eight years of operation. In particular, a very fine job of recruitment has been coordinated with the establishment of a spirit of experimentation and research. If the faculty could be given a freer hand by the Ministry of Education it appears probable that new ideas for engineering education for Brazil would stem out of São Carlos. If the promise of the first eight years is matched by the accomplishment of another period of equal length, São Carlos will be a factor of significance in Brazilian engineering education before 1970. There is already some evidence that engineering educators elsewhere in Brazil are aware of the unique type of faculty at São Carlos and are interested in its activities. Therefore, it has a far better chance to exert leadership than would be normal for a new and relatively small institution.

12-a. ENGINEERING DIVISION, PIRACICABA  
Engenharia Divisão, Piracicaba

Branch of the University of São Paulo

This is an agricultural college that lists all of its graduates as agronomical engineers. Actually, it has been giving no engineering training of any kind. The students do receive one year of so-called physics as freshmen, but it is doubtful that this amounts to more than a few concepts with specialized applications because it is not based upon subject matter background normally required of engineers. Following this first year, the students study farm machinery, structures and farm electricity in a part of the second year. Such a broad spread of subject matter necessarily must reduce the level to that of technician training. This work is properly described as "farm mechanics" rather than "engineering". It is now planned to increase the curriculum to five years by making the first two years basic. Then for some students the last three years can be directed toward a major in agricultural engineering. The staff is adequate for this purpose. The term "agronomical engineer" should then be dropped and only those who specialize in engineering should be entitled engineers.

13. THE UNIVERSITY OF MINAS GERAIS, BELO HORIZONTE  
Universidade de Minas Gerais

General Observations

This institution is a State university that now receives Federal support. It has the usual faculties of engineering, medicine, law, and philosophy. These faculties are housed in various locations in a city of 600,000. Hence there has been no natural force tending to draw them together. They form completely independent units both administratively and in terms of their unrelated curricula.

In the long-term future the various campuses will doubtless disappear as the institution is rebuilt on a suburban location, called Cidade Universitaria, which includes about 400 hectares of land well located for convenient transportation. At present, it is planned to complete the administration building and to provide student housing and recreation facilities at the University City campus. Thereafter its growth will depend upon essentially independent colleges deciding to give up convenient, well developed plants to rebuild on the central campus. One cannot predict the rate of such change, which will depend very largely upon the growth in student body beyond the current size of 3,000 and of new activities that may develop.

SCHOOL OF ENGINEERING OF THE UNIVERSITY OF MINAS GERAIS  
Including the Instituto Electro-Technico de Belo Horizonte

This institution, founded in 1911, has almost 1,000 students. About 500 are studying civil engineering, 300 electrical-mechanical engineering, 100 in mining-metallurgy, and a smaller number in chemical engineering. The general impression is that of a school with strong traditions which had a progressive approach in the 1911-20 period but that failed to grow beyond this point until the

past few years. Now it has been energized, partly with COSUPI funds, and shows a desire and intent to grow into a modern technological institute.

### Physical Plant

The old engineering plant was located near the center of the city on a square block. It was old and run down but it is currently being renovated rather completely. A new 8-story building has just been constructed adjacent to the old buildings. It provides excellent facilities for basic science and has two floors devoted to atomic or nuclear research, largely in the use of isotopes. Even though a new building has just been completed, plans are being made for the establishment of all branches of the university on a 1000-acre campus in the suburbs of Belo Horizonte. In fact, an administration building is half completed and an atomic reactor building including the reactor installation is approaching completion. The next step will be the completion of student dormitories. It appears that the first branch of the university to move to University City is likely to be the engineering school, if and when it expands beyond its present quarters. Other units may well be delayed by from 20 to 30 years, but the project seems reasonably assured over the long term. Immediate transfer is likely to be limited to activities requiring open space for inexpensive laboratories or new developments not incorporated in the present buildings.

### Students

As elsewhere, the students at the school of engineering are admitted by examination. Great dependence must be placed upon the faculty's ability to examine because, out of a thousand applicants in 1958, about 200 were admitted while in 1959, out of the same size group of applicants, only 135 were judged to have passed the entrance examination. This may be compared with practice in the United States, where entrance examinations are used, although it would be more normal in the United States to adjust the passing grade to admit approximately a pre-determined number of new students.

The number of students graduating after a standard 5-year program is roughly the same as the number of admissions five years earlier - perhaps 90 percent as large. This is explained by drop-outs and returns and by some transfers. However, it is stated that nearly all students admitted eventually receive degrees either at Belo Horizonte or elsewhere. Again, one's attention is called to the extraordinary drive of the students to complete a degree for the title of "engineer," which has great social prestige and financial value. Nevertheless, one has to question any system that assumes the ability to select students who will be uniformly successful in justifying the award of an engineering degree five or more years later. One cannot feel assured that degrees are not awarded after one or two years delay more or less on the basis of perseverance rather than achievement and capacity. Doubtless the extreme need of Brazil for more engineers will have its influence in this regard.

#### Faculty

The faculty presently includes 70 catedráticos, 120 assistants and 40 undergraduate tutors or instructors. The number of full-time teachers is small. The faculty of the engineering school has the strength and weakness inherent in the use of successful engineers for part-time instruction. The dean (Mario Werneck) and the vice dean (Candido Holanda de Lima) are both presidents of electric power and distribution companies although both are civil engineers. Plans are being made with COSUPI aid to increase the number of full-time personnel which is currently between 10 to 15 percent. A North American professor (Dr. Bennett) has been employed for a 2-year period to develop a pilot plant laboratory to strengthen the chemical engineering curriculum. He expressed a question as to the real usefulness that is being made of laboratories by the faculty. This agrees with the general observation that in many places in Brazil the laboratories seem to be of a demonstration

nature and are not designed for student experimentation. More attention should be given to laboratory instruction including experimentation which clearly is dependent upon the appointments of full-time personnel and full-time professors who will give the laboratory their personal attention and personal use for research.

### Laboratories

The electrical power laboratory visited was quite old but the equipment was well maintained and in good condition. A meter laboratory seemed reasonably well equipped even though much of the equipment was antiquated. The mechanical power laboratory, including steam power and internal combustion was also very old. In the field of internal combustion engines the laboratory's usefulness is limited essentially to demonstration of accepted methods without student tests or experimentation. An electrical traction laboratory with applications to street car problems seemed newer than the other electrical laboratories. However, such a laboratory is of very limited educational usefulness. A new laboratory for electrical instrumentation is under construction. COSUPI funds have been used to purchase a few modern instruments for this laboratory. The transmission line laboratory seemed entirely of the demonstration type. The illumination laboratory had some of the standard photometric equipment but it was largely of a demonstration nature.

The television and electronic laboratory is just being started by a graduate of São José dos Campos. COSUPI funds will aid this necessary development. In general, it may be said that throughout this part of the institution there is a minimum of equipment for the space available.

### Commercial and Teaching Shops

The engineering shops combine a commercial and a teaching objective. The machine shop is a standard commercial operation in 80 percent of the space.

A separate machine shop for student utilization occupies the remaining 20 percent of the space. The commercial shop has many quite expensive modern machines. In addition, the students are introduced to foundry practice and to large machining operations which may be quite important to Brazil. Although one would properly criticize such joint laboratory use in the United States it seems to fit the local situation at this time since students in five years are expected to graduate with capacity to solve practical problems beyond comparable demands upon young graduates in the United States. When employers establish training programs this responsibility can properly be dropped by the engineering school.

A new engineering building contains a hydraulics laboratory approaching completion but with little equipment in evidence. The materials testing laboratory is better equipped than most laboratories including a good tensile machine and the usual impact pendulums in evidence.

#### New Laboratory Building

The modern 8-story building has the first two floors set up for atomic energy research. The equipment is good, but it was impossible to determine the extent of its use. Equipment for ultraviolet spectroscopy, x-ray crystallography, polishing and testing of metals, and heat treatment equipment of the latest models was observed.

Above the first floor only the sixth floor was visited. On the sixth floor there are many excellent appearing chemical laboratories. In fact, the area devoted to chemical laboratories seemed beyond probable use for an institution that has not as yet organized a major in chemistry leading to a degree.

Postgraduate study seems limited to sanitation, pre-stressed concrete and nuclear science. In each case a full year course of three hours credit per semester is offered with some additional course work available under special circumstances.

The postgraduate courses (about six credit hours) plus a thesis is the requirement for the doctorate. However, since every engineer is given the courtesy title of "doctor," there have been no candidates for the earned doctorate, even under the limited requirements listed above. It seems clear that the doctorate must be given greater significance through stronger requirements before students will find it a worthwhile degree.

### Nuclear Reactor

The final laboratory visited was the nuclear reactor building on the University City campus. The expenditure of \$140,000 for the reactor plus \$100,000 for extra equipment and building is being subjected to some criticism. However, if one accepts the decision to buy a reactor, the type chosen is excellent. The size of 100 kilowatts is small enough to be useful for training. At the same time it is large enough to be a tracer element producer which is important in this isolated part of Brazil. It is not possible to defend a relatively large expenditure for a reactor in a university that is extremely short of basic science equipment for freshmen and sophomores. Nevertheless, there is a possibility that the influence of association with a going nuclear program, if such a program can be produced, will prove a stimulating factor in the entire institution resulting in demands from many quarters for modernized equipment that will have to be met.

At least the establishment of this top-level laboratory should influence the institution to produce more undergraduate majors in physics, chemistry, and mathematics, a result to be greatly desired.

### Library

There is an excellent development of the concept of a central engineering library at Belo Horizonte. The general engineering library holds at least 50,000 volumes and takes 700 periodicals. It is strengthened by having five percent of

its holdings in humanistic and social science fields. It has a budget of Cr\$ 5 million or \$30,000 annually. The basic science coverage is reasonably good and the reading room is excellent. This school deserves to be complimented upon the cultivation of its central engineering library.

#### Assessment of Engineering

This institution is fortunate in having one of the best engineering deans, even though he also acts as president of an electric power company. The school of engineering shows a progressive attitude despite much residual evidence of earlier stagnation. The latter may well be due to the catedrático, part-time system since engineering laboratories cannot be left to a poorly trained assistant. In particular, it should be said that the initiation of an electronic laboratory and a metals laboratory are encouraging signs. Even though all parts of the institute cannot be improved simultaneously, there is reasonable evidence that improvement is being sought. Several full-time foreign professors covering the most significant parts of the curricula could make a great impression upon this situation which is essentially one of flux. The personnel selection procedures used at São José dos Campos or São Carlos could make a great change in Belo Horizonte in the short period of 5 to 10 years.

#### MEDICAL SCHOOL, UNIVERSITY OF MINAS GERAIS

This school, located at Belo Horizonte, was started in 1911. It now has an enrollment of 300 and is accepting some 80 new students annually. The inspection was of laboratory facilities and programs in the departments of biochemistry, pharmacology, and physiology.

#### Plant and Budget

The teaching and research activities are now being moved into a large new building, in part of lavish construction. As is usual in Brazil the

building is in part completed and in use and in part still under construction. The budget for the medical school is Cr\$209 million including the hospital and including Cr\$50 million for construction purposes. This budget is low but there have been supplements from the Rockefeller Foundation for the past five years.

#### Staff in Medicine and Medical Sciences

There are 32 subdivisions with a total of 34 professors and 120 professional staff. In addition, there is a supporting staff of 130 persons. Except in clinical departments the professors are full-time and the staff members give full-time service.

#### Medical Library

The holdings are between 10,000 and 15,000 volumes. There are 580 journals. This represents only about 50 percent of the library holdings of Ribeirão Preto.

#### Laboratories in Basic Sciences

The departments visited were situated in contiguous, rather spacious areas. The equipment was effective for teaching and routine experimentation. There was evidence of rather severe economy in certain directions. For example, highly specialized modern biochemical-physiological work was strikingly absent-possibly in part because the laboratories were still being set up. Most of the equipment on hand represented purchases with Rockefeller Foundation funds.

#### Exceptional Activity Noted

The entire operation seemed to reflect the spirit and initiative of Professor J. Baeta Vianna of the department of biochemistry who is recognized as Brazil's outstanding teacher in biochemical science. He has a dozen of his former students well placed and recognized in other institutions. He emphasizes individual laboratory experience for his students which is not too usual in Brazil. His introductory class of seventy students is operated two full days a week. Dr. Vianna's forte appears to be inspiration and indoctrination of students since

little was said by him about a program of research. The heads of pharmacology (Santiago Americano Freire) and of physiology (Beraldo) are both former students of Vianna, so there may be a tendency to inbreed although each seems to be competent. Their work, however, appeared to be routine testing and assays connected with the biochemistry program. Interest was shown in "heart action" and "energy metabolism," including stimulants and inhibitors.

#### General Assessment for Basic Medical Sciences

It seems that the medical school at Belo Horizonte gives sound background training, but it does not represent a force in medical or biological research in a modern sense. It has obvious needs, although surprisingly in the departments visited the staff seemed quite happy with the available equipment and the help provided. They rather stressed overall needs of the entire school for outside contacts, i.e., for literature, exchange of personnel and fellowships. In general, the accomplishments of the school are laudable. Support of its active basic science groups would appear to be profitable in developing more scientists and for general scientific progress in Brazil.

#### FACULTY OF PHILOSOPHY, SCIENCES AND LETTERS, UNIVERSITY OF MINAS GERAIS

##### Natural History

The science faculty of the University of Minas Gerais is about 20 years old. The present division of natural history was started in 1946. It consists of eight areas each with a professor and two assistants. Only one professor and two assistants are on a full-time basis. It is planned to expand the number when a new building can be provided. Currently space for expanded activity does not exist.

##### Students

There are only about 30 students in the beginning year of the four-year program for a total enrollment of somewhat under one hundred. In addition, there are about 12 to 15 postgraduates working in the departments as assistants.

### Curriculum in Natural History

The course is three years with additional work available for a fourth year. The curriculum is fixed as follows:

first year - general biology, invertebrate zoology, botany, mineralogy;

second year - genetics, zoology, botany, geology; and

third year - vertebrate zoology, botany, paleontology, and elective.

Normally there are three lectures weekly for each course and four or more hours of laboratory, but the latter was not too definitely established.

### Biological Research

Professor Georgio N. Schreiber with a young group of collaborators is carrying on an active program in nuclear cytology. Packed together like squirrels in a nest, this group is busily at work. Specialized instrumentation available is adequate to good, including an excellent new Italian made micro-photo spectrometer apparently from the Rockefeller Foundation. One of Professor Schreiber's collaborators, Professor J. Pelegrino, has established a separate section with satisfactory minimal equipment for immunology. Botanical science, although present in the curriculum, was hardly apparent on inspection.

### Assessment of Natural History

The program of natural history of the faculty of philosophy was found to be in a feeble, stagnant state. Exceptions were not of sufficient influence to have much effect over-all. Possibly new quarters as planned would act as a stimulus, but more likely new blood and a reorganization will be required for effective modernization. In general, life sciences throughout this university seem relatively weak. The main stimuli to activity beyond the most elementary seem to stem from Professor Beata Vianna in biochemistry and physiology of drugs and Professor Georgio Schreiber in cytology. More first class biologists are needed for an effective over-all program.

## Physical Sciences

The physical science departments of this faculty are presently inadequately housed on the 20th and 21st floors of a downtown office building. Laboratory facilities and equipment in chemistry, physics and geology are inadequate, as is the library in these fields. The move to the new building just being completed may help alleviate these matters in part, if funds are available for equipment.

## Laboratories

Equipment was meager. Except for a few minor pieces, no outside grants for equipment have been received. Cr\$3 million is the annual budget for equipment and supplies for all sciences.

## Students

Some students were in evidence, though not in large number. The professors interviewed were obviously preparing for lectures the following morning.

In the four-year course in chemistry, 9 students were in the first year, 4 in the second, 4 in the third, and either 1 or 2 in the fourth. The curriculum is the standard specialized one.

## Faculty

All professors and staff in these departments are part-time. Only one professor and two assistants of the department of chemistry were interviewed, plus the dean of the faculty (a historian). It was intimated that it would be unproductive to talk with members of the departments of mathematics and physics, even if available.

There are four "chairs" in chemistry: physical (contratado rather than catedrático), organic, analytical, and inorganic. Typical staff are: for physical; one professor, two assistants, and one monitor (a student) and for organic; one professor, two assistants, and two postgraduate students.

The latter begin training by synthesizing organic compounds using standard procedures, and after several months of this practice they begin independent research. Their scholarships of Cr\$ 12,000 monthly are insufficient, and they supplement their income by outside work, sometimes secondary school teaching.

#### Possible Institute of Chemistry

No COSUPI funds have been made available for chemistry. The "congregation" of the faculty has approved an all university institute in chemistry, but in spite of this, the change is resisted. Availability of COSUPI funds might push it through, combining with the department of the engineering school. The possibility of this occurrence is further reduced by the new building for engineering and the new building for the faculty of philosophy being remote from one another, and from the University City campus.

#### General Comments on Chemistry Organization within the University Structure, as Exemplified at Belo Horizonte

The duplication and inefficiency of Brazilian university structure is well illustrated at the Universidade de Minas Gerais. Medical school students are undergraduates, entering from the colegio. During their first year at the university, they take a course labelled biophysics, which is in its content primarily physical chemistry (the text sometimes used is Glasstone). Laboratory work includes techniques of the use of the analytical balance, precision of measurements, and analytical chemistry.

Second year medical school students take a course labelled biochemistry. Professor Vianna (sometimes called the "Father of Biochemistry in Brazil") begins this course with intensive work in analytical chemistry, including volumetric analysis, colorimetric analysis, chromatography, electrophoresis, manometry. He also gives intensive work in organic chemistry. (He states that the students' previous preparation is not very good.) Further organic chemistry is included as part of the course of pharmacology, taken in the third year.

### Duplication of Course Work

There is obviously much duplication of subject matter with the comparable chemistry courses being taught in the faculty of philosophy, and in the school of engineering. With but 50-60 medical school students admitted annually in each class, and less than a score in both the school of engineering and the faculty of philosophy, it seems obvious that there is great waste in terms of instruction, equipment, and facilities.

### Library Duplication

Inefficiency and loss through duplication is also evident in terms of library resources. The medical school, engineering school, and faculty of philosophy have each attempted to maintain periodical collections as well as collections of books. All are deficient to a greater or smaller extent.

For example, the library of the faculty of philosophy has many gaps in its physical science journals. Currently, because of lack of funds, several subscriptions have lapsed, as, for example, the Journal of Chemical Physics. If library resources could be combined and coordinated in an orderly fashion, a much better library would be available to the limited number of scientists and engineers working in the field of chemistry at Belo Horizonte.

### General Assessment of the University of Minas Gerais

This is the least centralized of the large institutions visited. Accordingly, it would require a very strong rector to produce the basic elements of university cooperation. Instead, the present rector appears to be acting rather temporarily in an interim situation. In contrast, the dean of engineering is not only the best but the strongest engineering dean contacted. Outside of the university he is president of an electric power company and is a power himself in business and in educational affairs. With such an individual in charge of the largest, oldest and perhaps most distinguished college it would require a rector of superior

ability and prestige to accomplish any greater coordination of college activities than that approved enthusiastically by the dean of engineering. Perhaps as a single illustration of the loose confederation that exists between colleges it is worth mention that the land on which the engineering school now stands belongs in title to the school of engineering rather than to the university.

Considering the conflicts so evident in the lack of organization and central administration of the University of Minas Gerais it is rather surprising that a new University City is actually under construction. There is indication here that the council consisting of some 20-30 faculty, administrative and student members not only has vision but some actual authority. Apparently its authority is not sufficient to override a college decision, however. Instead, it has acquired large attractive acreage and is using the inducement to pull certain functions to the Cidade Universitaria in the suburbs of Belo Horizonte. Currently under construction there is an administration building, a nuclear reactor building and a student service and dormitory building. Some additional engineering activity is being planned for the University City but such plans are probably of a long term nature.

Hope for development of coordinated activity of a university nature, such as a central library or unified departments of science at Belo Horizonte appears futile in the near future. The main colleges have built or are building new buildings that will anchor their activities in their present separated locations for many years in the future. These separated locations will make them defend forcefully their separate libraries and their teaching of professionally oriented background sciences. Only a strong rector with prestige beyond the university could establish such an obviously necessary device as a

central library purchasing department and cataloguing system. It appears that time and the newly available building space at University City, plus the COSUPI funds, may eventually produce the beginning of a coordinated campus program.

14. NATIONAL SCHOOL OF MINES AND METALLURGY, OURO PRÊTO, MINAS GERAIS  
Escola Nacional de Minas e Metalurgia

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History

The National School of Mines and Metallurgy at Ouro Prêto is the second oldest engineering school in Brazil. It was commissioned by the Emperor Don Pedro II, in 1876, and Professor Henry Gorceix of France was the organizer. It presently occupies the ancient palace of the Governors of Minas Gerais, which was vacated when the capital of the state was moved to Belo Horizonte in 1897.

The school did an excellent job for many years, but because of lack of faculty interest and for other reasons it dropped into a very low state for a number of years. During the past three or four years it has had the beginning of a rejuvenation, under the impact of two programs - Campanha para Aperfeiçoamento dos Geólogos (CAGE) and COSUPI.

This school is part of the University of Brazil, which has its headquarters in Rio de Janeiro. One might think it should be affiliated with the University of Minas Gerais in Belo Horizonte; presumably because of its age the Rio affiliation was made prior to the University of Minas Gerais. Until four years ago the curriculum was limited to programs in civil engineering and in mining engineering. In spite of the school's location in the middle of a richly endowed mining area 97 kilometers from Belo Horizonte, there was no geology program prior to CAGE. Graduates of mining engineering who had a particular interest in geology did become geologists, however.

The CAGE program was organized under the Ministry of Education to train geologists, who are sorely needed in Brazil. Four programs are presently being supported; at the University of Rio Grande do Sul, at the University of São Paulo, at the National School of Mines and Metallurgy, and at the University of Bahia in Recife.

Ouro Preto is a very beautiful, old, historic town. It is a national historic monument, and in a sense it has properly been called the "Williamsburg of Brazil." It is a tourist attraction for Brazilians, and during July, 16,000 persons visited the Museum of Mineralogy of the School of Mines and Metallurgy.

Persons Contacted

Director; Dr. Salathiel Torres, Professor of Civil Engineering

Assistant Director; Dr. Teophilo Alvares Marques da Silva, Professor of Physics

Dr. Jair Carvalho da Silva, Professor of Mineralogy (Experience at U. S. Geological Survey in Washington, D. C., and at Brooklyn Polytechnic Institution)

Professor Moacy Leisboa, Coordinator of the geology course

Professor Antonio Pinheiro Filho (civil engineering)

Professor Ido Porto de Nemesis (civil engineering)

Professor Walmilio de Melo Mosteiro (metallurgy)

Dr. Josi Rollenberg Leite, Director of the Mining and Metallurgical Institute

Professor Benedito Alves (geology)

Professor Hans Ramburg, of the University of Chicago, visiting professor of mineralogy, at the school for several months

Professor Pierre Mandre, Ingenieur E.N.S.C.L., visiting professor for a two-year term from France (metallurgy)

Faculty

The faculty totals 40, including assistants. Only 10 professors are full-time, and these are all on the CAGE and COSUPI projects. There are six professors of geology in the group.

As at other institutions, there is excessive in-breeding in the faculty. Most of the faculty are graduates of the school, and only three have had any further educational experience at other institutions. Two of these

are understood to be older men about to retire. With the geographic isolation at Ouro Preto, it is important that there be more contact with the outside world by bringing in outside professors, by sending present members of the faculty abroad for at least one year, and preferably 2 or 3 years' experience, and in being sure that new appointments to the faculty are made from candidates who have had further study elsewhere.

Of the part-time faculty, most live in Belo Horizonte, working in industry, for the government, or carrying on private practice as civil engineers. These men usually come by bus from Belo Horizonte for 2 or 3 days a week. There is a shortage of housing in Ouro Preto, and such houses as are available are in poor shape.

Students

Three or four years ago there were only 100 students in the school, and the graduating class of 1959 numbered but 13. This year there are about 430 students, distributed among programs as listed below:

A 6-year course in mining engineering, metallurgical engineering and civil engineering . . . . .	223
4-year course in geology . . . . .	109
courses in mining engineering and metallurgical engineering:	
basic course in mineral engineering . . . . .	41
course in metallurgical engineering . . . . .	28
course in mineral engineering . . . . .	9

(These last two courses, have the same common basic 2-year introductory course.)

The school also operates a Ginásio (or Colégio), and there are 163 students enrolled in this pre-university course. This gives special emphasis to the sciences and mathematics, in preparation for mining and technology.

The president of the student body was invited to the director's dinner for the NAS Committee. He appeared an able man, sincerely interested in the school as well as in his course of study.

Students come from all parts of Brazil for study at Ouro Preto. There is no housing organized by the school for the students, but rather they live in "Republics." Recently there has been set up a restaurant for all students, since the manner in which they previously dined in the Republics was not too satisfactory.

### Curriculum

The curriculum in engineering is about as prescribed by law. The curriculum in geology has been updated and revitalized under the CAGE program, and the four years include the following subjects:

First year: Analytic geometry, descriptive geometry, differential calculus, vectors and statistics, first-year physics (mechanics, heat, optics), general chemistry, qualitative analysis, physical geology, general mineralogy, botany, zoology, and paleontology, and a course in technical English;

Second year: physics II (electricity, magnetism, and physical optics), physical chemistry, electrochemistry, quantitative analysis, systematic and determinative mineralogy, crystallography, optics of crystals, historical geology, microscopic stratigraphy, economic geology, topography;

Third year: petrology, sedimentology, geomorphology, geophysics, geochemistry, geology of Brazil, microscopy, general metallurgy, field work, interpretive topology and geologic topography;

Fourth year: economic geology, prospecting and exploration, industrial minerals and rocks, geology of petroleum, advanced geology, private engineering geology, micropaleontology, economics, politics, administrative law, mineral law, and Precambrian geology.

The course in physical chemistry has 46 students. There are three hours a week of lecture and four hours per week of laboratory. The text used is Prutton and Maron. The physical chemistry laboratory had ample quarters and had much better equipment than might have been anticipated. There is still opportunity for improvement in modern equipment, however.

#### Laboratories in Science

The equipment for beginning physics included some modern pieces, and a great deal of older, more classical equipment. Laboratory space seemed to be inadequate.

In metallurgy, there was excellent equipment, and this will be moved into the new laboratories as soon as they are completed (August, 1960). The new metallurgical laboratory will be modern and up-to-date. Students in metallurgy also will have the opportunity for practical work in the full-scale blast furnace, foundry, and machine shop, to be commented on later.

In mineralogy there is an extremely fine collection of minerals. It is said locally to be one of the three finest collections in the world. One of the NAS group commented that the only collection he had seen which was better was in the Museum of Natural History in London. The collection appeared to be well organized and well cared for.

In petrography and mineralogy there is excellent modern equipment for instruction and research. There are 26 petrographic microscopes for student use; 16 were pre-CAGE and 10 were bought with CAGE funds. There is also the modern equipment for petrographic and mineralogical research, including a Norelco X-Ray machine with several cameras (Weisenberg, etc.). Some difficulty is experienced in operating this modern equipment, because of the instability of the supply of electric power. It would seem that this could be corrected in time. Other difficulty was experienced because of the high humidity, and it was suggested that mechanical dehumidifiers or air conditioners would correct this. Any visiting professor from any North American university would find the same

equipment of the same quality in his particular field at Ouro Preto as he would at his home university, and good use of time could be made here.

### Laboratories in Engineering

All of the strictly engineering laboratories are of about the same vintage, i.e., 1900 to 1920. In fact, some equipment actually dates back well before 1900. (One dynamo was said to have been carried in by slaves, which places it before 1888.) The laboratory for strength of materials seems to have no machine under 50 years of age. Nevertheless, the standard testing machines are available, and they appear to be in workable condition. No specimens, either tested or prepared for testing, were observed.

The hydraulics laboratory is rather small, and very old. However again it appeared to be in workable condition for the study of hydroelectric power. It would serve as a minimum laboratory experience for non-majors in hydraulic work.

The internal combustion laboratory seemed to be merely a limited demonstration laboratory of the mechanics involved. No tests of a thermodynamic or power nature appeared to be possible in this laboratory. It may be classed as an ineffective museum with only about six exhibits.

The electric power laboratory has some post-war or late pre-war equipment, circa 1940. However, most of its equipment is very much older. Again it might serve as a minimum laboratory for providing experience for mining majors, but it is depressing as a factor in the outlook of engineers in 1960.

The engineering laboratories, therefore, must be classed as borderline in regard to useful training. If at all possible, the reconstructed institution should replace essentially all engineering laboratory equipment, for psychological as well as for operating reasons.

### Life Sciences at School of Mines and Metallurgy at Ouro Preto

Although the curriculum of this school includes courses in zoology and botany, very limited time is given to these subjects. The emphasis is entirely

on taxonomy and other descriptive aspects which form essential background for the course in paleontology, or more generally serves the needs of geologists or mining engineers. The teacher, Professor Jair Carvalho de Silva, has an interest in the exceptionally varied Pteridophyte flora (ca. 150 species) in the region, and presented a paper to the 1954 International Botanical Congress in Paris on this subject.

#### Research Activities

There was no apparent research activity of any consequence. No post-graduate students are at the school. It is doubted that the faculty understands what research is. (Professor Mandre commented that it was more like a high school than a university.) In mineralogy and petrography, although there was equipment which would be excellent for a research program, any work done with this appeared limited to identification and classification of minerals. It would be very helpful if a research mineralogist or petrographer could be found to spend a year or two in this laboratory, for the equipment is available and he might be able to demonstrate research activity to the staff of the school.

#### Commercially Operating Blast Furnace and Foundry

An unusual feature of the school was the commercial blast furnace and foundry.

The blast furnace itself has a capacity of 15 tons of pig iron per day. Four draws are made daily. It is charcoal fired and uses local ore. The pig iron produced is sold in São Paulo, at Cr\$12,000 per ton. The proceeds of the sale of pig iron provide for the entire operation of the furnace and foundry, and also considerable profit. This profit is used for the purchase of equipment, and for support of the school.

Students in metallurgy at the school get practical experience in the blast furnace, in the foundry, in the machine shop, and in the mine which the school operates to provide the ore needed.

## Library

The library is completely restricted to science and technology. There are 23,000 volumes in the library, and a fairly good collection of periodicals. (The periodicals are supplied by COSUPI funds.) Observed in the library were The Journal of Chemical Physics and the Physical Review, among other similar journals.

## Administration

The administration of the school seemed to be fairly informal. There appeared to be good spirit between the director and his staff. Some question might be raised as to having a civil engineer as director of this school of mining engineering and metallurgy.

## Assessment and Critique

In general, two members of the group would rank this school to be more worthy of support than the Instituto Eletrotécnico at Itajubá, with respect to the quality of plant and classrooms, maintenance, faculty, facilities (fairly good laboratories, classrooms capable of handling 60 to 70 students in economically sized groups, etc.) and equipment, and the raison d'être for its being in this particular location. The school appeared to have suffered from having been a part of the University of Brazil in Rio de Janeiro, in that funds for this school are somewhat limited. The school hopes to become independent, and Dr. Ernesto Oliveira, Jr. is attempting to help them in this matter.

It is extremely important that new blood and new ideas come into the faculty. This could probably best be done on a long-range basis by sending a number of graduates each year abroad for advanced study. A certain percentage of these might be expected to return to the faculty, and the others would undoubtedly benefit mineralogy and geology in Brazil. Meanwhile, visiting professors should be brought in in larger number, and some of the present staff should receive fellowship opportunities abroad.

There is need for more room for office space for professors, particularly in the department of geology. At present this is lacking. The COSUPI and CAGE programs appear to be very effective with respect to providing full-time staff, and providing modern equipment.

In discussing the possibility of fellowships for study abroad with the president of the student body, he was not too encouraging as to whether these would be taken up. He stated that every graduate now received twelve employment opportunities. These employment opportunities provide for on-the-job training. For example. Petrobras sends its new employees to Japan for further training.

Dr. Edward Steidle, Dean Emeritus of the College of Mineral Industries of the Pennsylvania State University, made a study of the school at the invitation of the director. The study was published by the school in 1959, and gives not only historic and general information about the school, but analyses the general economic needs in Brazil with respect to geology, mining, and metallurgy. It also makes rather sweeping proposals for reforms in this field.

#### Summary of Impressions

This institution corresponds to some of the smaller schools of mines that still operate in the Western states of the United States. The only explanation of why it happens to be associated with the University of Brazil rather than with the nearby University of Belo Horizonte is mentioned on page 106. Clearly the school of mines was completely obsolete and drawing very few students in three curricula - civil mining, metallurgy, and geology. However, registration has expanded suddenly under the impact of the slightly modernized 4-year curricula in metallurgy and geology, and by a general lift given the institution by COSUPI and CAGE funds. The effect of the COSUPI aid is seen particularly in metallurgy, which has two laboratories nearing completion and some excellent modern equipment ready

for installation. One has to wonder whether good judgment is being used in the attempt, even if successful, to modernize this backward institution. However, it is clear that students are responding to the efforts being made. The alternative of rebuilding the important parts of the institution on the new University City campus of the University of Belo Horizonte is said to be politically impractical, even though the cost would be less to provide necessary educational facilities there than the cost of rebuilding in Ouro Preto. One also has a strong feeling that a school of mines and metallurgy isolated from the university, in a small ancient town like Ouro Preto, has no real future in competition with institutions more favorably located.

Visit to Aluminum Company, Ltd. (a subsidiary of Canada ALCOA), 3 August 1960

The Aluminum Company, Ltd. plant at Ouro Preto was visited for the purpose of determining the problem to be encountered by any industrial organization in developing a technical staff. The company was established with the aid of technical service from Canada, and 2 or 3 Canadian personnel still remain. However, only 12 or 15 persons have engineering or science training out of a labor force of 1,200 plus 200 administrative personnel. Nevertheless, this plant produces one-third of the aluminum consumed in Brazil, and one-half of the aluminum production of Brazil. It was surprising to find the control laboratory which handles 20,000 tests a month to be staffed entirely with 60 individuals trained in the plant who had only graduated from grade school. Very few have a high school education, and none are college trained. The manager said it would be impossible to employ a chemist, for example. Hence it is not surprising that all tests are sent to Canada for checking upon results. The manager, who is a professor of descriptive geometry at Ouro Preto, said that he would like to employ several additional engineers, particularly mechanical and chemical, but saw little possibility. He also mentioned the decision which has been made to plan an expansion of the plant which will require more engineers for several years. It seems likely that such personnel would have to be borrowed from Canada, even though all process and mechanical-electrical design was performed there.

15. RURAL UNIVERSITY OF THE STATE OF MINAS GERAIS  
Universidade Rural, Estado de Minas Gerais

Administration

The Rural University of Minas Gerais consists of two separate units joined only under the rectorship of Professor Heraldo D. Machado; the veterinary school near Belo Horizonte (Director - Professor. Antonio Vieira Machado) and the schools of agriculture and home economics at Viçosa. Each institution apparently is operated independently of the other and each will be reported on separately below.

VETERINARY SCHOOL, BELO HORIZONTE  
Escola Superior de Veterinária

This institution is located a few miles outside the city of Belo Horizonte on an attractive site originally set aside for a medical school. A modern, exceptionally well designed, light and spacious 2-unit, 2-story building has been completed and for the past two months has been in the process of being equipped and put into operation. It includes 7,200 sq. m. (72,000 sq. ft.) for teaching and "handling" (operating rooms, etc.) of large and small animals both for research, routine testing and inspection purposes. Some additional animal quarters are to be built in the near future. Also student dormitories are planned for construction.

In the main building is a modern, attractive library and reading room adequately stocked with books and journals, all of it evidently obtained from Rockefeller Foundation funds.

It should be considered, however, that the institution is rather isolated at present, and without ready access to outside contacts.

### Curriculum and Students

At present a standard 4-year curriculum is offered but the plan is to shift to a 5-year curriculum next year.

The courses mainly are restricted to the professional specialties and the basic sciences of mathematics, physics, chemistry and biology. In addition to the strictly animal husbandry - animal disease areas, - which are covered in detail some attention is given to agronomy (matters of feeds and forage crops), and some organic chemistry and biochemistry is taught. No courses are provided of a general cultural nature. Only 120 students are enrolled. Perhaps the number will increase now that new, relatively excellent facilities are available.

### Staff

It was stated that the total professional staff numbers 41 including 15 full professors and 26 other professors and instructors. In addition there are about 15 technicians. (Possibly the total professional staff is 26 and the figure of 41 includes the technicians.) No definite information was given as to the extent of employment, but it seems doubtful that more than a few would be full-time.

The director is Professor Antonio Vieira Machado, who was absent at the time of our visit to the school but whom we met later. He gave the impression of a well informed, energetic and efficient man. He has had some experience in the United States at Cornell University.

According to the archives there are 18 departments (possibly only seven, with sub-sections). These include the standard basic sciences and veterinary clinical types; histology, pathology, and various husbandry departments. Also there is a department in organic chemistry, one in biochemistry, one in dairy products and apparently a very active one in microbiology and immunology.

The staff includes a number of seemingly active, vigorous young people, several with training abroad. Three or more have had graduate work at the well known veterinary school at Michigan State University. The range of activities covers the nature and control of diseases, metabolism and nutrition, and general endocrinology and fertility problems, as well as inspection and various testing projects on animals, meats, and dairy products.

The two latest archives (vol. II, 1958, 387 pp. and vol. 12, 1959, 535 pp.) contain a total of 56 professional articles by the staff.

The school undoubtedly serves very well its training, applied research, and other service functions for the State. With its new facilities it could very likely accommodate more students (only 31 of 54 applicants were admitted in 1960). All in all, this school has made an excellent beginning, but one wonders how it may continue to develop in its present location divorced from other agricultural sciences and technology.

Some suggestions were heard of a possible incorporation of this school with the University of Belo Horizonte. This might provide a somewhat broader base of instruction. Except for this and proximity, however, there would seem to be less reason for such a union than for its association with the agronomy school at Viçosa. A joining of those two places would seem to be desirable for effective instruction.

SCHOOL OF AGRICULTURE, VIÇOSA  
Escola de Agricultura

Location and Objective

This institution was started in 1927 on a 3,000 acre tract in Viçosa, a small valley of river bottom land and surrounding fairly steep hill slopes. The location is isolated, (150 km., 3.5 hrs. drive by jeep over difficult dirt roads from Ouro Preto and another 160 km. from Belo Horizonte, the nearest large center.)

The region generally seemed to consist of mountainous, poor to medium-poor land not suitable for large scale, mechanical farming methods, but no doubt capable of being used much more effectively than at present.

The school is engaged in a multiple program of instruction and applied agricultural "research" or testing and for the past eight years partly engaged in collaboration with a group from Purdue University under contract ETA No. 39.

#### Physical Facilities

Facilities include one large 2-story building housing the several departments and the library. It is used mainly for instruction. A second building is still under construction, but a part of it is in the process of being equipped for laboratory work of different kinds such as bacteriology, soils, entomology and chemistry. Removal of some departments to this second building will permit laboratory space for all departments in the old building. A part of the new building has been in use for the past two years even though much of it still has to be built.

An older dormitory building houses a portion of the students and a new unit is under construction. A second unit is in the planning stage. The three should handle most of the current enrollment. Both the new laboratory and dormitory buildings are being financed in part by COSUPI funds.

A home economics unit of 10,000 sq. ft. of usable floor space is nearing completion and is in partial use. When ready it should provide adequate facilities for class and practical instruction in the homemaking arts.

A forestry school unit is being inaugurated at one end of the campus. At present it consists mainly of some lath houses and cold frame areas now in use for propagation of a large variety of tree seedlings. A 177 acre "model farm,"

with a barn with accessories for about 50 cows, located in the hillsides surrounding a small freshwater pond, is used for demonstration purposes. It is being operated at a profit by a single family.

The university also is in charge of a 62 substation extension service system started by ACBAR in 1949 and developed under Professor Machado, the present rector, and transferred to the university within the past year.

Curricula

Instruction is furnished in the following programs and with the indicated enrollment in each year's courses:

Escola Superior de Agricultura  
(Curso Superior, upper-level)

Year	1	2	3	4	Total
Enrollment	98	68	52	35	253

Admitted in 1960 were 71 of 179 applicants.

Curso Técnico de Agricultura  
(high school level)

Year	1	2	3	Total
Enrollment	83	57	35	175

Admitted in 1960 were 61 of 297 applicants.

Escola Nacional de Florestas  
(Curso Superior, college level)

Year 1, with 26 students started now - out of 54 applications.

(Curso Medio)

Year	1	2	3	Total
Enrollment	45	46	--	91

(High school level, admitted in 1960 were 41 of 62 applicants.)

Escola Superior de Ciência Doméstica  
(home economics)

Year	1	2	3	4	Total
Enrollment	33	40	8	8	89

Applicants admitted in 1960 - 33 of 40.

Although the schedule of the courses taught suggests an intensive science course, instruction is at a rather low college level in the so-called superior or upper level courses. The entrance requirement for the upper level is completion of college, but for the intermediate or lower level (técnico), reading and writing were said to be the only prerequisites. Possibly there may also be some additional qualification, such as farm experience.

Until this year probably not enough space nor equipment has been available for effective laboratory instruction. Great improvement in this regard is now possible and is to be expected. The limitation of staff competence, however, must not be overlooked.

The level of instruction in the home economics division struck the Committee as too elementary to merit classification as higher education. However, the work will be helpful in better preparing people for routine home management. The graduates will serve as high school teachers and home economists in the extension service, highly important functions at this stage.

#### Students

A summary of the number of candidates, number admitted to the first year course and the backgrounds of students currently enrolled is provided.

"Dados Estatísticos sobre a Matrícula no Ano 1960"  
Alunos Matriculados 428.

Curso Superior	253
Curso Tec. de Agricultura	175

Distribuição dos alunos, por cursos, quanto a naturalidade:

	<u>Minas Gerais</u>	<u>Outros Estados</u>	<u>Países Estrangeiros</u>
Superior	141	81	31
Técnico de Agric.	141	34	--

Distribuição dos alunos por Estados

Minas Gerais	282	Ceará	2
Espírito Santo	27	Pernambuco	2
Rio de Janeiro	18	Rio Grande do Sul	2
Mato Grosso	17	Amazonas	1
São Paulo	16	Paraíba	1
Goias	12	Piauí	1
Bahia	4	Rio Grande do Norte	1
Paraná	4	Santa Catarina	1
Pará	3	Sergipe	1
Alagoas	2		

Distribuição dos alunos por países estrangeiros

Peru	24	Colombia	3
Bolívia	3	Japão	1
	Brasileiros	397	
	Estrangeiros	31	

Distribuição dos alunos quanto as profissões do pais:

Filhos de fazendeiros (grandes e pequenos)	198	46.26%
Filhos de bancarios, comerciarios, negociantes	73	17.05%
Filhos de medicos, engneheiros, advogados, professores, contadores, dentistas	58	13.55%
Filhos de funcionarios públicos	21	4.9%
Filhos de industriais, capitalistas, banqueiros	6	1.40%
Filhos de militares	4	0.93%
Filhos de diversas professoes	68	15.88%

The data show considerable selection in the case of men (less than 50% of applicants accepted) but practically none in the case of the girls. The male students by no means represent "poor farm boys" but tend to come from the upper economic and/or social strata throughout Brazil and many other Latin American countries, although the majority still comes from the state of Minas Gerais. No doubt the school enjoys a wide reputation for effective training.

The annual fees are:

- |                                   |              |
|-----------------------------------|--------------|
| 1) Full-time room and board       | Cr\$3,600,00 |
| 2) Half resident (semi-internato) | Cr\$2,800,00 |
| 3) Non-resident (Externato)       | Cr\$400,00   |

The problem of student prerogatives in influencing course content may not be as strong here as in most places but student influence may still be stronger than it ought to be in determining general policy and direction of courses.

#### Administration and Staff

The acting rector, Geraldo Machado, is a capable person but with minimal experience in university work other than the extension service which he has pioneered in Brazil and developed, from its beginning in 1949, to an exceptional status in the State of Minas Gerais. He has common sense and obvious talent in dealing with people. He may develop satisfactorily in his present position.

The faculty includes between 50 and 60 professors at the various levels. Their average level of competence is not high, and no single top-notch scientific worker was encountered. Several of the younger men, however, have had graduate work in the United States, especially at the University of California at Davis and at Cornell University, and all have had the benefit of the association with the Purdue program at Viçosa (in the past eight years).

Among the more vigorous men noted, not necessarily listed in order of estimated potential, were the following: (This list may well omit some of the better people.)

1. Professor Geraldo M. Chaves, plant pathology. He has a workmanlike laboratory and is isolating some pathogenic fungi new to Brazil (pink root).
2. Professor Flavio Augusto Araujo Couto in horticulture. He works on nutrition and nutrient compositor of vegetables (garlic, for example).
3. Professor Chotaro Shimaya, botany. Cytology and embryology of some lower plants.
4. Professor Frederico Vanetti, entomology. He is developing a good laboratory but has special interest in the applied phase, pest control and so on. He is handicapped by lack of equipment such as sprayers for field work. His area is a crucial one for effective agriculture in the Brazilian climate and should be greatly encouraged.

He said that at present there are only 50 entomologists in the country and estimated that 200 are needed.

5. Professor Walter Bruno, chemistry. He works, and has published papers, in biochemistry of flavonoids, partly in collaboration with others at São Paulo and with Delwiche at the University of California at Berkeley.
6. Professor Otto Anderson, fruit production. He trained with Crafts at the University of California at Davis in the translocation and effectiveness of herbicides and is now turning to other phases of physiology, tree crop production as well as vegetative propagation, and resistance to disease. He seems to be informed but without exceptional drive to get work done.

On the negative side - there appeared to be a glaring lack of concerted effort both in the plant physiology and soil sections. These sections urgently need work in mineral nutrition which is not being done. Lack of coordination between Professor Alvaro Dorofeeff in soils and his "counterpart", Professor Konke from Purdue, was mentioned as one reason for this situation. This type of work is being dabbled in by other departments as well, but should be given prompt and vigorous attention as the region is known to be deficient in major and minor elements. Responses to phosphorus and to boron have been demonstrated. Lack of zinc seems to be obvious and no doubt other elements are in imbalance or in short supply. A fuller understanding of this condition and its remedy, which can be relatively easily attained, might well have enormous beneficial consequences in crop production, animal nutrition and human health in the entire region.

SCHOOL OF HOME ECONOMICS, VIÇOSA  
Escola Superior de Ciências Domesticas

The school of domestic science comprises two courses: curso superior (4-year program) and administração do lar (1-year program), with total enrollments of 89 and 34, respectively. The 4-year program has developed under Purdue University guidance over the past eight years. It is now under the direction of a Brazilian woman, a graduate of the Rural University who has spent one year in study at Purdue.

The 1-year program (administração do lar) was intended to be established as a medium-level school (colegio level), and its graduates were to be prepared to teach domestic science in earlier grades. However, the high minimum age requirements for admission do not permit the entrance of such students, and the high minimum age requirements for school teachers do not permit graduates of the program to qualify for teaching positions. The purpose of the program consequently is confused.

The 4-year course (curso superior) appears to be based upon similar courses in the United States. Work at the elementary level in the basic sciences is required, with laboratory experience limited as noted elsewhere. The new building, occupied in 1960, appears to provide adequate facilities, and another wing is projected. In all, the instructional facilities are comparable with minimal acceptable domestic science facilities in United States high schools, although the total program is more specialized. Instruction in English, social sciences and humanities is included.

Registration in the first two years (33 and 40) is significantly larger than for the last two years (8 and 8). It is hoped to reduce this high mortality by a program of continuing scholarship assistance. Students enter from the colegio by examination. Graduates of the program are employed as county home demonstration agents, or by commercial companies, such as utilities, in sales development demonstration programs.

This is the only program of its kind in Brazil, and is said to be the only one in South America. Brazilians have been brought into its operation more and more, and the Purdue team is gradually withdrawing. Whether it will withdraw from Brazil completely, or attempt to establish additional programs at other centers is yet to be determined.

#### SCHOOL OF AGRONOMY, UNIVERSITY OF MINAS GERAIS

##### Chemistry

Instruction in chemistry is at the most elementary level. The new chemistry laboratories provide good space, and there appeared to be sufficient chemical glassware, chemicals, and balances, for adequate instruction at this level. The one professor, Dr. Walter Bruno, has some publications on biochemistry. He seemed alert and industrious, but would need other help to develop a vigorous program. (This last would raise questions as to the competence of the students to handle it.)

### Physics

In physics, instruction in the "Superior" program seems limited to agricultural physics. Laboratory work and equipment is negligible. No satisfactory laboratory space is available. Level of instruction appeared to be low.

### Mathematics

Mathematics appeared to be at the level of the United States secondary school, preparatory for work in topography and surveying.

No research of any kind was going on in any of the physical sciences or mathematics.

## UNIVERSITY OF MINAS GERAIS - GENERAL

### Extension Service

The extension service originally started under grant aid sponsorship of the Rockefeller Foundation (ABCAR) and initiated and developed under the leadership of Professor Geraldo Machado has this year been joined to the University. It is a culturally unique and economically important program consisting of 62 substations in the State of Minas Gerais each with 3 people, a county agent, a home economics advisor, and a helper. Professor Machado stated that progress was slow at first but that now the benefits of the program are beginning to be felt, and it is becoming increasingly effective. Over 1,000 farmers have attended 1-week courses and demonstrations given at Viçosa (in January and February of this year). Considering the isolated location and other conditions, this truly is an achievement.

### American Professors

ETA project No. 39 provides for a group of agricultural and home economics specialists to be furnished by Purdue University as advisors at Viçosa. The

program has been in operation eight years. The current personnel numbers 6 agriculturists and 3 home economists. One of the latter has been there for 6 years, most of the others between 1 and 2 years. They advise their respective "counterparts" in their specialties (soils, vegetable crop production, agricultural economics) and also serve in an advisory capacity to other rural universities in Brazil. Symposia are held and mimeographed copies of the records are distributed. They cover such topics as directions and discussions on various agricultural practices and how to raise specific crops.

Although this project has definitely given much useful service and in the case of certain individuals, no doubt represents outstanding contributions to improvement of agricultural practices, the program as a whole is considerably less effective than it might be in several respects: (1) the budget for effective laboratories and field work is too low--only \$8,000 for equipment and materials per year for the entire group; (2) lack of authority by the staff to deal effectively with either student problems (discipline) or research projects, except as individuals may be able to persuade their respective counterparts to act; (This relationship is often a tenuous one, as would be expected, especially in cases where the advisor may be a very young man not readily acceptable as the ultimate authority by the incumbent without danger of loss to his own status.) (3) possible limitations in staff competence; specialized training should be given the staff and broad view leaders should be engaged. (4) severe conditions of physical and intellectual isolation in a region not especially suitable for modern large-scale farming practices.

Mention should be made of the evident progress being made by Dr. H. Erickson in vegetable crops and by Dr. Hansen in the development of a forestry program of instruction and applied work. Forestry ought to be a major consideration in the region.

## Assessment

It seems clear that the school is an efficiently operated instrument for general instruction and guidance in the agricultural and homemaking practices. As such, it plays a most important role in developing the State's resources for more effective living. Its influence through extension service, and model farm demonstration, goes far beyond its immediate student and home campus activities. Its effectiveness could be increased in some respects, as indicated above. In addition as it grows, its curriculum should be broadened to include stronger programs in the liberal arts.

The possibility of joining the veterinary school with the agricultural set-up is, as noted on page 119, most reasonable and necessary from a teaching standpoint. However, this does not seem feasible from economic and possibly other considerations at the present time.

16. UNIVERSITY OF CEARÁ, FORTALEZA  
Universidade do Ceará

History

In the port city of Fortaleza, capital of the State of Ceará, located on the Atlantic Coast less than 4° from the equator, is the University of Ceará. The city, dating from 1577 and first settled in 1612, is rapidly growing in population, with 281,315 population in 1951 and 370,044 reported in 1958. The population of the entire state is about 3.25 million. The economy is primarily agricultural. Climatic conditions are tropical. An average of 2,00 mm. of rain falls during March, April and May, while the remainder of the year is dry. The annual average temperature is about 80° F. A constant sea breeze adds to habitability.

The university was organized only in 1955 from the several pre-existing schools, the oldest being the school of law dating from 1918. A 5-year course in engineering, presently limited to civil engineering, was inaugurated in 1956. The following schools or faculties are now functioning: law, pharmacy and dentistry, agriculture, medicine, philosophy,<sup>3</sup> social service, nursing, and economic science. There are also institutes of mathematics, and of chemistry and technology, the latter including electronics. COSUPI provides support for these two institutes. Also within the university is the Fortaleza Seminar which functions as the cultural center for the city. In addition is the recently dedicated outdoor music shell and Auditorium Antonio Martins Filho.

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<sup>3</sup> The faculty of philosophy is presently contracted from the Catholic University of Fortaleza. The University of Ceará hopes in the very near future to organize its own faculty of philosophy, science and letters, which will incorporate the various institutes.

## Budget

The annual total budget has been increased from Cr\$131 million in 1957 to Cr\$ 508 million in 1960. However, after correction for inflation of the currency, the figure has not increased materially in purchasing power.

## Students

Matriculated students in 1960 number 2,385, enrolled in the following different programs:

		Matricula 1960		
	<u>Grupos</u>	<u>P/Carreira</u>	<u>Total</u>	<u>%</u>
1.	Técnico-Científico (c/economia)	(Agronomia 185 (Engenharia 129 (C. Economicas 184 (Filosofia (pesq. de Física, Química, H. Natural, Matemática e Geografia)	498	20.9
2.	Medico	(Medicina 330 (Farmacia 61 (Odontologia 148 (Enfermagem 59	598	25.1
3.	Educacão	(Filosofia (licenciados) 377 (Filosofia (pesquisado- res Pedagogia) --- (C. Musica (Canto Orfeônico) 8 (Serviço Social 95	480	20.1
4.	C. Sociais	(Direito 565 (Filosofia (pesq. Historia) ---	565	23.6
5.	Letras e Artes	(C. Musica (menos Canto) 244 (Filosofia (pesq. Neo-Latinas e Anglogermanicas) ---	244	10.3
Totais:		---	<u>2,385</u>	<u>100.0</u>

(Note that the division above is not necessarily according to faculty or school. Note also the figure for the number of students per "cadeira", literally per "chair", but essentially per division or course within a given department).

## Faculty

Presently the faculties total about 400 professors and assistants in the teaching program of the University of Ceará. Only a small number of these are "tempo integral," (full-time) and these are in institutes supported by COSUPI funds.

### INDIVIDUAL SCHOOLS, FACULTIES AND INSTITUTES

#### Faculty of Philosophy

This faculty presently is actually a part of the Catholic University of Fortaleza, and has simply been contracted in name to be temporarily a part of the university, thus meeting the legal requirements for its organization. No work of consequence in the sciences or mathematics is offered. Plans are afoot for the organization by the University of Ceará of its own proper faculdade de filosofia, ciências e letras.

#### Escola de Agronomia e Instituto de Tecnologia Rural

This agriculture school consists of two units, the school of "agronomy" and institute of rural technology, both located on a 120 hectare tract on the outskirts of the city of Fortaleza. The institution started as a private agricultural school many years ago, but only during the past few years, subsequent to the inauguration of the Rural University, has there been significant progress. At present there is a unit of older buildings (or parts of one unit) mainly for administration and lecture-class rooms. It also houses a completely inadequate library of 2,000 volumes and 50 periodicals. An adjacent smaller building houses the biochemistry department, the bright spot on this campus. New, modern buildings of about 6,000 sq. ft. of floor space are being completed and are being put into operation by the departments of zoology, zootechnology, and entomology. A small laboratory and pilot plant building for food technology is nearly built but is as yet completely without equipment. A 3,000 sq. ft. building

is also under construction which will house testing and research on textile fibers, etc. The most impressive new building is the administration building of the rural institute. It consists of a series of secretarial offices and a central, totally enclosed director's office which is practically the only air conditioned space found on the campus. In addition to the above there are barns and various accessory buildings.

There is also a 100 hectare farm 18 km. away, which provides land typical of the region for field experiments. A new, 3,000 hectare farm, about 100 km. to the Southwest has been bought for work on arid soil types. It is tentatively planned, also, to enlarge the present campus through purchase of adjacent partially built up areas.

Most elaborate plans are entertained for enlargement of the biological institute, but the discussion made it clear that the intent is to add needed practical aspects of physics and chemistry in small doses within the biological institute. No serious consideration whatever is being given by this group to the development of a truly integrated curriculum in several departments in the sense of a modern university. Such a plan was in fact viewed as completely impractical.

### Students

The total enrollment was given as 165 students; the registration figures for the 4-year curriculum in 1960 are 64, 60, 33 and 29, i.e., a total of 186. The plan was to limit the entering class to 50, but this year close to 60 of 156 applicants were admitted.

### Curriculum

A degree, corresponding to a B.S., is offered, but the level of attainment must be considerably lower even than for the average B.S. degree in the United States.

The courses offered in each year of the 4-year curriculum, together with the numbers of lecture and laboratory hours per week are as follows:

<u>Matérias</u>	<u>Aulas por semana</u>		<u>Horas</u>
	<u>Teóricas</u>	<u>Práticas</u>	
<u>First Year</u>			
1. Química Analítico	1	2	5
2. Botânica Agrícola	2	1	4
3. Física Agrícola	3	1	5
4. Matemática (geometria Analítico e Cálculo Infinitesimal)	3	1	5
5. Zoologia Agrícola	2	1	4
6. Desenho	-	3	6
7. Trabalhos Práticos de Agricultura	-	1	2
T o t a l	11	10	31
<u>Second Year</u>			
1. Química Orgânica	2	1	4
2. Genética	2	1	4
3. Geologia Agrícola	2	2	6
4. Mecânica Agrícola	2	1	4
5. Botânica Agrícola	-	2	4
6. Zoologia Agrícola	2	1	4
7. Entomologia Agrícola	2	1	4
8. Trabalhos Práticos de Agricultura	-	1	2
T o t a l	12	10	32
<u>Third Year</u>			
1. Agricultura Geral	3	1	5
2. Horticultura e Silvicultura	3	1	5
3. Topografia e Estradas	1	2	5
4. Zootecnia Geral	2	2	6
5. Química Agrícola	2	1	4
6. Fitopatologia	3	1	5
T o t a l	14	8	30
<u>Fourth Year</u>			
1. Agricultura Especial	2	2	6
2. Zootecnia Especial	2	2	6
3. Hidráulica Agrícola	2	2	6
4. Tecnologia Rural	2	1	4
5. Economia Rural	3	1	5
6. Sociologia e Extensão	3	-	3
T o t a l	14	8	30

## Organization and Staff

The school is organized into 10 departments with professors and junior staffs as follows:

<u>Departamentos</u>	<u>No. Professores</u>	<u>No. Assistentes</u>
1. Departamento de Matemática	1 - Partial Time 1 - Full Time	1 - Partial Time
2. Departamento de Química Agrícola	1 - Full Time 2 - Partial Time	2 - Full Time 1 - Partial Time
3. Departamento de Física Agrícola	1 - Full Time 1 - Partial Time	2 - Full Time 1 - Partial Time
4. Departamento de Botânica Agrícola	1 - Full Time	1 - Full Time 1 - Partial Time
5. Departamento de Zoologia Agrícola	1 - Full Time 1 - Partial Time	3 - Full Time
6. Departamento de Zootecnia	2 - Partial Time	2 - Full Time 2 - Partial Time
7. Departamento de Agricultura	1 - Full Time 1 - Partial Time	1 - Full Time 1 - Partial Time
8. Departamento de Horticultura	1 - Partial Time	1 - Full Time 1 - Partial Time
9. Departamento de Economia Rural	1 - Partial Time	1 - Full Time
10. Departamento de Engenharia Rural	1 - Full Time	2 - Full Time

## Orçamento (Budget) Para o Ano de 1960

Cr\$60,713,500.00

The Director, Professor Prisco Bezerra, is a middle-aged, kindly and apparently practical man, but he seemed to lack the background necessary to lead the institution along modern lines of instruction and research. His intended visit to the United States, especially in connection with hydraulics-irrigation problems, would be useful also in the above connection, but probably too little and too late to influence the over-all administrative picture.

## Activities

Teaching seemed to be at a very low level. There were practically no laboratory materials and little indication that equipment would be effectively used even if made available now that adequate space has been obtained. Emphasis was clearly on lecture rooms and lecturing (probably for the most part without close reference to standard texts). The laboratories, which had been completed and are in use, were still practically bare.

No evidence of research was found with the notable exception of Professor Ventura's laboratories (the chemistry-biochemistry department). He and his group of young collaborators have developed a very well equipped laboratory including special instrumentation such as ultra-centrifuge, for identification of proteins which compares favorably with most small laboratories of its kind in the United States. The main interest of the group at present is in plant proteins, polypeptides and amino acid metabolism. Their recent publications, however, include various other items of analytical plant biochemistry.

Two young persons, Hollanda Lima and José Wilson Alencar, plan to study large polymer biochemistry abroad in the near future, and one bright undergraduate, who has worked in Ventura's laboratory as a student helper, has applied to work with H. F. Deutsch in the department of physiological chemistry at the University of Wisconsin after graduating in January.

J. Marcondes Borges is a young man, also a professor at Viçosa, who is in charge of the food technology installation. He has had some training at Purdue University, but it seems questionable that he will be able to complete his assignment in the next two years. So far not a single piece of equipment or machinery for his building is on hand and most of it still must be purchased.

## General Impressions

This school is in an extremely poor condition. Although a number of new buildings have been erected and elaborate plans exist for additional expansion, there seems to be practically no personnel capable of developing even the simpler applied phases of agricultural testing or training programs which are sorely needed in the region. The only hope would seem to be the bringing in of a number of experts mainly from abroad.

Areas of work which are in obvious need of attention are plant disease and pest control (probably the same in the case of animals), soils, plant nutrition and irrigation methodology.

Professor Bezerra and Professor Dario Soares (Director of Instituto de Tecnologia) are aware of the problems as is the rector of the university. In fact, plans for action in the indicated and other areas and purchase of equipment for existing buildings and for some additional construction are included in their plans for the period 1960-66. The estimated cost is Cr\$185 million (\$1 million). If these funds are enough to accomplish their objectives and can be used effectively, it would be difficult to envisage a more significant investment in "human betterment." Unfortunately it seems most doubtful that the types of specialists needed to make these plans realistic actually can be obtained. Perhaps more progress would be made with 2 or 3 times the stated expenditures concentrated in some limited portions of the envisaged program.

## Projected Marine Biology

The university administration, at least the rector, was keenly aware of the need and possibility of promoting the fishing industry of the region by establishing a limnology institute mainly perhaps for the study of fishing practices in the region. So far, however, nothing concrete has been done.

There are 26 extension centers in the State of Ceará operated by the school of agriculture. The rector has had contact with and has been at the University of Kansas, and studied similar problems there.

#### SCHOOL OF ENGINEERING, UNIVERSITY OF CEARÁ

This school of engineering was established in 1956 as a 5-year program. Its present curriculum is limited to civil engineering; other curricula will be considered in the future. COSUPI support covers some 20 percent of the engineering budget.

#### Students and Faculty

A faculty of 70, of which one-half are professors, is currently conducting classes for 128 students. Of the 14 students admitted five years ago, one student died and another dropped out. Twelve students are expected to graduate, which is a rather phenomenal survival rate. This year 35 students were accepted from 110 applicants. Actually 50 vacancies existed, but the applicants were poorly prepared and many are taking a preparatory course given by the school of engineering. Of the faculty, those who teach basic science courses are largely full-time under the COSUPI agreement. Those who teach engineering courses are largely part-time professors.

#### Laboratories and Library

The basic science laboratories are wholly inadequate. First year physics is taught in a new laboratory equipped with crude homemade apparatus. The second year physics laboratory is better equipped with some modern meters of an essential nature, but the laboratory is not above a minimum high school standard in the United States. A small materials testing laboratory has been given COSUPI funds and has excellent new testing machines (German). Also the machine shop has several new quality machine tools.

The electric power laboratory now being installed will be well equipped with motors and meters manufactured in Brazil. Two diesel-electric generators will provide power for the laboratories and testing equipment as well. The so-called thermodynamics laboratory is a simple mechanism demonstration laboratory of high school level. There are no experiments of any kind planned. A combined chemistry - chemical engineering laboratory is set up for work on palm oils. The equipment is in the stage of construction, but it appears that it will be useful in developing controls and standards for local industry. Doubtless it will also be useful for some specialized instruction.

The geology laboratory seems quite well developed for a department only five years old.

The engineering library contains no more than 2,000 volumes, which is entirely inadequate.

#### Assessment of Engineering

The single curriculum structure of the School of Engineering of the University of Ceará is being stretched out of its basic form to attempt to prepare engineers to serve all purposes of this region of Brazil. Basic science work must be quite weak even though theoretical preparation in mathematics may be rather good. It would be best for the school to set up a second curriculum in mechanical-electrical power and then give two groups of engineers better specialized instruction. Clearly, however, both laboratories and faculty must be improved to make the result creditable. It will be necessary to train young Brazilians in foreign countries and to hire permanently some foreign professors to strengthen this purely provincial staff.

An unusual feature of the engineering school was the instruction in English made optional for all students, and requiring two hours per week of class time. About one-half of the students in the school elect this course.

## INSTITUTE OF MATHEMATICS, UNIVERSITY OF CEARA

### History and Background

This institute came forth from a private institution, namely the Instituto Cearense de Matemática, founded in 1954 by the board of the institute. The members of the Executive Board of the Institute are: Professor F. S. Cavalcante, Director; Professor Milton C. Martins; and Professor A. G. Colares.

The main activities of the institute are regarded as instruction of undergraduate students and the preparation of future graduate students. For this latter task, the institute has been in close contact with the leading mathematical centers in Brazil, namely the Instituto de Matemática Pura e Aplicada (IMPA), Conselho Nacional de Pesquisas (CNP), and the Department of Mathematics of the University of São Paulo.

### Faculty

There are three members of the institute on leave of absence from the University of Ceará working in graduate courses in the IMPA, Rio de Janeiro. All of these members work in the field of differential geometry, under the direction of Professor Elon L. Lima, Ph.D (Chicago). The minimum period they will stay in IMPA is about two years, beginning 1959.

During the years 1959-60 the institute brought under contract several professors who gave courses at an advanced level. The general subjects included in these lectures point toward the direction of harmonic analysis, namely Banach algebras, integration theory, Hilbert spaces and Haer's measure.

### Library

As a private institution, the institute received a grant of US\$1,000 from the Rockefeller Foundation for the library. Following the Rockefeller Foundation's policy in its granting, its purchasing department was furnished a priority list of books to be selected.

Beyond the Rockefeller Foundation support the institute received a grant of Cr\$200,000 from the Conselho Nacional de Pesquisas (CNP) for its library.

#### Outside Support

The institute, on several occasions, received very stimulating support for some of its activities from the CNP and the Campanha Nacional de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

The CAPES gave a total of four air fares between Rio-Fortaleza-Rio and a non-utilized air fare between New York-Fortaleza-New York. This trip was abandoned because of the difficulties presented by the non-American mathematician, Dov Tamari, to leave the United States for a few weeks to stay in Fortaleza. However, the institute hopes to have him working in cooperation with them next year. Beyond these air fares grants, the CAPES gave to the institute a fellowship in an amount of Cr\$12,000 per month. This fellowship is being utilized now by a member of the institute, at the IMPA.

The CNP, beyond the grant for the library, gave three fellowships, one to be occupied at IMPA and two at the institute.

#### INSTITUTE OF CHEMISTRY AND TECHNOLOGY, UNIVERSITY OF CEARÁ

This institute is under the direction of Professor Manuel Matheus Ventura, a graduate of the agricultural school, and professor of biochemistry there. (His active research program and well equipped laboratory have been commented upon earlier.) The institute presently seems primarily concerned with applied research and consulting, which is carried on for various governmental units and agencies, as well as for private business. This is often, if not completely, on a cost-reimbursement basis, and is a part of the community-state service program of the university.

At present, the institute can handle chemical and electronic problems. The chemical work is directed by Professor Ventura; the electronic work is under the assistant director of the institute, Carlos Ernesto de Pontes Dias. He is a graduate of ITA at São José dos Campos, a native of Fortaleza, with two years of study and work in Sweden and two years in Germany. He is fluent in Portuguese, Swedish, German and English. The staff consists of four agriculture school graduates in chemistry, and one in electronics.

The laboratories of the institute are about to move into a new building of modest size, which will be completed within a few months. Professor Ventura's own laboratory is at the agriculture school several kilometers distant, and will remain there.

An attempt is being made currently to organize an institute of physics.

#### Libraries

Libraries are specialized by institutes of schools. A centralized common card catalog is being organized at the Reitoria, and possibly a main library may be in prospect.

Expenditures for books for the year 1960 are Cr\$1,2 million. The present libraries are considered inadequate.

#### Six-Year Development Program

An impressive feature of the University of Ceará is the "Six-Year Development Program (1960-66), which was conceived and worked out with full faculty participation through the first and second annual seminars of the professors. Reproduced in mimeographed form, this plan opens with a valid statement of the philosophy of a true university, followed by a statement of objectives (carefully determined to meet regional needs), and the manner in which these objectives are to be achieved, namely specific programs, personnel organization, and needed staffing.

Estimates of student enrollment take into account the population growth of Ceará, and the increase already apparent in the number of secondary school students. The responsibility of the university to improve the quality of pre-university education is recognized. Almost unique is the recognition by the university of the necessity of a program of student recruitment, and the plans for inaugurating such a program.

Estimates of staffing for instruction, research, and administration have been made for the six-year period. Budget estimates of capital and current fund needs are projected.

This forward planning appears to meet the most recent criteria set forth in the United States as necessary for U. S. institutions of higher learning in recent foundation-sponsored conferences and publications. It is doubtful if there are 10 percent of U. S. institutions that have done as thoughtful and as comprehensive a projection of program and needs.

#### Assessment

The rector of the university, Dr. Antonio Martins Filho, seems to have a better over-all concept of what a university should be than almost any other rector met in the institutions visited.

A critical problem exists relative to the quality and training of the faculty, but it is believed that the rector is aware of this. Staff is currently being sent abroad for training.

If resources (financial) and quality staff can be found in adequate amount, and the projections already made can be implemented, the University of Ceará should become a strong institution, and a leading factor in the development of the "Other Northeast" of Brazil.

17. UNIVERSITY OF PARAÍBA, CAMPINA GRANDE AND JOÃO PESSOA  
Universidade da Paraíba

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ENGINEERING SCHOOL AT CAMPINA GRANDE

General Information

This institution was organized seven years ago. It has graduated two classes of about 10 civil engineers each. However, current admission is some 35 students per year. The school is a provincial civil engineering school which is being helped by COSUPI to attain a professional standard. It is presently located in a single building in the center of town. A new building is being constructed at the edge of the city. It may, therefore, be assumed that an adequate plant will be available shortly. The plans and site were inspected. Work is progressing at a reasonable rate.

Students and Faculty

Since the students are admitted by examination and only one-third of the applicants are admitted, it may be assumed that the students have an adequate level of intelligence for undergraduate engineering study. The standards of the best schools of engineering, where only one student in ten is admitted would probably be out of keeping with the kinds of jobs available in the region.

Employment is presently restricted to work with three Federal and State government agencies, The Highway Department, The Irrigation and Drainage Department, and the Department of Mineral Resources. Hence, it is understandable that the most important initial study for this region would be civil engineering. However, unless this region industrializes, its 23 million people appear to be in the serious position of a continued low-caloric diet because the region is not a fertile farming area and is beset with drought.

The dean or director, Antonio da Silva Morais, seems to be a satisfactory administrator and engineer. His background is that of a chemist or chemical engineer. The faculty now consists of six full-time professors supported by COSUPI and 22 part-time teachers from government agencies, a total of 28. There are also 18 student monitors from the upper classes.

#### Laboratories and Library

There are essentially no laboratories at the Campina Grande School of Engineering. There is a very limited mineral collection in one case and a physics laboratory with limited space and equipment. The part-time professors attempt to teach their students in the laboratories of the local Federal or State agencies. A soils laboratory and a concrete testing laboratory were inspected in the building of the Highway Department. These laboratories were adequate and quite unoccupied. Hence, they may be available for student laboratory use. The concrete being poured at the new college building was of such poor quality and so non-uniform in consistency that one wonders whether there is much for the student to learn about modern quality control methods in this area which utilizes provincial tools and methods.

The library contains some 2,000 volumes on all phases of engineering and supporting sciences and economics. It must also serve as a textbook source for many students who cannot or do not buy texts. It is therefore quite inadequate. It is about the size of many civil engineering department libraries in United States institutions when they are backed up by a central engineering and science library for faculty and advanced student use.

#### Assessment of the Campina Grande School of Engineering

This situation reminds one of some so-called "resident centers" in the United States where education courses or technical courses are given by a small resident

staff with the aid of local teachers. It is no better handled in Brazil than in the United States. Everything is wrong with the engineering school of Campina Grande except its enthusiasm and the need for its services by the town and region. It would have to be condemned as a visionary experiment except for the fact that it now has COSUPI support and will doubtless be Federalized shortly. With its new plant and COSUPI professors it could be lifted to minimum professional status in 5 to 10 years. The necessary steps would be to send about six of its best graduates to the United States or Europe for two years of advanced training. Even before they return, three or four permanent foreign professors of known capacity should be added to the staff. This group of perhaps 10 persons could then be trusted to set up a plan for perhaps two curricula and for the supporting laboratories and library that could be bought with COSUPI funds. This technique could be expected to produce within 5 to 10 years an atmosphere more nearly like that observed at the School of Engineering of São Carlos. Such an institution would quickly attain the level of accreditation demanded by ECPD in the United States. An institution such as Rose Polytechnic Institute might approximately represent the objective sought. Only if industry develops quite rapidly in this region would it seem essential to plan on a much larger institution with a research objective at Campina Grande. The school's present plans for expansion to perhaps 500 students in 10 years would seem realistic and adequate for local needs.

#### ENGINEERING SCHOOL AT JOÃO PESSOA

##### General Information

This school of engineering is located at the central location of the University of Paraíba in the city of João Pessoa (20,000 population) at a

distance of some 50 to 60 miles from Campina Grande. It is somewhat surprising to find two schools of engineering operated by one small university in towns so close together. The surprise is considerably greater when it is discovered that each offers only a curriculum in civil engineering with identical courses. Even this duplication might be explained if the institutions had long histories and had been established at a time when communication was limited. However, these excuses are entirely absent since the school at Campina Grande is seven years old and the one at João Pessoa is four years old. It seems clear that these institutions were established in competition as a matter of local pride without a sufficient reason and without a plan of cooperation.

#### Faculty and Students

Of some 900 students in the university fewer than 100 are at João Pessoa in engineering. Only five will graduate in the first class in 1961. Only 16 students passed the entrance examination for admission in 1960 out of 38 candidates. Hence the selectivity is the lowest for any engineering school visited. Two professors are listed as full-time in basic science instruction for the engineers. All other professors and assistants are part-time. It was also stated that the students were largely part-time which probably explains why only 5 out of 11 fifth year seniors will graduate in 1961.

#### Plant and Laboratories

Up until the present time the plant and laboratories have been nonexistent. Apparently this was not accepted as a reason why engineers could not be educated at João Pessoa, however.

Currently, an old prison building is being renovated by a contractor who is also a professor of descriptive geometry. The building will provide minimum space for about 100 students, but it is not being adapted to laboratories.

In fact there is no indication of a plan to construct engineering laboratories. The plan does include a chemical laboratory, a physics laboratory and instruments for surveying and mensuration. The instruments purchased for physics left one with the feeling that texts had been surveyed for pictures of equipment and the nearest thing selected from a catalog. For example, some balances had been ordered from a seventeenth century design and placed beside a modern automatic balance that is not even available in most engineering schools in the United States. Then one observed the most expensive brocular microscopes worth \$300 apiece where simple instruments are in common use in the United States at a cost one-third as great. Such inconsistencies indicated that the instruments were either selected by uninformed part-time professors or by the administration without sufficient advice.

The half dozen professors interviewed briefly did not seem to be as alert as those at Campina Grande perhaps partly because of a considerable age differential. In general they gave the impression of being capable practical engineers without much experience as professors. This impression was heightened by the personality of the dean who is a general of Army engineers that maintains an establishment in João Pessoa. It seemed clear that he was the dominant figure not only in the college of engineering but in university administration where he had no hesitancy in speaking for the rector in the rector's presence. Perhaps such an individual may be needed to establish an engineering college from scratch but his influence is clearly not of a useful nature academically. His answer to the question of why two engineering colleges were being operated by one university was that three or four are needed. This answer gives a picture of the individual since the surrounding area is the least industrialized and the poorest along the Brazilian

coast. So far the only employers of engineers have been the State and Federal governments. One good engineering school would strain the resources of the area for its adequate support and would quickly produce engineers for export if it developed an economical size of 600-800 engineers subdivided into the main engineering branches.

#### NON-ENGINEERING SCHOOLS OF THE UNIVERSITY OF PARAÍBA

The University of Paraíba has three wholly incorporated faculties of philosophy, nursing and dentistry and three affiliated faculties of medicine, law and social sciences. Engineering at Campina Grande is incorporated, but at Joao Pessoa it is merely affiliated.

This is a state institution receiving its funds for operation from the State of Paraíba but obtaining building funds from the Federal Government. COSUPI funds are being used to construct the new engineering building at Campina Grande and to buy equipment for both engineering schools. The faculty of philosophy contains staff for only geography, languages and sociology. The other schools were not inspected and were not suggested for inspection probably because of their lack of adequate status. This is clearly a state of birth rather than maturity for a university.

The rector expressed a strong interest in establishing an institute for the study of economic problems. He mentioned only agriculture but offered no very convincing explanation as to why a school of agriculture might not be more useful to the university than an institute of economics. The feeling engendered is that insufficient planning has been done in all areas of the university. Perhaps the fact that the rector has been in office only five months and shows little evidence of real leadership explains the situation observed.

## Mathematics, Physics, Chemistry and Life Sciences

At Campina Grande very little exists at present in the physical sciences. However, the director seemed to understand the problem and the need for such development. Given finances he may be able to generate the necessary impetus to achieve an acceptable level of undergraduate instruction in basic science to support his school of engineering. Nothing beyond this can be anticipated.

At João Pessoa there is no instruction in mathematics or physical science except in the school of engineering. Even there the Committee found no evidence of understanding of how a laboratory for physics or chemistry should be developed. Considerable new equipment purchased with COSUPI funds seemed almost randomly selected. The outlook here for physical science instruction even at the beginning college level is quite bleak.

Life sciences are practically nonexistent at the University of Paraíba and according to the rector none are contemplated or needed. However, in response to questions, the rector and dean of engineering stated that 90 percent of the economy of the State is from agriculture. Cotton, sisal and sugar are the main crops. It would appear, therefore, that the responsible people have little understanding of the relationship of the university to the economy of the State or they would recognize that an attack upon biological and especially agricultural problems through education is an important task for the University of Paraíba.

### UNIVERSITY CITY

As in many places in Brazil, a University City is being planned although neither plans nor the location were presented for inspection, which was unusual. It was stated that the first new building would be started in December, 1960. This is to be a student union and dormitory. Other buildings apparently under

planning are an auditorium and administration building. The rector had no response to the suggestion that perhaps the first buildings should be academic. Enough money for 3 or 4 average buildings, Cr\$ 82 million, has been appropriated by the Federal Government for the University of Paraiba.

#### ASSESSMENT OF THE UNIVERSITY OF PARAÍBA AND ITS SCHOOLS OF ENGINEERING

All evidence points to a lack of coordination and of central planning that would successfully produce the elements of a university. Two undeveloped engineering schools within one university some 50 miles apart, giving the same single curriculum, is wholly inexcusable. Note that these two institutions are not branches of a single engineering school. The plan to expand all available funds for buildings of an extra-curricular nature without providing any academic facilities is without precedent in the previous inspections by the Committee. The only excuse given for planning the development of two competing engineering schools was that they would be federalized so that the financial burden would not be borne by the region. Finally, there was no evidence of educational leadership or of faculty recruitment in engineering that could offer any hope that two creditable engineering schools would emerge. Outside control should clearly be used from any available source to develop the Campina Grande School of Engineering which seems to offer the best possibility for development, but funds should not be wasted on the less promising competing school at João Pessoa.

As background for engineering it will be necessary to give much greater attention to the physical sciences and mathematics. Again, with two engineering schools this will mean dissipation of effort in the physical sciences. Any development in the area of life sciences appears to be probably limited to the school of medicine unless the critical need for agricultural education should be assumed by the University of Paraíba.

## 18. THE UNIVERSITY OF RECIFE

### General Survey

This university is located in a city with a population of 800,000, the largest in the Northeastern area, and the fourth largest in Brazil. Its over-all enrollment is 3,000. The oldest unit, engineering, was established in 1876; the university was established in 1946.

The University City site has an area of 50 hectares. Quarters for the faculty of philosophy and the chemical institute are now being erected on the site. This is a small but brave beginning. Thirteen institutes and eleven schools, a total of 24 units, make up the University of Recife. Obviously, many years will be required for the transfer of these units to University City.

The university has been beset by strikes during the past year or two. As a matter of fact, there was a strike in progress at the time of the visit. Moreover, on good authority it was learned that the students are planning a general strike in protest against the administration for its failure to put in their ideas of needed courses and to have a live educational program in keeping with the needs, as they see them, of Brazil. According to statements made by officers of the student body, the recently constructed engineering building was the outgrowth of an earlier student strike. These students also sat in when the Committee met with the rector and members of his staff.

Obviously the teaching program cannot be strong in light of the student discontent and loss of time because of strikes. On the other hand, some solid work seemed to be in progress in 2 or 3 of the research institutes, notably those of mycology, antibiotics and oceanography.

The remainder of this report will deal with engineering and the research programs of the institutes.

### School of Engineering

This institution, established in 1896, is a Federal school offering curricula in civil, mechanical, electrical and mining engineering. Elsewhere in the university there is a school of chemistry and chemical engineering, but no coordination exists between these two branches of engineering, and no courses are shared in common. COSUPI funds are being used in the purchase of equipment on a small scale in engineering even though there are no full-time COSUPI professors in the school of engineering. Although, generally speaking, the university appeared to have little influence upon the school of engineering, it should be noted that an embryo chemical engineering curriculum was dropped in favor of the school of chemistry when the university was federalized. Nevertheless, the existence of an institute of mathematics and an institute of geology seems to have had no recognition by the school of engineering in terms of dependence thereon; mathematics and geologic chemistry and physics are being taught to engineers wholly within the framework of the school of engineering.

### Students and Faculty

There are 300 students in total, which is very low for a rather elaborate polytechnic institute with a long and distinguished tradition. It seems evident that the reputation of the institution is no longer distinguished. For example, only 43 new students could be accepted in 1960 out of 180 applicants because of low quality. The part-time faculty includes 50 professors and 70 assistants. It was estimated that 40 percent of the students are in civil engineering with 25 percent each in mechanical and electrical engineering.

### Curricula and Laboratories

Since all basic science for engineers is given within the polytechnic

institute there are laboratories of chemistry, physics and geology. These appeared to be acceptable when used only by engineering majors. They would be quite inadequate for instruction beyond an introductory level in science. It was not possible to visit the civil engineering laboratory, but this was described by students as being limited to testing materials without soils mechanics or hydraulics. The laboratory of electric power appeared adequate although much of the equipment was old. No other engineering laboratories exist although some are planned. These plans appear to be waiting for completion of the new laboratory building for electrical and mechanical engineering which is an excellent structure. However, unless a great deal of new laboratory equipment is purchased the new building may not add greatly to the rather limited emphasis upon experimental work that has evidently been the pattern up to now.

#### Engineering Library

A well balanced engineering library of 10,000 volumes exists and seems to be in more use than has been observed elsewhere. It is clear that the library is well organized and well handled.

#### Graduate Work

There is no organized graduate work in this school which is surprising in view of the fact that it has been the main institution of higher learning in its region. An occasional specialized course has been given as a service to employed engineers in Recife. Although graduate work is not well developed elsewhere, greater interest was shown in it in several other institutions.

#### Assessment of Engineering at Recife

One quickly recognizes the engineering school at Recife to be one that is very proud of its tradition. However, it has not really developed beyond its

original status as a school of civil engineering despite the organization of other curricula. No real laboratories were provided and the part-time faculty showed little interest in laboratory instruction. The students stated that they had forced the construction of the new laboratory building just being completed by striking - two years ago. This was confirmed by the Director of COSUPI.

If it is true that a student strike was needed to initiate provision for minimum laboratory development, there isn't very much reason to assume that the result will be very effective. This institution clearly needs some young blood from centers where there is a scientific approach to laboratory experimentation. Such individuals must be employed full-time and given status comparable to the catedráticos. With the addition of 3 or 4 able laboratory teachers and provision for modern equipment designed to aid experimentation by students, the character of the institution might undergo rather rapid change. However, unless the change can be initiated from within, rather than in opposition to the desires of the rather large faculty already in existence, it might well fail. One gets an impression in this institution that change may be strongly resisted.

## LIFE SCIENCES, UNIVERSITY OF RECIFE

### Mycology Institute

The institute of mycology has its headquarters in a small old building on the downtown university site. Its exterior suggests an old small herbarium, museum or possibly a private home which totally belies the intense scientific activity within. The director, Dr. A. Chaves Batista, is a dynamic, forceful personality who about six years ago was given the opportunity, by the rector of the university at that time, to build up his own program in mycology.

Dr. Batista is engaged in several projects. First, he is predominantly interested in a systematic study of fungi (taxonomy and general biology) but also, in various practical aspects, with some emphasis on species which are pathogenic to man and animals. At present he has a staff of 24 trained professional collaborators and a total group of about 60 people working with him. This includes various visiting specialists from abroad (This year, for example, from England, the international type collection in Holland, Argentina, the United States.)

The activities of this group last year included the classification of about 2,500 specimens of fungi sent to this institute for positive identification. Studies were made of various pathogenic species and some progress was achieved in their control with antibiotics and other drugs. One cure was recorded of an ordinarily blinding and fatal fungus case, using a new antibiotic.

In the course of six years a type collection of about 20,000 living fungus specimens (species or items) has been developed and is being maintained for comparative purposes. Also a standard slide collection of about 20,000 fixed

preparations has been prepared and indexed for use.

Dr. Batista has built up a surprisingly complete library for his general and specialized needs - mainly by the ingenious device of obtaining (often as a gift or loan) microfilms of important classical works and having these expertly copied and bound by his own skilled personnel. They also print numerous publications from the institute. The copying procedure eliminates both the high foreign purchase and import costs, which normally would be prohibitive. Some of these and other activities have overflowed the limited quarters into small units of primitive construction in the "back yard" of the institute.

The director has also a clinical set-up for research, including a comprehensive study of relationships of asthma attack to concurrent specific fungus spore populations in the air, and to fungus infections. By noon on the day of the visit, over 240 patients had been examined or treated on the premises in a small, simple but workmanlike "laboratory set-up." The waiting room was merely a few benches under a circular palm frond roof. A second such arrangement with tables served as work space and also for eating quarters for staff and other personnel.

This unique beehive of pure and applied scientific activity obviously is the product of and is dependent on Dr. Batista's drive, scientific acumen, dedication and organizational capacity. He stated that only by exhaustive effort, by completely divorcing himself from all social activities and from "university committee work" of various kinds, had it been possible to attain the present working organization. Even so, he stated, it could not have been achieved within the framework of departments of the faculty of philosophy.

## Finances

The budget was discussed in general terms and with reference to some specific items such as the library and personnel. Apparently the main support is from university funds, (the director of the institute is responsible directly to the rector) but some additional sources no doubt also are being tapped. Real difficulty is encountered in holding competent specialized personnel because of low salary limits. Two persons, devoted scientists but unable to support families on Cr\$15,000 per month allotments, had left within the past month for private medical practice. Another was going into a commercial firm in São Paulo.

Professor Batista holds the chair of plant pathology in the university agricultural school, where he teaches the regular course in this subject. This year the enrollment is 28 students, who have two hours of lecture and four hours of laboratory work per week. He stated that attendance in his classes was 100 percent except for bona fide illness absences, not because he insisted on attendance, but because the parents insisted on it since all knew that otherwise the students would be failed. It is believed that this point serves to illustrate further the dynamic qualities of Dr. Batista and also points up the importance of the individual teacher in the success of any system of instruction.

## Plant Pathology in Agriculture

Professor Batista stated that the total effort in applied aspects of plant pathology is confined largely to the State of São Paulo. There training in this area is provided at Piracicaba by Professor Galli, in plant disease control by Professor Vargas at Campinas, and considerable work is done at the Instituto Biológico. The Committee has seen that some work is also being started at Viçosa in Minas Gerais. It would seem, however, that at present this nationally

vital agricultural problem is given far from realistic consideration.

No departments in life sciences in the school of philosophy were recommended and hence were not visited.

#### ANTIBIOTICS INSTITUTE, UNIVERSITY OF RECIFE

The Instituto Antibiótico is an ultramodern Cr\$14 million structure recently built on a 1,000 hectare new university site. It is located next to the first unit of the chemistry institute which is now nearing completion on a 7-hectare plot allotted to this science and close to the medical school teaching and research center, parts of which evidently are in operation. A hospital is in the early stages of construction. The institute, therefore, is strategically situated.

Its director, Professor O. Gonçalves de Lima, unfortunately was out of the city at the time of the visit.

The total scientific staff consists of some 20 senior professional people, 12 technicians and about 10 to 12 graduate students. The operating budget is Cr\$5 million per year. The technicians' salaries were stated to vary from Cr\$6,000 to Cr\$26,000 per month. It hardly seems possible, therefore that the above budget would include salaries of professors.

The separate sections are housed in one or more modules of a completely integrated two-story building. Each module consists of a stall about 25 ft. long and 18 ft. wide open to a common corridor on each side and with an adjacent small glass brick enclosed room used for storage, etc. There are six modules per floor.

The work of the sections is coordinated to a greater degree than is generally true in institutes with "departments." The microbiology section, shown by Dr. J. O. Falcão de Moraes, is engaged mainly in systematic and yield aspects of antibiotic producing strains of streptomyces and other fungi. The microbiology section is the only one with a regular teaching program. An introductory micro-

biology course with 3 lectures and 6 hours of laboratory for 30 weeks, is being given to 24 students this year. The average regular attendance was estimated at about 60 percent of the enrollment. Advanced instruction is provided to 6-10 students a year. This year there are 3 students from chemistry and 3 from the medical school.

The basic subjects of the other sections are taught in the chemistry department or institute of the school of philosophy.

The biochemistry section under Professor Bento Magalhaes Neto is engaged in the isolation and characterization of biologically active substances which have been disclosed by the microbiologists. At present two main chemicals are being processed as possible practical antibiotics. Both are in crystalline form but as yet of unknown structure. One, from a plant source is called biflorine.

Professor Aristides de Paula Gomez in the laboratory of experimental cancer is testing the carcinogenic or anti-carcinogenic action of some of the fungal products which are being isolated on a comparative basis with known tumor agents and inhibitors on rats. This project was on a minor scale and seemed to be completely uninspired.

A project in a fourth section on mass culture of *Torula* and other possible fodder yeasts with the intent to produce high protein feed from sugar mill wastes seemed to be inexcusably primitive considering the marked progress in this type of work elsewhere during and after the war.

Professor Alberto Martins Moreira showed me the new chemistry unit being completed next door. It is architecturally a very novel and most pleasant building. It should provide room for teaching the several standard chemistry courses to some 100 to 200 students (much emphasis had been placed on student

laboratories), and ample room is still left for research facilities for the staff. Judging by the set-up in the chemistry department in its old quarters, some doubt might be raised as to the extent to which research may be pursued in the new quarters.

#### General Impressions

Excellent space and good equipment is provided and used for small scale work on antibiotics. The staff, at least in microbiology and biochemistry, seemed to measure up to average international standards of workmanship. However, there was no evidence of unusual originality or unique local flavor in anything that was shown. The half dozen professors who conducted the tour did not communicate enough in any common language to make possible detailed discussion of their work; however, it was clear that most operations were of a routine nature. Equipment necessary for large-scale experiments or for applied work in fermentations, etc., was not seen, and probably is not available in the building or elsewhere.

#### PHYSICAL SCIENCES AND MATHEMATICS, UNIVERSITY OF RECIFE

Although instruction in the physical sciences is offered in several faculties and schools at the University of Recife, the activity appeared to be developing in the newly created institute of physics and mathematics. The institute of chemistry is reported to be preparing an active program of research, and already to have good equipment in its new University City building. Instruction in these disciplines within the faculty of philosophy and the school of engineering appeared typical of most Brazilian institutions, with quality of instruction leaving much to be desired, a meager number of students, and inadequate laboratories and libraries.

Instituto de Física e Matemática (Institute of Physics and Mathematics)

This institute, organized in 1954, appears typical in being outside of other faculties and schools of the university in organization, yet overlapping in personnel. Apparently the establishment of such institutes is motivated in part as a means to circumvent the narrow curricular restrictions of the Federal Law, and in part to overcome the impediments and inertia of the "Cadeira" system, and catedratic professorships. The staff presently consists of one theoretical physicist, Professor Freire, who is the director of the institute and "tempo integral," and seven mathematicians. Of the latter group, only one is "tempo integral:" 2 are assistant professors and five professors; other appointments are in the faculties of philosophy and architecture, the schools of engineering and chemistry; outside commitments range from 6-13 hours per week. There is no work in applied mathematics. The need for more physicists, especially experimental physicists, is realized; already under contract is a cosmic ray physicist who is returning from study in the United States.

The institute has led an active program of visiting professors, with stays ranging from several weeks to three months: Denjoy (Paris), Godement (Paris), Bruhart (Nancy), Nachbin (CNP and IMPA - Instituto de Matematica Pura e Aplicada - Rio de Janeiro), Albuquerque (Coimbra, Portugal), Kahane (Montpellier), Ehresman (Paris), and Gomes (ITA). Seven publications, primarily text notes for the courses offered, have been issued by the institute.

The institute has about 20 students at present; it has had a total of 35 students, 10 of them "postgraduate." Several of its students are now at IMPA.

Seven scholarships are provided by CNP. Of its present annual budget of Cr\$ 5 million, 40 percent is from the University of Recife, 40 percent from

COSUPI, 10 percent from CAPES and 10 percent from CNP. COSUPI funds are used for support of "tempo integral" appointments, and for the journal purchases for the library. The director feels that the institute should have a budget of Cr\$10 million, which would provide a larger staff, more "tempo integral," more library books and periodicals, and more fellowships.

Students in the institute come from the faculty of philosophy, and from the engineering school. Apparently they are proselytized, and elect the work at the institute solely because of intellectual bent. The institute staff provides lectures and courses for other units of the university voluntarily or on request, with greater or less success. For example, in the school of agriculture where no work in statistics is given, an institute member offered a course in elementary statistics. However, only the professors of mathematics and physics in the school appeared for the course; none of the geneticists or agronomists, and no students took it. The "resident physicians" (students) of the university hospital requested a course in statistics which was provided for them.

With respect to the course structure and syllabi within other faculties, an interesting comment was made that while Federal Law governs the description and number of "cadeira," it does not govern the exact arrangements within a given course. For example, the 2-year prescribed program in differential and integral calculus has been reorganized internally along the modern concepts for instruction in the United States and elsewhere, the course beginning with number theory and progressing from there.

The institute would like a visiting professor of statistics to give middle level courses.

Commenting upon the suggestion of having outstanding professors from the United States give seminars and courses during July and August, members of the

staff indicated they would look with favor upon such arrangements, but would want to have plans completed at least six months, and possibly one year, in advance. This would give them opportunity for anticipatory courses or seminars to prepare their students to take maximum advantage of the course of the visiting distinguished professor. Seminars or colloquia during the July vacation should have associated with them fellowships or travel grants to enable the participation of professors or advanced students from all of Brazil (Cf., the 1960 Latin-American Institute of Physics at Rio de Janeiro.) English could be used as the medium of instruction.

Some students at the undergraduate level refuse all texts in English, and staff members estimated that only about 30 percent read texts in English. (An even smaller number read German.) There is felt a lack of and need for good books in basic science and mathematics in Portuguese. It was suggested that the Bi-National Centers might offer courses in scientific and technical English, possibly with United States engineers as instructors.

#### Escola Superior de Química (School of Chemistry)

Because of a university holiday it was reported that the school of chemistry was closed. Dr. Skoog did visit this school, however, and reported good equipment. He felt that good research would be initiated because of the equipment and the school's proximity at the University City to the institute for antibiotics. An able young man, Ricardo Ferreira, is leaving, because of lack of support, to work with Jacques Danow in radio chemistry at Centro Brasileiro de Pesquisas Físicas.

#### Other Work in Physical Sciences

The school of engineering was reported to be very poor in its physics laboratories and its equipment. At the Catholic University of Pernambuco, Recife, it is reported that a center for studies in physics is undertaking a research

program, and has one or two good professors from abroad. The only mathematics at the Catholic University consists of service courses for physics and engineering. Engineering professors at Catholic University are appointed from the school of engineering of the University of Recife.

#### Interruption of Class Schedules

Considerable complaint was made of the lack of a university calendar, and the consequent impossibility of planning course schedules and timing. There are many holidays, usually not announced in advance. Some are traditional, and include city holidays, State holidays, Federal holidays, church holidays, and special university holidays, as well as student strikes. At the time of the visit, there were overlapping the university holiday commemorating the 133rd anniversary of the founding of the school of law, the 5-day sympathy strike of the students, a request from the rector to suspend classes to permit greater attendance at the international writers' congress being held in Recife, and immediately following the cessation of the strike, a religious holiday, commemorating the Holy Mother. Beyond this, 90-minute classes often begin as much as 30 minutes late, thus requiring one-half day to be set aside for a student to attend a single class.

#### INSTITUTE OF MARINE BIOLOGY AND OCEANOGRAPHY Instituto de Biologia Marina e Oceanografia

This institute was organized in 1952. It has since acquired a small but modern, well-equipped laboratory on the beach about 15 kms. south of the center of Recife. In 1958, Professor François Ottmann of the marine geology section of the laboratory of physical geography at the Sorbonne was appointed director, joining the curso de geologia (CAGE program) as professor of sedimentology. (His wife, Dra. Jeanne-Marie Ottmann is assistant in the chemistry of sediments.)

With a staff of about 10, organized in sections of chemistry of sea water, geology and sedimentology, physical oceanography, sediment chemistry, and marine biology, there is underway an active and well-conceived research program on oceanographic problems of significance in the area of Recife.

The institute has purchased a fishing boat (dragger) of 20 meters length and 5 meters draft, which is presently being converted for research use in a practical and soundly planned manner. Progress in the conversion is slow because no suitable boat yards are available in Recife. It will be berthed in the Recife harbor. At its beach station, the institute has a small 5-meter outboard launch.

#### GENERAL ASSESSMENT OF THE UNIVERSITY OF RECIFE

The low enrollment in engineering, the absence of full-time teachers in the school, the lack of up-to-date equipment indicate a failure on the part of the institution to live up to its potentialities. In sharp contrast with other universities visited, the faculty and administration exhibited little interest in adapting the program to the needs of Brazil and of the students.

Under the present administration it appears unlikely that the institution will realize its potential of service to the community and the state. The institutes in oceanography and in biological sciences described are bright spots in the picture, for some excellent research work is found there. The teaching program in the university does not appear to have the same vitality.

This impression may be partly the result of the strikes which most obviously have affected the attitude of the administrative and teaching staffs. On the other hand, past, present and prospective strikes are evidence that the impression gained reflects the true state of the institution.

19. CATHOLIC UNIVERSITY OF PERNAMBUCO, RECIFE  
Escola Politécnica

General Impressions

This institution has received aid from COSUPI which it has used most effectively in two areas of mechanical engineering and physics. An Englishman has been employed to teach machine design and operation and mechanics of materials. He is dedicated to this work, qualified and an enthusiast. There is no question but that his spirit is being instilled into a group of students by the apprenticeship system. They work together on projects to develop new equipment and he teaches by example as well as by theory.

Then in physics, the Committee talked with an Italian professor who showed excellent command of nuclear theory and was also directing students in nuclear experiments by the apprenticeship method. He too carries students along by his enthusiasm for his subject. This was demonstrated by the fact that his class was at work with him even though the students were officially on strike in sympathy with a student strike in Bahía. Of course, the fact that he is a full-time professor has its own influence.

Future Prospects

It was stated that this small, under-equipped institution has a larger student body (400) and a greater number of applicants in 1960 than the Polytechnic Institute of the University of Recife. If other areas of experimental activity and enthusiastic teaching exist, or can be developed in this institution, it might well occur that the relative importance and reputation of the two competing institutions in Recife would change rapidly. This may even be anticipated since the current

dean of the Catholic Polytechnic is said to be responsible for the developments observed and to be quietly moving ahead to stimulate equivalent developments in other departments. He deserves support in this effort.

The director or dean is Dr. José Torres Pires. The Reitor Magnifico is Padre Aloisio Mosca de Carvalho. In opposition to this rather optimistic report it should be stated that laboratories other than the two mentioned seemed quite uninspiring and inadequately equipped. Only a small start has been made toward development of a significant technological institute.

## 20. THE UNIVERSITY OF BAHÍÁ, SALVADOR

The University of Bahiá has features found in no other University in Brazil. It does not plan a University City. It has two campuses instead, a new one for engineering, and the old campus where the remainder of the divisions are located. It has a music and drama program, partially supported by the Rockefeller Foundation, with a little theater type of auditorium provided by Rockefeller funds. It has several foreign area and language institutes, each housed in a separate building. The North American and French institutes are completed and in use. The Spanish institute is under construction. Each institute has a small library of books in the language of the country represented and dealing with that country. The new engineering building, now practically completed, is the largest of such buildings encountered in Brazil. Two other smaller structures are planned for but not yet begun.

The rectory containing the offices of the rector and of other administrative staff members is an elegant building and apparently well adapted to its purposes. It lacked the gaudiness sometimes found in its counterparts at other universities. It is not a new building though it has recently been redecorated. There was an air of efficiency there not often encountered elsewhere. Though a medical doctor by profession, the rector gives full time to his administrative duties. He no longer practices medicine though he is active in community affairs.

Salvador, a former capital of Brazil, is a city of churches, 365 in number, according to reports. Many are famous for their antiquity and for their splendor. In the crypt of one of these are interred the remains of all former Cardinals of the country. This setting accounts perhaps for another unique feature of the University of Bahiá, a museum of sacred art that is housed in an early 17th century building which was formerly a monastery. A special exhibit of sacred art

was on display in the museum at the time of the Committee's visit.

It is difficult to assess the administrative organization of the institution. The rector is energetic, has built a magnificent plant, but seems to have been weak in building staff. He is apparently quite unpopular with the students since their desire to remove him is assigned as one of the causes of a quite prolonged student strike. He was said to have little or no interest in science and technology though one of the largest and most impressive engineering buildings found in Brazil was just being completed at the time of the visit. The dean of engineering seemed energetic and aggressive but gives the impression of knowing little about the real meaning of engineering education. The other staff members encountered seemed less than first rate.

The equipment for the new building seemed pitifully inadequate which led to the query whether good judgment would not have dictated use of part of the funds invested in the building for equipment instead.

In the long run the university would seem to have prospects of being an important asset to Brazilian higher education because of its splendid plant, but before it realizes that promise, it is possible that it will need some new blood in the administrative and teaching staffs. Despite the magnificence of the new engineering building it does not seem that the concern for improving science and technology in this institution is in line with that found in other universities in Brazil.

#### PHYSICAL SCIENCES AND MATHEMATICS, UNIVERSITY OF BAHIA

Research in the physical sciences and mathematics in the faculty of philosophy, sciences and letters, and in the polytechnic school is practically non-existent, and instruction has been very poor, owing to inadequate, poorly

trained faculty, deficient laboratories, and poor equipment. (The situation in the schools of medicine, dentistry, or agriculture in biochemistry and biophysics is not believed to be significantly different; repeated efforts to contact personnel involved were made in vain.)

#### Polytechnic School (Escola Politécnica)

The polytechnic school was in the process of moving into a new building of magnificent proportions (one half of the building project for the school), which will provide adequate physics and chemistry laboratory space. The space for chemistry is being occupied with the expectation of more space when permanently assigned laboratories in the second building become available after it is constructed; for example, there is no space available for a unit operations laboratory in the new building.

In the polytechnic school all catedráticos are part-time, and more often than not, have unrelated jobs during half of each day. For example, the catedrático de fisico-química, who is also chairman of the department of chemistry, works as an engineer in the design of reinforced concrete construction during the afternoon. When asked, many state they wish to be "tempo integral," and with new Federal legislation for the first time providing adequate salaries, they hope that they may be employed full-time. In many cases, individual training, talent, and motivation cast doubt as to the benefit to be derived.

Of the existing programs in the polytechnic school entering students are distributed as follows: civil engineering, 60-100 per year; electrical engineering, 20 per year; chemical engineering, 6 per year. (Programs in mining engineering and in mechanical engineering will be planned in the future.) The chemistry department presently has seven chairs (catedras, cadeiras): physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, organic to industrial chemistry, industrial chemistry, and industrial physics (said to be unit operations).

It is planned to split some of these chairs; for example, industrial chemistry would be divided into petrochemistry and other specialties.

Other chairs in mathematics and physics are shared in common with civil engineering and electrical engineering. All engineering students take courses in the basic sciences together.

The department of chemistry has good equipment for radiochemistry, but was planning to use it for fall-out determinations; it is doubtful that the capability exists for the use of tracer techniques, etc., in spite of equipment availability.

The chairman of the department of chemistry requested assistance in obtaining a visiting professor to set up the laboratory for unit operations, even though space for this is non-existent.

Undergraduate instruction in physics at the polytechnic school is again under part-time men, whose main interest may lie elsewhere. (An interesting self-commentary was found in the provision of "listening rooms" in the new library, where it was explained that students would have the opportunity of listening over and over to tape recordings of the professors' lectures.)

Faculty of Philosophy, Sciences and Letters (Faculdade de Filosofia, Ciências e Letras)

Perhaps more so than at other universities visited, the faculty of philosophy has been concerned with the training of secondary school teachers and is thus held in low esteem by the other schools and faculties, and is not influential in the university council. The dean is a part-time catedrático with little interest in the development of a sound program.

The chairman of the department of physics and chemistry is a physician, biochemist, who is also a catedrático in the medical school and in addition operates his own private clinic. Other men in chemistry are also part-time. While it was

not possible to gain admission into the chemistry laboratory, it occupied but a small area and is said to be poorly equipped. Course work in chemistry is purported to be routine, and no research is in progress.

In mathematics, the situation in the faculty was described as similar to that in chemistry.

In physics, although it is combined with chemistry in a single department, in the presence of Professor (contradito) Ramiro Porto Alegre Moniz (A.B. and A.M. from California - Berkeley) there appears a spark of life. Giving the third-year in modern physics he finds himself handicapped, however, by the poor physics courses of the first two years. At present he is setting up a laboratory program for the first-year course in general physics, and has ambitions for an instrument shop, new courses, and more laboratories. It is far from certain that these can be fully achieved, and even if so, it is doubtful that a significant program of research would ever be inaugurated. There are presently no fourth-year students in physics, and only six in the first three years.

#### Institute of Physics and Mathematics (Instituto de Física e Matemática)

At the instigation of the rector, there is in the process of organization an institute of physics and mathematics. Presently working on this is Professor Porto Alegre, and he has just been joined by a mathematician, Professor Rubens Gomes Linty of São Carlos. They hope to actively recruit other young men to staff the institute.

If it becomes fully operating, the institute will fulfill three functions: (1) carry out an active program of research with properly qualified full-time staff; (2) provide modern courses in mathematics and physics which are impossible of introduction in other faculties or schools, either because of restrictions of Federal Law, rules of the university council, or the control of catedráticos.

(Students of other faculties and schools would take these courses as optional electives); (3) provide instruction for regular courses as requested by other schools and faculties. While it is hoped that possible cooperation may be gained from the catedráticos in physics and mathematics in the faculty of philosophy, it is not presently believed that any immediate alliance is forthcoming with the polytechnic school. Library resources are meager, but a number of standard journals are currently being received, and it is planned to build back runs with microfilms or microcards.

An institute of chemistry built along similar lines is also being activated by the rector, who asked assistance in finding a North American to head it during its organizational period.

#### School of Geology (Escola de Geologia)

With the assistance of Professor Humphrey, Head of the Institute of Petroleum Geology of Petrobras, on leave from Stanford University, the university organized the school of geology three years ago. (This is outside the CAGE program,) The curriculum is modeled on the Stanford curriculum in geology, and while no humanities or social science is included, courses in English are required for seven out of the eight semesters. A start has been made on the library, and adequately equipped laboratory facilities are at hand. The staff consists of three geologists (two from the United States), and one each in geography, mathematics, physics and chemistry (plus one assistant in chemistry). English is used for instruction where necessary.

There are presently 47 men in the classes of 1961, 1962 and 1963. Scholarship assistance is provided for those who have need, averaging Cr\$2,000 per month.

The required 8-week summer field camp following the third year will be university financed, costing Cr\$800,000 for 20 students (including an allowance for spending money). An elementary school in the interior is being rented by the university to provide living and laboratory quarters. Equipment is to be taken

out from Salvador. Transportation out to field stations will be by a bus and a truck to be purchased by the school.

There seems an anomaly in that, whereas this school has had freedom in determining its curriculum and courses, since it was not established by Federal Law (and is subject only to the regulation of the university council), it must follow Federal regulations with respect to the admission and retention of students.

A refreshing aspect of the school is the manner in which its quarters have been established in a former private residence of large size, and in two inexpensive pre-fabricated wooden buildings which have provided a 150 square-meter area at a total construction cost of Cr\$600,000. Petrobras assisted in this, and presently is using a part of the space.

#### Institute of Petroleum Geology

Organized and financed by Petrobras to provide needed trained geologists, this is formally affiliated with the university only in that graduates of the 2-year program receive diplomas from the university certifying completion of postgraduate work. The director is Professor Humphrey of Stanford University.

At present, students are recruited from graduates of engineering schools, faculties of science, and schools of agriculture, and become employees of Petrobras for the 2-year training program. The work is currently normal undergraduate work in geology, although as graduates of newly established university programs in geology become available, instruction at the institute will be at the graduate level. Students not performing adequately lose their Petrobras positions, and are dropped from the program.

## SCHOOL OF ENGINEERING, UNIVERSITY OF BAHÍA

At this stage of its relocation one finds it very difficult to report objectively on this engineering school. Such contrasts as a small student body of 300-400 (by different estimates) but the largest single building perhaps yet constructed for a school of engineering (with others planned for early construction) are difficult to understand. Elsewhere the Committee has seen equivalent student bodies housed in a small fraction of this new building. This building, which is 600 feet long and seven stories high, contains about 150,000 square feet of floor space and could handle 1,000 students without crowding. In fact, considering the part-time nature and poor attendance of Brazilian students, the building could possibly handle a registration of 2,000 students.

This extraordinary structure located on a hillside with a near view of the ocean, or the Bay of All Saints at Salvador, is essentially completed, but it is also essentially without equipment. The small amount of equipment being moved in seems to be quite old and hardly fitted in the main to the objectives of such a building. The director explained that he had asked the rector for \$600,000 for equipment. This is probably as much equipment as could be used with any degree of effectiveness by the present part-time faculty, but the building would hold three times this amount of experimental equipment if it should be needed by an active faculty. A library exists and is being stocked at present, but its extent is unknown. Doubtless, like the equipment being moved from the old site, the library will be in great contrast to the plant.

### Faculty and Students

Currently the school of engineering is accepting 1 out of 4 applicants. It took in about 70 new students in 1960, which in five years would provide only

350 students or less. It seems clear from the ratio of new to total students that failures are quite low. Applicants are said to be poorly prepared in the main. Some rather radical change must occur either in numbers or in quality of applicants to justify the construction of the monumental building described above. Only a few faculty members were found in the building which may or may not be due to the current student strike. However, there is so much to be done to put this building into useful operation that one would have expected a beehive of activity of professors and their assistants. Little activity was observed. The teachers available were of the type termed "work horses" in the United States institutions, that is, routine individuals who would not inspire students. The ages of the teachers contacted were noticeably high, and their ideas were not particularly progressive so far as observed. However, the percentage of the fairly large staff available for interview was so small as to be quite insignificant statistically.

#### Administration of the School of Engineering

The dean of the school of engineering is a very active, forceful individual who is doubtless personally responsible for completion of the building. He is obviously a businessman rather than an educator. He was probably indispensable in the construction period, but our discussion led to no plan of educational development and staff recruitment that would give much hope for the growth of an institute of technology that could live up to the magnificent plant already largely prepared. One is reminded of the early days of the Northwestern Institute of Technology at Evanston, Illinois, where all faculty energy for 10 years or more went into planning of the building and equipping the laboratories while education and particularly research took secondary positions. After such a period of artificial activity it is difficult if not impossible to change the interests of the faculty

into more significant academic channels. This seems almost certainly to be the problem at the Engineering School of the University of Bahiá unless a different kind of educational leadership should develop.

One cannot entirely divorce the administrative problem in engineering from the over-all administration of the University of Bahiá. The rector is a highly controversial figure who has been in power since 1946. He is an able administrator and a dominant personality, but it is not certain that he would understand the difference between superficial operation of a college of engineering and the scientific stimulation necessary to produce engineers rather than routine technicians. His interests clearly have advanced the beauty of the campus and many humanistic activities of a somewhat extra-curricular nature. The university, for example, has a wonderful music hall and has restored a magnificent early colonial church. Its institutes of French, Spanish and American culture, already noted, are not clearly integrated into the educational pattern of any college. Such work is taken as an extra activity, if at all. One suspects that except for a few full-time scholars, most student contacts with these institutes may be superficial. Certainly they are not significant to the curriculum in engineering as currently operated. If the feeling of the inspector is justified, to the effect that the rector's interests are to achieve a superficial refinement of the surface of the university rather than to achieve scholarship in depth, the problem of obtaining a scholarly experimental approach in the engineering school may be greatly delayed since it will not be achieved under the present dean.

#### Specialized Curricula in Engineering

This is the first engineering school visited where some specialization in petroleum technology is possible. Doubtless this is due to the existence near

at hand of a semi-academic, semi-commercial research institute of petroleum technology supported by industry and staffed heavily by Americans. There is also supposed to be a chemical engineering curriculum although the son of the rector, who is professor of medicine, said that its enrollment had been insignificant. The chemical, electrical and mechanical curricula are termed "industrial" which is a different terminology than used in the United States. Electrical and mechanical curricula each receive respectable registration although the largest group of students is still in civil engineering. The laboratory equipment for mechanical engineering seems particularly inadequate as in every institution visited (not excepting São José dos Campos). Clearly, Brazilian universities need to take the development of mechanical engineering much more seriously. This holds for both staff and equipment.

#### Assessment of Engineering School at Bahía

It is difficult to assess a school that has abandoned its old plant but has not re-established itself more than 25 to 30 percent in its new quarters, whose students have been on strike for two months (one month being vacation, however), and whose faculty is obviously taking advantage of the strike to either relax or earn additional income. The picture is more confused by visiting the new building which is one of the largest individual engineering educational buildings in the world and would cost more than \$3 million in the United States. The plant would care for three times the present student body on a full-time basis. Plans are going ahead for two additional buildings. All of this seems to add up to questionable planning or to clairvoyance regarding future applications since only 70 acceptable applicants were received this year.

In total one feels that enthusiasm for show rather than strong educational objectives is behind the administration both of the engineering school and the

University of Bahiá. Unless an educational leader takes hold of the school of engineering in the reasonably near future with the idea and temperament to recruit good scientists, engineers and experimentalists, the new plant may be only a white elephant. Its proper equipment alone will be a great problem to solve with the aid of only practicing engineers who teach as a part-time occupation. However, if one-half of the faculty becomes full-time teachers and the necessary new blood is brought in from foreign countries the school of engineering may well have a new birth and new life.

#### LIFE SCIENCES, UNIVERSITY OF BAHIA

##### School of Philosophy

Many of the stated general conclusions with reference to chemistry teaching and research apply equally to the life sciences. Although several requests were made to see the premises and to meet staff members, no contacts were made. Actually, little productive effort in these areas could be expected as the professor of zoology (Professor Seabra) is also professor of surgery in the medical school and his primary interest is in anatomy. Although an excellent lecturer, his talents are further diluted in various administrative jobs. Apparently he also has an administrative position in the school of philosophy. The professor of botany, Leal Costa, is also professor of parasitology in the medical school. Although a capable person, his interests appear to be mainly in taxonomy. The assistant in botany, Dr. Cora Pedreira, is currently working on a tuberculosis project but is mainly interested in human genetics and is now arranging to transfer her activities to the hospital to pursue this line of work. All in all there would seem to be little hope for the development of basic biology in the school of philosophy in the foreseeable future.

Botanical sciences have been practically disregarded at the University of Bahía. A state school of agriculture exists about 200 km. away which, it was stated, has a large physical plant but is completely lacking in competent staff even now after about 20 years of operation.

#### Medical School and Hospital

Basic sciences in the medical school could not be observed, but a rather detailed account of its principal activities was obtained in a discussion with Professor Roberto Santos, professor of internal medicine in the university hospital and son of the rector. He stated that the medical school was started in 1808, and a faculty of medicine was organized in 1832. It developed gradually into a large institution with over 1,200 students. It has since contracted, with advantage, to a current size of about 360 students in its 6-year curriculum.

The staff includes 33 chairs (fixed professorships), some additional free ones without salary and an average of 3 assistantships for each chair, to give a total staff of about 135. In addition there are about 25 technicians.

Theoretically instructors and assistants are required by law to pass an examination to move up or to move on after 2 years, but this law, due to personnel shortages, has been circumvented for a period of 20 years.

In addition to the medical school, a separate school of dentistry is now functioning independently in a large, modern building and is establishing its own departments of teaching and research in various biological areas. Thus, for example the university was said to have three separate departments engaged in teaching of general physiology. This degree of duplication probably is not more than average. Some subjects may be taught in five departments, and in the case of liberal arts, the situation apparently is worse. For example, there are three schools of music.

One reason for the difficulties in Bahía is the manner in which the faculty of philosophy was organized in 1942. Approximately 70 chairs were handed out to prominent people more or less without regard to their qualifications in the assigned specialties.

Although some attempts to integrate curricula have succeeded, the level of teaching competence in the medical school generally must be on a rather low level, because Professor Santos stated that separate programs of research and teaching are being set up in the university hospital, an institution with about 400 beds, of which about 280 are kept occupied with suitable cases for teaching and research purposes. The cost of operating the hospital, some Cr\$158 million per year, includes complete cost of patients.

Dr. Roberto Santos had organized a laboratory for clinical aspects of physiology dealing with problems of membrane permeability, accumulation of electrolytes by cells, etc. This basic program includes fellowships for persons from abroad such as Professor Leaf from Harvard and Massachusetts General Hospital, and others from England. Installation of new equipment was being supported in part by a \$120,000 grant from the Kellogg Foundation for the 1957-62 period. A program in human genetics is being started in the hospital and apparently work is also being done here in areas of cytology and embryology.

An interesting sideline activity of this project is an instructional program in basic sciences, physics, mathematics, etc., to train technicians. This program started in 1958 with 16 students. The second group was 40, which will gradually be cut to a smaller number of competent people.

In general, it was stated that the situation in medical and biological instruction is poor, but much progress has been made in the last 10 years, and conditions will be expected to reach a much more satisfactory state within a few years.

This observer rather doubts that this university is more than holding its own and suspects that it may actually be losing ground in the life sciences.

Although the economy of the region is mainly agricultural, no work in functional aspects of plant or animal sciences was found or heard of. The possibility of having the agriculture school become associated with the university, "has been considered by the administration," but nothing concrete has been done. Evidently such a move would be welcome only if outside finances were in sight.

The general impression was gained that the University of Bahiá- although to be commended for its outstanding activity in the arts, the institution of a program in economics under an American professor, and a good start in geology - is woefully deficient and unlikely to become effective in sciences and engineering under its present regulations and administrative set-up.

Some principal needs were said to be changes in regulations and, particularly, competent personnel, mainly from abroad.

#### Over-all Assessment

It appears that in the scientific realm of the University of Bahiá, certain bright spots exist, such as the current development of a geology department and the promise of integrated combined teaching and research institutes in chemistry, physics, and eventually mathematics. These developments, however, have been more or less prompted and supported by outside interests, business and COSUPI, in connection with the oil fields and other natural resources in the region which may be of possible national industrial importance. In general it might be said that the University has taken the position of an ostrich with its head in the sand concerning the practical solutions to the pressing economic and social problems of the state and

its large, low income population. The administration seems to be living in an artificial - colonial or plantation - atmosphere of its own with major attention being paid to the arts and "finer things of life." Leadership in cultural activities is to be commended, but the willingness of the administration merely "to consider agricultural education if outside help would be available" seems out of keeping with the facts of life in a community largely dependent on its agricultural productivity.

Engineering science, in spite of the acquisition of a palatial building also seems far less than needed now and unpromising, under its present leadership, for developing the technology demanded for effective exploration of oil and other natural resources of the region.

#### VETERINARY SCHOOL AND INSTITUTE OF BIOLOGY

On the recommendation of Professor Dacorso of the Rural University, Rio de Janeiro, and others, a visit was made to Professor Fulvio Alice, director of the institute of biology and professor in the Bahiá State Veterinary School. This institution is located near the university but is completely independent of it. The veterinary school, in its sixth year of operation, provides a regular 4-year program for approximately 60-70 students with 13 in this year's graduating class. This school also provides work in "agronomy," i.e., in certain aspects of plant parasites and pest control as well as in animal husbandry and diseases. Even a small forestry project is operated on the same and adjacent premises. The school recently has entered into a contract for COSUPI support.

Dr. Alice's work is mainly in the institute of biology, where he has a staff of approximately 20 persons very actively engaged in various aspects of virus diseases. Projects include the isolation of new viruses, the testing of

their pathogenicity and the preparation of vaccines for these as well as for more common ones such as rabies encephalites, hoof and mouth disease and even poliomyelitis for human use. Dr. Alice's program includes many basic and applied aspects of virology, including recently developed methodology of culturing virus in animal tissue cultures. The laboratory operates on a relatively small scale as far as production of vaccines is concerned but evidently is much used and depended on in the region. Income from the sale of usable products helps to support a part of the cost of research.

Dr. Alice's simple and sincere manner confirms his reputation as an exceptionally capable worker. He received his graduate training at Iowa State College and at the University of Wisconsin. He directs a most active and useful program in a small, but efficiently equipped and busy laboratory.

In a general discussion of veterinary science in Brazil he stated that good virus laboratories, some on a very small scale, exist in Belem (Dr. Otto Causey), São Paulo (Instituto Biológico), University of Brazil (Paulo de Goes) and the Pan American Aftoso Center in Rio de Janeiro.

As to the need for expanded activity, and especially for the training of first-class veterinarians, he suggested that the best way is to ferret out especially talented students for intensive training in the best places in Brazil and abroad. He stated that there is also an urgent need for more students in the regular veterinary science training program. Encouragement to enter this field should be brought about by "advertising" the real meaning of the profession to young students in the secondary schools. He estimates that at present there are only about 2,000 practicing veterinarians in Brazil, of which only about 100 are in the state of Bahía and only three in the Northwest portion of the country which includes

about half the area of Brazil. The cattle population of the country is about the same as the human population (about 65 million) and includes millions in the above mentioned Northwest.

He stated that the cattle business would benefit immensely by increased veterinary services. One aspect of this is to teach the ranchers the nature of vaccination and the difference between it and antibiotic treatments against infections; Lack of understanding of this distinction has undermined confidence in the use of vaccines, i.e., in the ability to prevent but not to cure disease.

It is clear that improved general husbandry as well as disease cases need attention from veterinarians, but one must make allowances for Dr. Alice's enthusiasm for developing his profession.

Dr. Alice also stated that animal nutrition is a second major factor in productivity. Here the problem is to determine what the deficiencies and imbalances may be and to correct these mal-conditions, in part through adequate plant nutrition. This also would increase crop and forage yields.

In reply to a question, he confirmed the existence of fairly severe symptoms of mineral malnutrition in both man and animals in vast areas of the country.

The Rockefeller Foundation has, of course, been cognizant of the need for improved veterinary practices and has supported much work in this line including "essential" support to Dr. Alice's laboratory for equipment and supplies.

Expanded support of this type of institution would seem to be a most desirable and economically practical endeavor.

21. THE UNIVERSITY OF BRAZIL - (THE NATIONAL UNIVERSITY)  
Rio de Janeiro

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General

The University of Brazil is the national university, and is located within the city of Rio de Janeiro. It is a university of complex structure with many faculties and schools, which are in part scattered throughout the city of Rio de Janeiro. At least one school is remotely located several hundred miles distant.

Units of the university, which have been described in previous separate reports, are the National School of Engineering in Rio de Janeiro and the School of Mines and Metallurgy in Ouro Preto, Minas Gerais.

Physical Facilities

Many of the schools and faculties of the University of Brazil are located in the Praia Vermelha section of Rio de Janeiro, along Avenida Pasteur. The medical school, the National Institute of Chemistry, the school of architecture, and others are located in this area. Numerous associated institutions or groups, such as the Centro Brasileiro de Pesquisas Físicas, the Nuclear Energy Commission, and the Military School of Engineering are also located here. Other segments of the university are located elsewhere in the city, including the faculty of philosophy and the National School of Engineering. As noted above, the school of mines and metallurgy is remotely located in the State of Minas Gerais at Ouro Preto.

Several miles outside the central city near the Galeão Airport is the site of the University City of the University of Brazil. Already completed at this site and in use is a small center for child development. Presently at the point of completion is a beautiful new building to house the school of architecture. It is understood that the members of the faculty of the school of architecture wish to avoid moving into this newly completed structure, because it would make them more remote from their downtown private offices in which they practice

architecture. Nearing completion are the first units for the school of engineering, and these will provide a remarkable improvement in the physical facilities for that school. Partially constructed and in a dormant state for several years is the tremendous new hospital and medical school building. No work is being done on this at present, and its completion within the next few years seems highly unlikely. Again, the remote location from the center of the city may be influential in the attitudes of individual members of the faculty.

Sufficient land area is available on the site of University City to provide an excellent campus for the University of Brazil. However, recent and new construction on the old site, the heavy investment in buildings and facilities there, and the attitudes of faculty, are discouraging insofar as the integration of the university in this new University City is concerned.

#### Faculty

For the most part, individual faculty of the University of Brazil are part-time. The professional men on the faculty almost all have a private practice unrelated to the university proper, and maintain other offices away from the university itself. Many of the faculty pay lip service to the need for full-time faculty, and some of the younger members of the faculty and the younger assistants, through the combination of faculty appointments and research institute appointments, are essentially full-time. However, the faculty itself is very conservative, and is said to be very much under the control of the faculty of law.

#### Students

In all, it was reported by the rector of the university that there are approximately 12,000 students enrolled. It is believed that this figure includes all associated schools, such as the National School of Engineering and the School of Mines at Ouro Preto. Many of these students are undoubtedly part-time students. Reports were heard that some students at the university are "professional students" who remain there year after year without necessarily progressing toward the com-

pletion of their work. Others may complete the work under one faculty, and immediately enroll again under a second faculty. Among the leaders of the student organization, it was said that some are as much as 35 years of age.

The student restaurant at the university is heavily subsidized by Federal Government funds, and by law meals must be provided at a ridiculously low rate to the students themselves. Thus the "professional student" is heavily subsidized by the Government. (The financial support for these professional students is hazy, at best. Innuendo has it that it comes from subversive groups.) The student body generally should not be judged by such active minorities. The appearance of the students at the university was similar to that of any students at any university. Press reports are apparently exaggerated. For example, a member of the faculty of the National Institute of Chemistry stated that students there had not participated in a recent student strike, although newspaper reports had it that practically all students at the university had participated.

#### Mathematics and the Physical Sciences

Work in mathematics and the physical sciences at the University of Brazil is duplicated in several faculties and schools, as is the situation generally in the Brazilian universities.

In mathematics, the active mathematicians in the Rio de Janeiro area are associated with the Instituto de Matemática Pura e Aplicada (IMPA). The professors catedráticos are not active in research, and for the most part are part-time. In one case, a chair in mathematics had remained vacant for 10 years, and the "concurso" has been postponed during this period, thus preventing the opportunity for one of the able young mathematicians of Brazil to compete for this chair.

In physics, the greatest activity in research is at the Centro Brasileiro de Pesquisas Físicas. This center was organized about 10 years ago to provide the

opportunity for research in physics to go along with the program of instruction for physicists in the Rio de Janeiro area. In recent years the center has established instructional laboratories, and presently students from the department of physics of the faculty of philosophy are taking their lectures and laboratory work at the center. The center is located physically at the Praia Vermelha area of the campus, but this is remote from the downtown faculty of philosophy. The center is presently trying to establish closer relations with the National Institute of Chemistry (physically five minutes' walk from the center), so that students in chemistry can take their instruction in physics from physicists at the center, in common with the students from the faculty of philosophy. The National Institute of Chemistry has its own physics laboratory and its own professor of physics, and it is not at all certain that this proposed consolidation can be effected. At the center there are opportunities for advanced training, and students come to the center from other universities in Brazil. Advanced degrees are offered. Excellent laboratory and library facilities are maintained, and the staff at the center is active and alert.

The work in chemistry at the university is centered in the National Institute of Chemistry. This institute occupies a new building, and the laboratories are spacious and well equipped. The faculty is predominantly part-time, and there was no evidence of any active research program, although a laboratory for research in organic chemistry using radiochemical techniques was under construction. The library was no more than adequate.

Active programs of research in chemistry are going on in other parts of the university, such as in the laboratory of Dr. Carlos Chagas at the medical school. Also elsewhere in Rio there is some chemical research underway. An example is in the chemical laboratories of the Department of Agriculture located in the Botanical Garden.

## Engineering

The work in engineering at the University of Brazil has been described in Section 2, the National School of Engineering.

### INSTITUTE OF BIOPHYSICS

This institute, under the direction of Dr. Carlos Chagas, has been a leading center of biological research in Brazil for a long time and needs little further reporting here. It is under the administrative direction of the rector of the university but otherwise operates as an independent unit in the University of Brazil. Its activities have long been supported in part by the Rockefeller Foundation and recently in part by research grants from the National Institutes of Health.

Its research activity encompasses a very broad but coordinated program in "functional aspects" of biology, but pertinent areas such as histology are covered as well. The institute perhaps is best known for its contributions in cell physiology (electrophysiology and related subjects), but current work includes several separate programs by mature investigators in such areas as protein biochemistry and enzyme action.

The total staff is about 70 people. The institute has no specified teaching function but has served as a principal center in South America for advanced training in physiology and its various specialties.

### RESEARCH AT THE BOTANICAL GARDEN, RIO DE JANEIRO

The world famous Jardim Botânico in Rio de Janeiro is not only a showplace of the exotic tropical flora of Brazil, but it long has been a center of research as well.

In the cytology section, Dr. Milanez has carried out technically painstaking and exhaustive investigations into the origin of the latex vessels. These vessels, contrary to some common concepts, are not an interpenetrating network of invading

cells but a system of channels formed by redifferentiation of cells involving fusion of cells and segments of protoplasts of cells in the meristematic regions. This process occurs both in primary meristems and in the young tissue associated with cambial activity.

This investigation has been brought to the degree of completion that can be achieved by use of ordinary microscopy. It is now proposed to continue it in more detail on the level attainable through electron microscopy.

Dr. Raul Machado, who in the past two years has specialized in "molecular morphology" with Dr. Porter at the Rockefeller Institute, is constructing a new laboratory building especially for work in this field. It is being built by the garden work staff itself (under the Department of Agriculture) and instrumentation will be financed in part by the Rockefeller Foundation. It will be ready for occupancy in a year and should provide excellent facilities for an active group of workers. Dr. Machado has made significant new contributions to the field and no doubt will continue to do so.

There is also a most elaborate wood-anatomy collection including elegantly prepared microscope slides of about 2,000 species of trees.

At one end of the garden is a physiological laboratory equipped for work in water relations and especially in photo periodism of plants. The responsible investigator for whom the laboratory was built, however, has just moved to the University of São Paulo.

#### DEPARTMENT OF AGRICULTURE - INSTITUTE OF CHEMISTRY

Adjacent to the Botanic Garden is the Institute of Chemistry of the Department of Agriculture.

This institute is housed in a series of buildings, some old and some new, and still under construction.

It consists of six coordinated divisions and a very complete (about 20,000 volumes) chemistry library. The six divisions are:

1. soils,
2. plant chemistry,
3. food technology (quality control),
4. physical chemistry,
5. analysis (quality control, etc.), and
6. technology (chemistry).

Work in progress includes isolation of toxic plant products from various species. Selection of material has been partly in terms of large-scale occurrences of poisoning of cattle and partly on past and current medical usages. The equipment was quite adequate. Most types of modern instruments and apparatus were available for chemical and biochemical work and some results were being obtained. Some of the sections seemed to be quite efficiently operated. The soil survey and testing laboratory perhaps is, and in any case, should be an important part of this institute. Much has been done in the areas surrounding Rio de Janeiro and also in the State of São Paulo. Still, the section is in need of much expansion, and the new laboratory space which is being provided will hardly suffice.

The institute carries out much routine and special testing for the government departments. One interesting side line at the moment, was tests of cinnamon to determine quality grades for purposes of taxing imports. This may be an illuminating example of misplaced emphasis of work in relation to the real needs of the country. General soil surveys and food and drugs control, which are placed under this institute, are services of a type which need much greater expansion of facilities and personnel than can be achieved in this one location.

#### SUMMARY, UNIVERSITY OF BRAZIL

It was not possible to spend time at the University of Brazil commensurate with the importance of this institution. The general impression based upon the limited time available was that this institution had the potential in the past,

if not presently, to become the great university, but that the conservative attitudes of the members of the various faculties and the administrative officers had to date prevented the achievement of this greatness.

With the move of the capital of Brazil to Brasilia, and the establishment of the new University of Brasilia, repercussions at the University of Brazil might be favorable to the increase in its stature as a university. On the other hand, it is conceivable that it could be eclipsed by the new University of Brasilia.



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