3.3 Execution of the Project

3.3.1 Executing Agency

The Ministry of University Affairs (MUA) will be executing agency for the Project, and Chulabhorn Research Institute (CRI) will execute research works planned by the Project.

3.3.2 Execution System

The Ministry of University Affairs (MUA) will be responsible for all the works related to the Project undertaken by Thailand side, and Foreign Relations Division of the Office of the Permanent Secretary which is substantially in charge of the works will be a section to contact about the Project. Dr. Wichit, Permanent Secretary of MUA, is in charge of CRI as Deputy Director who assists Princess Chulabhorn, Director of CRI.

After the construction of the Institute is completed, research activities of CRI will be substantially commenced through selection of researchers, staff, etc. MUA will carry out all the works related to the Project implementation such as provision of necessary facilities and equipment, formulation of the budget plan and selection of personnel.

The building and facilities of the Institute and the provided equipment is used for CRI's research activities. CRI will be responsible for the operation and maintenance of the equipment, administration of the required personnels, and budget control. At present the researchers of the science faculty of the Mahidol University where CRI is located are performing actual research works. In the execution of the Project, these researchers will prepare research plans of the Project.

3.4 Present Status of the Project Site

3.4.1 Contents of the CRI Construction Plan

The facilities of CRI are now under construction at Bang Khen in Bangkok at the total cost of 102 million baht by the budget of Thai Government. According to the planned schedule it will be completed in October, 1990. The area of the site is approximately 2.75 hectare, and the building is six-story reinforced concrete structure with the total floor ares of 5,306.8 m2.

The outline of the construction project is as follows.

(1) Building Outline

i) Floor area

1st floor	1,200	m2
2nd floor	920	m2
3rd floor	817.7	m2
4th floor	789.7	m2
5th floor	789.7	m2
6th floor	789.7	m2
Total area	5,306.8	m2

ii) Structure

Foundation: concrete piling foundation

Building: reinforced concrete structure, Rahmen structure with six stories

iii) Exterior finish

Floor: stone and tile

Wall: paint or spray tile, partially tile

Window: aluminum sash, partially aluminum curtain wall

Entrance: aluminum door

Roof: waterproof asphalt, reinforced finish

iv) Interior finish

Floor: artificial stone finish or tile, particially plastic tile

Wall: mortar finish, VP finish

Ceiling: rock wool sound absorbing board

Fitting: wooden fitting

(2) Construction Schedule

The construction schedule of CRI building is shown in the following table.

Table 3.1 Construction Schedule

Schedule	1989										1990											
	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Grading Works	—																					
Filling Works		—	—	—	—																	
Piling Works					—	—																
Building Works						—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Plumbing Works									—	—	—	—	—	—	—	—	—	—				
Electrical Works									—	—	—	—	—	—	—	—	—	—	—			

(3) Outline of Facilities

i) Electric Facilities

a. Main power source

The power source is three-phase three-wire system in which the power received in 12KV/50Hz will be reduced in voltage by 800KVA outdoor transformer into 380/220V, and then supplied to the main power board inside the building through an underground cable, and finally to each power board. For each laboratory and equipment room, three-phase power source is supplied with circuit breaker. As a spare power source, a generator with 380/220V, 50Hz, 400KVA is installed by three-phase four-wire system which is to be operated automatically at power failure, supplied to the spare power board. Spare power board operates to the demand load, but power is distributed through stabilizer if necessary. Stabilizer has such functions as breaking current at the time of extraordinary high voltage (120 percent higher than ordinary voltage), removing extraordinary wave, adjusting momentary extraordinary voltage and noise (peak line voltage ±20 percent), etc.

b. Electric lamp and plug socket

Illumination apparatus include ordinary electric lamp ad emergency lamp with built-in batteries. Plug socket is an universal type used properly according to capacity.

c. Light electric appliance

Light electric appliances include telephone, fire alarm, television community receiving system and broadcasting facilities. Telephone is installed in office rooms, laboratories and other appropriate rooms. Fire alarm facility is a system in which an alarm bell rings by a sensor and a push button. Television is available on every floor by the community receiving system. Broadcasting facility is a system using an amplifier with the capacity of 200w and a speaker on every floor.

ii) Water Supply, Drainage, and Piping Facilities

a. Water supply

Drinking water is pumped up from the water pool on the first floor to the water storage tank on the roof, and then supplied to each floor. It is designed to keep hydraulic pressure above 15psi (1.05kg/cm2) at the end. Beside drinking water, distilled water used for experiments is produced by a distillation apparatus (distillation by ion exchange) on the roof, and supplied to each laboratory through circulating pipes.

b. Drainage

Drainage is separated into household waste, human waste and chemical waste. Household waste is discharged directly into an osmatic tank, and human waste is discharged into an osmatic tank through a sewage disposal tank. Chemical waste is diluted with rinsing water and neutralized by chemical treatment in a disposal tank, and then discharged as household waste.

c. Fire extinguishing system

Indoor fire hydrant is installed on each floor. Water is supplied from the water pool on the first floor, pumped up, directly to the fire hydrant on each floor. In addition, portable extinguishers will be installed.

d. Gas

LPG gas is supplied to each laboratory from the gas cylinder on the first floor. Various kinds of gas supplied similarly from the gas cylinder to each laboratory.

e. Others

From the compressor installed on the first floor compressed-air is supplied to each laboratory. On every floor above the third floor a vacuum pump is installed, and reduced-air pipes are installed in each laboratory.

iii) Air-conditioning Facilities

The system of air-conditioning includes a central piping duct system and a separate system. The exhaust is a forced exhaust system using a ventilating installed in each room.

iv) Other Facilities

a. Elevator

Two elevators are installed to be used from the first to sixth floor. One of them is equipped with an emergency power source.

b. Cold-storage room

A cold-storage room is installed where the temperature is kept 0oC to 4oC under the condition of outside temperature at 36oC. A refrigerating machine has the capacity of 2.15 kw, and the width of the room is 3.5 x 2.0 x 2.8m.

c. Electric wave shield

In the room with the Nuclear Magnetic Resonator (NMR) which is planned to be provided by West Germany, an electric wave shield is installed.

d. Laboratory-table

In each laboratory a center laboratory-table or a side laboratory-table is installed if necessary. A center laboratory-table is equipped with center shelf, sink, faucet, distilled water faucet, gas tap, compressed-air tap, reduced-air tap, and plug socket. A side laboratory-table is equipped with shelf, sink, faucet, and plug socket. In the laboratories above the third floor a side-table is installed with the width of 60 cm by the window.

e. Draft chamber

In a laboratory, a draft chamber is installed if necessary. A draft chamber is equipped with faucet tap, gas tap and

ventilation duct.

(3) Outline of Places to install Requested Equipment

The rooms and laboratories to install requested equipment are shown in the following table.

Table 3.2 Places to Install Requested Equipment

Name of Room	Room NO.	Floor	Area m²	Electric Facilities			Water Supply	LPG	Air-conditioning	Laboratory -Table
				Capacity AT	Spare Power Source	Stabilizer				
Instrument Room A	R109	1st	56	45	○	○	○	—	○	—
Biochemical Lab.	R303A	3rd	56	40	○	○	○	○	○	○
Pharmacology Lab.	R303B	3rd	56	40	○	○	○	○	○	○
Environmental & Toxicology Lab.	R303C	3rd	56	40	○	○	○	○	○	○
Instrument Room B	R304	3rd	84	40	○	○	○	○	○	—
Biotechnology Lab.	R403A	4th	56	40	○	○	○	○	○	○
Immunology Lab.	R403B	4th	56	40	○	○	○	○	○	○
Pathobiology Lab.	R403C	4th	56	40	○	○	○	○	○	○
Tissue Culture Lab. A	R403D	4th	28	*20/10	—	—	○	○	○	○
Instrument Room C	R404	4th	56	40	○	○	—	—	○	—
Tissue Culture Lab. B	R405	4th	14	40	○	○	○	—	○	—
Auto Clave Room	R419	4th	28	20	—	—	○	—	○	—
Radioisotope Lab.	R620	6th	28	40	○	○	○	○	○	○

* Electric Capacity : 20AT(3φ)
10AT(1φ)

4. BASIC DESIGN

4. BASIC DESIGN

4.1 Basic Design Principles

CRI is a comprehensive research institute which plays a leading part in Thailand in initiating basic and applied researches in various fields of science and technology. In the research areas of CRI the content and scope of research work in one laboratory is closely related to another. Therefore, in the basic design a detailed analysis will be made in this respect so that an effective and proper equipment project will be organized without overlapping. The equipment of the chemical laboratories will be provided by West Germany. Taking this into consideration, the Project was intended to be well-balanced as a whole.

The policies of the basic design based on the above described outline are as follows.

i) All the planned equipment should be well-coordinated with the research subjects of each laboratory.
ii) The focus should be placed on basic and general-purpose equipment, taking due consideration of the necessity in selecting specialized equipment with limited use.
iii) The equipment commonly used should be shared by a plural number of laboratories without causing any inconvenience to the research work.
iv) The content of equipment should not be overlapped with those of the chemical laboratories which are to be provided from West Germany.
v) The Project should properly correlate with the construction scheme so that it may fit into the scale of the laboratory and the content of the facilities as effectively as possible.

4.2 Basic Design Conditions

As CRI plays a leading role as a central research institute in Thailand, it is likely that more advanced and specialized equipment is required than other institutes in the country in order to meet the standard of highly advanced research work undertaken by the researchers with qualified caliber. The conditions of selection of equipment is summarized as follows.

i) The level of the equipment should correspond with the content of the research based on the consideration of the present status in

Thailand.

ii) The equipment that require special expendable supplies and chemicals unavailable in Thailand should be excluded.

iii) The equipment should not require a large amount of operation cost.

iv) The maintenance of the equipment should be easy, and a qualified system of repairing service should be available in the country.

v) The equipment discharging hazardous wastes that cannot be disposed in the country should be excluded.

vi) The equipment that require a large scale of alteration of the construction scheme to be installed should be excluded.

4.3 Equipment of the Project

4.3.1 Selection of Equipment

The equipment required for the Project were selected based on the content of the research conducted in each laboratory of CRI and the analysis of experimental methods used for each research subject. The use and necessity of the equipment was examined closely on the research flow of each subject in "3.2 Analysis of the Content of the Project".

4.3.2 Equipment List

The Project Equipment List prepared by each laboratory are shown in the following tables.

Equipment List by Laboratory

Code No.	Equipment	Q'ty	Application
A. Environmental Toxicology Laboratory			
A-01	GC-MS	1	Identification and Determination of compounds mass
A-02	Ultracentrifuge	1	Fractionation and analysis of samples
A-03	Liquid Scintillation Counter	1	Radioactivity counting in materials
A-04	Automated Nucleic Acid Extractor	1	Extraction of nucleic acids
A-05	HPLC	1	Isolation, purification, and qualitative and quantitative analysis of materials
A-06	Gamma-Counter	1	Counting of γ-ray in materials
A-07	High Speed Refrigerated Centrifuge	1	Isolation and fractionation of materials
A-08	Lyophilizer	2	Freeze-drying of materials
A-09	Laminar Flow Station	2	For experiment in sterilized state
A-10a	Autoclave	1	Sterilization
A-10b	Autoclave	1	Sterilization
A-11	Auto Sample Preparation System	1	Preparation of sample before analysis
A-12	Deep Freezer	2	To store samples under low temperature
A-13	Water Bath Shaker	2	Culture under constant condition with shaking
A-14	Fraction Collector	2	Fractionation of liquid samples
A-15	Gas Chromatograph	1	Isolation of component in gas sample and quantitative and qualtitative analysis
A-16	Rotary Evaporator	1	Condensation and drying up of sample solutions
A-17	Spectrophotometer	1	Qualitative and quantitative analysis of compounds
A-18	Tissue Homogenizer	1	Destruction of cells and tissues
A-19	pH Meter	1	pH measurement of liquid samples
A-20	Liquid Nitrogen Container	1	To preserve sample at liguid nitrogen temperature
A-21	HPLC Column	1	Isolation and analysis of compounds in mixture
A-22	UV Viewing	1	To detect fluorescence compounds by UV light in electrophoretic gel

Equipment List by Laboratory

Code No.	Equipment	Q'ty	Application
B. Biotechnology Laboratory			
B-01	Automated Peptide Sequencer	1	Determination of amino acid sequence in peptides and proteins
B-02	Automated DNA Sequencer	1	Determination of nucleobase sequence in DNA
B-03	Ultracentrifuge	1	Fractionation and analysis of samples
B-04	High Performance Electrophoresis Apparatus	1	Isolation and analysis of biopolymer
B-05	Spectrophotometer	1	Qualitative and quantitative analysis of compounds
B-06	High Speed Refrigerated Centrifuge	1	Isolation and tractionation of materials
B-07	Growth Chamber	1	Plant culture under constant condition
B-08	Densitometer	1	Patern analysis of electrophoretic gels
B-09	Personal Computer for DNA & Protein Analysis	1	Sequence data analysis of proteins and DNA
B-10a	High Speed Refrigerated Microcentrifuge	1	Isolation and fractionation of small quantity materials
B-10b	High Speed Refrigerated Microcentrifuge	1	Isolation and fractionation of small quantity materials
B-11	Electrophoresis Apparatus for DNA Sequencing	1	Determination of nucleobase sequence in DNA
B-12	Pulse Field Electrophoresis Apparatus	1	Isolation and analysis of biopolymers
B-13	Incubator A	3	Cell and tissue cultue under constant condition
B-14	Incubator B	3	Cell and tissue cultue under constant condition
B-15	PCR Machine	1	Mass production of nucleic acids by polymerase
B-16	Deep Freezer	1	To store biological samples
B-17	Incubator	1	Cell and tissue culture with shaking
B-18	Water Bath Shaker	1	Culture under constant conditon with shaking
B-19	Laminar Flow Station	1	For experiment in sterilized state
B-20	Centrifugal Lyophilizer	1	Freeze-drying of materials
B-21a	Ultrasonic Cleaner	1	Washing of apparatus by ultrasonic
B-21b	Ultrasonic Cleaner	1	Washing of apparatus by ultrasonic
B-22	Electrophoresis Apparatus	1	Isolation and analysis of biopolymers
B-23	Low Temperature Water Bath	1	Culture under low temperature

Code No.	Equipment	Q'ty	Application
B-24	Autoclave	1	Sterilization
B-25	pH Meter	1	pH measurment of liquid samples
B-26	Liquid Nitrogen Container	1	To preserve sample at liquid nitrogen temperature
B-27	UV Transilluminator	1	To detect fluorescence compounds by UV light

C. Biochemistry Laboratory

C-01	HPLC	2	Isolation, purification, and qualitative and quantitative analysis
C-02	Ultracentrifuge	1	Fractionation and analysis of samples
C-03	Fraction Collector	1	Fractionation of liquid samples
C-04	Water Bath Shaker	4	Culture under constant condition with shaking
C-05	Water Purification System	1	Pure water production
C-06	Peptide Hydrolysis System	1	Hydrolysis of peptides and proteins
C-07	Cold Cabinet	1	Column chromatography under low temperature
C-08	Ultrafiltration Unit	3	Isolatin and purification of materials by filtration
C-09	Phase Contrast Microscope	1	Observation of microorganisms, cells and tissues
C-10	High Speed Refrigerated Microcentrifuge	1	Isolation and fractionation of small quantity materials
C-11	Photosystem	1	To take picture of electrophoretic gels
C-12	Electrophoresis Apparatus	1	Isolation and analysis of biopolymers
C-13	Spectrophotometer	1	Qualitative and quantitative analysis of compounds
C-14	Refrigerator	1	To store samples under low temperature
C-15	pH Meter	1	pH measurement of liquid samples
C-16	High Speed Refrigerated Centrifuge	1	Isolation and fractionation of materials
C-17	HPLC colum	1	Separation and analysis of various component in liquid sample
C-18	UV transilluminator	1	To detect fluorescence compounds by UV light

Equipment List by Laboratory

Code No.	Equipment	Q'ty	Application
D. Immunology Laboratory			
D-01	Fluorescence Activated Cell-Sorter and Analyzer	1	Fractionation of specific cell from cell mixture
D-02	Automated Protein Synthesizer	1	Synthesis of peptides and proteins
D-03	High Speed Refrigerated Centrifuge	1	High speed refrigerated centrifuge
D-04	Fluorescent Microscope	1	Observation of cells and tissues
D-05	CO_2 Incubator	3	Animal cell and tissue culture under constant CO^2 concentration
D-06	Laminar Flow Station	2	For experiment in sterilized state
D-07	Automated Microplate Reader	1	Analysis of antigen-antibody reaction
D-08	Water Purification System	1	Production of high purity water
D-09	Electrophoresis Apparatus	1	Isolation and analysis of biopolymers
D-10	Phase Contrast Microscope	1	Observation of microorganisms, cells, and tissues
D-11	Cell Harvester	1	Fractionation of cells on microplate
D-12	Fraction Collector	1	Fractionation of liquid samples
D-13	Incubator	2	Cell and tissue culture under constant condition
D-14	Deep Freezer	1	To store biological samples
D-15	Autoclave	1	Sterilization
D-16	Lyophilizer	1	Freeze-drying of materials
D-17	Spectrophotometer	1	Qualitative and quantitative analysis of compounds
D-18	High Speed Refrigerated Microcentrifuge	1	Isolation and fractionatin of small quantity materials
D-19	Incubator Shaker	1	Cell and tissue culture with shaking
D-20	Low Speed Refrigerated Centrifuge	1	Fractionation and separation of samples
D-21	Water Bath Shaker	2	Culture under constant condition with shaking
D-22	Freezer	1	To store biological samples
D-23	Dissecting Microscope	2	Dissecting and observation of biological samples
D-24	pH Meter	1	pH measurement of liquid samples
D-25	Liquid Nitrogen Container	1	To preserve sample at liquid nitrogen temperature

Code No.	Equipment	Q'ty	Application
E. Pathobiology Laboratory			
E-01	Electron Spin Resonance Spectrometer	1	Qualitative and quantitative analysis of materials by electron
E-02	Auto Cell Counter	1	Counting of cells and blood cells
E-03	HPLC	1	Isolation, purification, and qualitative and quantitative analysis of materials
E-04	Calcium Analyzer	1	Analysis of intercellular calcium distribution
E-05	Luminescence Analyzer	1	Qualitative and quantitative analysis of compounds by chemiluminescence
E-06	High Speed Refrigerated Centrifuge	1	Isolation and fractionation of materials
E-07	Impedance Aggregometer	1	Analysis of blood cell agguration by chemiluminescence
E-08	Liquid Scintillation Counter	1	Radioactivity counting in materials
E-09	Water Purification System	1	Pure water production
E-10	Spectrophotometer	1	Qualitative and quantitative analysis of compounds
E-11	Dissecting Microscope	2	Dissecting and observation of biological sample
E-12	High Speed Refrigerated Microcentrifuge	1	Isolation and fractionation of small quantity materials
E-13	Deep Freezer	1	To store biological samples
E-14	Ice Maker	1	Ice production for low temperature experiments
E-15	Autoclave	1	Sterilization
E-16	Low Temperature Water Bath	1	Culture under low temperature
E-17a	Ultrasonic Cleaner	1	Washing of apparatus by ultrasonic
E-17b	Ultrasonic Cleaner	1	Washing of apparatus by ultrasonic
E-17c	Ultrasonic Cleaner	1	Washing of apparatus by ultrasonic
E-18	pH Meter	1	pH measurement of liquid samples
E-19	Liquid Nitrogen Container	1	To preserve sample at liquid nitrogen temperature
E-20	HPLC Colum	1	Separation and analysis of various component in liquid sample
E-21	Recorder	2	Complemental data recording combined with HPLC system by different detectors
E-22	UV Viewing Cabinet	1	To check x-ray film of electrophoresis gel
E-23	UV Transilluminator	1	To detect fluorescence compounds by UV light
E-24	Hematocrit Centrifuge	1	To separate blood components

Equipment List by Laboratory

Code No.	Equipment	Q'ty	Application
F. Pharmacology Laboratory			
F-01	Organ Bath	1	Physiological analysis and observation of animal organ responses by stimulating compounds
F-02	Respiratory Mechanics Analyzer	1	Analysis of respiratory mechanism of experimented animals
F-03	Animal Activity Cage	1	To measure the spontaneous behavior of rats or mice
F-04	Spectrofluorometer	1	Quantitative analysis of materials by fluorescence
F-05	Phase Contrast Microscope	1	Observation of microorganisms, cells, and tissues
F-06	Polygraph	1	For monitoring of ECG, respiration, pulse, and EEG of animals
F-07	Non-Invasive Blood Pressure Monitor	1	Blood pressure measurment of experimental animals
F-08	Differential pH Meter	1	pH control of solution by titration
F-09	Spectrophotometer	1	Qualitative and quantitative analysis of compounds
F-10	Respiratory Analyzer	1	Respiration analysis of animals
F-11	Ultrafiltation Unit	2	Isolation and purification of materials by filtration
F-12	Peristatic Pump	1	Constant feeding of solution
F-13	Tail-Flick Apparatus	1	For animal study experiments
F-14a	Ultrasonic Cleaner	2	Washing of apparatus by ultrasonic
F-14b	Ultrasonic Cleaner	1	Washing of apparatus by ultrasonic
F-14c	Ultrasonic Cleaner	1	Washing of apparatus by ultrasonic
F-14d	Ultrasonic Cleaner	1	Washing of apparatus by ultrasonic
F-15	Treadmill	1	For animal excise experiments
F-16	Tissue Homogenizer	1	Destruction of cells and tissues
F-17	High Speed Refrigerated Microcentrifuge	1	Isolation and fractionation of small quantity materials
F-18	Hematocrit Centrifuge	1	To separate blood components

5. IMPLEMENTATION PLAN OF THE PROJECT

5. IMPLEMENTATION PLAN OF THE PROJECT

5.1 Organization for Implementation of the Project

The executing agency related to the equipment provision of the Project is the Ministry of University Affairs.

After the Exchange of Notes is concluded between the Governments of Japan and Thailand, a contract of the implementation will be made with the Government of Thailand by a Japanese consultant firm on the detailed designs and supervision, and by a Japanese trading firm on the supply and installation work of the equipment.

5.2 Undertakings of Both Governments

The purpose of the Project is to provide the bioscience research equipment corresponding with the construction of new research facilities of CRI in Thailand. Undertakings of both Governments for the Project are shown in the following table.

Table 5.1 Undertakings of the Works

Work Items	Japan	Thailand
(1) Equipment		
1) To procure the equipment	0	
2) Installation of the equipment	0	
3) Test run	0	
4) Orientation in the Thailand	0	
(2) Electrical works		
1) Distributing line to the distribution panel and terminal		0
2) Wiring between each equipment	0	
(3) Water supply and drainage works		0
(4) To secure the space to store the equipment		0
(5) To provide utilities		0
(6) To ensure import/custom clearance		
1) Transportation to Thailand	0	
2) Tax exemption/custom clearance		0
3) Internal transportation in Thailand (from the Port to the Site)	0	
(7) To bear the commissions to Japanese foreign exchange bank for banking services based on the B/A (Banking Arrangement)		0
(8) To accord convenient official services for Japanese nationals whose work may be required in connection with the Project at their entry into and departure from the Thailand and during their stay therein for the performance of their work		0
(9) To maintain and use properly and effectively the equipment provided by the Grant-in-Aid		0
(10) To bear all expenses other than those to be borne by the Grant-in-Aid necessary for the construction of facilities as well as for the transportation and installation of the equipment		0
(11) Procedures to get approvals necessary for the works, etc.		0

5.3 Execution Plan

5.3.1 Execution Principle Items to be Considered

Considering the Project is carried out through the grant aid provided by the Government of Japan, the following items should be considered in the execution of the Project.

i) Coordination between the construction work performed by the Government of Thailand and the installation work of the equipment.
ii) Clarification of undertakings by both Governments concerning the utility works such as electricity, water supply and sewerage, gas, etc. to carry out the execution smoothly and effectively.
iii) Keeping good relationship between the Thai Government and the Japanese consultant and the equipment suppliers through sufficient discussion to exchange opinions.
iv) Prevention of accidents in temporary storing, delivery and installation.

5.3.2 Execution Supervision Plan

In the supervision of the Project, a careful supervision plan will be formulated based on sufficient preliminary arrangements with the Thai Government. The following points should be taken into account on the supervision.

i) Careful coordination will be made with the Thai Government in the detailed designing stage in order to install the equipment smoothly. Especially, it is necessary to exchange enough information for the construction field work by Thailand side to meet the requirements of the installation, and coordinate the additional works by Thailand side to be completed before installation of the equipment.
ii) Prior to the installation, the execution plans submitted by the supplier concerned will be fully examined, and the propriety of the work process, equipment supplies and specifications will be evaluated.
iii) Preliminary examinations of the equipment will be made in Japan to enable smooth installation in the Project site.
iv) As for the delivery of the equipment, it will be confirmed whether the specifications meet the design requirements, and the instructions

of installation work and methods of usage are appropriate.

5.3.3 Coordination with the Bulding Construction Plan

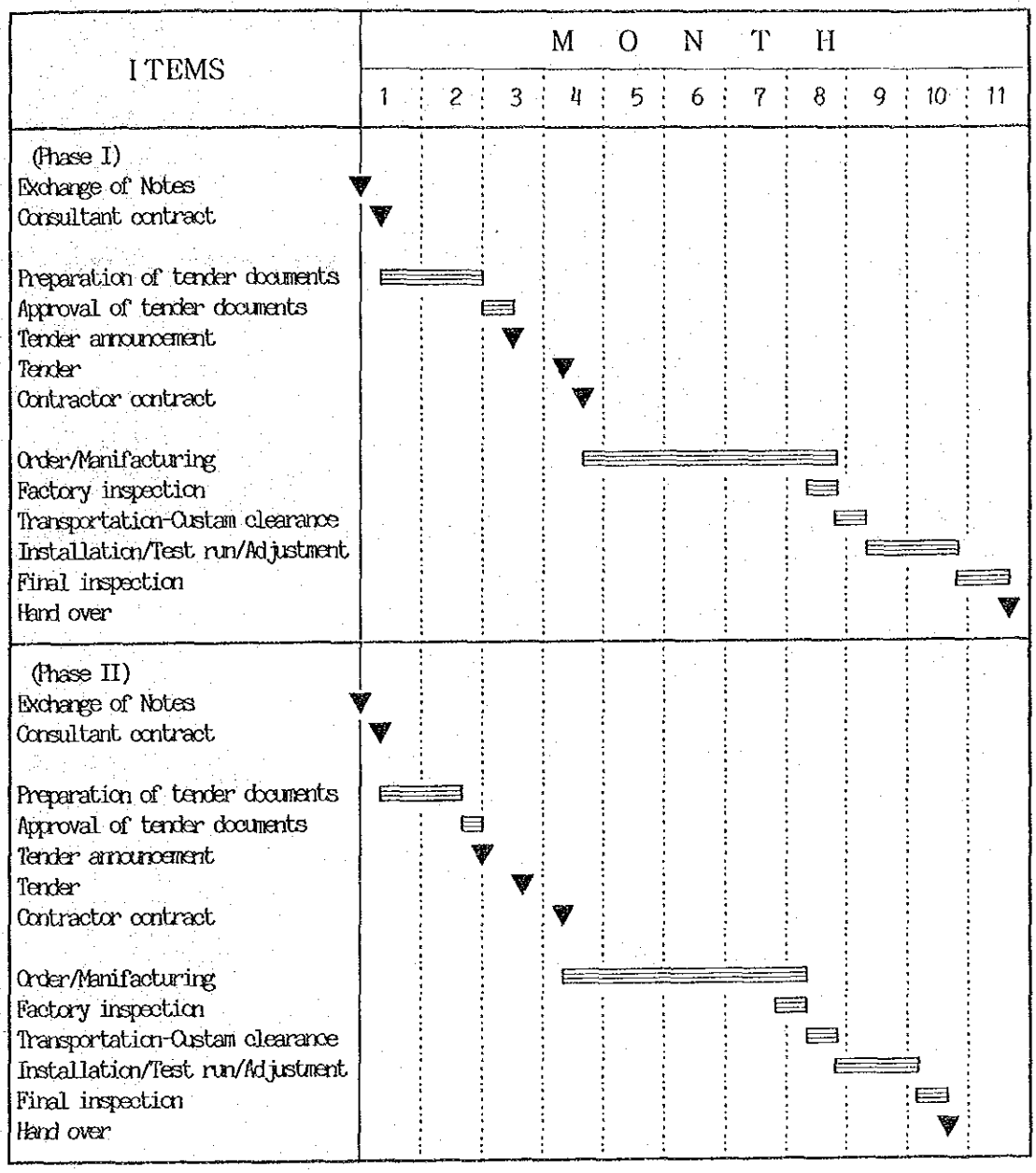
As the construction work is on the finishing stage now, a large scale of alteration in the design is impossible. A detailed examination should be made in the detailed design stage on the contents of works to be revised by the construction side necessary for installation of the equipment, and an efficient coordination should be made with the related agencies to carry out the additional facilities works by the Thailand side following revised plan.

5.4 Implementation Schedule

The Project will be executed in two separate phases. The first phase will focus on the general-purpose equipment to be shared by several laboratories and those required for the initial part of research so that effective research can be made in each laboratory. The second phase will focus on the specialized equipment with limited use and those required less urgently.

The following is the implementation schedule of the Project. It is divided into three stages of detailed design, bidding and supervision.

Table 5.2 Implementation Schedule



5.5 Project Cost Undertaken by the Thai Government

It is estimated that the project cost for the building construction work of CRI funded by the Thai Government is approximately 102 million baht. The Thai Government will pay for the additional revised facility works to install the equipment.

6. OPERATION AND MAINTENANCE PLAN

6. OPERATION AND MAINTENANCE PLAN

6.1 Operation System

The operation of CRI will be temporarily conducted in the Mahidol University until the construction of the new building is completed. At present most of the activities including research works are supported by the professors and researchers in the Mahidol University. The operation system of each laboratory in the research section is planned to assign one principal investigator, two staff scientists for carry out research works, two to three research assistants & laboratory technicians, one janitor and about two visiting research fellows.

The research staff is summarized in the table below.

Table 6.1 Research Staff List

Research Staff	Application	Number of Staff (Staff/Lab)	(Staff/Institute)
Principal Investigator (Lab.Head)	Permanent	1	12
Staff Scientist	By Contract	2	24
Research Assistants & Lab. Technicians	Permanent	2-3	30
Visiting Research Fellows	Temporary	2	24
Janitor	Permanent	1	12
	Total		about 102
	Permanent		about 50

*Research members are invited from outside by three to five year contract for every project. Outside researchers stay at demand. The total number of laboratories is 12.

6.2 Maintenance System

The operation and maintenance of the equipment of CRI is in charge of full-time technical staff.

Table 6.2 Technical Maintenance Staff

Technical & Administrative Staff		Number of Staff Research Field A	Research Field B-D
Technical Staff	Equipment Specialists	3	3
	Equipment Operators	3	3
	Electronic Engineers	1	2
	Glass Blowers	2	-
	Veterinarians	-	2
	Animal Care Takers	-	6
	Facility Technicians	1	1
	Radioactive Specialists	-	1
	Technical Illustrators & A/V	2	2
Administrative Staff	Secretary	1	4
	Typist	2	8
	Total	15	32

* All the staff are full-time workers. Research field A belongs to the chemistry laboratory (West Germany's aid), and B-D belong to the bioscience laboratories (Japan's aid).

6.3 Operation and Maintenance Cost

The annual cost of the operation and maintenance for the equipment provided by the Project is estimated to be approximately 21,853,000 baht. Although this estimated cost does not include the operation and maintenance cost for the equipment provided by West Germany, the total cost will be less than 30 million baht, which is the budget amount of CRI in 1990. It is considered that there is no problems in execution of the budget, as CRI is the high priority project in Thailand, and the Government and the Ministry of the University Affairs and the government will be responsible for the disbursement necessary for the operation. Besides this budget, CRI receives the financial aid of about 10 million baht every year from the Chulabhorn Foundation as well as other grants from certain international institutions.

(1) Personnel Cost

The annual personnel cost of the research areas required for the operation and maintenance of CRI is estimated to be approximately 11,620,000 baht. The breakdown of the cost is shown as follows.

Table 6.3 Breakdown of the Personnel Cost for Research Area of CRI

Staff	Number of Staff	Salary (Baht/Month)	Annual Personnel Cost (Baht)
Upper Researcher	10	13,970	1,676,400
General Researcher	42	10,730	5,407,920
Technician	55	5,300	3,498,000
Secretary	5	5,020	301,220
Typist	10	3,590	430,800
Janitor	10	2,550	306,000
Total	132	-	11,620,340

* Unit cost of monthly salary is based on the salary chart of the government employees in 1990.

(2) Maintenance Cost

The overhead expenses for the operation and maintenance of the provided equipment is estimated to be approximately 10,233,000 baht annually.

1. Electricity
   850kw*hr/day x 20days/month x 12months x 1.23baht/kw*hr= 250,920baht
2. Water supply
   13.5m3/day x 20days/month x 12months x 8.7baht/m3*hr = 28,188baht
3. Gas
   4.5m3/day x 20days/month x 12months x 5.9baht/m3*hr = 6,372baht
4. Expendable supplies 9,948,000baht

Total 10,233,480baht

(3) Budgetary Measure

The budget request concerning the Project of CRI is made from the Office of the Permanent Secretary in the Ministry of University Affairs to the Budget Bureau, and executed after the approval is given by the Parliament. As this Project is a royal project which is given high priority, the disbursement necessary for the operation of CRI is guaranteed.

CRI also receives financial aid of 10 million baht every year for its operation from the Chulabhorn Foundation, and grants and donations from certain international institutions such as UNDP, and other countries and organizations.

Table 6.4 Budget Results of CRI

(Unit:Million Baht)

Items	Budget Year				
	1987	1988	1989	1990	1991(Plan)
Maintenance	12.0	-	15.0	30.0	30.0
Construction Plan	-	-	20.0	101.2	166.0
Relief Cost for Flood & Disaster	-	-	60.0	-	-
Total	12.0	-	95.0	131.2	196.0

* Budget year in Thailand begins in October in the previous year and ends in September in the year concerned.

The official budget of CRI is disbursed from the Office of the Permanent Secretary in MUA. The budget results of the office is shown as follows.

Table 6.5 Budget Results of MUA

(Unit:Million Baht)

Budget Year	1985	1986	1987	1988	1989	1990
Budget Results	74.4	73.8	73.4	74.0	178.70	593.13

7. EVALUATION OF THE PROJECT

7. EVALUATION OF THE PROJECT

7.1 Effects of the Project Implementation

7.1.1 Signficance of Activities of CRI

CRI is one of the high priority national projects, playing a leading part in Thailand as a central institute of comprehensive science and technology. CRI is aiming at the education and training of personnels in a wide scale, academic exchanges, execution of significant national projects as well as the promotion of the own research works. It also has a function as a collaborate facility to be shared by all the national universities and institutes.

As was previously described, the objective of CRI is to improve the public health and medical care, and raise the productivity by using resources effectively, and thereby contribute to meeting the basic human needs of the nation, especially the inhabitants in rural areas, and improving the quality and stability of public life.

Another goal that CRI is planning to achieve through the Project is to establish a network of research information in and out of the country. The Third Academy of Science which has its headquarters in Trieste, Italy and The World Laboratory in Switzerland are planning to build a research work that connects CRI with other research institutes all over the world including Southeast Asian countries.

It is expected that the effect of the activities of CRI will contribute not only to the development of the level of science and technology and public welfare in Thailand but also to the improvement of the quality of life of people living in Southeast Asia and other countries through the academic exchanges with foreign countries.

7.1.2 Effects on the Society of the Thailand

In Thailand where constitutional monarchy has been established since 1932 the king is deeply trusted by the nation. The present king, His Majesty Rama IX, is a scientist himself, and the third daughter, Her Royal Highness Princess Chulabhorn is actively engaged in the research works as a chemist at home and abroad. CRI, which was established by the Director, Her Royal Highness Princess Chulabhorn seeking for such research activities as will meet the expectations and trust of the nation, has a great substantial impact on the mid of the nation and the society of

Thailand.

The research equipment provided by the Project will be used for the subjects that will directly contribute to the improvement of the public health and clinical medicine, and the public welfare through the effective use of natural resources and the increased productivity. The results of the researches are expected to help the achievement of the goals including the improvement of the quality of life, promotion of the social development and correction of the regional differentials, which are the major issues of the present Sixth National Economic and Social Development Plan in process now.

The effects of the achievement of each research subject studied in CRI are summarized in the following table.

Table 7.1 Research Subjects of CRI and their Effects

Research Subject	Effects of the Research: Social Effects	Effects of the Research: Economic Effects
*Vitamin B deficiencies and carcinogens in hepatic tumor development	*Decrease of hepatic tumor *Improvement of natural medical standard *Improvement of nutritional status of the nation	*Relief to human resources *Decrease of medical cost
*Physiological and pathological studies on evaluation of industrial pollution and pesticides	*Prevention of pollution *Improvement of labor hygiene *Formulation of safety standard of harmful materials	*Decrease of processing cost of harmful materials
*Biodegradation of toxic industrial chemicals and pesticides	*Prevention of pollution *Purification of environment *Improvement of public hygiene	*Decrease of processing cost of harmful materials
*Development of disease resistant rice	*Improvement of quality of life of farmers	*Increased productivity of food *Increase of exports *Acquisition of foreign currency
*Synthesis of oligosaccharides by enzyme reactions	*Improvement of quality of life of farmers	*Production of goods with high added values *Promotion of new industries
*Development of immunodiagnostic methods for tropical infectious diseases	*Improvement of national medical standard *Decrease of death rate *Early detection of serious disease	*Relief to human resources *Decrease of medical cost
*Pathophysiological studies on hypoxemia by thalassemia	*Development of effective therapeutic method	*Alleviate to human suffering *Deduction of medical cost
*Studies on cerebral malaria	*Development of effective therapeutic method *Development of fundamental method for therapy	*Development of new medicine *Relief to human resources *Decrease of medical cost

7.2 Justification of the Project

The purpose of the Project is to improve the "Quality of Life" of the nation of Thailand through the research activities of CRI, and thereby expected to contribute both directly and indirectly to the improvements of public health and medical care, life environment and welfare. All the eight research subjects of CRI are corresponding with these goals.

As a result of the close examination of the contents of the research subjects in "3.2 Analysis of the Contents of the Project", it is recognized that the Project is very significant in achieving the goals of CRI. The research methods of each subject are also appropriate according to the current standard of science and technology in the field. Some of the research equipment require specialized operation and high operational cost due to the expensive expendable supplies and chemicals. Nevertheless, the Thai Government is to take all possible measures to meet the requirements for its operation in the personnel and financial aspects, as the researches of CRI are urgent matters for the Thailand. Namely, it is agreed that the Government will provide necessary staff and supplementary equipment, chemicals and expendable articles in order to start the research work immediately using the equipment provided by Japan and West Germany. It is also agreed that the Government will provide necessary staff, supplemental equipment, chemicals and consumables, and will take the proper measures necessary for the construction and facility works to conduct the installation and operation without delay as well as for the operation and maintenance thereafter.

CRI is regarded as a high priority project with the aim to be a leading central institute of comprehensive science and technology. The result of the Country Aid Research done by JICA also shows the importance of the cooperation with the research institutes in Thailand and assistance in the improvement of the public welfare. Thus the purpose of CRI, which is to perform the research on the improvement of the public welfare of the nation in Thailand, especially the inhabitants in the rural areas, agrees with the object of the grant aid of the Government of Japan. Considering the above mentioned conditions and the fact that the contents of these researches are significant and urgently required in the present status of Thailand, it is determined that it is appropriate to carry out the Project by the grant aid.

8. CONCLUSION AND RECOMMENDATION

8. CONCLUSION AND RECOMMENDATION

8.1 Conclusion

The Project is to assist CRI to achieve its goal by utilizing the fruit of the research for improving the "Quality of Life" of the nation in Thailand, by providing the research equipment to the bioscience laboratories in CRI and assisting in their effective research activities. The research fields of CRI are subjects to maintain fundamental public life, such as the improvement of public health and medical care for the local farmers, establishment of higher standard of living, advancement of environments, and prevention of pollution. It is expected that the results will make a direct and indirect contribution to the improvement of the public welfare in Thailand.

The objective of CRI, corresponding with the purpose of the present Sixth National Economic and Social Development Plan, will be of a help to the well-balanced social and economic development in the country. As its social influence is great, it is judged the implementation of significant to implement the Project is significant by dint of the grant aid from the Government of Japan.

8.2 Recommendation

8.2.1 Recommendation to the Thai Governmant

It is recommended that the Thai Government will take the following measures in the execution and operation of the Project.

i) The Thai Government will be responsible for the construction work to provide CRI with the facilities and equipment necessary for the installation and operation of the research equipment provided by the Project.

ii) The Thai Government will make the necessary procedures concerning the works undertaken by the Government of Japan.

iii) The Thai Government will clarify the person who is responsible for the operation and control of the equipment and keep good maintenance in order to use the equipment effectively.

iv) The Thai Government will take budgetary measure for supplying expendable articles, chemicals, spare parts necessary for the operation of the equipment.

v) The Thai Government will select and hire efficient research staff

including researchers, engineers, operators, etc. required for the effective use of the equipment.

8.2.2 Recommendation for Technical Cooperation

As for the technical cooperation, the Thai Government made a strong request for dispatching Japanese experts. From view points of upgrading research development potentiality of CRI and effective implementation of the Project, the request is considered to be justifiable and to be handled positively. Furthermore mechanical engineers and operators are planned to be assigned according to the personnel plan of CRI in the Project. Among the equipment provided by the Project, those which require high level of technique and knowledge for its operation and maintenance are recommended to implement technical training aiming at their effective use.

APPENDIX 1

1.1 Members of the Basic Design Study Team

1) Basic Design Study

Name	Speciality	Present Department
Haruo SUZUKI	Leader	Deputy Managing Director, Grant Aid Project Managemant Deparment, JICA
Kanju OSAWA, Ph.D.	Agricultural Chemistry	Assistant Professor, Nodai Research Institute, Tokyo University of Agriculture
Atsunobu TOMOMATSU, Ph.D.	Biotechnology	Agrticultural Development Specialist, JICA
Soichi TAKAI	Research Equipment (1)	System Science Consultants, Inc.
Yasuhiro HONDA, Ph.D.	Research Equipment (2)	System Science Consultants, Inc.
Harunobu YOSHINO	Equipment Layout/ Cost Estimation	System Science Consultants, Inc.

2) Draft Report Explanation

Name	Speciality	Present Department
Toru IMAMURA	Leader	Grant Aid Division Economic Cooperation Bureau Ministry of Foreign Affairs
Atsunobu TOMOMATSU, Ph.D.	Biotechnology	Agrticultural Development Specialist, JICA
Soichi TAKAI	Research Equipment (1)	System Science Consultants, Inc.
Yasuhiro HONDA, Ph.D.	Research Equipment (2)	System Science Consultants, Inc.

1.2 Study Team Survey Itinerary

1) Basic Design Study

(1/2)

	Date	Itinerary	Description
1.	Apr. 15 (Sun)	Narita-Bangkok	Tokyo to Bangkok
2.	16 (Mon)	Bangkok	Meeting at JICA Thailand and DTEC Courtesy visit to MUA Meeting at Embassy of Japan
3.	17 (Tue)	Bangkok	Total Meeting with MUA and CRI Explanation of the Inception Report and confirming the request Explanation and discussion of the research subject of CRI
4.	18 (Wed)	Bangkok	Discussion on each research subject and personnel equipment
5.	19 (Thu)	Bangkok	Visiting Mehidol University and discussion on the research equipment
6.	20 (Fri)	Bangkok	Inspection of the construction site of CRI and discussion on the plan of the building Visiting Chulalongkorn University
7.	21 (Sat)	Bangkok	Visiting Kasetsart University (Dr. Osawa and Dr. Tomomatsu) Adjustment of research equipment, planning and research subjects Preparation of draft of Minutes
8.	22 (Sun)	Bangkok	Interval meeting Adjustment of data and result of meeting
9.	23 (Mon)	Bangkok	Discussion on the Minutes of Discussion and signing Report to JICA Thailand
10.	24 (Tue)	Bangkok	Leaving to Japan (Official members) Discussion on the schedule and details of research equipment
11.	25 (Wed)	Bangkok	Discussion on details of research equipment
12.	26 (Thu)	Bangkok	Discussion on details of research equipment and questionnaire

Date	Itinerary	Description
13. Apr. 27 (Fri)	Bangkok	Discussion on details of construction plan of CRI building (Mr. Takai and Mr. Yoshino at the site) Discussion on details of research equipment
14. 28 (Sat)	Bangkok	Discussion on details of research equipment Adjustment of the result of discussion
15. 29 (Sun)	Bangkok	Study on quantity of research equipment Preparation of equipment list
16. 30 (Mon)	Bangkok	Preparation of layout plan of research equipment Discussion on schedule Meeting at UNDP
17. May 1 (Tue)	Bangkok	Report and discussion of the results of study Integrated meeting between MUA, CRI and the Team Confirmation of the Project
18. 2 (Wed)	Bangkok	Inspecting the construction site, Visiting Kesetsart University and Atomic Energy Office (Dr. Honda and Mr. Yoshino) Adjustment of the results of study and collecting data (MR. Takai)
19. 3 (Thu)	Bangkok	Adjustment of contents of the Project Collecting the date and report to JICA Thailand
20. 4 (Fri)	Bangkok-Narita	Leaving to Japan (Consultant members)

2) Draft Report Explanation

Date	Itinerary	Description
1. Jul. 2 (Mon)	Narita-Bangkok	Tokyo to Bangkok
2. 3 (Thu)	Bangkok	Meeting at JICA Thailand Meeting at Embassy of Japan Courtesy visit to MUA Submitting the Final Draft Report Inspecting the CRI construction site
3. 4 (Wed)	Bangkok	Total Meeting with MUA, CRI and DTEC Explanation and discussion of the Draft Final Report Discussion on the equipment Discussion on the Minutes of Discussion
4. 5 (Thu)	Bangkok	Collecting the data Discussion on the equipment with University of Mahidol Discussion on the Draft Final Report with MUA Preparation of the Minutes of Discussion Signing of the Minutes of Discussion
5. 6 (Fri)	Bangkok	Collecting the data Inspecting the local equipment agency Discussion on the Draft Final Report with MUA Report to Embassy and JICA Thailand
6. 7 (Sat)	Bangkok	Collecting the data Leaving to Japan (Mr. Imamura)
7. 8 (Sun)	Bangkok	Leaving to Japan (Dr. Tomomatsu) (Dr. Osawa and Dr. Tomomatsu) Adjustment of the data and results of discussion
8. 9 (Mon)	Bangkok-Narita	Inspection of the construction site Leaving to Japan (Consultant members)

1.3 List of Members Contacted

Organization & Position	Name
□Embassy of Japan	
Secretary	Mr.Yosihiro Chiba
□JICA Thailand	
Representative	Mr.Shinji Abe
Officer	Ms.Chisa Hara
□Ministry of University Affairs	
Permanent Secretary of MUA	Dr. Wichit Srisa-an
Deputy Director, CRI	
Director, Foreign Relations Div.	Mr. Vibool Phinit-Akson
Foreign Relations Div.	Ms. Supatra Srichumsin
Foreign Relations Div.	Mr. Thongchang Chaiyadej
Academic Affairs Div.	Dr. Amornwich Nakornthap
Director, lanning Div.	Mr. Suchart Muangkaew
□Mahidol University, Faculty of Science	
Dept. of Chemistry	Dr. Somsak Ruchirawat
Dept. of Microbiology	Dr. Stitaya Sirisinha
Dept. of Biotechnology	Dr. Skorn Mongkolsuk
Dept. of Pharmacology	Dr. Jutamaad Satayavivad
Dept. of Pharmacology	Dr. Udom Chantharaksri
Dept. of Biochemistry	Dr. M.R.Jisnuson Svasti
Dept. of Pharmacology	Dr. Mathuros Ruchirawat
Dept. of Microbiology	Dr. Sansanee Chaiyaroj
Dept. of Biotechnology	Dr. Suvit Loprasert
Dept. of Biochemistry	Dr. Em-on Benjavongkulcha
□Public Works Department	
Architect	M.L. Poomarirat Chongcharoensuk
Civil Engineer	Mr. Thamnob Sanguandikul
Electrician	Mr. Tanin Musickvit
Sanitary Engineer	Mr. Voranit Chayariwattanawong
Electrical Engineer	Mr. Uthai Jiseree
Mechanical Engineer	Mr. Tossaphon Loypetch
Civil Engineer	Mr. Sanit Srisuk
□DTEC	
Chief of Japan Sub-Div.	Mr. Sutin Susila
Japan Sub-Div.	Mr. Vudhisit Virysiri
German Sub-Div.	Mr. Jiroj Itiratana

Organization & Position	Name
□Chulalongkorn University,	
Institute of Biotechnology and Genetic Engineering	
Director	Dr. Naline Nilubol
Deputy Director	Dr. Surapong Navankasatusas
Deputy Director	Dr. Pairdh Pinphanichakarn
Researcher	Dr. Jarunya Ngernprasirtsiri
Researcher	Dr. Mana Sriyudthsak
Researcher	Dr. Dararat Rodphaya
□Kasetsert Universuty, Faculty of Science	
Dean, Faculty of Science	Dr. Sumin Smutkupt
Head, Dept. of Botany	Dr. Orady Tanpatta-Anun
Dept. of Microbiology	Dr. Savitree Limtong
□United Nations Development Programme	
Assistant Regional Representative	Ms. Akiko Naito-Yuge
National Programme Officer	Ms. Suchada Kulawat
□Office of Atomic Energy for Peace,	
Ministry of Science, Technology and Energy	
Director, Waste Management Div.	Dr. Pathom Yamkate
Head, RWM Section, Waste Management Div.	Mr. Pirat Sriyatha

1.4 Minutes of Discussions

1) Basic Design Study

MINUTES OF DISCUSSIONS
ON
THE PROJECT FOR ESTABLISHMENT OF BIOSCIENCE LABORATORIES
IN
CHULABHORN RESEARCH INSTITUTE
IN
THE KINGDOM OF THAILAND

In response to the request of the Government of the Kingdom of Thailand, the Government of Japan decided to conduct a basic design study on the Project for Establishment of Bioscience Laboratories in Chulabhorn Research Institute (hereinafter be referred to as "the Project"), and entrusted the study to Japan International Cooperation Agency (JICA). JICA sent to Thailand the Study Team headed by Mr. Haruo SUZUKI, Deputy Managing Director of Grant Aid Project Management Department, JICA, from April 15 to May 4, 1990.

The Team had a series of discussions on the Project with the officials and researchers concerned of the Ministry of University Affairs, shown in Annex 4, and conducted a field survey in Bangkok and its vicinities.

As a result of the study and discussions, both parties agreed to recommend to their respective Governments that the major points of understanding reached between them, as attached herewith, should be examined toward the realization of the Project.

April 23, 1990

Mr. Haruo Suzuki Team Leader Basic Design Study Team, JICA	Dr. Wichit Srisa-an Permanent Secretary, Ministry of University Affairs

ATTACHMENT

1. TITLE OF THE PROJECT

The title of the Project is "the Project for Establishment of Bioscience Laboratories in Chulabhorn Research Institute".

2. OBJECTIVE OF THE PROJECT

The objective of the Project is to equip the 6 selected research laboratories of Chulabhorn Research Institute (CRI) with instruments needed for conducting basic and applied researches of national importance, in particular, those which will improve the quality of life.

3. IMPLEMENTING AGENCY

The implementing agency of the Project is Chulabhorn Research Institute, Ministry of University Affairs.

4. PROJECT SITE

The site of the Project is located at Chulabhorn Research Institute at Laksee, Bangkhen, Bangkok as shown in Annex-1.

5. SUMMARY OF REQUEST

(1) It is confirmed that the request of Thai side, part of which was revised and newly submitted to JICA Team, is the financial assistance for procurement of the equipment/instruments to be installed in CRI. Thai side also expressed its sincere hope of sending some of CRI technicians for factory training in Japan.

(2) At the request of JICA Team, Thai side explained, on the basis of revised plan of organizing laboratories as well as the original project proposal, the details of research projects, flow chart of experiments and required instruments. Discussions centered upon the researches' socio-economic benefits and justification of the necessity of instruments. Annex 2 which is the outcome of the discussions indicates (A) Selected Laboratories, (B) Proposed Research Projects and (C) List of Instruments needed for immediate implementation of those research projects.

(3) Final version of prioritized instruments list will have to be worked out taking into account of the effective use of the instruments, demarcation of central and specific instruments, research area-wise installation plan, etc. on basis of (C) above.

6. JAPANESE GRANT AID PROGRAMME

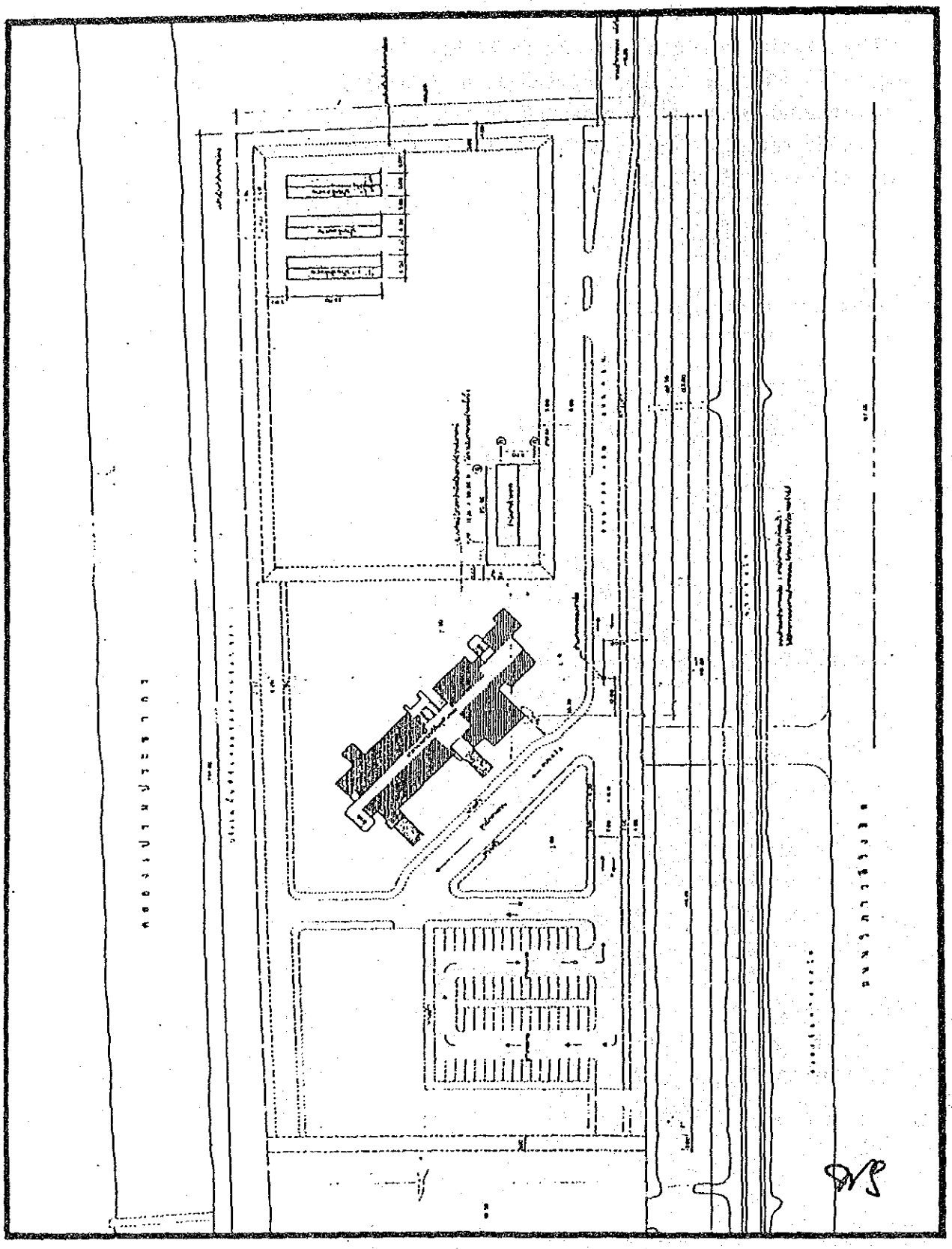
Thai side understands the system of the Japanese Grant Aid Programme explained by the Team, which includes the principle of the Grant Aid and the use of a Japanese consultant firm and Japanese contractor for implementation of the Project.

7. NECESSARY MEASURES TO BE TAKEN BY THAI SIDE

The Government of the Kingdom of Thailand will take the necessary measures listed in Annex-3 on condition that the Grant Aid by the Government of Japan is extended to the Project.

Annex-1 : PROJECT SITE

The address of the Construction Site of CRI Building is;
Chulabhorn Research Institute
Vibhavadee Rangsit Road, Laksee, Bangkhen, Bangkok.



Annex-2 : SUMMARY OF REQUEST

(A) Selected Laboratories	(B) Proposed Research Projects
# 4 Laboratory of Environmental Toxicology	① Influence Studies of Vitamin B Deficiencies on the Mechanisms of Carcinogenesis and Induction of Liver Cancer by Nitrosamines ③ Evaluation of Industrial Pollutants or By-products, and Pesticides as Predisposing Factors or Modulators of Physiological and Pathological Status
# 6 Laboratory of Biotechnology	⑤ Isolation and Characterization of Microorganisms for Biodegradation of Toxic Industrial and Agricultural Chemicals ⑥ Genetic Manipulation of Aromatic Rice to Produce Disease Resistant Rice
# 7 Laboratory of Biochemistry	⑧ Plant Carbohydrate Metabolising Enzyme and Their Use for Oligosaccharide Synthesis
# 8 Laboratory of Immunology	⑦ Development of immunodiagnostic Methods for Some Unique Tropical Infectious Diseases and Some of Their Complications
# 9 Laboratory of Pathobiology	④ Pathophysiological Study of Hypoxemia in Thalassemia
#10 Laboratory of Pharmacology	② Basic Biomedical Research to Support the Improvement of Cerebral Malaria Treatment Regimen

Note : Number of Laboratories and Research Projects are adopted as same ones as the revised plan and request.

(C) List of Instruments

Specific instruments for laboratory #4 (Environmental Toxicology)

ITD GC-MS with data station
Ultracentrifuge with 3 rotors
Liquid Scintillation counter
Automated DNA/RNA Extractor
Water's HPLC system for Ion-/biogenic amines with Workstation
Gamma-counter with RIA software
High speed refrigerated centrifuge
Lyophilizer (2 units)
Laminar flow hood (2 units)
Autoclave (1 large unit & 2 small units)
Auto-Sample Preparation
Deep Freezer (-85°C) (a small unit)
Incubator Shaker
Deep Freezer (-85°C)
Fraction collector (2 units)
Autoclave (one small unit)
Rotary vacuum evaporator
UV-Visible Spectrophotometer
Polytron tissue homogenizer
pH-meter

Specific Instruments for Lab.#6 (Biotechnology)

Automated protein sequencing
Automated DNA sequencer and solfware
Ultracentrifuge with 3 rotors
HPEC system for protein and nucleic acid
UV-visible Spectrophotometer with accesaries
High speed refrigerated centrifuge with 2 rotors
Plant growth chamber
Video densitometer and solfware for the analysis of protein including two dimension and nucleic acid
Sequencing gel reader and gel dryer
DNAsis, PRosis computer program for nucleic acid and protein analysis with AT computer & 40HD-printer
High speed refrigerated microcentrifuge with rotors (2 units)
Manual DNA Sequencing system including high voltage power supply 4000Volts
Pulse field electrophoresis
Bacteria incubator (3 units)
Low temperature incubator 15 cu ft.
PCR machine
CD-rom for gene bank and protein data-base
Upright -85°C 15 cubic feet freezer
Incubator Shaker
Water bath shaker (2 units)
Laminar flow hood
Lyophilizer
Ultrasonic cleaners (1 large and 2 medium)
Electrophoresis for mini- and regular sizes with power supply
Low temperature water bath
Autoclave (small unit)
pH-meter

Specific instruments for Laboratory #7 (Biochemistry)

Semi-Preparative HPLC
Table top Ultracentrifuge
Amino acid and peptide analyser
Fiac-300 fraction collector, pump and accessaries
Water bath shaker (4 units)
Isoelectric focusing
Preparative electro focusing
Ultrapure water system (by Reversed Osmosis)
Peptide hydrolysis system with vaccuum pump
Cold cabinet
Speed vaccuumU.V. detector/recorder for fraction collector
Circulating/heating cooling bath
Ultrafiltration unit(3 units)
Phase contrast/ light microscope
High speed Micro Centrifuge (2 units)
Polaroid and single len reflex cameras
Electrophoresis (two dimension)
UV-Visible Spectrophotometer
Refrigerator
pH-meter
Gel dryer

Specific Instruments for Lab. #8 (Immunology)

Fluorescence Cell-Sorter (FACS)
Automated protein synthesis
High speed refrigerated centrifuge with 2 rotors
Fluorescent microscope (epifluorescence type)
CO_2 incubator (3)
Laminar flow hood (2 units)
Elisa reader
Water purification system
Electrophoresis, electroblotting and cooling systems including 2D-gel, and drier unit
Phase contrast microscope (inverted microscope with phase contrast condensor & objective)
PhD cell harvester
Pharmacia fraction collector with accessories
Water jacket Incubators. (2 units)
Bacteria incubator (3 units)
Deep Freezer (-85°C)
Autoclave (1 large)
Lyophilizer (1 units)
UV-Visible Spectrophometer
High speed microcentrifuge (refrigerated)
Incubator Shaker
Sorvall refrigerated centrifuge
(for tissue culture)
Water bath shaker (2 units)
Freezer (-20°C)
Dissecting microscope (2)
pH-meter

Specific instruments for Lab.#9 (Pathobiology)

Electron Spin Resonance
Differential cell counter
Jasco's LC-800 HPLC with Chemiluminescence/ electrochemical/fluorescence and UV-detectors
Intracellular calcium analyser (Jasco CAF-100)
Luminescence Reader (Aloka BLR-201)
High speed refrigerated centrifuge with 2 rotors
Chronolog Impedance Aggregometer with data module
Small Liquid Scintillation counter
Reversed osmosis ultrapure water system (10 L/hr)
UV-Visible Spectrophometer with special flow cell and temperature regulator.
Dissecting microscope (2 sets) one with camera set
High speed Micro Centrifuge (2 units)
Deep Freezer (-85oC)
Ice-maker
Autoclave (1 small unit)
Low temperature water bath
Ultrasonic cleaners (4 small sizes)
pH-meter

Specific instruments for laboratory #10 (Pharmacology)

The Schuler organ bath with 4 containers
Buxco Respiratory mechanics analyzer
Animal acticity cage
Spectrofluorometer
Microscope equipped with phase contrast, epifluorescence, micro flex UFX-IIA with micro manipulator
Polygraph with accessories
Non-invasive blood pressure monitor in rat
Differential pH meter
UV-visible Spectrophotometer with kinetic attachment
Buxco noninvasive respiratory measurement for conscious animals
Ultrafiltration unit (2 units)
Peristaltic pump P-1
Tail-flick apparatus
Ultrasonic cleaners (1 large and 2 medium & 2 small sizes)
Rota-rod treadmill for mice
Polytron tissue homogenizer
Hematocrit centrifuge

Annex-3 : NECESSARY MEASURES TO BE TAKEN BY THAI SIDE

1. To provide data and information necessary for the Project.

2. To construct a building with necessary facilities and utilities for proper operation of the instruments to be procured under the Grant Aid.

3. To ensure prompt unloading, tax exemption and customs clearance of the products purchased under the Grant Aid at port of disembarkation in Thailand.

4. To exempt Japanese nationals engaged in the Project from customs duties, internal taxes and other fiscal levy which may be imposed in Thailand with respect to the supply of the products and services under the verified contract.

5. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Thailand and stay therein for the performance of thier works.

6. To ensure the necessary budget and personnel for the proper and effective operation and maintenance of the instruments to be procured under the Grant Aid.

7. To provide necessary permissions, licences and other authorizations to carry out the Project.

8. To bear two kinds of commissions to the Japanese foreign exchange bank for the banking services, based upon the "Banking Arrangement", namely, the advising commission of the "Authorization to Pay" and payment commission.

9. To bear all the expenses, other than those to be born by the Grant Aid.

Annex-4 : RECORD OF MEETING

1. Date; April 17, '90
   Place; Ministry of University Affairs
   Subject ; Explanation of Inception Report & Discussion on Research Projects, etc.
2. Date; April 18, '90
   Place; Ministry of University Affairs
   Subject ; Discussion on Research Projects, Details of Researhes & Instruments/Equipment, etc.
3. Date; April 19, '90
   Place; Faculty of Science, Mahidol University
   Subject ; Discussion on Details of Researches & Instruments, etc.
4. Date; April 20, '90
   Place; Construction Site of CRI, Laksee, Bangkhen
   Subject ; Discussion on Laboratory, Facilities, etc.

<Members of Thai side>

		(Attended Meeting)
‡ Ministry of University Affairs		
Dr. Wichit Srisa-an	Permanent Secretary of MUA Deputy Director, CRI	(1,2)
Mr. Vibool Phinit-Akson	Director, Foreign Relations Div.	(1,2,4)
Ms. Supatra Srichumsin	Foreign Relations Div.	(1,2,4)
Mr. Thongchang Chaiyadej	Foreign Relations Div.	(1,2,4)
‡ Mahidol University, Faculty of Science		
Dr. Somsak Ruchirawat	Dept. of Chemistry	(1,2,3,4)
Dr. Stitaya Sirisinha	Dept. of Microbiology	(1,2,3,4)
Dr. Skorn Mongkolsuk	Dept. of Biotechnology	(1,2,3)
Dr. Jutamaad Satayavivad	Dept. of Pharmacology	(1,2)
Dr. Udom Jantraraksi	Dept. of Pharmacology	(1,2,3)
Dr. M.R.Jitsanusan Svasti	Dept. of Biochemistry	(3,4)
‡ Public Works Department		
M.L. Poomarirat Chongcharoensuk	Architect	(1)
Mr. Thamnob Sanguandikul	Civil Engineer	(1)
Mr. Sanit Srisuk	Civil Engineer	(4)
Mr. Tanin Musickvit	Electrician	(4)

2) Draft Report Explanation

MINUTES OF DISCUSSIONS
ON
THE BASIC DESIGN STUDY
THE PROJECT FOR THE ESTABLISHMENT OF BIOSCIENCE LABORATORIES
AT CHULABHORN RESEARCH INSTITUTE
IN
THE KINGDOM OF THAILAND

In response to the request of the Government of the Kingdom of Thailand, the Government of Japan decided to conduct a basic design study on the Project for The Establishment of Bioscience Laboratories at Chulabhorn Research Institute (herein after referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA had sent to the Kingdom of Thailand the basic design study team headed by Mr.Haruo Suzuki, Deputy Managing Director of the Grant Aid Project Management Department, JICA, from April 15 to May 4, 1990.

As a result of the study, JICA has prepared a Draft Final Report and dispatched a team headed by Mr. Toru Imamura, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, to explain to the relevant officials of the Government of the Kingdom of Thailand and discuss on the Draft Final Report from July 2 to 9, 1990.

Both parties had a series of discussions on the Draft Final Report and agreed to recommend their respective Governments that major points of understanding reached between them, attached herewith, should be examined towards the realization of the project.

Bangkok, July 5, 1990

Mr. Toru Imamura
Leader, Draft Final Report Team,
Japan International Cooperation
Agency

Dr. Wichit Srisa-an
Permanent Secretary,
Ministry of University
Affairs

ATTACHMENT

1. The Thai side agreed in principle to the basic design proposed in the Draft Final Report and requested additional miscellaneous equipment shown in ANNEX I.

2. The Thai side has understood the system and principle of the Japanese Grant Aid Programme.

3. The Government of the Kingdom of Thailand reconfirmed the necessary measures for the realization of the Project which are manifested in the "Minutes of Discussions" on the Project signed on April 23, 1990.

4. The Thai side agreed that the Project shall be implemented in two phases.

5. The Final Report (10 copies in English) will be submitted to the Government of the Kingdom of Thailand by the end of September 1990.

ANNEX 1 Additional miscellaneous equipment requested.

Code No.	Equipment	Q'ty
M-01	Toploading electronic balance	7
M-02	Electronic analytical balance and stabilizing slab	4
M-03	Oven	6
M-04	Magnetic stirrer (small size)	3
M-05	Magnetic stirrer (large size)	3
M-06	Hotplate with stirrer	10
M-07	Micropipettes (20, 100, 1,000 microL)	36
M-08	Multimicropipettes	4
M-09	Liquid nitrogen container	4
M-10	Test tube mixer	9
M-11	Deionized and distilled water apparatus	2
M-12	Colony counter	1
M-13	Microscope with camera	3
M-14	Refrigerator	7
M-15	Plastic desiccating cabinet	6
M-16	Incubator shaker	1
M-17	UV lamp	2
M-18	Ice maker	2
M-19	Melting point measurement apparatus	1
M-20	Vacuum pump and gauge	6
M-21	Water bath	6
M-22	Heating mantle and tape set	1
M-23	Electroconductivity meter	1
M-24	Vacuum sealer	2
M-25	Hot plate	1
M-26	Polarometer	1
M-27	Digital thermometer	2
M-28	Glassware and plasticwares	1set
M-29	Ceramic, plastic, and metal wear	1
M-30	Dissecting microscope	3
M-31	HPLC column	24

Code No.	Equipment	Q'ty
M-32	Stopwatches	13
M-33	Dissecting stand for small animal	2
M-34	Dissecting tool sets	6
M-35	Rat and mouse cage	2,000
M-36	Rabbit cage	50
M-37	Illuminator	1
M-38	Cooling unit	1
M-39	Slide projectors	4
M-40	Overhead projecter	4
M-41	Tool sets	6
M-42	Camera and lense set	2
M-43	Dark room equipment	2
M-44	Integrated recoder	2
M-45	Blender	4
M-46	Blowtorch	1
M-47	Dryer	2
M-48	Instrument cart	2
M-49	UV viewing cabinet	2
M-50	UV transilluminator	3
M-51	Air compressor	1
M-52	Laboratory jack	2
M-53	Copy machine	3
M-54	FAX machine	1
M-55	Lettering system	2
M-56	Hematocrit Centrifuge	2
M-57	Tele-Thermometer	1
M-58	PH Meter	3

1.5 List of References

<Statistics>

1. Statistical Yearbook, Thailand, 1989
2. Statistical Handbook of Thailand, 1988
3. Key Statistics of Thailand, 1988
4. 1987 Educational Statistics in Brief, Ministry of Education
5. 1988 Educational Statistics in Brief, Ministry of Education
6. 1989 Educational Statistics in Brief, Ministry of Education

<National Plan>

1. The Sixth National Economic and Social Development Plan (1987-1991)

<Ministry of University Affairs>

1. Educational Report on Institutions of Higher Education Under the Ministry of University Affairs in Academic Year 1897 (in Thai)

<Chulabhorn Research Institute)

1. Chulabhorn Research Institute
2. The International Training Workshop on Risk Assessment and Management of Toxic Chemicals, 1989
3. Environment Toxicology I & II, Training Course Materials for International Toxicology Seminar, 1988
4. AIDS, a New Global Challenge: Impacts on Developing Countries
5. International Conference on Environmental and Industrial Toxicology : Research and Applications
6. An International and Environmental Science : Molecular Approaches

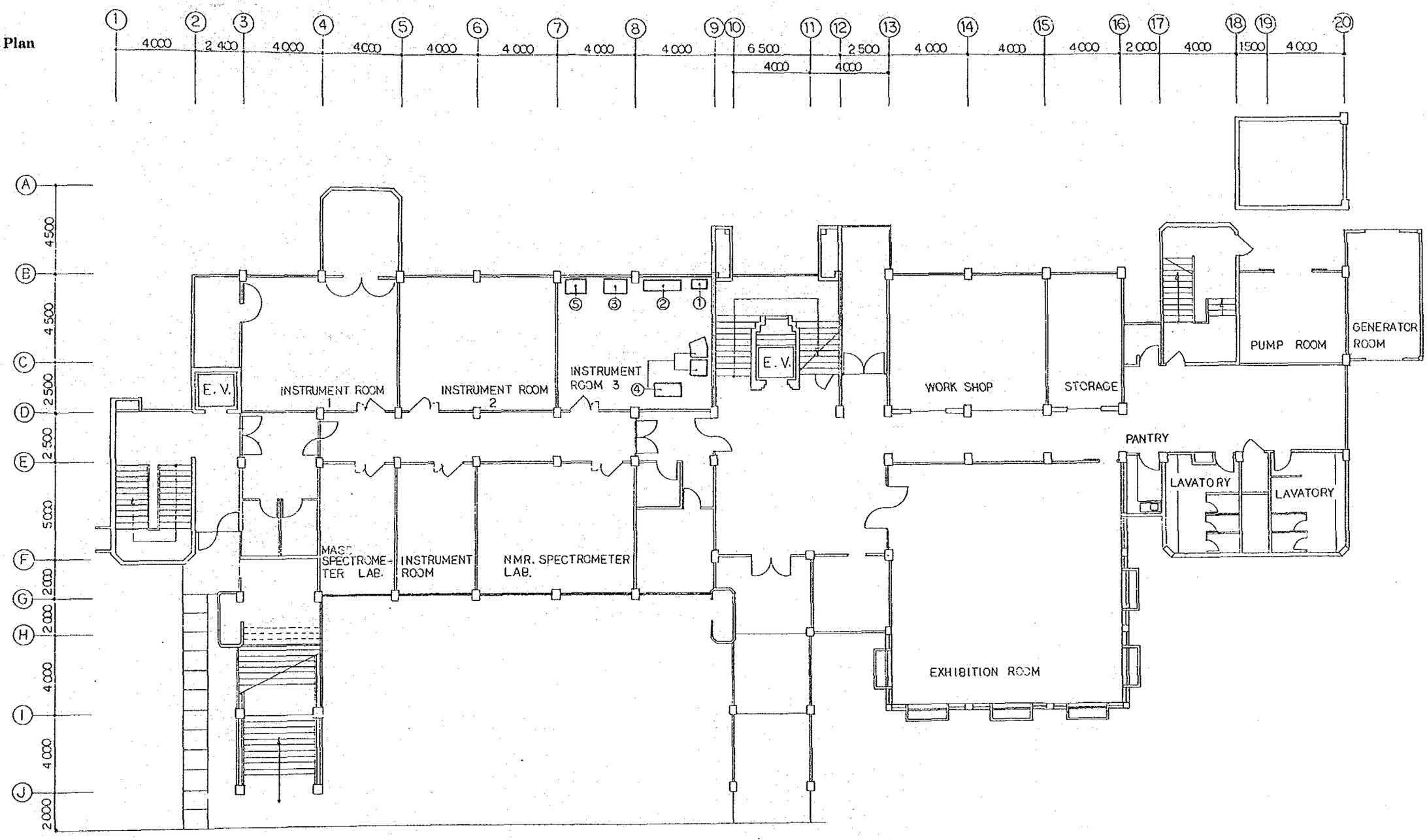
<UNDP>

1. Project Document, Environmental Research and Training to Support Industrial Development, 1988
2. Project Document, Rehabilitation and Reconstruction of Flood Affected Areas in Southern Thailand, 1989
3. Approval of Assistance to a Project of the Government of Thailand, Rehabilitation of Flood Affected Areas in Southern Thailand, 1989
4. Summary Progress Report, The Restoration and Integrated Development of The Flood Affected Areas in Southern Thailand, 1989
5. Project Performance Evaluation Report, Environmental Research and Training to Support Industrial Development, Oct. 1988 - Oct.1989
6. Annual Report, Restoration and Integrated Development of the Flood Affected Areas in Southern Thailand, 1990

<Others>

1. Working Document in the Thai Public Health Assembly of the Ministry of Republic Health, September 1988 (in Thai)

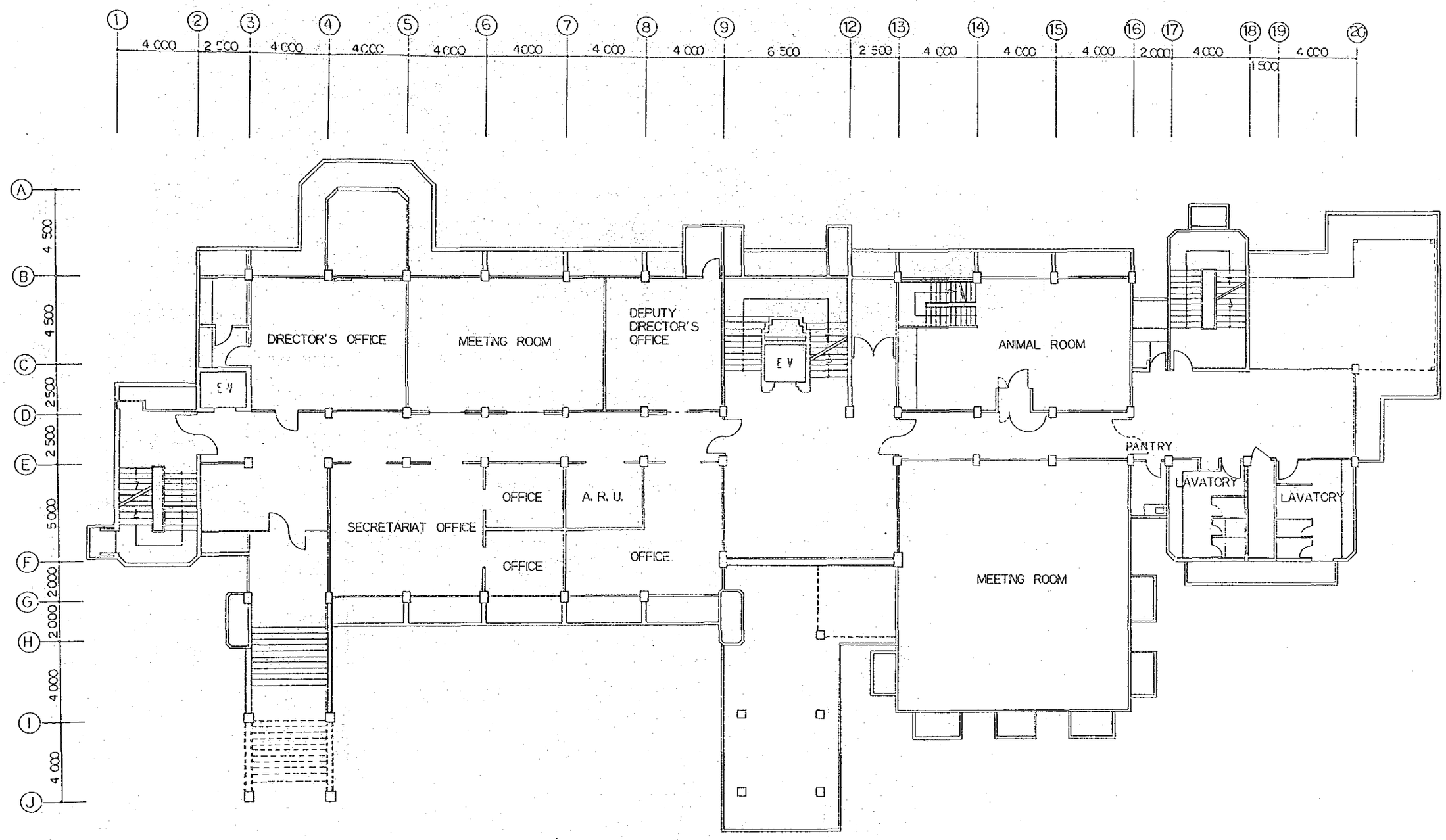
1.6 Layout Plan



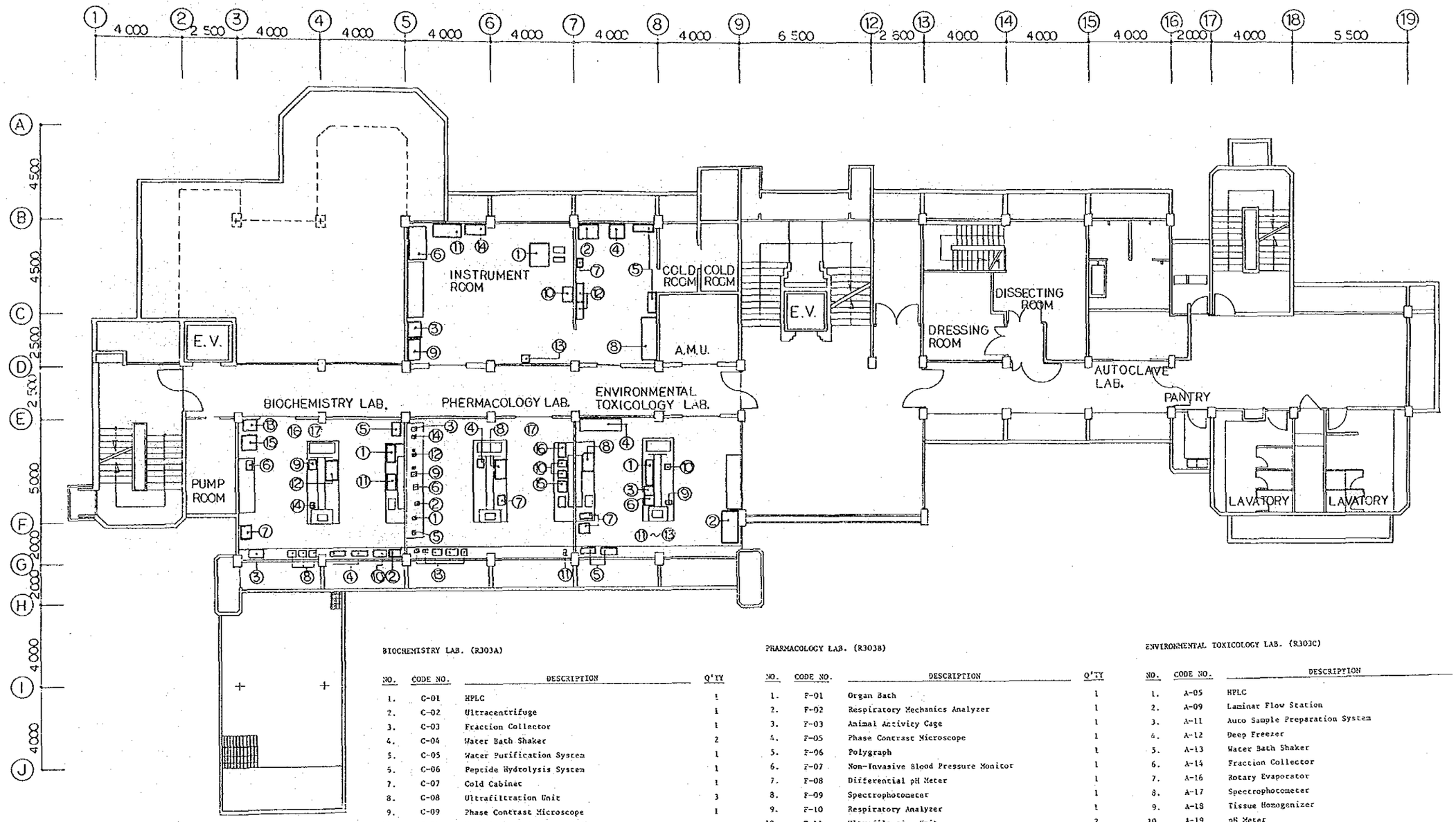
INSTRUMENT ROOM 3 (R109)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	B-01	Automated Protein Sequencer	1
2.	B-02	Automated DNA Sequencer	1
3.	B-04	High Performance Electrophoresis Apparatus	1
4.	E-01	Electron Spin Resonance Spectrometer	1
5.	D-02	Automated Protein Synthesizer	1

1 st FLOOR PLAN



2 nd FLOOR PLAN



INSTRUMENT ROOM (R304)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	A-01	GC-MS	1
2.	A-02	Ultracentrifuge	1
3.	A-04	Automated Nucleic Acid Extractor	1
4.	A-07	High Speed Refrigeraced Cencrifuge	1
5.	A-08	Lyophilizer	2
6.	A-09	Laminar Flow Station	1
7.	A-10	Autoclave	1
8.	A-12	Deep Freezer	1
9.	A-14	Fraction Collector	1
10.	A-15	Gas Chromatograph	1
11.	C-01	HPLC	1
12.	C-04	Water Bath Shaker	2
13.	C-11	Photosystem	1
14.	F-04	Spectrofluorometer	1

BIOCHEMISTRY LAB. (R303A)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	C-01	HPLC	1
2.	C-02	Ultracentrifuge	1
3.	C-03	Fraction Collector	1
4.	C-04	Water Bath Shaker	2
5.	C-05	Water Purification System	1
6.	C-06	Peptide Hydrolysis System	1
7.	C-07	Cold Cabinet	1
8.	C-08	Ultrafiltration Unit	3
9.	C-09	Phase Contrast Microscope	1
10.	C-10	High Speed Refrigerated Microcentrifuge	1
11.	C-12	Electrophoresis Apparatus	1
12.	C-13	Spectrophotometer	1
13.	C-14	Refrigerator	1
14.	C-15	pH Meter	1
15.	C-16	High Speed Refrigerated Centrifuge	1
16.	C-17	HPLC Column	1
17.	C-18	UV Transilluminator	1

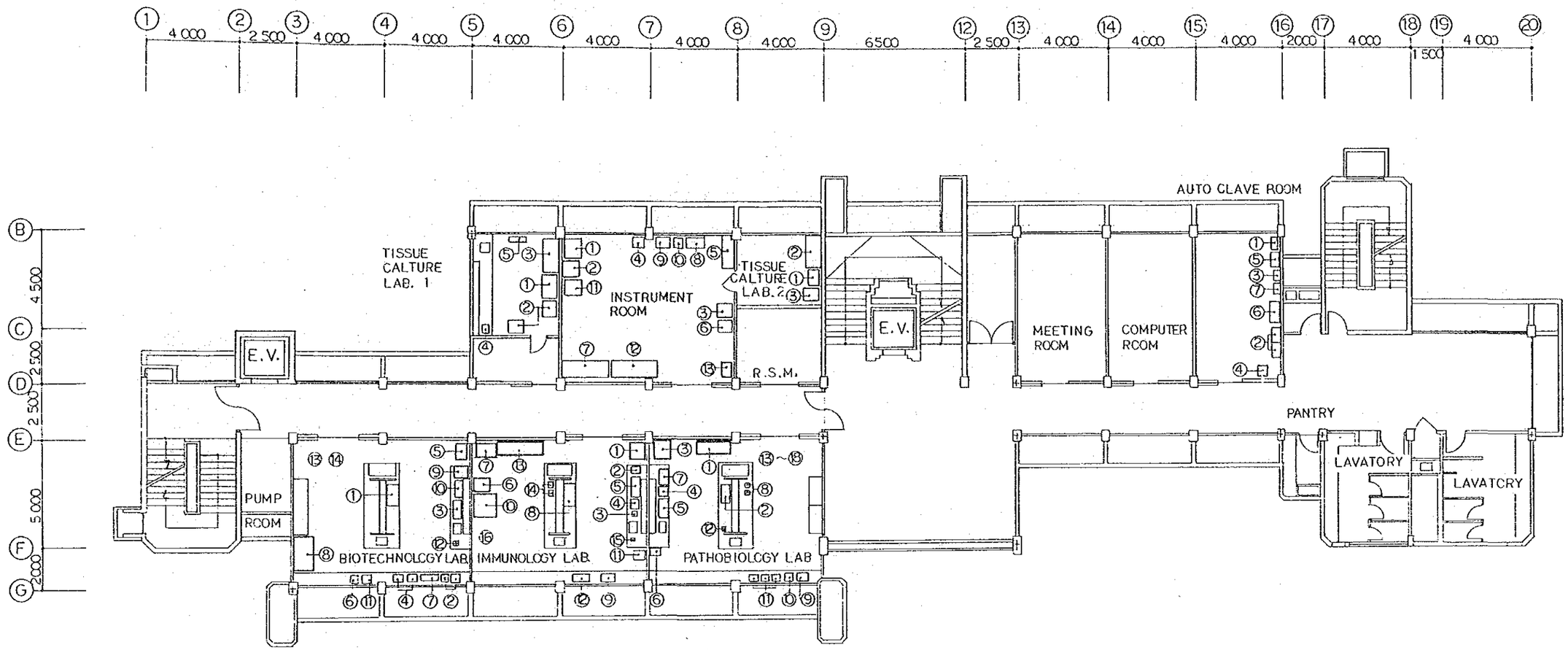
PHARMACOLOGY LAB. (R303B)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	F-01	Organ Bath	1
2.	F-02	Respiratory Mechanics Analyzer	1
3.	F-03	Animal Activity Cage	1
4.	F-05	Phase Concrast Microscope	1
5.	F-06	Polygraph	1
6.	F-07	Non-Invasive Blood Pressure Monitor	1
7.	F-08	Differential pH Meter	1
8.	F-09	Spectrophotometer	1
9.	F-10	Respiratory Analyzer	1
10.	F-11	Ultrafiltation Unit	2
11.	F-12	Peristaltic Pump	1
12.	F-13	Tail-Flick Apparatus	1
13.	F-14	Ultrasonic Cleaner	5
14.	F-15	Treadmill	1
15.	F-16	Tissue Homogenizer	1
16.	F-17	High Speed Refrigerated Microcentrifuge	1
17.	F-18	Hematocric Centrifuge	1

ENVIRONMENTAL TOXICOLOGY LAB. (R303C)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	A-05	HPLC	1
2.	A-09	Laminar Flow Station	1
3.	A-11	Auto Sample Preparation System	1
4.	A-12	Deep Freezer	1
5.	A-13	Water Bath Shaker	2
6.	A-14	Fraction Collector	1
7.	A-16	Rotary Evaporator	1
8.	A-17	Spectrophotometer	1
9.	A-18	Tissue Homogenizer	1
10.	A-19	pH Meter	1
11.	A-20	Liquid Nitrogen Container	1
12.	A-21	HPLC Column	1
13.	A-22	UV Viewing Cabinet	1

3 rd FLOOR PLAN



TISSUE CULTURE LAB. 1 (R403D)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	B-17	Incubator Shaker	1
2.	D-05	CO_2 Incubator	2
3.	D-06	Laminar Flow Station	1
4.	D-10	Phase Contrast Microscope	1
5.	D-21	Water Bath Shaker	1

INSTRUMENT ROOM (R404)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	B-03	Ultracentrifuge	1
2.	B-06	High Speed Refrigerated Centrifuge	1
3.	B-07	Growth Chamber	1
4.	B-08	Densitometer	1
5.	B-09	Personal Computer for DNA & Protein Analysis	1
6.	B-13	Incubator A	1
7.	B-16	Deep Freezer	1
8.	D-01	Fluorescence Activated Cell-Sorter & Analyzer	1
9.	D-04	Fluorescent Microscope	1
10.	E-04	Calcium Analyzer	1
11.	E-06	High Speed Refrigerated Centrifuge	1
12.	E-13	Deep Freezer	1
13.	E-14	Ice Maker	1

TISSUE CALTURE LAB. 2 (R405)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	D-05	CO_2 Incubator	1
2.	D-06	Laminar Flow Station	1
3.	D-13	Incubator	1

AUTOCLAVE LAB. (R419)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	A-10	Autoclave	1
2.	B-21	Ultrasonic Cleaner	2
3.	B-24	Autoclave	1
4.	D-08	Water Purification System	1
5.	D-15	Autoclave	1
6.	D-16	Lyophilizer	1
7.	E-15	Autoclave	1

BIOTECHNOLOGY LAB. (R403A)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	B-05	Spectrophocometer	1
2.	B-10	High Speed Refrigerated Microcentrifuge	2
3.	B-12	Pulse Field Electrophoresis Apparatus	1
4.	B-13	Incubator A	2
5.	B-14	Incubator B	1
6.	B-15	PCR Machine	1
7.	B-18	Water Bath Shaker	1
8.	B-19	Laminar Flow Station	1
9.	B-20	Centrifugal Lyophilizer	1
10.	B-22	Electrophoresis Apparatus	1
11.	B-23	Low Temperature Water Bath	1
12.	B-25	pH Meter	1
13.	B-26	Liquid Nitrogen Container	1
14.	B-27	UV Transilluminator	1

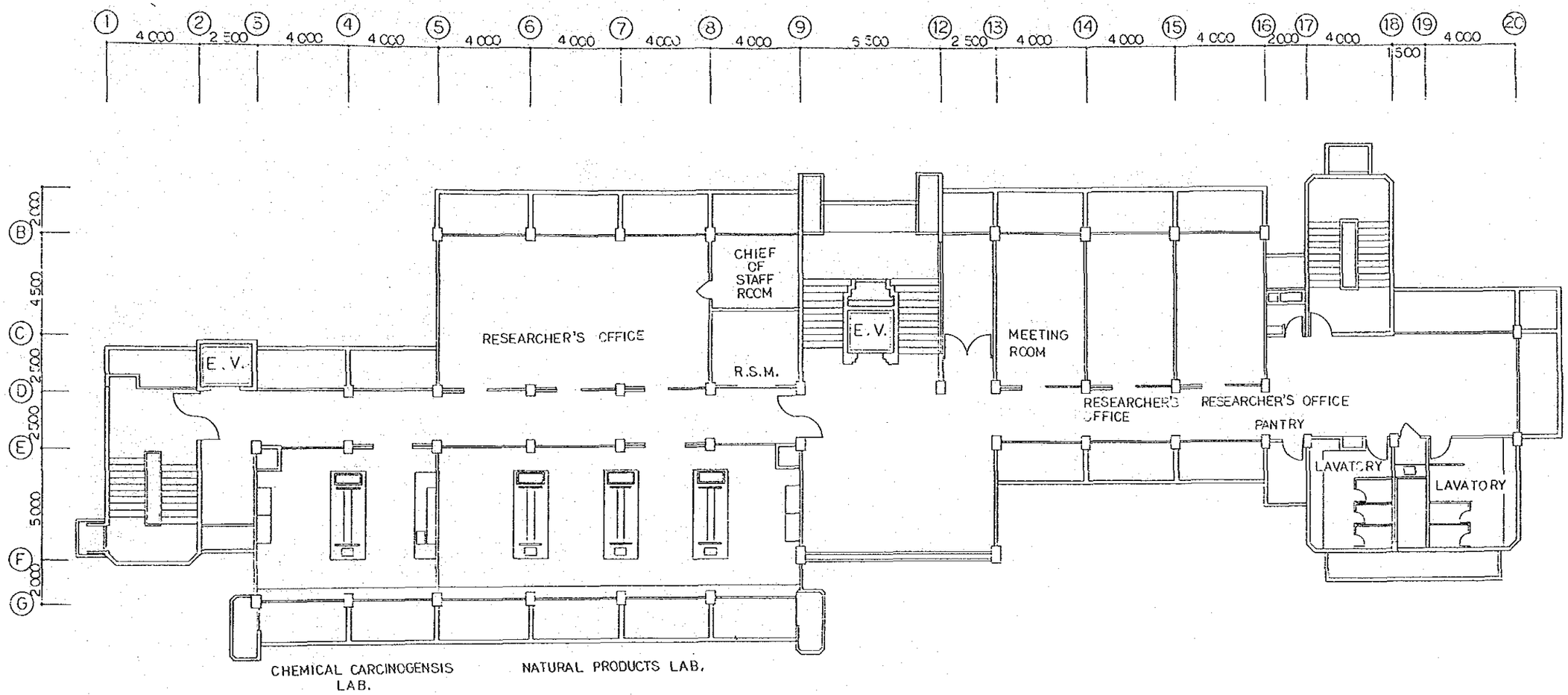
IMMUNOLOGY LAB. (R403B)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	D-03	High Speed Refrigerated Centrifuge	1
2.	D-07	Automated Microplate Reader	1
3.	D-09	Electrophoresis Apparatus	1
4.	D-11	Cell Harvester	1
5.	D-12	Fraction Collector	1
6.	D-13	Incubator	1
7.	D-14	Deep Freezer	1
8.	D-17	Spectrophotometer	1
9.	D-18	High Speed Refrigerated Microcentrifuge	1
10.	D-19	Incubator Shaker	1
11.	D-20	Low Speed Refrigerated Centrifuge	1
12.	D-21	Water Bath Shaker	1
13.	D-22	Freezer	1
14.	D-23	Dissecting Microscope	2
15.	D-24	pH Meter	1
16.	D-25	Liquid Nitrogen Container	1

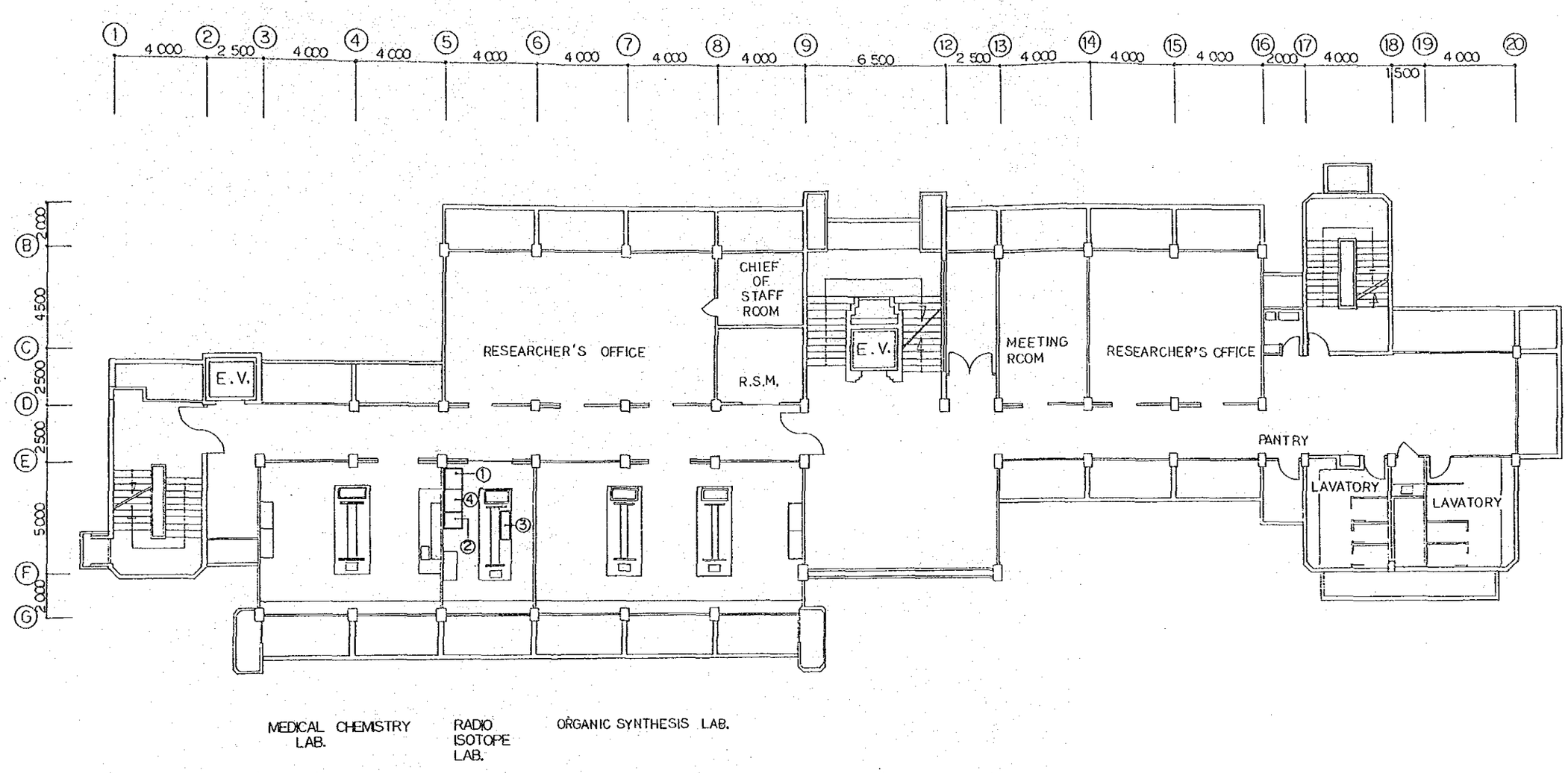
PATHOBIOLOGY LAB. (R403C)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	E-02	Auto Cell Counter	1
2.	E-03	HPLC	1
3.	E-04	Calcium Analyzer (Double Cell)	1
4.	E-05	Luminescence Analyzer	1
5.	E-07	Impedance Aggregometer	1
6.	E-09	Water Purification System	1
7.	E-10	Spectrophotometer	1
8.	E-11	Dissecting Microscope	2
9.	E-12	High Speed Refrigerated Microcentrifuge	1
10.	E-16	Low Temperature Water Bath	1
11.	E-17	Ultrasonic Cleaner	3
12.	E-18	pH Meter	1
13.	E-19	Liquid Nitrogen Container	1
14.	E-20	HPLC Column	1
15.	E-21	Recorder	2
16.	E-22	UV Viewing Cabinet	1
17.	E-23	UV Transilluminator	1
18.	E-24	Hematocrit Centrifuge	1

4 th FLOOR PLAN



5 th FLOOR PLAN



RADIOISOTOPE LAB. (R620)

NO.	CODE NO.	DESCRIPTION	Q'TY
1.	A-03	Liquid Scintillation Counter	1
2.	A-06	Gamma-Counter	1
3.	B-11	Electrophoresis Apparatus for DNA Sequencing	1
4.	E-08	Liquid Scintillation Counter	1

6 th FLOOR PLAN

APPENDIX 2

TABLE I GROSS NATIONAL PRODUCT AT CURRENT MARKET PRICES BY INDUSTRIAL ORIGIN AND NATIONAL INCOME: 1985-1988

(Millions of Baht)

Industrial origin	(1985)	(1986)	(1987)	(1988)
Agriculture	169,895	180,841	198,284	247,748
Crops	105,221	108,217	121,098	163,576
Livestock	14,995	19,870	22,595	24,847
Fisheries	12,763	15,136	14,304	15,069
Forestry	8,962	9,048	9,037	9,311
Agricultural services	7,438	7,111	7,199	7,838
Simple agricultural processing products	20,516	21,459	24,051	27,107
Mining and quarrying	40,167	34,398	38,203	44,333
Manufacturing	224,456	255,029	295,512	357,851
Construction	56,824	56,564	62,995	74,524
Electricity and water supply	23,590	28,689	31,858	37,487
Transportation and communication	78,076	85,371	92,947	106,834
Wholesale and retail trade	153,130	169,828	192,381	232,231
Banking, insurance and real estate	35,988	37,376	48,671	60,032
Ownership of dwellings	41,091	44,842	48,802	52,702
Public administration and defence	48,545	50,612	52,712	56,242
Services	142,637	151,129	171,665	195,752
Gross Domestic Product,(GDP)	1,014,399	1,094,679	1,234,030	1,465,736
Plus : Net factor income payment from the rest of the world	-17,597	-22,437	-22,599	-25,330
Gross Nationl Product, (GNP)	996,802	1,072,242	1,211,431	1,440,406
Less : Indirect taxes less subsidies	113,917	127,652	150,091	199,299
Provision for the consumption of fixed capital	81,436	93,365	102,919	117,598
National Income, (NNP)	801,449	851,225	958,421	1,123,509
Per Capita GNP (Baht)	19,287	20,364	22,599	26,412

Source : Statistical Yearbook, 1989

TABLE II TRENDS OF NATIONAL EDUCATION BUDGETS, FISCAL YEARS: 1893-1987

Unit : Million Baht

Fiscal Years	National Budget	Appropriation for Education	Ministry of Education Budget	Ministry of University Affairs Budget	MUA Permanent Secretary's Office / 16 State Universities/ Institutes	Other Government Agencies Budget
1983	177,000.0	37,142.9	31,120.9	5,068.2	67.6 / 5,000.6	953.8
1984	192,000.0	38,670.6	32,783.8	5,215.2	74.3 / 5,140.9	671.6
1985	213,000.0	39,593.4	34,238.3	5,333.3	74.4 / 5,258.9	21.3
1986	218,000.0	39,822.5	34,423.3	5,373.7	73.8 / 5,299.9	25.5
1987	227,500.0	41,111.0	35,629.6	5,426.4	73.4 / 5,353.0	55.0

Source : Key Statistics of Thailand, 1988

TABLE III POPULATION FROM POPULATION CENSUS BY REGION : 1919, 1929, 1937, 1947, 1960, 1970 AND 1980

Year	Whole Kingdom	Central	Bangkok Metropolis	Northeastern	Northern	Southern
1919	9,207,355	2,870,450	(1)	3,253,412	1,830,496	1,252,997
1929	11,506,207	3,892,804	(1)	3,887,255	2,239,984	1,486,164
1937	14,467,105	4,836,461	(1)	4,952,288	2,836,620	1,841,736
1947	17,442,689	4,733,643	1,178,881	6,210,281	3,159,084	2,160,800
1960	26,257,916	6,134,867	2,136,435	8,991,543	5,723,106	3,271,965
1970	34,397,374	7,534,516	3,077,361	12,025,140	7,488,683	4,271,674
1980	44,824,540	9,726,272	4,697,071	15,698,878	9,074,103	5,628,216

Source : Key Statistics of Thailand, 1988

TABLE IV NUMBER OF EMPLOYED POPULATION 11 YEARS AND OVER BY INDUSTRY, WORK STATUS, HOURS WORKED/WEEK : 1985-1986

(Thousand persons)

Item	(1985)		(1986)	
	Male	Female	Male	Female
Industry	**13,971.5**	**11,881.0**	**14,387.3**	**12,303.4**
Agriculture, forestry hunting & fishing	9,385.7	8,288.7	9,423.4	8,392.0
Mining and quarrying	47.2	22.0	29.9	11.7
Manufacturing	1,143.9	922.6	1,137.8	931.1
Construction, repair and demolition	478.4	103.8	507.2	82.6
Electricity, gas, water and sanitary service	90.3	11.2	103.9	19.5
Commerce	1,127.7	1,248.1	1,213.2	1,482.0
Transport, storage and communication	485.4	46.3	554.3	49.7
Services	1,205.3	1,230.8	1,405.9	1,324.6
Activities not adequately described	6.6	6.8	11.4	9.7
Work Status	**13,971.5**	**11,881.0**	**14,387.3**	**12,303.4**
Employer	210.1	61.9	217.7	53.0
Government employee	1,091.6	514.0	1,251.6	585.7
Private employee	2,846.8	2,108.8	3,016.1	2,296.1
Own account worker	5,880.7	2,053.2	5,961.6	2,082.3
Unpaid family worker	3,941.9	7,142.9	3,940.1	7,286.1

Source : Key Statistics of Thailand, 1988

TABLE V NUMBER OF STUDENTS IN INSTITUTION BY LEVEL OF EDUCATION ACADEMIC YEAR 1983-1987

Items	1983	1984	1985	1986	1987
Total	10,280,216	10,407,041	10,449,747	10,720,780	10,727,608
Pre-primary	471,597	531,941	672,080	1,009,131	1,158,466
Elementary	7,272,153	7,233,541	7,151,054	7,160,49.	7,100,226
Lower Scondary	1,224,140	1,304,647	1,308,872	1,277,619	1,217,228
Academic Stream	1,222,037	1,302,258	1,306,251	1,274,973	1,214,698
Technical	2,103	2,389	2,621	2,646	2,530
Upper Scondary	967,573	944,307	934,501	907,231	892,981
Academic Stream	532,888	557,095	564,109	554,586	551,191
Technical	433,722	385,927	370,392	352,626	341,787
Teacher Training <1	963	1,285	-	19	3
Higher Education	344,753	392,605	383,240	366,305	358,707
Technical	152,645	182,529	189,213	164,118	149,342
Teacher Training	75,994	69,592	61,004	52,203	51,050
Bachelor's Degree	102,696	125,984	117,352	132,166	138,258
Higher than Bachelor's Degree	13,418	14,500	15,671	17,818	20,057

Remarks<1 : Excluding Ramkhamhaeng Unuversity & Sukhothaithammathirat Open University

Source : Statistical Yearbook, 1989

TABLE VI DEATH BY PRINCIPAL CAUSE GROUPS: 1984-1987

Cause Groups	Number of deaths				Rate per 100,000 population			
	1984	1985	1986	1987	1984	1985	1986	1987
Total	225,282	225,088	218,025	232,968	444.2	435.5	414.1	434.6
Intestinal infectious diseases	2,405	1,976	2,116	2,612	4.7	3.8	4.0	4.9
Tuberculosis	5,168	5,344	5,169	5,471	10.2	10.3	9.8	10.2
Other bacterial diseases	3,319	3,063	3,555	4,219	6.5	5.9	6.7	7.9
Malignant Neoplasms all sites	13,159	13,964	14,709	16,905	25.9	27.0	27.9	31.5
Diseases of the nervous system	4,585	4,387	4,721	5,550	9.0	8.5	9.0	10.3
Pulmonary circulation & other form of heart disease	16,774	17,827	18,694	21,626	33.1	34.5	35.5	40.3
Cerebrovascular diseases	5,536	4,789	4,844	5,112	10.9	9.3	9.2	9.5
Respiratory system other than the upper respiratory tract	5,123	6,639	5,969	6,758	10.1	12.8	11.3	12.6
Pneumonia	3,757	3,837	3,319	4,577	7.4	7.4	6.3	8.5
Diseases of Digestive system	10,147	10,269	9,785	10,595	20.0	19.9	18.6	19.8
Diseases of urinary system	3,317	3,324	3,211	3,888	6.5	6.4	6.1	7.2
Transport accidents	5,852	4,457	4,408	4,636	11.5	8.6	8.4	8.6
Suicide & self-inflicted injury	3,023	3,008	2,860	3,105	6.0	5.8	5.4	5.8
Homicide & injury purposely inflicted by other persons	7,354	6,131	5,425	5,229	14.5	11.9	10.3	9.7
Notifiable infectious disease according to Infectious Diseases Act 1980 A.D.	1,244	1,277	1,094	1,104	2.4	2.5	2.1	2.1
Others	134,519	134,796	128,146	131,581	265,5	260,9	243,5	245,7

Source : Statistical Yearbook, 1989

TABLE VII AREA AND PR4ODUCTION BY PRINCIPAL CROPS: 1985/1986-1987/1988

(Area in thousand rais <1, production in thousand tons)

	Planted area			Production		
	1985/1986	1986/1987	1987/1988	1985/1986	1986/1987	1987/1988
Rice	63,422	61,571	58,474	20,264	18,826	18,041
Maize	12,377	12,194	10,941	4,934	4,309	2,781
Cassava	7,748	8,820	9,879	15,255	19,554	22,307
Sugar cane	3,443	3,370	3,664	24,093	24,450	27,191
Mung beans	3,426	3,172	2,900	323	301	267
Sorghum	1,935	1,212	1,105	404	211	192
Soy beans	1,524	1,799	2,260	309	356	338
Kenaf	1,454	1,283	1,005	247	226	158
Groundnuts	778	790	763	171	169	162
Cotton	519	315	412	102	57	74

Remarks<1 : 1 rai = 0.16 ha
Source : Statistical Yearbook, 1989

TABLE VIII EXPORTS-QUANTITY AND VALUE OF SELECTED COMMODITIES: 1986-1988

(Quantity in metric tons or thousand number, value in thousand Baht)

Items		1986	1987	1988
Total	Quantity(ton)	231,224,934	299,853,087	403,569,839
Rice	Quantity(ton)	4,523,597	4,443,301	5,701,450
	Value(1000 Baht)	20,314,783	22,703,015	34,676,400
Cassava	Quantity(ton)	6,318,607	6,210,927	8,121,533
	Value(1000 Baht)	19,086,515	20,661,255	21,844,182
Natural Rubber	Quantity(ton)	760,857	885,913	937,701
	Value(1000 Baht)	15,115,860	20,539,175	27,188,744
Prawns	Quantity(ton)	35,478	42,727	54,150
	Value(1000 Baht)	5,056,061	6,732,904	10,259,810
Canned sea animal	Quantity(ton)	205,737	227,246	300,652
	Value(1000 Baht)	10,928,154	13,223,846	20,085,716
Sugar	Quantity(ton)	1,960,635	2,025,759	1,855,156
	Value(1000 Baht)	7,271,482	8,573,249	9,664,045
Textile &	Quantity	x	x	x
Textile articles	Value(1000 Baht)	34,969,041	54,202,567	66,036,561
Garment	Quantity(1000 No.)	303,667	449,696	532,210
	Value(1000 Baht)	20,162,306	35,849,944	44,559,670
Precious, pearls	Quantity	x	x	x
& jewelry	Value(1000 Baht)	13,457,935	20,216,143	24,157,894
IC(integrated	Quantity(1000 No.)	797,321	950,227	686,982
circuits)	Value(1000 Baht)	12,817,982	15,178,802	8,690,888

Source : Statistical Yearbook, 1989

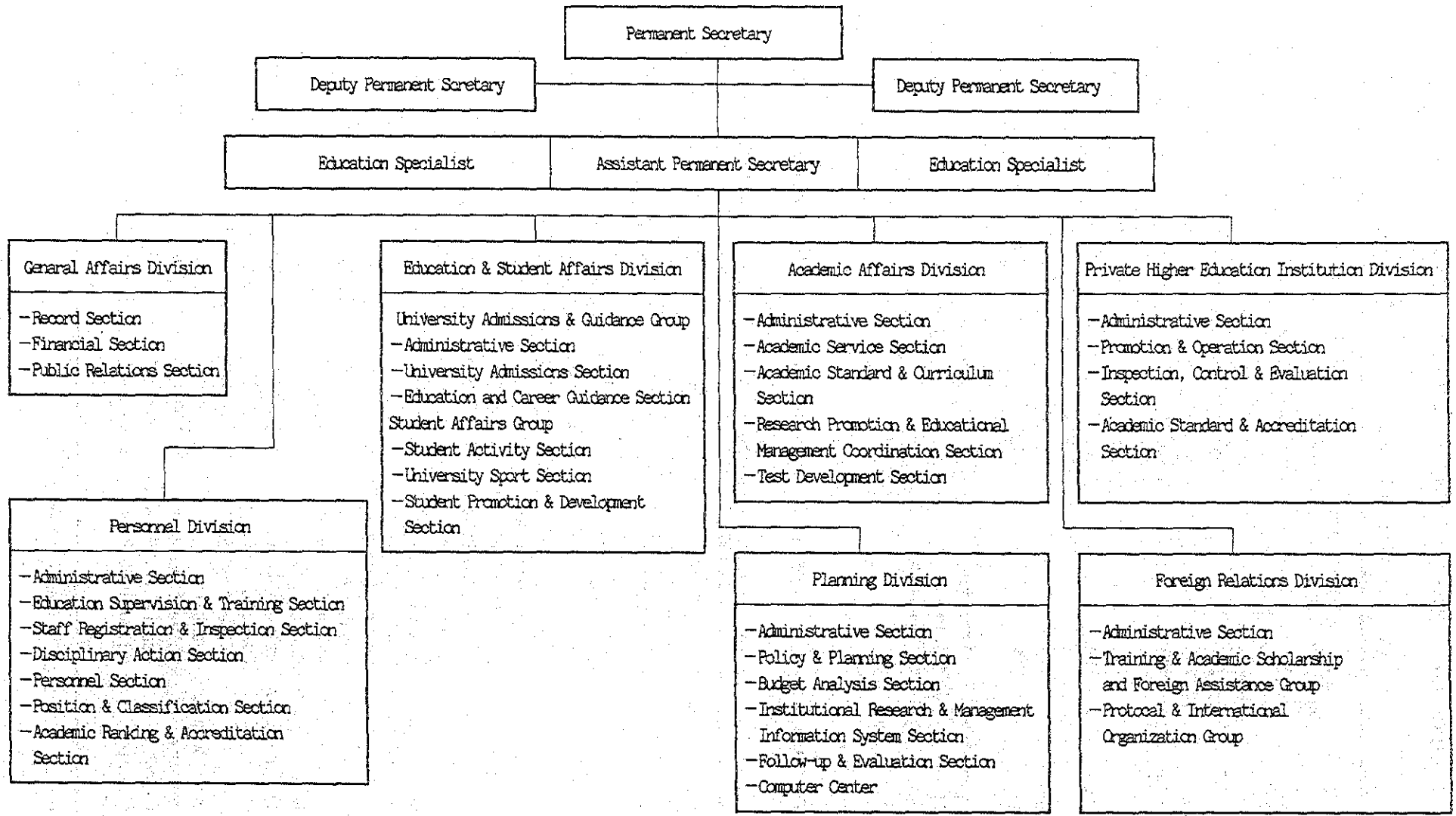


CHART I OFFICE OF THE PERMANENT SECRETARY ORGANIZATION