

PAKISTAN
SCIENCE
FOUNDATION
ANNUAL
REPORT
1979-80



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ANNUAL REPORT

1979 - 80

LETTER OF TRANSMITTAL

Islamabad

Dear Mr. Secretary

I have the honour to transmit herewith the Seventh Annual Report of the Pakistan Science Foundation for the Fiscal Year 1979–80, alongwith its audited accounts, as adopted by the Board of Trustees for submission to the National Assembly as required by the Pakistan Science Foundation Act III of 1973.

Respectfully,

Sd/-

(DR. M. D. SHAMI)
Chairman
Pakistan Science Foundation

Secretary,
Ministry of Science & Technology,
Government of Pakistan,
Islamabad.

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Mr. S. Irshad Ahmad, Managing Director, NESPAK, Lahore.

Dr. G. M. Khattak, Director General, Pakistan Forest Research Institute, Peshawar.

Dr. Abdul Khaliq, Secretary, Health Departement, Government of Baluchistan, Quetta.

Mr. A. G. Mufti, Joint Secretary to the Federal Government, Ministry of Science & Technology, Islamabad.

Sardar M. Habib Khan, Adviser to M.L.A for Food & Agriculture, NWFP, Peshawar.

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LIST OF ABBREVIATIONS

Province:

B	Baluchistan
C	Centre
F	Frontier
P	Punjab
S	Sind

Sponsoring Institutions:

AC	Agricultural College
AU	Agricultural University
EU	Engineering University
QU	Quaid-i-Azam University
KU	Karachi University
HC	Government College, Haripur
PU	Peshawar University/Punjab University
SU	Sind University
KMC	Khyber Medical College
NHL	National Health Laboratories
CSIR	Council of Scientific and Industrial Research
JPMC	Jinnah Post Graduate Medical Centre
NIAB	Nuclear Institute for Agriculture & Biology

Disciplines:

AGR	Agricultural Sciences
BIO	Biological Sciences
ENG	Engineering Sciences
MED	Medical Sciences
PHY	Physical Sciences
CHEM	Chemical Sciences
MATH	Mathematics & Computer Sciences
EARTH	Earth Sciences
OCEAN	Oceanography
ENVR	Environmental Sciences

INTRODUCTION

The creation of the Pakistan Science Foundation, as an alternate source of funding, for the financing of scientific research and the promotion of science, is a landmark in the forward march of the nation on the road to modernization and building scientific and technical capability. It is a recognition of the crucial role of science and technology in change and development and is amongst the more important measures instituted by the Government of Pakistan to create a thriving scientific and technological tradition in the country.

The Foundation is also the fulfilment of a long outstanding demand of the scientific community. The scientists have worked under painfully difficult conditions – viz lack of funds and facilities for scientific work, under-utilization and mis-utilization of highly trained specialists, inadequacy of the information and documentation services, isolation of the scientific workers from the current of modern scientific thought and lack of appreciation by society of the vital role of science in development, etc. A science organization with the requisite authority and financial resources, such as the Pakistan Science Foundation, was badly needed to help the scientists overcome some of these handicaps.

The Pakistan Science Foundation was established on June 30, 1973, under the Pakistan Science Foundation Act, III of 1973 (annexure--I) as a financing agency for:-

- (a) (i) the establishment of comprehensive scientific and technological information and dissemination centres;
 - (ii) the promotion of basic and fundamental research in the universities and other institutions, on scientific problems of national significance relevant to the socio-economic development of the country;
 - (iii) the utilization of the results of scientific and technological research, including pilot plant studies to prove the technical and economic feasibility of processes found to be promising on a laboratory scale;
 - (iv) the establishment of science centres, clubs, museums, herbaria and planetaria;
 - (v) the development of learned bodies, scientific societies, associations and academies engaged in spreading the cause of scientific knowledge in general or in the pursuit of a specific scientific discipline or technology in particular;
 - (vi) the organization of periodical science conferences, symposia and seminars;
 - (vii) the exchange of visits of scientists and technologists with other countries;
 - (viii) the grant of awards, prizes and fellowships to individuals engaged in developing processes, products and inventions of consequence to the economy of the country; and
 - (ix) special scientific surveys not undertaken by any other organization and collection of scientific statistics related to the scientific effort of the country.
- (b) The Foundation was also charged with the responsibility to:-
- (i) review the progress of scientific research sponsored by the Foundation and evaluate the results of

such research;

- (ii) maintain a National Register of citizens of Pakistan who are highly qualified and talented scientists, including engineers and doctors, in or outside Pakistan and to assist them, in collaboration with the agencies concerned, in finding, within Pakistan employment most suited to their genius; and
- (iii) cultivate liaison with similar bodies in other countries.

The achievements made by the Foundation during the performance of above statutory functions are described in the ensuing chapters.

CHAPTER – I

ACTIVITIES AND PROGRAMMES

The salient features of the progress made by the Foundation during 1979–80 in the discharge of the functions entrusted to it under the Charter are summarised below:

I. **Establishment of Scientific and Technological Information and Dissemination Centre (PASTIC) at Islamabad:**

(i) *Revised PASTIC Project*

The revised project of PASTIC was approved by the ECNEC on 14th Sept. 1979. The distinctive features of the revised scheme, interalia, are: the creation of a National Information Net-work with the participation of S&T organizations alignment of the national information network with the regional and international information system; training programme for the professional personnel in the contemporary methods and techniques of information handling and management; initiation of industrial information; building up National Science Reference Library and construction of a permanent building for PASTIC.

(ii) *Implementation of Revised Project*

As a step forward towards the implementation of the revised project, the following actions were taken:

(a) *UNDP Technical Assistance:*

A document for obtaining UNDP technical assistance as envisaged in the revised PC-I was prepared and forwarded to the Economic Affairs Division through the Ministry of Science & Technology for further necessary action.

(b) *PASTIC Permanent Building:*

The model of three storeyed PASTIC building was prepared by the PEPAC (the local Consultant Architects) on the basis of architectural design prepared by the UNESCO Consultant Architect namely Mr. Michale Brawne. The structural drawings and basic quantities, required for the construction of the building were prepared by the Pak. P.W.D. The construction of PASTIC buildings was started on 5th June, 1980 with the ground breaking ceremony held on site at the Quaid-i-Azam University Campus, Islamabad.

(c) *National Information Network System:*

Basic information was collected from Libraries of various universities and centres of excellence/ specialized institutions about their holding for the establishment of information network system.

(d) *National Science Reference Library:*

Eighty nine (89) reference books published on different S&T topics were acquired for the Library. Furthermore, 400 valuable scientific and technical reference books and journals worth Rs. 60,000/- were received under the Netherland Technical Assistance Programme.

(iii) *PASTIC Services:*

In addition to above mentioned developmental work, the PASTIC continued to provide the following

services to the S&T users

(a) *Information Transfer and Current Awareness Services:*

Current and latest information in the form of NTIS reports, catalogues and state of art review on S&T subjects of vital interest were disseminated to the end users to facilitate them in selecting and ordering NTIS literature. As a result of these services, an order for supply of 4400 NTIS reports costing US \$ 8,000 was placed and necessary arrangements were made to procure these reports from US NTIS. Apart from this, one hundred and thirty more reports were ordered from other sources. These were also procured and supplied to clients during the period under review.

(b) *Patent Information Service:*

One hundred and ten (110) patent orders were received by PASTIC for the supply of patent specifications and indexes relating to various technological topics. Out of these, one hundred and six (106) were supplied to the clients. Canadian patents have been assembled, listed and published on nine industrial and technological topics and disseminated to about three hundred (300) R&D organizations in the country.

(c) *Supply Service (Document, translation, bibliography and printing)*

Three thousand five hundred and fifty seven (3,557) fresh requests were received from different scientific and technological organizations, universities, industries, other academic institutions and individual scientists during the period under review. All the above orders have been acknowledged and processed and orders placed with the internal and foreign supplying agencies and cooperating libraries. Two thousand, seven hundred and thirty five (2,735) orders have been fulfilled by supplying various documents containing fifty eight thousand, five hundred and twenty two (58,522) photocopy pages, three thousand, seven hundred and sixty three (3,763) microfilm pages, seventeen thousand, two hundred and seven (17,207) translated words. two lac, thirty one thousand, three hundred and eight (2,31,308) printed impressions were reproduced and despatched to the clients.

(iv) *INFOTERRA Focal Point:*

In order to popularise International Referral System (UNEP/INFOTERRA) among the environmental scientists, a user's guide and three brochures on various services being offered by the PASTIC were sent to nearly one hundred (100) institutions. About twenty (20) queries from individual researchers in the field of Environment received by PASTIC have since been replied.

(v) *Publication of Pakistan Current Contents and Pakistan Science Abstract*

Six volumes of Pakistan Current Contents (Monthly) were published and supplied to two hundred fifty (250) R&D organizations. Nearly seven hundred (700) abstracts of the articles contained in local S&T journals were produced and the author and subject indexes compiled for two more volumes of Pakistan Science Abstracts.

(vi) *Visits/Training Programme:*

During the report period following visits and training programmes were arranged.

(a) Miss. Vietta Dowed, representative of National Technical Information Service (NTIS) USA visited PASTIC National Centre, Islamabad and sub centre, Karachi and discussed various measures for improving NTIS services within Pakistan.

(b) Dr. A. R. Mohajir, Project Director, PASTIC represented Pakistan in the UNEP/INFOTERRA con-

ference on Management of Environmental Information which was held from 1–6 October, 1979 at Moscow, USSR

- (c) Mr. Ghulam Hamid Khan, Senior Documentation Officer, attended Training course in Environmental Information Handling and Management held at New Delhi, India from 2–11 April, 1979.
- (d) Mrs. Sultana Akhtar, Documentation Officer, attended the UNESCO training programme on Information Handling organized at New Delhi, India from 10–22 September, 1979.

II. Research Support

The promotion of basic and fundamental research in Universities and other Institutions on Scientific problems relevant to the socio-economic development of the country.

The Foundation carries out its statutory responsibility for the support of research through the programmes namely (a) grants of research projects submitted by individuals or groups of scientists in the universities and other research institutions (b) institutional support – provision of equipment, literatures, staff training facilities, etc. to build institutional capability for conducting research (c) organization of integrated research programmes: (d) support for participation in regional and international research programmes.

(a) *Grants of research projects submitted by individual research workers or group of scientific workers:*

One of the major functions of the Foundation is to promote and finance basic and fundamental research having relevance to the socio-economic needs of the country. The progress made under this head is an under -

Twenty seven (27) projects requesting for funds costing Rs. 8,622 million were received by the Foundation during the report period. Thirty six (36) project proposals at various stages of their processing were brought forward from the previous year. Thus in all 63 project proposals remained under active consideration of the Foundation during 1979-80. Out of these only 29 projects could however, be sanctioned at an estimated cost of Rs. 2,580 million. List of the sanctioned grants is given at Appendix-II.

The criteria for research grants are. (a) competence of the scientific personnel available to carry out the research (b) institutional capability i.e. availability of requisite equipment, library facilities and support from scientific colleagues (c) scientific merit of the proposed research, (d) likelihood of completion of the project within the stipulated time.

Each proposal after the initial review was placed before the relevant Technical and Finance committees prior to the final sanction by the Executive Committee of the Foundation

Discipline-wise distribution of grants so far made by the PSF is shown in table-I (page 6).

TABLE - 1

SCIENTIFIC RESEARCH PROJECTS SANCTIONED DISCIPLINE WISE DURING JULY, 1973 TO JUNE, 1980

Discipline	1973-74		1974-75		1975-76		1976-77		1977-78		1978-79		1979-80	
	No. of Scheme	Amount Sanctioned	No. of Scheme	Amount Sanctioned	No. of Scheme	Amount Sanctioned	No. of Scheme	Amount Sanctioned	No. of Scheme	Amount Sanctioned	No. of Scheme	Amount Sanctioned	No. of Scheme	Amount Sanctioned
Agricultural Sciences	1	0.362	6	1.636	8	1.163	3	0.429	2	0.252	--	--	2	0.253
Biological Sciences	9	1.470	13	2.162	2	0.074	9	0.999	3	0.139	5	0.453	8	0.747
Chemical Sciences	7	1.409	9	1.262	8	1.037	11	1.319	6	0.372	6	0.980	10	0.727
Earth Sciences	1	0.300	3	0.391	3	0.079	3	0.339	--	--	1	0.049	1	0.054
Engineering Sciences	1	0.057	1	0.035	1	0.030	1	0.267	--	--	--	--	--	--
Environmental Sciences	--	--	--	--	3	0.379	6	0.686	--	--	1	0.115	3	0.274
Mathematical Sciences	1	0.069	1	0.100	1	0.045	--	--	--	--	--	--	--	--
Medical Sciences	1	0.014	7	0.185	2	0.270	5	0.446	2	0.122	1	0.049	2	0.101
Oceanography	1	0.146	--	--	1	0.036	--	--	--	--	--	--	1	0.283
Physical Sciences	4	0.441	1	0.514	--	--	3	0.934	3	0.538	4	0.492	2	0.136
TOTAL:	26	4.268	41	6.285	29	3.113	41	5.319	16	1.423	18	2.038	29	2.575

Research Projects.

Summaries of the research proposals sanctioned during the year 1979–80 are given below :

1. Agricultural Sciences*

P–AU/AGR (31/1)

Title: *Genetical investigations supported by cytological studies of branched ear derivatives in wheat.*

This project is an extension of the research work carried out under the project entitled "Cytogenetic studies of branched ear derivatives in wheat", wherein efforts were made to find out various parameters for unstable behaviour of most of extracted lines in wheat.

During the extension proposal, transfer of the character of branching of spike in wheat species from *T. turgidum* to common bread wheat *T. aestivum* will be studied and efforts will be made to establish stable lines with spike possessing more than 100 fully developed kernels per spike. Crosses will be made between promising derivatives and resistant varieties of *T. aestivum* for developing varieties which are resistant against leaf rust, etc.

The development of such varieties would help increasing the wheat yield.

P–PU/AGR (64)

Title: *Eco-Physiological studies on some important weeds of wheat.*

Weeds are undesirable plants which compete with cultivated crops for water, mineral nutrients, light, space and other growth requirements thereby adversely affecting the quantity and quality of the produce and in general cause greater losses than either insects or plant diseases.

The project envisages following studies on three species of weeds namely *Chenopodium allum*, *Asphedelus tenuifolius* and *Euphorbia helioscopia* in various districts of Punjab

- (i) Preliminary survey of the occurrence of important weeds in wheat fields around Lahore.
- (ii) Analysis of soil samples at site of their minimum and maximum occurrence.
- (iii) Seed germination in relation to climate and other environmental factors, and
- (iv) Weed crop competition.

The results of this study will help in taking suitable measures for the biological control of above mentioned weeds.

P–AU/BIO (40/1)

Title: *Control of avian and mammalian pests of Agriculture*

Detailed study on the ecology, behaviour, reproductive biology and economics of all the major Rodent pests and preliminary study on avian pests like house sparrow and rose ringed parakeet in central Punjab were conducted under a PSF grant No.: P–AU/Bio (40) during the year 1976–79.

The present project being an extension of the previous work, aims at evolving suitable techniques for the control of rodent and avian pests which may be used by the ordinary farmers.

* For names of the Principal Investigators and sponsoring institutions refer Annexure–II.

The results of these studies will help the farmers in saving the economic loss due to Rodents and birds.

P-PU/BIO (74)

Title: *Biological control of plant diseases caused by root infecting pathogenic fungi.*

Wilts, root rots, stem rots, damping off and various smuts are major diseases of the plants of economic importance. The pathogens in these diseases are soil born and the infection takes place through the root. The soil also contains spores of Endogone fungi which forms various species of mycorrhiza a "universal symbiont", known as Vesicular Arbuscular mycorrhiza, which is a deterrent to pathogenic root infection. Moreover the sulphur compounds, coming out of the crucifer plants as exudates from the roots, also suppress the activity of the soil pathogens.

The project aims at investigating the antibiotic role of VA mycorrhizas and exudates of crucifers against soil born pathogenic fungi and finding out bases for pathogenesis and resistance in various mycorrhizal fungi and root pathogens.

The results of the study would enable the researchers to propose suitable measures for the control of the root diseases of forest and agricultural plants.

P-AU/BIO (86/1)

Title: *Epidemiological survey and serogrouping of type strains of leptospirosis in the vertebrate animals in Pakistan*

A survey was conducted under PSF grant No. P-AU/Bio (86) to study the occurrence of type-strains of Leptospirosis in vertebrate animals in the Lahore Division. The survey has revealed a high rate of incidence of Leptospirosis in buffaloes, cows, sheep and horses. Man being in close association with these animals, catches infection through their urine and through the carriers of pathogens which are rats.

The project which is an extension of previous work aims at collecting serum samples from a wider range of domestic animals as well as human beings for detection of agglutinin and its possible correlation with specific disease conditions in animals and men.

P-PU/BIO (91)

Title: *Studies on the incidence of Hydatid in Lahore Division and its effects on the Host tissues.*

The project envisages studies on the occurrence, bionomics and epidemiology of hydatidosis in Pakistan and its effect on host tissue. The results of this study would provide reliable information about the occurrence and magnitude of losses caused by hydatidosis in Lahore Division which could serve as an index for other parts of the country with more or less similar ecological conditions.

S-KU/BIO (92)

Title: *Majid crabs of the Arabian sea.*

The coastal waters of Pakistan are rich in marine life among which crustacean fisheries are a major source of protein rich food. At present, local fisheries is supported by penaeid prawns. There is, however, a need for studying other crustacean as possible fisheries resources – even if not for local consumption then for export purposes.

The project aims at conducting a detailed faunistic study on crabs belonging to family Majidae. The results of these investigations will be published in the form of a monograph on Majid crabs of Pakistan.

P-PU/BIO (93)

Title: *Morphological and metabolic hazards of chlorinated insecticides on small mammals in Pakistan.*

Insecticides, specially those of organochlorinated type are being used extensively for increasing the agricultural production in country. These have been reported to effect the non-target animals adversely by their bio-activation in the mammalian system. Their effects on histology of liver; reproduction and reproductive behaviour; genetical complements and characters; blood Chemistry and their preferential deposition in various tissues of the body have been reported by different researchers.

This project envisages morphological and bio-chemical investigations on the effects of chlorinated insecticides on the liver and blood of small mammals.

The data thus collected will be of great help in controlling the unwarranted use of these insecticides and for extrapolation of results to human beings.

S-KU/BIO (98)

Title: *Floating raft cultivation of the green mussel (Perna viridis).*

Increased fishing pressure on natural fish stocks and reduced yield from some of the conventional fisheries have served to focus attention on aquaculture which is an effective means of filling the gap in current and future supplies of many of the favoured seafoods. The cultivation and artificial propagation of desired species of marine animals involve specialised techniques. The animals which land themselves most easily for cultivation are two groups of sedentary bivalve molluscs, namely, Mussels and Oysters. These shellfishes are fairly abundant on the coast of Pakistan and their biology has already been studied to some extent. As there is not much demand for mussels or oysters in Pakistan so that if a fishery is to be developed in our country, it would have to be an export fishery, more or less along the lines of our shrimp fishery which are exported frozen and canned from Pakistan to earn a considerable amount of foreign exchange in addition to providing means of livelihood to a large number of local fishermen.

The scheme aims at establishing a pilot project for artificial cultivation of green mussels through floating raft method.

The results of this study will be handed over to The Marine Fisheries Department for development of an export fishery based on cultivated mussels.

S-KU/BIO (99)

Title: *Catalogue/records of the Zoological Museum of Karachi University*

The Zoological Museum of the University of Karachi possesses over two hundred thousand specimens of terrestrial and aquatic animals mostly from Pakistan and some from foreign countries. In the past years, efforts were made to study selected groups of insects, birds and invertebrates and results of these studies published in the form of Museum records. However, no concentered efforts have been made towards developing proper check lists or records of the entire holdings of the museum.

The project envisages proper cataloguing and preparing check lists of the holdings of the Zoological Museum of Karachi University for their eventual publications in the form of Zool record/bulletins.

The revised catalogues/records, on completion would be an important source for the compilation of the fauna of Pakistan.

2. **Chemical Sciences**

S-KU/CHEM (89/1)

Title: *Primary Metabolites of Fungus candida and their Biological activity*

This proposal is an extension of the project entitled; Investigation of fungal metabolites of *Candida albicans* & *C.tropicalis* carried out under PSF grant No. S-KU/Chem (89). The preliminary investigations have revealed two higher molecular weight proteins one of which has shown some proteolytic activity.

The extension work envisages identification and characterization of metabolites from *Candida albicans* and *C. tropicalis* and testing their biological activity as anti-influenza and anti-carcinogenic agents.

P-GC/CHEM (90)

Title: *Fisher Tropsch synthesis-Production of liquid fuel from coal.*

In the past decade, there has been considerable rise in prices of crude oil due to decrease of petroleum reserves in various countries and increasingly more demanding requirements in environmental protection, particularly in the energy producing sector. These developments have given impetus to deliberation/research identification of new sources of energy as well as conversion of raw materials like coal into non polluting fuel.

This project aims at developing an economical process for conversion of coal into liquid fuel through a modification of Fischer-Tropsch synthesis method developed in Germany in 1945.

The results of this study will help obtaining non-polluting heating and motor fuels as well as other basic chemicals for the organic industry from coal of which large deposits are available in the country.

P-CSIR/CHEM (93)

Title: *Production of various types of enamels.*

In Pakistan, the enamel industry is not fully developed. The general technology is already known to our enamelling factories, but the manufacturing of the enamels is beyond their technical know-how. Accordingly, these factories are using the imported enamel powders.

The project aims at developing enamels of varied properties and colours from the indigenous raw materials such as quartz, feldspar, clay and flourpar which are abundantly available in the country.

The results of these investigations may help preparation of enamel powder from the indigenous sources on pilot plant scale.

S-SU/CHEM (98)

Title: *Effect of snake venom on cancerous cells and other proteins.*

Presently, research work on cancer and its treatment has become very long drawn and expensive. Billions of dollars have gone into these projects in various countries. The only successful treatment so far is generally by radiation of various kinds alongwith some drugs. Some reports in popular magazines and semi-scientific journals have appeared in which people have used snake venom for the treatment of cancer on the proviso that lysis of new cells will be purpential. It is known that the snake venom has the effect on certain blood coagulation factors. It causes the activation of Prothrombin which is quite similar to the physiological activation by Xa-th factor.

The project aims at investigating the use of snake venom for the treatment by undertaking the physiological studies and biochemical analysis of various types of snake venom and their interaction of cancerous tissues and the entire body of normal and experimental animals.

The results obtained may prove to be interesting not only for the application to cancerous tissues but also from the academic point of view.

C–QU/CHEM (99)

Title: *Investigation of Hydrolysis Mechanism of Lactones.*

Lactone rings are very important in pharmacologically active compound such as (Santonin Pulchellin, with oferin). It has been found that the hydrolysis mechanism of γ -Lactones is influenced by the number and the type of substituents present in the ring. The electron donating groups stabilize the ring while the electron attracting groups destabilize it. The structure dependence of ester hydrolysis is well known. However, the mechanism of lactone hydrolysis and its dependence upon structure, an analoge of ester, is not yet established.

The present work envisages to syntheses a series of γ -Lactone and to study the hydrolysis mechanism by the mass spectrometric method.

P–CSIR/CHEM (103)

Title: *Microbial production of Xanthan gum for industrial use.*

Xanthan gum produced by fermenting molasses or glucose finds extensive use in food and other industries. The basic raw materials and technical know-how in terms of fermentation technology are available. However, the process for the microbial productions of Xanthan gum needs to be developed.

The project aims at (i) screening & selection of bacterial culture capable of producing Xanthan gum and improving their ability to syntheses the product at high yield and productivity, (ii) kinetic studies of growth and product formation in 10 & 50 liter capacity fermenter (iii) production of Xanthan gum at a pilot plant in 100 x 500 liter fermenters (iv) evaluation of the product in food industries.

The results of this study will benefit the food, pharmaceutical, ceramics glazing, paint and other industries.

S–CSIR/CHEM (105)

Title: *New medicinal derivatives from santonin*

The santonin which is insolated from Artemesia plants is useful as an anthelmintic. As santonin is now being replaced by other anthelmintics, it is necessary to develop new uses for this raw material to ensure a market in future for this product.

The project aims at isolating the santonin and other compounds from Artemesia plants and synthesing its derivatives of especially those containing Aziridine and medium sized heterocyclic rings which are known to have tumor inhibiting activity and pain killing effects respectively.

The results of these investigation may yield some new medicinal derivatives from Artemesia.

P–PU/CHEM (106)

Title: *Synthesis and catalytic aspects of new transition metal alkyls and aryls.*

One of the major problems being faced by the world over is how to make efficient use of the conventional

resources of energy. Efforts are being made to solve this problem through various methods including the development of new and effective chemical processes. Many of the chemical reactions catalyzed by transition metal species involve the production of reaction of hydrocarbons and their derivatives. Thus detailed study of chemical compounds with transition metal carbon bonds would help developing new chemical processes.

The project envisages to investigate the chemistry of transition metal alkyls and aryls exhibiting unusual structures and chemical reactivities that are likely to make these of particular value as homogeneous catalysts. For this purpose the synthesis, reactivity, and structures of diverse transition metal alkyls and aryls, with particular emphasis of kinetic and catalytic aspects will be studied.

The development of new catalyst system, as a result of these investigations, may help in improving the efficiency and selectivity of the chemical processes to carry out specific chemical transformations.

P-CSIR/CHEM (107)

Title: *Pilot plant production of Butanol by fermentation*

Butanol and its derivative Butyle acetate being the industrial chemicals, are imported in the country for paint industry and for the recovery of penicilline from fermented broth.

The project envisages the development of a technology for the production of butanol through fermentation, under anaerobic condition, of molasses which is abundantly available in the sugar industry of the country and is presently being exported at throw-away prices.

The results of these investigations would help utilizing the indigenous raw material and saving foreign exchange which is being spent on the import of butanol and its derivatives.

P-PU/CHEM (112)

Title: *A study on removal of industrial pollutant gases by absorption.*

The absorption of such gases are react with liquid reactant or among themselves in the presence of an inert liquid is an important purification process for the removal of toxic gases from chemical and allied industries like fertilizers, natural gas, heavy chemicals etc; which pose great danger to the biosphere in the form of atmospheric pollution. One of the problems with this reaction is that a gas after being absorbed in a liquid may undergo a chemical reaction not only with the liquid but also with the product being formed, which reaction may influence the rate of the gas absorption.

The project envisages a study of simultaneous absorption of H_2S and CO_2 into aqueous solution of a variety of amines and simultaneous absorption of SO_2 and CO_2 into aqueous slurries of fine suspended particles of alkaline earth hydroxides $Ca(OH)_2$, $Mg(OH)_2$, $Zn(OH)_2$ and $Ba(OH)_2$

The data thus obtained will be useful in designing industrial scrubbing systems for pollutant-free emissions. It will also contribute to the existing knowledge of gas absorption with chemical reaction.

3. Earth Sciences

P-PU/EARTH (24)

Title: *Geochemistry and mineralogy of the speckled sandstone formation and the related rocks in Salt Range, Punjab.*

There is a general impression that metallic minerals do not occur in the province of Punjab. However, the

nature of origin and mode of formation of the Salt Range indicates that its material was derived from south as the weathered stuff of the Indian Peninsular region. The occurrence of metallic minerals, therefore, cannot be ruled out entirely. Furthermore, sporadic staining of rocks due to copper minerals is known, particularly in the so called speckled sandstone formation.

The proposal is aimed at carrying out detailed geochemical and mineralogical analyses of the speckled sandstone formation and to find out quantitatively, the real potential of the rocks with special reference to metallic elements such as copper, gold, silver etc.

The result of this study will provide information regarding the availability of major as well as minor elements in these rocks.

4. Environmental Sciences

P-NIAB/ENVR (18)

Title: *Mutagenicity testing of children's consumables.*

In under developed countries, the use of substandard food which may contain strongly mutagenic compounds as bacterial and fungal metabolites or as additive to improve the quality of inferior food products, is abnormally high. Exposure of our population to hazardous compounds is further increased by excessive and unnecessary use of newly available synthetic chemicals and large scale adulteration in food stuff.

The project aims at determining the presence of mutagenic contaminants in prepared food, generally consumed by children in different parts of Pakistan. For this purpose about 400 children's food samples collected from three areas presenting different modes of life will be tested for the presence of genetically active contaminants. Genetic activity will be determined by induction of mutation.

The information obtained will be used to create public awareness against the chemicals having mutagenic activity.

P-PU/ENVR (3/1)

Title: *Ecological studies on fresh water hypomycetes*

The project being an extension of scheme with same title, conducted under PSF grant No. P-PU/ENVR aims at investigating the effects of hydrocarbons and other pollutants on the growth and sporulation of fresh water hypomycetes and pathogenicity testing of various isolates on susceptible crops and survival of hypomycetes in submerged plant debris under drier conditions.

The results would help establishing a correlation between the fungi and the degree of pollution caused by various fertilizers and pesticides.

P-GC/ENVR (23)

Title: *Hydrobiological studies of the lakes of Punjab*

The natural and artificial lakes are reservoirs of fresh water which can be used for domestic, industrial or agricultural purposes. However, many of the lakes receive either municipal wastes or pollutant which are washed down the streams from the fields and may result in changing the water quality as well as fauna & flora of these lakes.

The project envisages a hydrobiological survey of the lakes in Punjab to find out, on seasonal basis, the

(i) physio-chemical nature of the water; (ii) variations in fauna and flora and their correlation with each other and (iii) factors responsible for the eutrophication of lakes.

The result of this study would provide basic hydrobiological data on the water reservoirs in Punjab.

4. Medical Sciences

S-JPMC/MED (44)

Title: *Investigations on therapeutical values of indigenous plants used in traditional medicine for the control of Diabetes.*

Diabetes is a life long misery requiring a strict control of diet and continuous medication in the form of oral hypoglycemic agents or parenteral administration of insulin itself. The type of diabetes prevalent in Pakistan and other tropical countries are mild in nature and responsive to oral hypoglycemic agents. A number of plants are being used in the Unani system of medicine for the control of diabetes in the Indo-Pakistan subcontinent. However, their efficacy in the control of diabetes on the scientific lines is not known.

The project aims at establishing the efficacy of indigenous plant products in the control of diabetes in alloxan induced diabetic rats and their metabolic action in diabetic state on more scientific lines. The plants which are known to have antidiabetic properties, showing promising results during initial scrutiny, will be subjected to detailed investigations. At a later stage the isolation of active constituents and their identification and characterisation will be carried out.

The results of this study besides establishing the efficacy of indigenous plant products, may provide some new anti-diabetic drug.

S-KU/MED (45)

Title: *Haemoglobin structural changes and their impact on functions.*

Anaemia is an important health problem in developing countries. Though it is presumed that most of the cases are due to nutritional deficiencies, it would be interesting to determine the contribution of abnormal haemoglobin to this condition.

The project envisages a systematic study of the abnormal haemoglobin in anaemic pregnant patients (i.e., those with 9g or below) attending the antenatal clinic in Jinnah Postgraduate Medical Centre, Karachi. Later when the patients are admitted in labour the cord blood will be taken for study. Once a mutant haemoglobin has been detected, the Amino acid sequence of the isolated abnormal peptides shall be determined and mutational site established. The effect of structural changes will be co-related with functions of molecule.

The results of this study will help in diagnosis and therapy of haemoglobinopathies and will give an indication to the cause of anaemia either due to structural defects of haemoglobin or due to nutritional defects.

5. Marine Sciences

S-KU/Ocean (4)

Title: *Shore erosion studies of Pakistan coast in the Vicinity of Karachi.*

During the last decade, marine sciences/oceanography have developed rapidly in all the advanced countries of the world so as to exploit the oceans for fuel, ores, minerals and food potential. However, in Pakistan, except for some information about marine fauna and flora, weather, waves, tides etc., the basic data in respect of oceanography

is not available.

The project envisages a study of shore erosion which is caused due to waves and tides of the ocean and training researchers in the field of physical oceanography.

The result of this investigation may throw some light on measures to be taken for preventing erosion of coastal area.

6. Physical Sciences

S-KU/Phys (24)

Title *Measurement of electrical conductivity of some solids at and below room temperature.*

Solids are extensively used in industries, laboratories and agriculture. The behaviour of solids is studied by working their optical, thermal, electrical, magnetic and mechanical properties. The intrinsic behaviour of solids however, cannot be studied at and above room temperature because lattice vibrations dominate and mask other properties. The nature and mechanism of defects can only be studied at lower temperature.

The project aims at studying the electrical conductivity of some solids such as copper, brass and steel at and below room temperature. The result of this study would help in understanding the electrical behaviour of solids.

C-QU/Phys (33)

Title. *An investigation of the weak and electromagnetic interactions of particles with particular reference to high energy neutrino scattering and electron positron annihilation.*

The basic forces of nature can be classified into four type, namely strong, electromagnetic, weak and gravitational in descending order of their strength. Unifying these forces into a single master force is a physicists' ultimate dream. Extensive research is in progress in this direction.

The project envisages the analysis of (i) vast experimental data on various distributions to deduce the quark-parton structure of various hadrons in fine detail and precise information about the quark fragmentation functions, (ii) di / tri leptonic events discovered at the Fermi Lab. in USA and CERN in Geneva and (iii) to investigate the jet structure in the electron positron annihilation at high energies.

The result of this project would help understanding various properties of the Charmed Particles particularly their weak interactions.

(b). Institutional Support:

The Pakistan Science Foundation assists in the provision of equipment and chemicals, etc., to research workers, who for some reason are unable to get these from their own institutions and it is established that such support would lead to quick progress of research of national significance.

Some of the grants sanctioned during the current year, to enhance the institutional capabilities are as follows.

- (i) An amount of Rs. 1,14,000/- was sanctioned to the Gomal University, D.I.Khan for the purchase of an Atomic Absorption Spectrophotometer.
- (ii) An amount of Rs. 15,000/- was sanctioned to the Army Medical College, Rawalpindi, for the purchase of library books/reference material.

III. Utilization of Research Results

Title: *The utilization of results of scientific and technological research including pilot plant studies to prove the technical and economic feasibility of processes found to be promising on laboratory scale.*

The Pakistan Science Foundation provided financial assistance to the R&D institutions to utilize the results of research and develop appropriate technologies for the following projects:*

PSF/ATDO/UTZ (41)

Title: *Conversion of petrol engine to bio-gas.*

The project involves the manufacture of a small 2-6 H.P. spark ignition engine and subsequent modification of the engine to run on Bio-gas, Kerosine, Naptha, Sui-gas and LPG, all of which are cheaper than gasoline and diesel.

The engine if developed successfully, would also serve for pumping water, generating electricity from bio-gas plants to provide fuel for cooking and lightening purposes.

PSF/ATDO/UTZ (38)

Title: *Cement from rice husk.*

PCSIR have evolved by adaption a technology to manufacture cement mainly from rice husk. The cement has shown promising results and can be exploited by recycling agricultural waste to achieve portland cement substitution.

The project envisages the fabrication of pilot plants for the preparation of cement from rice husk and their installation for experimental operation, one each in Punjab and Sind rice growing areas.

The operation of pilot plants under local conditions will be studied for techno-economic feasibility and viability for commercial adoption.

PSF/ATDO/UTZ (45)

Title: *Low-cost rural roads.*

The provision, maintenance and improvement of existing roads within limited resource of the country is becoming a difficult task. Thousand of miles of rural roads and a very large number of light and heavy vehicles plying on them signify the dependence on these roads, of the entire system of collection and distribution of farm produce. Therefore, in order to keep pace with the increasing requirements of transportation, it is imperative to devise ways and means for laying soil stabilized cheap roads by utilizing/improving the existing technologies in this field.

The project envisages the construction of two miles strip of low cost rural road by using soil stabilized blocks of locally available material such as gypsum, soil, sand, lime etc.

The result of this project would provide feasibility report for the construction of rural roads with soil stabilized blocks.

IV. Science Centres

The establishment of Science Centres, Clubs, Museums, Herbaria and Planetaria

The establishment of Science Centres, Clubs, Museum etc. is essential for creating science awareness among

masses in the country. The Foundation is endeavouring to establish such institutions to popularize science among people.

Progress made by the Foundation in this regard is as under :

(a) *Establishment of Pakistan Museum of Natural History*

The scheme for the establishment of Pakistan Museum of Natural History was approved by the Government on 4th November, 1978 and its implementation during 1978–79 was undertaken according to the approved plan.

Further progress made and difficulties encountered by the Museum during the report period are as under :

- (i) As clearance for the appointment of senior directorial staff in the Museum was pending with the government, therefore, remaining project staff could not be inducted and the Botanical & Zoological Divisions could not be initiated as per approved plan of PC-1. The only officer (an Associate Curator) appointed in the Earth Sciences Division continued to establish this Division.
- (ii) The matter regarding bifurcation of 202 acres of land allocated for Zoo cum Botanical gardens and Pakistan Museum of Natural History was taken up with the Ministry of Science & Technology. The case is under their active consideration.
- (iii) Deposit work for the manufacture of office cum laboratory furniture, show-cases and display cabinets for the Exhibit Halls was assigned to M/s Small Industries Corporation, Rawalpindi.
- (iv) Letters of credit worth 0.255 million were opened with foreign suppliers for the import of scientific equipment namely Leitz research microscopes (1), Leitz stereo-microscopes (2), Griffions microscopes and olympus Photographic microscope. Furthermore, office equipment namely photocopying machine, typewriters, stationary etc. were purchased.
- (v) An allocation of Rs. 1 million including a foreign exchange component of Rs. 0.280 million was made in the ADP for the year 1979–80, against which of sum of Rs. 0.930 were utilized.

(b) *PSF National Science Centre*

During the report period the nucleus of PSF National Science Centre, arranged a number of talks/seminars/symposia/film shows etc., for creating public awareness and providing a forum for meeting of scientists and persons from other walks of life.

V. Scientific Societies and Learned Bodies:

The Foundation makes annual grants to the established learned bodies and scientific societies and endeavours to provide all possible assistance to the new ones. Annual grants amounting to Rs. 0.33 million (Annexure–IV) were given this year to various scientific societies and learned bodies for the achievement of their approved objectives.

Special grants totalling Rs 0.13 million were given to various scientific societies/institutions for their publication programmes (Annexure–V)

VI. Science Conferences:

The organization of periodical Science Conferences, Symposia, Seminars etc.

Conferences, seminars and symposia serve as important means for the exchange of ideas and information

amongst the scientific workers. The Pakistan Science Foundation during the report period has provided grants amounting to Rs. 1,05,000/- to various scientific societies/institutions in the country for holding the conferences/seminars (Annexure-VI). A brief account of some of these is given below:

1. The 19th Annual Urdu Science Conference organized by the Scientific Society of Pakistan was held from 1st to 6th Sept., 1979 at Quaid-i-Azam University, Islamabad. The conference was attended by large number of scientists from universities and other research organizations.
2. An International Conference on Recent Advances in Earth Sciences Studies was held from 23 to 28th Jan., 1980 at the Quaid-i-Azam University, Islamabad in collaboration with the Royal Geographic Society, London and the Geographic Society of China, wherein the foreign as well as local geophysicists, geographers and geologists presented papers in the field of Geomorphology, Seismology, Glaciology Earthquake stress and Impulse Radar Techniques for the measurements of glaciers, ice thickness. The Conference was followed by an expedition to Karakorum for field studies
3. The First Annual Conference of Zoology was held under the auspices of the Zoological Society of Pakistan from 30th April to 1st May 1980 at the Quaid-i-Azam University, Islamabad and was attended by the Zoologists from all over the country. The scientists besides presenting the original research papers also reviewed the research so far carried out in various branches of Zoology in order to provide guidelines for future research work relevant to socio-economic needs of the country.
4. The Third National Seminar on Solid State Physics, organized by the Physics Department of the Karachi University, from 23rd to 25th June, 1980 was attended by the physicists from all over the country. The main objective of the Seminar was to keep the physicists informed about the latest development in this field.

VII. Exchange of Visits:

Exchange of visits of Scientists and Technologists with other countries

The Pakistan Science Foundation supports the visits of Pakistani scientists, engineers and doctors for participation in international conferences/seminars held in foreign countries. However, due to financial constraint during the report period, the Foundation sanctioned travel grants totalling to Rs. 34,945/- only to support the visits of three scientists to enable them to present research papers in international conferences/meetings. The details of these grants are given in Annexure-VII.

VIII Awards and Fellowships:

Grant of awards, prizes and fellowships to individuals engaged in developing processes, products and inventions of consequence to the economy of the country

The Foundation did not receive any proposal of Scientific merit for the award of prizes/medals. However, two fellowships were sanctioned under two research projects for M Phil studies

IX. Surveys and Statistics:

Under this programme, the Foundation had assigned a project entitled: "Review of the research in major fields such as Agriculture, Medicine, Irrigation, Housing and Works, Industry etc." to the National Science Council of Pakistan. The achievements made under this project during the report period (i.e. the 3rd project year) are as follows:

- (1) Directory of research establishments in agriculture in Pakistan was finally composed and sent to press for printing.

- (ii) **Directory of scientists and technologists engaged in R&D in the field of Agriculture, stated to be compiled in the previous annual report of the Foundation, has been reviewed further for appropriate additions/amendments and is now ready for printing.**
- (iii) **Compilation work on directory of scientists and technologists engaged in R&D in fields other than Agriculture, could not be finalized due to non-availability of requisite information from concerned research organizations.**

X. Research Evaluation:

The Foundation evaluated the following technical/fiscal reports, received during the report period, as per procedure laid down for reviewing the progress of scientific research supported by the Foundation and evaluating the results of such research.

(i) *Semi-Annual Reports:*

Twenty-nine semi-annual reports, invited after the initiation of each project and after the submission of the annual reports, were scrutinized by the Science Wing to assess the interim progress of these projects.

(ii) *First and Second Annual Reports:*

Eleven First annual and fifteen Second annual reports submitted by the Principal Investigators, after initial scrutiny by the PSF Science Staff, were sent for detailed evaluation to active scientists in the relevant field of specializations.

These progress reports were then submitted to the relevant Technical Committees for consideration along with the evaluation report of the experts concerned. The reports were ultimately accepted by the subject committees.

(iii) *Final Reports:*

Sixteen final reports in respect of the completed research projects, received during the year under report, were also sent to the subject experts for evaluation. On receipt of the evaluation reports, these were considered and accepted by the relevant technical committees.

XI. PSF Scientists' Pool:

The Scientists' Pool, established in the Pakistan Science Foundation in 1973-74, was a step aimed at utilizing high-level trained scientific manpower. During the report period, seven scientists, who had returned from abroad after completing higher education and were looking for jobs suited to their qualifications, were placed on the Scientists' Pool and assigned to various Universities and other Scientific Organizations.

XII. International Liaison:

The Foundation, during the report period, remained in contact with international, regional and national agencies like United Nations Educational, Scientific and Cultural Organization (UNESCO), Man & Biosphere, United Nations Environment Programme (UNEP), Economic & Social Commission for Asia and the Pacific (ESCAP), National Technical Information Centre (NTIS) and US-National Science Foundation and their representatives visited Pakistan Science Foundation to discuss mutual collaboration in the field of Research, Conferences and Seminars.

CHAPTER – 2

PROGRESS OF THE PSF-SUPPORTED PROJECTS

An account of the progress reports of PSF-supported projects, received during the year 1979-80, is given below :—

(A) Final Reports

During the year under review sixteen final reports were received. Particulars of these projects and brief summaries of the achievements made are given below :—

<i>Project No.</i>	: S-KU/Bio (36)
<i>Project Title</i>	: Survey of Trace elements in soils of Sind Province & their effectiveness on the productivity of Wheat & Rice.
<i>Name of Investigator</i>	: Dr. M. Ishaq Khan
<i>Project Particulars</i>	:
Duration	: Three years
Date of commencement	: 1st May, 1975
Date of Completion	: 30th April, 1978
Implementing Agency	: University of Karachi, Karachi.
Total Expenditure	: Rs. 1,08,694.68
<i>Main Objectives</i>	: To examine and record the distribution of trace elements in soil profiles and to find ways and means of increasing the yield of wheat, paddy and cotton under normal irrigation and drought conditions by maintaining the requisite levels of these elements.

Summary of the Work Done:

Soil samples were collected from Tharparker, Nawabshah, Hyderabad, Dadu, Larkana, Sangher and Khairpur districts. Physical and chemical properties of these samples were determined. Analysis of trace elements like Zinc, Copper and Boron in soil samples were also carried out.

Experiments were conducted to study the effects of Zinc, Copper and Boron on the growth and yield of wheat and rice plants. The results achieved are as under.

- (a) Zinc promoted the growth as compared to the control but increasing concentrations did not have any effect. In other pot experiments the effect of Zinc on growth of wheat plants in sandy loam and silty clay soils was also investigated. Zinc supplied in small amount as chelate (Zn EDTA) to plants growing in sandy loam, substantially increased the yield similar to that obtained by large amount supplied as sulphate. The addition of Zinc as chelate and as sulphate to silty clay soil at higher conc (10 lbs/acre Zinc and 5 lbs/acre Zn EDTA) significantly suppressed the yield. Foliar application of Zn as chelate (5 lbs/acre) to plants grown in sandy loam and silty clay significantly

increased the dry matter yield. In field experiments Zinc & Boron applied through the soil significantly promoted the growth of rice plants.

- (b) Pot experiments were also carried out to evaluate the effectiveness of different concentrations of copper by soil and foliar treatments on the growth and yield of wheat plants. The amount of copper in the plants was also determined.
- (c) Effect of boron concentration on the yield were studied in the same manner. Boron when supplied to the clay soil singly or in combination with other trace elements, resulted in a marked reduction of dry matter and grain yield.

The effect of different concentration of boron on the yield of wheat plants were carried out under field conditions. Progressive effects were observed by increasing boron concentrations except the highest (10 lbs/acre), which neutralized the promotive effect.

From the element experiments it was concluded that the fresh weight, dry weight and grain yields of wheat plant responded significantly to the amount of boron and copper present in the soil.

Project No. : P-AU/BIO (40)
Project Title : Ecology of some avian and mammalian pests.
Name of Investigator : Dr. Mirza Azhar Beg

Project Particulars

Duration : Three years
Date of commencement : 1st June, 1976
Date of completion : 31st May, 1979
Implementing Agency : University of Agriculture, Faisalabad.
Total Expenditure : Rs. 88,602.62

Main Objectives : To reduce the Pest birds and rodent populations by evolving a combination of ecological and chemical devices. This would involve studies of their behaviour, life cycles, ecology and reactions of avrious chemical and physical stimuli and thus evolve integrated control programmes which are effective and feasible.

Summary of the Work Done:

A series of basic studies investigating reproductive biology, demography and ecological distribution of pest rodents of agriculture were undertaken. The results of these investigations are summarised below :-

As a first step towards the development of suitable control practices against the Rodent Pests the following aspects of the rodent problem in the croplands of central Punjab are studied.

- Biology and Ecology of the pest rodents.
- Non-geographic variations
- Impact on the Crop System

- Effect of Rain on Rodents
- Food Preferences and Consumption
- Migration Patterns and Habitat Distribution
- Implications for Control

The results of these studies are as under :-

I. **Biology and Ecology of the Pest Rodents**

Intensive trapping in various cultivated crops of central Punjab resulted in the capture of a large number of specimens of rats and mice belonging to the species: Northern Polar Squirrel (*Funambulus pennanti*), Indian gerbille (*Tatera indica*), House mouse (*Mus musculus*), Bandicoot rat (*Bandicota bengalensis*), Shorttailed mole rat (*Nesokia indica*).

The reproductive biology, population structure, abundance and micro-habitat distribution of these species were investigated thoroughly.

II. **Non-geographic Variation**

The specimens collected for the above studies were used for studying non-geographic variations in the body and skull elements, and for assessing the use of dental wear pattern in ageing of the wild-caught specimens. Approximation of age in the field-caught specimens is of central importance in demographic studies.

III. **Impact of Pest on the Crop System**

In the spring of 1977 and 1978 vast areas of wheatland were sampled for rodent damage in Faisalabad, Jhang and Sargodha districts. It was found that 5.0% to 7.5% of the wheat tillers were damaged by rodents. Using this as an index of losses to the wheat crop, it was computed that wheat grains, at least, worth Rupees 36 to 62 crores were annually lost to rodents in the province of Punjab.

Rodent damage to sugarcane was assessed in three districts of central Punjab namely Faisalabad, Jhang & Sargodha. In addition to this, species composition and the mode of injury to the cane stalks were also studied. It was found that only two species namely *B. bengalensis* and *N. indica* were the major depredators of the cane crop. Further it was estimated that rat depredation was responsible for 5 to 15% of decrease in sugar yield.

IV. **Effect of Rain on rodents**

Variation in the intensity of rainfall during 1976-79 afforded an opportunity to study the effect of rain on rodent abundance in a wheatland near Faisalabad. It was found that relatively heavy rains in February 1979 had considerably decreased rodent abundance and depredation in the wheatfield.

V. **Food Preferences & Consumption**

Consumption rates and food preferences with respect to five most common types of food grains were studied in the northern palm squirrel, *Funambulus pennanti*. The order of preference was wheat, millet, rice, corn and sorghum.

The squirrels on the average consumed 6.09 gm/squirrel/day (or 19.13 cal/squirrel/day) when the grains were offered in combinations of two. When only one food item was offered, the rate of consumption was 5.16 gm/squirrel/day (or 16.60 cal/squirrel/day). The squirrels preferred water-soaked grains over air-dried ones.

VI. **Migration Pattern and Habitat Distribution**

The pattern of infestation and migration in *Bandicota bengalensis*, *Rattus meliade*, *Mus musculus*, and

Tatera indica was studied from February 1977 to April 1978 on a 40 hectare canal irrigated farmland near Faisalabad. The first three species infested sugarcane from six to nine months of the year. They began to migrate to wheatlands in large numbers after the crop had started booting. Though in much smaller numbers, these species also infested leguminous fodders. Excepting *T. indica* all species from harvested wheat fields became concentrated in small scattered fields of clover and grassy banks of irrigation ditches. By early June they dispersed to kharif fodders and later on to sugarcane. In the Kharif fodders, *T. indica* was also present. The relative importance of the various species changed from crop to crop.

VII. Implications for Control

The ultimate goal of the foregoing studies on ecology, behaviour and economics was to obtain the data necessary for developing an intelligent and ecologically sound methods of control in the local context. Based on the results of these studies, suggestions for inhibiting rodent depredation in the cropland have been made in several of the research papers mentioned below. Using certain features of these suggestions, a pilot control programme was carried out to protect wheat crop from rodent damage over eight 6-acre experimental blocks, four of which were used as treatment and the other four as reference blocks. The bait used consisted of 96% wheat grains, 2% refined cotton oil and 2% Zinc phosphide. The technique comprised of baiting rat burrows in recently harvested sugarcane fields and surface baiting in wheat fields. As a result of the poisoning programme, damage to wheat tillers declined to 3.2% and the density of rat burrows in the treatment blocks reduced to 2.2 burrows/acre whereas the damage to wheat tillers in reference block being 12.4% and the density of burrows 9.8 acre.

A tentative strategy for alleviating the rodent problem in the croplands has been chalked out and its application will be studied in detail in the extension proposal now in operation.

Publications as a result of these investigations

1976. Field biology of *Mus musculus* and *Mus booduga* in the Punjab; Pak. J. Zool; 8(2); 135–141.
1977. Reproduction in the Indian gerbille, *Tatera indica* (Hardwicke), Mammalia (France), 41(2): 213–220.
1977. Rodent damage to wheat crop in Faisalabad district, Pak. J. Agri. Sci. 14(4): 37–44.
1977. Reproductive cycle and population Structure of the northern plam squirrel, *Funambulus pennanti* Pak.
1978. Ecology of the field rat, *Rattus meltada pallidior* in central Punjab (Pakistan, Pak. J. Zool., 10(2): 163–168.
1978. Non-geographic variations in *Funambulus pennanti*, Biologia, 24(2): 297–304.
1978. Some additional information on rodent damage to wheat in central Punjab, Pak. J. Agri. Sci., 15 (3-4): 105–106.
1979. Rodent problems in sugarcane fields of central Punjab Pak, J. Agri. Sci., 16 (1-2): 123–199. (Reprints have not yet been received).
1979. Observations on reproduction in *Bandicota bengalensis* and *Nesokia indica*. (Submitted for publication in Biologia).
1979. Inhibiting rodent damage to wheat crop. (Submitted for publication in Pak. J. Agri. Sci.)
1979. Effect of flooding on rodents in wheatlands. (Submitted for publication in Pak. J. Zool.)

1979. Pattern of rodent infestation of field crops on a farmland near Faisalabad. (Submitted for publication in Pak. J. Zool.).

1977. Rodent damage to wheat crop in Faisalabad district, Pak. J. Agri. Sci., 14 (4): 37–44.

Project No. : S-KU/BIO (47)

Project Title : Culturing of microalgae strains to produce animal feeds for commercial exploitation.

Name of the Investigator : Dr. Jamil Ahmed

Project Particulars:

Duration	: Two years
Date of commencement	: 1st July, 1975
Date of completion	: 30th June 1977
Implementing Agency	: University of Karachi, Karachi.
Total expenditure	: Rs. 1,01,685.00

Main Objectives

- (i) To screen microalgae inhabiting lakes, rivers & soils of Sind.
- (ii) To obtain unialgal and exemic cultures.
- (iii) Subsequent studies on their growth, characteristics, chemistry of proteins, amino acids, lysine content, nucleic acids, lipids, minerals and vitamin contents.
- (iv) To test the proteins extracted from these cultures for their digestibility and nutritional value.
- (v) To grow the algal strains on mass scale for commercial exploitation to provide an additional source of protein for human and animal consumption at economical cost.

Summary of the Work Done

Water samples from ten locations in and around Karachi were screened for micro algae and it was observed that *Chlorella*, *Chlamydomonas*, *Oocystic*, *Scenedesmus*, *Monoraphidium*, were abundant in these waters. Thirty algal strains were isolated and brought to exemic state.

Growth of *Chlorella vulgaris*, *Scenedesmus dimorphus* and *Scenedesmus bijuga* were studied in modified Kessler's medium. The effect of the deficiency of various constituents of the medium were also investigated. Attempts were made to devise a cheap medium using urea, super phosphate and soil extract for the growth of unicellular algae.

Moisture, fat, crude fibre, total carbohydrate, total nitrogen, protein, amino acids, nucleic acids, vitamins (riboflavin), and minerals (Na, K, Ca) were determined qualitatively in *Chlorella*, *Scenedesmus*, *Oscillatoria tonuis*, *Chlorococcum humicola* and *Spirulina*.

Nutritive values (digestibility, biological value and chemical score) of *Chlorella vulgaris* and *Scenedesmus*

dimorphus show that these species can be exploited as a valuable source of cheap proteins.

Project No. : PCSIR/BIO (69)
Project Title : Production of amylolytic enzymes for industrial use.
Name of Investigator : Dr. Abdul Qadir

Project Particulars:

Duration : Three years
Date of commencement : 1st October, 1976
Date of completion : 30th September, 1979
Implementing Agency : PCSIR Laboratories, Lahore
Total expenditure : Rs. 52,994.61

Main Objectives

- (i) To study local production and profitable application of amylolytic enzymes.
- (ii) To study the findings on the laboratory scale for commercial production of these enzymes within the country.

Summary of the Work Done

The work done describes the production of amylolytic enzymes such as alpha-amylase and amyloglucosidase by locally isolated cultures of *Bacillus subtilis* and *Aspergillus niger* respectively. The enzymes production was carried out by solid substrate fermentation and submerged fermentation method using wheat bran and brans of other cereals as substrates. Of all substrates, however, wheat bran was found to be the best for the production of these enzymes. Optimum conditions for maximum production by both processes were also determined. The solid substrate fermentation process was found to be more economical for the synthesis of these enzymes using locally available raw materials. Solid substrate fermentation was carried out in 1-litre conical flasks containing wheat bran or bran of other cereals as substrate. The use of wheat bran or rice bran for the production of these enzymes by submerged fermentation process was carried out in one litre conical flasks on rotary shaker and 50 litre glass stainless steel fermenter.

Alpha-amylase of *Bacillus subtilis* in the crude form was evaluated as desizing for the removal of starch from grey cloth in the textile industries. The results were quite comparable with the imported materials. Two tons of maize starch was also hydrolysed at the Paskages Ltd. for sizing paper during manufacturing process. The performance of starch hydrolysate as sizing was quite satisfactory and economical as compared with that of oxidized starch. Maize starch and defatted rice bran were also hydrolysed to glucose by enzyme – enzyme process i.e. using enzymes in the crude form.

The present work describes the production of (i) alpha-amylase and (ii) amyloglucosidase by locally isolated cultures of *Bacillus* and *Aspergillus* species respectively. The selected cultures were further improved by mutation. The enzyme production was carried out by solid substrate fermentation using wheat bran as substrate in one litre conical flasks and by submerged fermentation in stirred fermenters. Alpha-amylase produced in the laboratory was also evaluated as desizing enzyme in textile industry and for starch hydrolysis as sizing in the paper industry for coating purposes.

Publications as a result of these investigations;

1. Biosynthesis of enzymes by solid substrate fermentation II Production of Alpha amylase by *Bacillus subti-*

is accepted for publication in Pak. J. Sci. & Ind. Res. Karachi.

2. Production of Amyloglucosidase in a stirred fermenter (Submitted).
3. Utilization of Rice bran for the production of Amylolytic enzyme. (Submitted)

Project No. : P-PU/Bio (75)

Project Title : Heterotopic transplantation of entire muscles in mammals.

Name of Investigator : Dr. Shezad Mufti

Project Particulars

Duration	: Two years
Date of commencement	: 1st June, 1977
Date of completion	: 31st May, 1979
Implementing Agency	: University of the Punjab, Lahore.
Total expenditure	: Rs. 1,45,639.7

Main Objectives : To determine (i) reaction of pre-denervation treatment to the muscle; (ii) histological, histochemical and biochemical events during successful muscle transplantation; and, (iii) new methods for more successful muscle transplantation in Man.

The results will help identifying the adaptive mechanisms which enable a mammalian muscle, pretreated by denervation or near-cained to withstand the early avascular period following free grafting and to become reintegrated both structurally and functionally with the body of the host.

Summary of the Work Done

A. Various morphological, morphometric, histological histochemical and bio-chemical characteristics of the transplantation of extensor digitorum longus (EDL) muscle in normal and experimental rats were studied and the results achieved are as under:-

1. *Normal EDL Muscle*

A normal rat EDL muscle, which is about 0.06% of the total body weight, and is without any adipose tissue, contains an average of 1514 muscle fibres. Each muscle fibre consists of an average of 3320 sarcomeres each with an average length of 0.02 mm. These muscles contain an average of 4.55 ± 0.15 mg DNA/gm muscle weight and 5.34 ± 0.18 RNA/gm muscle weight.

2. *Entire EDL Muscle After Transplantation*

EDL muscles were transplanted heterotopically without any pretreatment. Almost of all the origi-

nal muscle fibres degenerated followed by regeneration of new myotubes. Cross-sectional area decreased from 204.49 mm² to 131.320mm² on post-transplantation day 30. The destruction and degeneration of the muscle during the first 3 days is indicated by a reduction in the quantity of RNA&DNA. By the 7th to 15th day, the DNA content shoots up while the RNA content does not appear to be much affected.

3. *EDL Muscle After Denervation*

The muscle fibres atrophied.

4. *EDL Muscle After Transplantation with Lignocaine-Pretreatment*

Effect of various doses of myotoxic drug-Lignocaine (local anaesthetic agent) were studied on the normal and transplanted muscles. A dose of 0.5 ml of 20% lignocaine solution caused destruction and degeneration of muscles, which later on never regenerated. Stronger doses i.e. 0.5%, 2% and 10% of lignocaine caused atrophy of the transplanted muscle fibres with little muscle degeneration and almost no muscle regeneration.

5. *EDL Muscle after Transplantation with Mechanical Injury Pretreatment*

The mechanical injury in the form of cross and longitudinal incisions result into a more or less complete degeneration of the original muscle fibres followed by regeneration of new myotubes. The mechanical injury, therefore, appears to be a good pretreatment for muscle transplantation.

6. *EDL Muscle After Transplantation in Femurectomised Rats*

In femurectomised animals, transplantation of normal EDL muscles results into a more or less normal regeneration during first two weeks. There are distinct atrophic changes within the transplant after that. This shows that proper physical activity is essential for a successful muscle transplant.

7. *Muscle Regeneration following Transplantation in a Denervated Condition*

EDL muscles were transplanted in a denervated condition. An initial phase of muscle regeneration was observed followed by an eventual atrophy and degeneration of the regenerating muscle fibres. These results indicate that for a proper growth and maturation of the regenerating fibers proper innervation is necessary.

B. Some other experiments were done on the orthotopic transplantation of anterior tibialis muscle in mice and EDL muscles in rabbits. The following conclusions were drawn.

1. *EDL Muscle Transplantation in Rabbits*

In rabbits EDL muscles were transplanted heterotopically. Regeneration activity though quite similar was slower from that of rats. It is so because rabbit EDL muscle is 30 fold larger than rat EDL muscle.

2. *EDL Muscle Regeneration with Hormone Pretreatment*

EDL muscles were transplanted heterotopically in insulin and testosterone treated rabbits. The diameter of insulin treated regenerating muscle fibres was found to be larger than normally regenerating muscle fibres. Regeneration process was also rapid with the increase in the concentration of insulin. On the other hand, testosterone seemed to accelerate the rate of regeneration on the target muscle (Levator ani muscle) only.

6. *Transplantation of Anterior Tibialis Muscle in Mice*

Anterior tibialis muscle does not possess an appreciable ability to regenerate in a transplanted condition. There was no indication of viable myoblasts or myotubes even by the end of one week. By about the end of one month, the transplant had not only reduced in size but was almost completely composed of connective tissue and adipose tissue.

c. **Significance of biochemical studies**

The various morphological changes in the muscles during transplantation are reflected in the metabolism also. The estimation of levels of various macromolecule like DNA, RNA, protein, amino acids and various glycolytic enzymes etc. can be used as excellent indicators of metabolic changes. Some preliminary data collected in this connection revealed interesting results. This work needs to be extended on all the above designed experiments on full fledged scale in order to account for the biochemical basis of changes during transplantations. This part of the project could not be done during the stipulated period for the non availability of rats/experimental rats in sufficient numbers and extensive histological work which kept the research workers busy throughout.

<i>Project No.</i>	: F-HC/Bio (89)
<i>Project Title</i>	: Studies on the practical applications of Conditioned Taste Aversion (CTA)
<i>Name of Investigator</i>	: Dr. Saeed-ul-Islam
<i>Project Particulars</i>	
Duration	One year
Date of commencement	: 1st December, 1978
Date of completion	: 30th November, 1979
Implementing Agency	Government College, Haripur, Hazara.
Total expenditure	: Rs. 14,188.00
<i>Main Objectives</i>	To conduct experiments on different predators like sparrows, rats, parrots etc. by exposing them to poisonous foods and see the effect of taste aversion. The results of the study can be used in a practical way in controlling the predation in nature.

Summary of the Work Done

Cobra, krait and scorpion neurotoxins and viper's haemorrhagic venoms were used as unconditioned stimulus (US) in conditioned taste Aversion (CTA) paradigm and compared with lithium chloride, a standard stimulus for producing taste aversion. The results indicate 10 and 7.5 µg of cobra and 20, and 15 µg of krait venom produce clear cut aversion in mice. CTA established in rats by associating saccharin drinking with subsequent poisoning by Russell's viper venom is reduced to 56% by pretherapeutic injection of polyantivenin groups of the rats anaesthetised with Sodium nembutal and subsequently injected with neurotoxic scorpion venom, the anaesthesia does not prevent CTA engram formation. Even antihistamine adrenaline fails to decrease efficiency of *Echis* venom induced CTA.

Publications as a results of these investigations:

1. Severe conditioned taste aversion elicited by venom of Russell's viper: *Experientia*, vol. 35 No. 9 1979.

2. Conditioned taste aversion in anaesthetised rats by Scorpion venom; *Physiologia Bohemoslovaca*. 1979 (in press).
3. Snake neurotoxins and conditioned taste aversion in mice; *International Journal of Neuroscience* 1980 (in press)
4. Antihistamines fail to decrease efficiency of viper venom induced CTA (Under preparation).

Project No. : C-QU/Chem (41)

Project Title : Infrared studies of organic compounds.

Name of Investigator : Dr. Athar Yaseen

Project Particulars

Duration	: Two year and four months.
Date of commencement	: 1st May, 1975
Date of completion	: 31st August, 1977
Implementing Agency	: Quaid-e-Azam University, Islamabad.
Total Expenditure	: Rs. 71,234.08

Main Objectives : To investigate the problem of the stability of isomers by studying the infrared spectra of the compounds in different solvents.

Summary of the Work Done

Infrared spectroscopic measurements have been made for twelve compounds and the resultant data is contained in this report. These investigations indicate that 1,2-dichloroacryloyl chloride exists in one form only which is the trans conformer at ordinary temperatures. Bromo and iodo-acetyl chloride exist as a mixture of two isomers which are the trans and gauche forms. Investigations indicate that the trans form is relatively more stable. A normal coordinate analysis calculations for iodoacetyl chloride has been made on the basis of 7-atom model and using Urey-Bradley force field which takes into account contribution from the nonbonded interactions to the potential function. This calculation shows that the azimuthal angle of internal rotation for the gauche isomer is about 1500. For crotonyl halides two isomers are identified as the trans and cis forms. Vibrational frequency assignments in each case are made tentatively.

All the three halides show two bands each in the C = O and C = C absorption regions and also in the C-halogen stretching regions. Trans form is more stable than the cis form. As for crotonyl fluoride, CIS form is found to be more abundant in the vapour phase.

Fumaryl chloride presents an interesting case where the possibility of four isomers exists. These are trans-trans, cis-cis, tran-cis and cis-trans. The last two are identical from symmetry considerations. The carbonyl and C = C stretching bands do not appear for the cis-cis and trans-trans isomers in the infrared due to the presence of an inversion centre. The two bands in this region arise from the trans-cis isomer. The existence of trans-cis isomer is easily established due to appearance of bands in the carbonyl and C = C stretching regions. The bands assigned to other forms stand on a tentative basis due to lack of Raman data.

For 2-Bromobutyroly chloride there are several possibilities and as such the spectrum is complex. More insight into the problem of internal rotation for such compounds can only be gained by measurements of spectra at very low temperatures coupled with Raman spectral measurements.

3-bromoacryloyl chloride also shows two bands in the C = C (1950 and 1715 CM⁻¹) and C = C (1590 and 1575-CM⁻¹) absorption regions. The later pair of bands is of medium intensity. In addition, four bands are

observed in the C–halogen stretching region (780 (m), 720 (m), 660 (s) and 610 (s). These experimental facts indicate very strongly that the compound exists as a mixture of two rotational isomers-probably trans and cis forms. The 3–haloacrylic acids and 2–haloacrylic acids exist as dimers and the observed spectral features are interpretable on the basis of dimer formation resulting from strong hydrogen bonding. A medium intensity band around 880 cm^{-1} and the occurrence of O – H stretching band at about 3000 cm^{-1} observed in each case bands characteristic of a dimer.

Project No.	: P–CSIR/Chem (49)
Project Title	Production of single cell protein from industrial wastes.
Name of Investigator	Dr. Yaqoob Chaudhry
Project Particulars	
Duration	: Three years
Date of Commencement	: 1st May, 1975
Date of completion	30th April, 1978
Implementing Agency	: PCSIR Laboratories, Lahore-16
Total Expenditure	: Rs. 1,74,286.85
Main Objectives	: To produce microbial proteins from industrial wastes such as molasses, corn steep liquor etc. for feed and food purposes.

Summary of the Work Done

Selection of a suitable microbial culture and choice of substrate and their characterization are the two main pre-requisition of an economical process.

Yeasts capable of assimilating industrial wastes as the sole source of carbon were isolated from a wide variety of natural sources during investigation on yeast production by enrichment culture techniques and were purified by conventional streak method.

Newly isolated yeast strains alongwith stock cultures were tested for their affinity towards industrial wastes such as kerosene oil and diesel oil of petroleum fractions, sulfite waste liquors, hydrol of maize 'gur' and molasses as sole source of carbon. During cultivation of yeasts on the above mentioned substrates, growth parameters such as substrate and N_2 concentration both quantitative as well as qualitative, were studied. Their influence on the biomass formation, % yield and quality of biomass has been reported.

Apart from substrate and N_2 concentration special emphasis has been given to the availability of oxygen and its influence on yield of biomass.

Taxonomical studies revealed that these new sixteen isolates included one strain of *Saccharomyces cerevisiae*, five of *Pichia membranefaciens*, two of *Candida tropicalis*, four of *C. quilliermondil*, two of *C. rugosa*, one of *C. parapsilosis* and one of *Rhodotorula mucilaginosa*.

These industrial wastes were analysed chemically and then used as sole source of carbon.

After the characterization of cultures and substrate come most important step is the fermentation stage in the production of Single Cell Protein (SCP). Growth parameters such as medium composition, carbon and nitrogen concentrations, PH, temperature and supply of oxygen have been studied in shake flask experiments.

The growth of *Candida parapsilosis* (H-D₅) was much faster than that of kerosene oil. Maximum cell concentration of 8.1 g/l was observed in case of (NH₄)₂ SO₄ when compared to 7.2 and 6.4 g/l with NH₄Cl and NH₄NO₃ respectively while studying influence of different nitrogen sources on the growth of *Candida lipolytica* using diesel oil as the sole source of carbon.

Effect of oxygen availability on the growth of *Candida parapsilosis* (H-D₅) using diesel oil as the sole source of carbon showed a remarkable increase in biomass synthesis with a corresponding increase in the availability of oxygen to the culture broth and thus resulted in better utilization of the substrate.

The biomass obtained in sulfite waste liquor (SWL) fermentation were 3.4, 2.8 and 2.4 g/l respectively in case of cultures *Candida rugosa* (A), *C. tropicalis* (B₃) and *C. parapsilosis* (H-D₅) when the inoculum size was 0.8 g/l. The increase in inoculum size upto 6.4 g/l increased the biomass formation from 3.4 to 16.0 g/l, 2.8 to 14.2 g/l and 2.4 to 11.8 g/l respectively.

Biomass formed ranged between 41.3 to 42.5% protein and 6.0 to 7.0 % lipid. Maximum biomass formation was observed in Medium II when compared to Medium I while cultivating *Candida rugosa* (A) in different concentration of SWL.

Effect of different concentrations of NH₄Cl on the growth of *C. rugosa* (A) using maize 'gur' as the sole source of carbon showed that maximum biomass formation was obtained (12.72 g/l— when nitrogen level was 4 g/l).

Biomass was found to contain 37.5% and 35% protein in case of molasses and glucose experiments with *Rhodotorula glutinis* when the lipids were 22% and 48.5% respectively.

Biomass formation was increased from 5.8 to 16.3 g/l after 120 hrs while cultivating *C. rugosa* with 6% molasses. The yield of biomass was calculated to be 50% on the basis of sugar consumed and protein content was 45.4%.

Regarding scale up studies with laboratory scale fermentors, the following experiments were carried out in 4 L and 60 L working volume fermentors.

Batch cultivation of *Candida lipolytica* was carried out in 4 L working volume fermentor using diesel oil as carbon source. Biomass increased from 1.14 to 9.85 g/l after 96 hrs.

The biomass formation was observed while cultivating *Candida rugosa* (A) and *Rhodotorula glutinis* (R44) with 6% maize 'gur' in a 3.5 l working volume and found to be 9.5 and 11.5 g/l respectively after 120 hrs. Yield was calculated to be 46% on the basis of sugar consumed.

Effect of different concentrations of maize 'gur' on the growth of *Candida rugosa* under constant aeration (11/1/min) showed that with the increase in sugar concentration in the medium, yield of biomass is decreasing.

Biomass increased from 2.0 to 20.8 g/l after 96 hrs. while cultivating *C. rugosa* using molasses (4% sugar content) in a 60 L working volume fermentor.

Regarding quality of biomass obtained from hydrocarbon and molasses experiments was analysed for protein, lipid, RNA and some essential amino acids. The amino acid profile of these yeasts protein indicates that it could serve as a good source of food and feed protein.

Publications as a result of these investigations:

- (1) Chaudry, M.Y., Mahmud, B.A., and Shah, F.H. "Production of Microbial Fats and Fatty Acids". Proc. of CENTO Panel Meeting on "Edible Oils and Fats" PP. 54–58 Lahore, Pakistan (Dec. 9–11–1975).

- (2) Shah, M.A. Baqai, A., Chaudhry, M.Y., and Shah, F.H. "Isolation and Identification of Yeast Strains from Pakistani Environments". *Pak. J. Biochem.*, 9 (2), 81 (1976).
- (3) Shah F.H and Chaudry, M.Y. "Utilization of Petroleum Resources for Production of Single Cell Protein". Symposium of Petroleum Institute of Pakistan on "Energy Problems and Options for the Third World Countries", PP. 1-7, Hotel Intercontinental, Lahore, Pakistan (Dec. 14 and 15, 1977).
- (4) Chaudry, M.Y., Shah, M.A., and Shah, F.H. "Utilization of Sulfite Waste Liquor for Production of Single Cell protein". *Pak. J. Biochem.*, 10 (1977).
- (5) Chaudry, M.Y., Shah, M.A., and Shah, F.H., "Studies on Utilization of Maize 'Gur' for Single Cell Protein Production". *Pak J. Biochem* (submitted).
- (6) Chaudry, M.Y., Shah, M.A. and Shah, F.H. "Single Cell Protein from Hydrocarbons". *Pak. J. Sci. Ind. Rs.* (submitted).
- (7) Shah, M.A. Chaudry, M.Y., and Shah, F.H. "Isolation, Screening and Identification of Yeasts Capable of Utilizing Agro-Industrial Wastes for Single Cell Protein Production". Proc. of the CENTO Symposium on "Biological Conversion of Agro-Industrial into Food and Feedstuffs". PCSIR Laboratories, Lahore, Pakistan (Feb. 21-23, 1978).
- (8) Chaudry, M.Y., Shah, M.A. and Shah, F.H. "Production of Single Cell Protein from Industrial Wastes and by-products". Proc. of the CENTO Symposium on "Biological Conversion of Agro-Industrial Wastes into Food and Feedstuffs", PCSIR Laboratories Lahore, Pakistan (Feb. 21-23, 1978).

<i>Project No.</i>	: P-CSIR/Chem (75)
<i>Project Title</i>	: Fortification of Human Diet with Leaf Protein Concentration (LPC)
<i>Name of Investigator</i>	: Dr. Abdul Salam Sheikh
<i>Project Particulars</i>	
Duration	: 1 year and six months
Date of commencement	1st December, 1976
Date of completion	31st May, 1978
Implementing Agency	: PCSIR Laboratories, Lahore-16
Total Expenditure	: Rs. 47,006.00
<i>Main Objectives</i>	<ol style="list-style-type: none"> (i) Preparation, evaluation and standardisation of LPC fortified dishes. (ii) Chemical tests and medical examination of children before feeding experiments. (iii) Trial tests with 100 children <ol style="list-style-type: none"> (a) receiving regular diet (b) additional 200 g of milk (c) receiving LPC & periodic medical of trails. (iv) Clinical and medical tests at the completion of trails

Summary of the Work Done

Mixed grasses and barseem (*Trifolium alexandrinum*) were used for extraction of protein using IBP (International Biological Programme)²⁹⁻³⁰ pulper and press. Ten dishes, popular in the local dietaries were selected for the feeding programme. Each dish was prepared by the recipe earlier developed by Toosi and Shah,²² with and without the incorporation of LPC. Representative sample of these dishes were homogenized and subjected to chemical analysis for dry matter, protein, fat, crude fibre and ash. Dry matter, ash and fibre were determined by the Official ADAC methods.³¹ Protein was estimated by Microkjeldahl method³² using selenium mixture (K_2SO_4 , $CUSO_4$, SeO_2 , 9:1:0.02). The crude protein contents were calculated as % N x 6.25.³³ Crude fat was extracted in a soxhlat extractor for eighteen hours using hexane as a solvent.³¹ Carbohydrates (other than fibre) were calculated by difference.

Organoleptic Evaluation

Standard and LPC incorporated dishes were evaluated organoleptically by a panel of five experienced judges. Samples were independently graded by scalar scoring (D-10) for their colour, taste, texture and flavour.³⁴

Selection of Dishes

Acceptable dish (containing maximum LPC) in each case was selected. Minor modifications were made in recipes so as to make dishes isoproteinous and isocaloric with 200 g of milk. These dishes were again subjected to organoleptic evaluation.³⁴

Selection of Subjects

The children of "Katchi Abadi" were screened medically by Dr. Aziza Rasool of Research Cell, Ganga Ram Hospital, Lahore. Hundred subjects from 7 to 14 years of age were selected for the trials. Children suffering from chronic diseases were not included.

Feeding Programme

The children were fed daily in the afternoon according to the following programme:

- Group-I: (Control) Children were allowed to continue their normal diet as usual.
- Group-II: Children were given 200 gm of milk sweetened with 10 gm of sugar once daily in addition to their regular diet.
- Group-III: (LPC). Children were given LPC fortified dishes, isoproteinous and isocaloric with milk once daily in addition to their normal regular diet. Feeding programme was continued for a period of eight months without any break. Feeding was also done on Fridays and other Gazetted holidays.

The results of the preliminary health survey gave an extremely black picture. About 55% of the children were considered of unsatisfactory health and only 15-17% of the children were found healthy. 38-48% children were found to be infested with worms or cyst. A limited survey carried out by the Nutrition Cell Planning and Development Division, Government of Pakistan showed that from 0.3% - 15.9% of the population under survey as infested with parasites. Among the rural population 1.07% was found to be infested with hook worms, 1.3% with ascariasis and 0.13% with both of the parasites. The findings of the present studies indicated that the children under survey were highly infested by these worms. The reason may be that the children under trial were selected from the lowest stratum of the society living under most unhygienic conditions. Lack of sanitation and cleanliness further aggravated the situation.

Project No. : P-CSIR/Chem (76)

Project Title : Enzymic hydrolysis of raffinose for the

improvement of sugar recovery in beet processing.

Name of Investigator

Dr. Abdul Qadir

Project Particulars

Duration	Two years
Date of commencement	16th June, 1977
Date of completion	15th June, 1979
Implementing Agency	PCSIR Laboratories, Lahore-16.
Total expenditure	Rs. 52,015

Main Objectives

To isolate mould cultures from the soil capable of producing enzyme namely alpha-galactosidase used for the improvement of sugar recovery from sugar beet molasses.

Summary of the Work Done:

The technology of the production of enzyme alpha-galactosidase by fermentation process, using locally available agricultural by-products as substrates, was developed. The most suitable source of enzyme, in crude form, are pellets of mould *Mortierella vinacea* that can be easily produced in shake flasks and in stirred fermenter semi pilot scale. The use of mycelial pellets, as insoluble enzyme, for the hydrolysis of raffinose in beet molasses, was carried out with encouraging results. These findings after pilot plant studies, in collaboration with the industry people, can be economically exploited. The application of this enzyme in the beet sugar manufacture would result in the improvement of sugar recovery with large crystal size. Other processing conditions such as filtration would also become easier.

Publication as a result of these investigations:

Two research papers have been submitted for publication in Pak. J. Sci. & Ind. Res. Karachi.

Project No. : S-KU/Chem (84)

Project Title : Isolation and structural studies on the chemical constituents of some indigenous flowering plants.

Name of Investigator : Dr. Viqar-ud-Din Ahmed

Project Particulars

Duration	: One year
Date of commencement	: 1st October, 1978
Date of completion	: 30th September, 1979
Implementing Agency	: HEJ Post graduate Institute of Chemistry, University of Karachi, Karachi.

Total Expenditure : Rs. 29,788/-

Main Objectives

To isolate and structurally determine the

constituents of plants namely (i) *Prosopis juliflora*, (ii) *Morinda citrifolia* (iii) *Bongon villea glabra* and (iv) *Euphorbia lactre*, growing abundantly in and around Karachi.

Summary of the Work Done:

Under this project, work was carried out on the isolation, characterisation and structural investigation on the chemical constituents of the following plants.

1. *Prosopis juliflora*, DC
2. *Morinda citrifolia* Linn.
3. *Bougenvillea glabra* Choisy
4. *Nepeta hindostana* (Roth) Haines

The work on the chemical constituents of *Prosopis juliflora* DC has led to the isolation of three new alkaloids and a number of neutral constituents. The structure of one of the alkaloids was elucidated completely and of another alkaloid partly. The main alkaloid, juliflorine was found to possess strong antibacterial activity against *Bacillus Subtilis*, *Bacillus magathelium* and *Sarcinia lutea*.

From the leaves of *Morinda citrifolia* Linn. two neutral compounds were isolated which have been identified as B-sitosterol and ursolic acid. The presence of stigmasterol was also detected.

Chromatographic separation of the ethyl acetate soluble fraction of the extract of leaves of *Bougenvillea glabra* Choisy has yielded dotriacontanol and oleanolic acid.

Chemical reinvestigation of the aerial parts of *Nepeta hindostana* has led to the isolation of several neutral and acidic substances in pure state. These include oleanolic acid, triacontane. B-sitosterol which have already been reported by earlier authors. The nepetol reported by earlier authors appears according to the present investigation to be identical with a amyrine. An aliphatic alcohol isolated from this plant has been identified as triacontanol.

The hydrocarbon fraction isolated appeared to be a mixture of tritriacontane and hentriacontane from the mass spectrum. In addition to the above compounds, three triterpenoids, were isolated in pure state. From the spectroscopic studies they appear to belong to the lupance series.

<i>Project No.</i>	: S-KU/Chem (86)
<i>Project Title</i>	: Investigation of Fungal Metabolites of <i>Fusarium chlamydosporum</i> and <i>Fusarium moniliforme</i> .
<i>Project Investigator</i>	: Dr. Ata-ur-Rehman
<i>Project Particulars</i>	
Duration	: One year
Date of commencement	: 1st August, 1978
Date of completion	: 31st July, 1979
Implementing Agency	: HEJ Institute of Chemistry, University of Karachi, Karachi-32
Total expenditure	: Rs. 26,477.75

Main Objectives : To grow the cultures of these fungi for isolation, structural elucidation and toxicological determination of their fungal metabolites.

Summary of the Work Done:

Studies on *Fusarium chlamydosporum* and *F. moniliforme* have resulted in the isolation of three hitherto unknown metabolites. The growth conditions of these fungi were established after experimental optimisation. Preliminary structural studies on the new metabolites isolated, by high resolution mass spectroscopy, NMR spectroscopy, and I.R. and U.V., have provided valuable information about their structure. A preliminary communication of the work achieved is being submitted for publication.

Project No. : F-PU/Envr (2)

Project Title : Testing for mitotic gene conversion in yeast by food colours and other chemicals.

Name of Investigator : Dr. Bashir A. Siddiqi

Project Particulars

Duration : Three years
Date of commencement : 1st June, 1977
Date of completion : 31st May, 1980
Implementing Agency : University of Peshawar, Peshawar.

Total Expenditure : Rs. 1,16,336.97

Main Objectives : To investigate the genetic activity of the food colours and other additives. The results of this study would help developing food safety standards in our country.

Summary of the Work Done:

Altogether 43 food additives and flavours were tested to assess their mutagenic and possible carcinogenic potential. The results of this study indicate that of all the tested food colours, 41 were non-mutagenic without any further metabolic activation in diploid yeast. They failed to increase significantly the frequency of mitotic gene conversion, mitotic crossing over and reverse mutation in diploid yeast. Two food colours, Rouge S and Auramine O, were detected as powerful mutagens in diploid yeast. They induced a significantly high frequency of mitotic gene conversion, mitotic crossing over and reverse mutation in D4 and D7 of *S. cerevisiae*. While all the non-mutagenic food dyes were non-toxic, Rouge S and Auramine O were severely cytotoxic even at comparatively low concentrations. They inhibited the cell division and significantly reduced the cell viability. Both the colours were active in stationary as well as in log-phase tests and their mutagenic and cytotoxic effects were dose dependent.

None of the 20 food flavours induced mitotic gene conversion, mitotic crossing over and reverse mutation in strains D4 and D7 of *S. cerevisiae* under the experimental conditions employed. With all the tested flavours, neither significant cell killing nor inhibition of cell division was observed. EMS, used as a positive control, exhibited recombinogenic and mutagenic activities as expected. This is an evidence for the reliability of the test systems.

Since most of the tested food additives are in common use, the work has direct application and possible significance for man.

Publications as a result of these investigation:

1. Testing for mitotic gene conversion in yeast by some food colours and flavours. *19th All. Pak. Annu. Sci. Conf. Islamabad, Sept. 1–6, 1979 P. 27–28.*
2. Testing for mitotic gene conversion in *Saccharomyces cerevisiae* by some food flavours. *Proc. Reg. Botanical Conf. October 23–25, 1979, P–1.*
3. Testing of some food colours and flavours for the induction of mitotic gene conversion in *Saccharomyces cerevisiae*. *Proc. International Symp. on New Researches in Biology and Genetics: Problems of Science and ethics, held under the auspices of UNESCO, Ministry of Education, Govt. of Pakistan and Hamdard National Foundation, December 8–13, 1979.*
4. Testing of some food flavours for the induction of mitotic gene conversion mitotic crossing over and reverse mutation in diploid yeast (*Mutation Research, 1980*).
6. Non-mutagenicity and recombinogenicity of Phloxine in diploid yeast (Under preparation).
7. Mutagenicity and recombinogenicity of a food dye Rouge S. in diploid strains of *Saccharomyces cerevisiae* (Under preparation).

Project No.	: P–GCR/Envr (15)
Project Title	: Study of pollution and aquatic organisms of the Leh Stream, Rawalpindi.
Name of Investigator	: Prof. S. Rashid Ali
Project Particulars	
Duration	: Two years
Date of commencement	: 15th May, 1978
Date of completion	: 14th May, 1980
Implementing Agency	: Gordon College, Rawalpindi
Total Expenditure	: Rs. 1,16,712.99
Main Objectives	: (i) Studying the different kinds and degrees of pollution in Leh Stream. (ii) Identifying the biological organisms which are pollution indicators and (iii) Controlling water pollution by biological means.

Summary of the Work Done:

Investigations on the physio chemical nature of water and flora and fauna as pollution indicator of Leh stream were undertaken. It is concluded that the water is nonpolluted in the upper reaches of the Leh and its tributaries in Islamabad. The total hardness is higher as compared to the International Standard of Drinking Water. After receiving the pollution there is an increase in total alkalinity and total hardness. There is gradual increase in magnesium, sodium, and potassium. Certain plants and animals can not tolerate pollution. After pollution there was decrease in algae and macrofauna but increase in microfauna. The gradual increase in the quantities of sodium and po-

tassium indicated domestic pollution. A few algae, micro and macrofauna indicate the pollution.

Publications as a result of these investigations:

1. Ali, S R. 1979 A checklist of Fresh water Algae of Rawalpindi District. Bull. Hydrobiol. Res. Ser. 2. No. 5. 48-54.
2. 1979 Distribution of Mayflies (Order. Ephemeroptera) of Pakistan. Abstract, 3rd International Conference on Ephemeroptera, Canada. P. 4.
3. Khatoon, S. & Ali, S R. 1979 Nymphs of order Odonata of Pakistan. Abstract, Biology Section, 19th Annual Sci. Conference, Sci. Soc. Pak. P. 35.
4. Ali, S.R. *et al.* 1979 Effects of Industrial Wastes on Aquatic Fauna. Abstract (Biology), 26th & 27th Pakistan Sci. P. 53.
5. Ali, S.R. & Khatoon, S. 1980 Microfauna of the Leh stream and some indicator species (submitted for publication).
6. 1980 Seasonal Variation in the algal flora of the Leh stream and its tributaries (Manuscript).

Project No. S-JPMC/Med (20)

Project Title Epidemiological study of nutritional disorders in pre-school children in urban community.

Name of Investigator Dr. Razia J. Rahmtoola

Project Particulars

Duration : Three years and two months.
Date of commencement : 1st August 1976
Date of completion : 30th September, 1979
Implementing Agency : Jinnah Post-graduate Medical Centre, Karachi-35.

Total expenditure Rs. 2,12,444.00

- Main Objectives*
- (i) Determination of epidemiological characteristics of nutritional problems in pre-school children of our urban community with a view to determine the relative importance of various casual factors.
 - (ii) Institution of an intervention programme to deal with factors causing protein calorie malnutrition in pre-school children.
 - (iii) Evaluation of the intervention pro-

grammes instituted for the control of nutritional disorders of the pre-school children in community.

Summary of the Work Done.

In order to elicit the causes of malnutrition and to find a solution to this problem in a community of poor socio-economic group in an urban area, this project was carried out at Mahmoodabad colony, Karachi. The survey included baseline data of 750 families (approximate population 5000), during the first year. This covered the local predisposing factors of material and childhood under nutrition by interview, screening, and investigations in the population sample.

Details of income, occupation of male earning members, availability and quality of food, personal hygiene, water supply, water pollution and toilet facilities, were all noted. Certain other factors such as cultural influences in the distribution and restriction of foods to certain groups, ages or sexes, food fads ("hot" and "cold" foods) and child rearing practices were also studied.

Clinical examination of children was carried out including anthropometric measurements (height, weight, head and mid-arm circumferences), to assess the degree of malnutrition, the type of nutritional deficiencies, the incidence and types of diseases, and their effect on nutrition of the children.

Birth and death statistics were maintained. From the weights of new borns the incidence of prematurity, and its relation to mother's nutrition was elicited.

From this study it was noted that only 26.7% of 1300 pre-school children were in the normal category, while the rest were suffering from malnutrition. Most of the families (90%) live in unhygienic surroundings, with little water supply, (as they have to collect the water from community taps), and poor toilet facilities. The refuse is thrown in the little lanes between houses, as the municipal dumps are few and far between.

The illiteracy rate is high (70.2%); the literate have only primary education and few have any idea of hygiene and cleanliness. The child mortality is very high, most deaths being due to diarrhoea, respiratory infections, tuberculosis and measles. The deaths are more in the malnourished children.

There is a lack of medical care in this area as there is only one dispensary of Karachi Municipal Corporation which is open in the morning hours. There is no MCH Centre for mothers and children and no immunisations were carried out for prevention of infectious diseases in children. Most mothers delivered at home and were attended to by untrained "dais", leading to a high neonatal mortality, chiefly due to tetanus, prematurity and complications during delivery.

In this survey following factors causing malnutrition have been elicited in the pre-school children.

(a) *Failure of Lactation*: Most mothers were breast feeding the infant at birth (83%), but this declined to 25% at one year age, as the mother was ill-nourished and she had lactation failure, or she was ill or started another pregnancy. Failure of lactation leads to giving the child top-feeds which are diluted and of low caloric value.

(b) *Due to poverty*: Mothers cannot buy adequate quantity of milk for infants nor can they give high calorie and high protein feed (such as butter, eggs, meat). Poverty leads to poor housing, lack of water supply and unhygienic conditions. The water supply is limited as water has to be collected from community taps, and often only one bucket is available for the whole day.

Mothers were given advice on refuse disposal and maintaining hygienic conditions.

(c) *Ignorance*: Very few mothers know when to add the weaning foods to the diet and the type of food to

be given. Most mothers were giving tea and biscuits, from 6 months to 1 year age. After that the home diet was given, and the child could not eat chapati and vegetables. This caused malnutrition in 6 months to 3 years age group.

They were taught to cook soft diet, (Kitchri, Kheer, Soji Halwa etc.) to give to the children. These were prepared from home diet and were not expensive.

(d) *Cultural patterns and feed fads*: The best food was given to the male earning member and then to the children. Meat was cooked twice a week in most families but the larger shares was given to the man, with little left for wife and children. Food fads due to "hot and cold foods" were also noted and advise given to the family.

Mothers were taught the value of "Dal" a second class protein, which can be given easily to the children, mixed with rice or vegetables. One cup of cooked "Dal" contains 6 gm. protein. They were also told to give the share of meat to the children first and then to the elders.

(e) *Lack of Immunization*: Leads to a high incidence of preventable diseases such as whooping cough, measles, tuberculosis, etc. This caused high mortality and morbidity, and malnutrition.

Lack of Medical Care: Children were not treated until they were very ill. They were advised to bring the child early for treatment and immunisations were carried out for all infectious diseases.

(f) *Lack of family planning*. Large family size with low income leads to gross malnutrition in children, as the parents cannot provide for high calorie food. In this study, the degree of malnutrition was related to family size. Family planning advise and advise on spacing of pregnancies has been given.

On the basis of this survey following conclusion have been arrived at:

(1) Malnutrition in children can be prevented by intensive health education of the mothers, by adequate potable water supply, better toilet facilities and refuse disposal.

(2) Semi-solids prepared from the home diet can give sufficient calories, if mothers are motivated to prepare them and give them at 4-5 months age in addition to breast milk.

(3) Good antenatal and post-natal care of mothers is necessary for reducing premature birth and small-for-date infants, and for adequate breast milk for the child.

(4) Decrease in family size and family spacing will improve the child's health, as mothers can give better attention to less number of children.

Often it seems that fathers are indifferent to child care, and they do not agree to family planning. It is necessary to motivate the fathers also, as without them family spacing programme can not succeed.

Education of fathers is also necessary regarding diet of the child, so that he does not take the major share of high protein food and this is given to the child.

(5) Community centres must be established in slum areas in addition to child carecentres, so that mothers can take interest in other activities, such as sewing and knitting, etc. This would even help improve their economic condition and provide recreational facilities.

Publications as a result of these investigations:

1 Environmental factors in causing malnutrition in children. Paper read at the International Year of Child Health (IYC) Conference at Lahore, February, 1979.

2. Feeding habits of pre-school children and its relation to malnutrition.
3. Anthropometric measurements and nutritional deficiencies in a poor socioeconomic group in pre-school children. (Karachi Urban Sector).
4. Malnutrition in pre-school children in a poor socio-economic group (Karachi Urban), and how to combat it.

By Applied Economics Research Centre, University of Karachi in collaboration with Dr. James Knowles of Ford Foundation "The Determinants of mortality in a low income area of Karachi.

Combat malnutrition – Publication for IYC – 'International Year of Child'.

Manuscripts (copies of all 3 years annual reports) have been submitted to Pakistan Medical Research Council.

<i>Project No.</i>	: S-JPMC/MED (22)
<i>Project Title</i>	: Epidemiological study of viral hepatitis.
<i>Name of Investigator.</i>	Dr. Sarwar Jehan Zuberi.
<i>Project Particulars</i>	
Duration	: Two years
Date of Commencement	: 1st January, 1976.
Date of Completion	: 31st December, 1977.
Implementing Agency	: Jinnah Post Graduate Medical Centre, Karachi-33.
Total Expenditure	Rs 41,652/-
<i>Main Objectives</i>	(i) To determine the delayed hypersensitivity and antibody response to selected antigens in malnourished and anemic pre-school children and in a suitable group of controls for the same ecosystem.
	(ii) To measure changes in immune response after recovery from the nutritional insult.

Summary of the Work Done

Viral hepatitis is a major public health problem in Pakistan. It is infectious and can be transmitted from one individual to the other via oral, oro-faecal, parenteral or venereal routes or through insect vectors like mosquitoes and bed bugs.

The disease seems to occur all year round. Type A cases are mostly seen in small outbreaks in summer months while cases of type B are seen all year round but mostly in between the spurt of type A variety and also in winter months. Most cases of hepatitis recover from the disease but some may develop chronic hepatitis and cirrhosis of the liver.

Individual exposed to hepatitis patients may develop the disease or vague symptoms resembling common disorders like amoebiasis. The mere non-recognition of these cases by itself may be a health hazard as they may act as potential reservoir of viral infection and can thus spread the disease through contact. The exact extent of spread of disease in the contacts of hepatitis cases and those at the highest risk is not known in this country. It was, therefore, planned under this project to study the types of hepatitis seen amongst the patients admitted in the hospital and determine the extent of spread of disease in their household contacts. The findings of these investigation are as under. —

1. Intrafamilial Spread of Hepatitis B Surface Antigen (HBs Ag).

- (i) Hepatitis Bs antigen occurs more frequently in young males, who might become healthy carrier or develop apparent or liver disease.
- (ii) Contact is most likely mode of spread of HBs Ag.

2. Vertical Transmission of Hepatitis Bs Antigen

- (i) Minor abnormalities of liver function tests observed in pregnant women are due to physiological changes during pregnancy, production of enzymes by placenta and the effect of changes occurring in foetal organs on maternal blood.
- (ii) Sera of pregnant women tested for HBs Ag with CIEP (Less sensitive technique) showed a frequency of antigenaemia of only 0.97% and with R.I.A (more sensitive technique) 9%. Cord sera of two babies of mothers with HBs antigenaemia was positive for HBs Ag indicating transplacental transmission and 3 HBs Ag positive cord sera in antigen negative mothers indicating an in utero transmission.

3. Publications as a result of research investigations:

- 1. Zuberi, S.J , Lodi, T.Z., and Siddiqui, M (1978) Intrafamilial spread of Hepatitis Bs Antigen. J.P. M.A. 28:61.
- 2. Samad, F., Maqsood, R., Zuberi, S.J. et al (1979) Liver function tests in pregnancy and in the maternal and cord sera, Pak. J. Med. Res 18 17.
- 3. Samad, F. Lodi, T.Z., Zuberi, S.J. et al (1979) Vertical Transmission of Hepatitis B Surface antigen. Asian Medical Journal (Japan) 22.678.

(B) Second Annual Reports

The second annual reports of the following projects were received and processed by the Foundation during the report period:—

<i>Project No.</i>	<i>Title of the Project</i>
P-PU/Agr (5)	Effect of Tractor powered tillage practices on crop yield and soil characteristics.
S-AC/Agr (21)	Investigation of Virus Diseases of Solonaceous crops in Hyderabad region.
P-AU/Agr (55)	Pathology of Trees

S-KU/Bio (5)	Chemistry of Nucleosides.
P-PU/Chem (27)	Characterization and production of enzymes of commercial importance from indigenous micro-organisms.
F-GU/Chem (53)	Investigation of Alkaloids present in plants native to Pakistan.
P-CSIR/Chem (66)	The development of Steroid Chemistry because of its Pharmaceuticals as well as socio-economic impact.
C-IU/Chem (73)	Kinetic electrochemical and Optical investigation of herbicides.
P-CTT/Eng (14)	Dyeing problems in Blended Fabrics.
F-PU/Env (2)	Testing for Mitotic gene Conversion in yeast by food colour and other chemicals.
P-PU/Envr (3)	Ecological studies on fresh water Hypo-mycetes.
C-PU/Med (36)	Frequency and natural history of Rheumatic fever in Islamabad.
S-JPMC/Med (38)	Biochemical studies on the Cataractus Human lenses.

(C) First Annual Reports

The first annual reports of the following projects were received and processed further by the Foundation during the report period:—

<i>Project No.</i>	<i>Title of the Project</i>
P-AU/Agr (42)	The Surveillance and monitoring of diseases naturally transmitted between Vertebrate animals and related health hazards.
P-AU/Agr (55)	Pathology of trees.
P-PU/Bio (79)	Studies on Wood preferences of termites.
S-KU/Chem (10/1)	Structural and Synthetic studies in some B-Carboline bases.
S-CSIR/Chem (91)	Effect of germination on the protein and Carbohydrate fraction of legumes and the study of other constituents of nutritive significance.
SI-Med (6)	Determination of Human Placental Lactogen level and guide to foetal well being during pregnancy.
P-PU/Phy (19)	Impact of ions on Solids.
S-KU/Phy (23)	Spectroscopy of diatomic molecules.
C-QU/Phy (26)	Nonlinear Wave propagation in plasma.
S-KU/Ocean (4)	Shore Erosion Studies of Pakistan Coast in the Vicinity of Karachi.

CHAPTER – 3

ORGANIZATION AND ADMINISTRATION

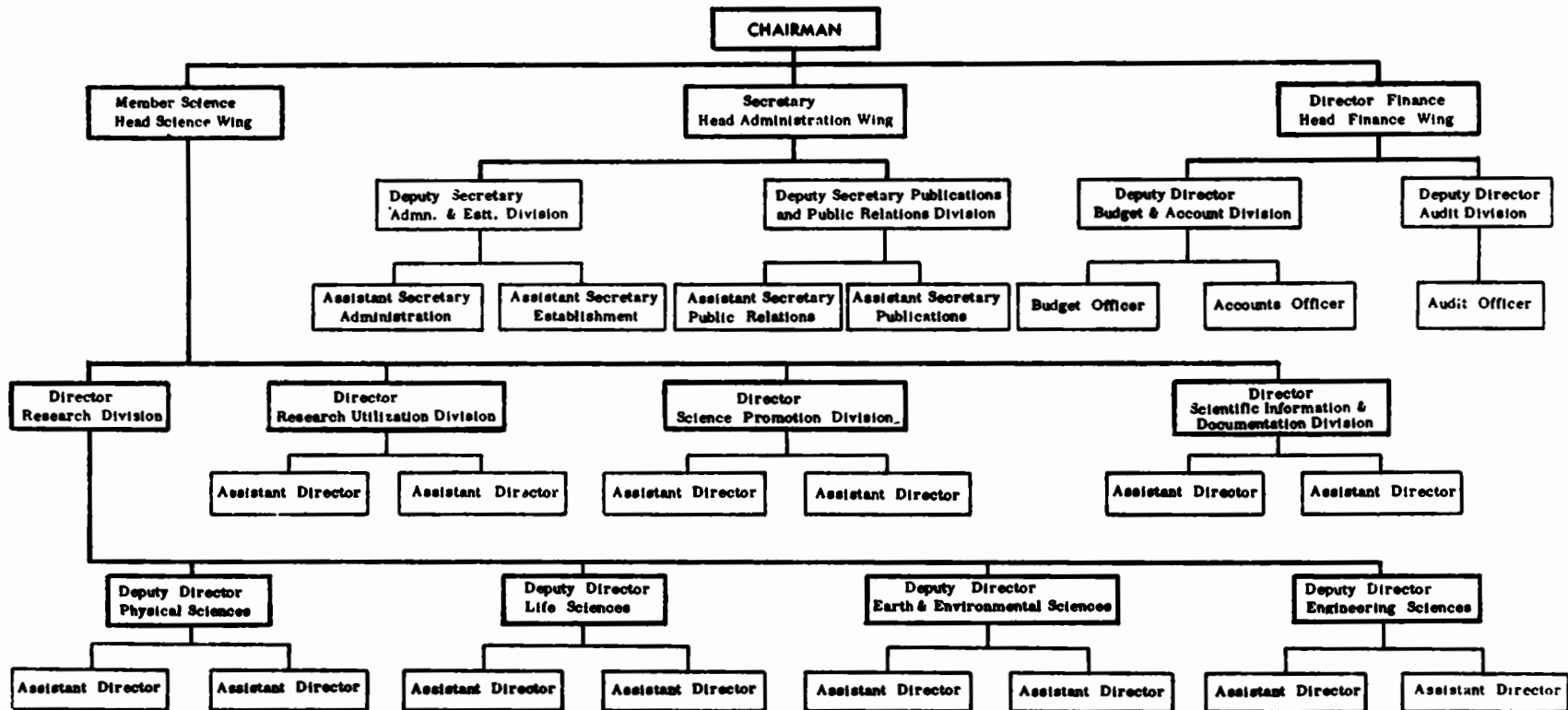
The ultimate organizational and administrative structure of the Foundation is given in the charts on page 63 and 64. The staff in position during the report period is as follows:

Officers

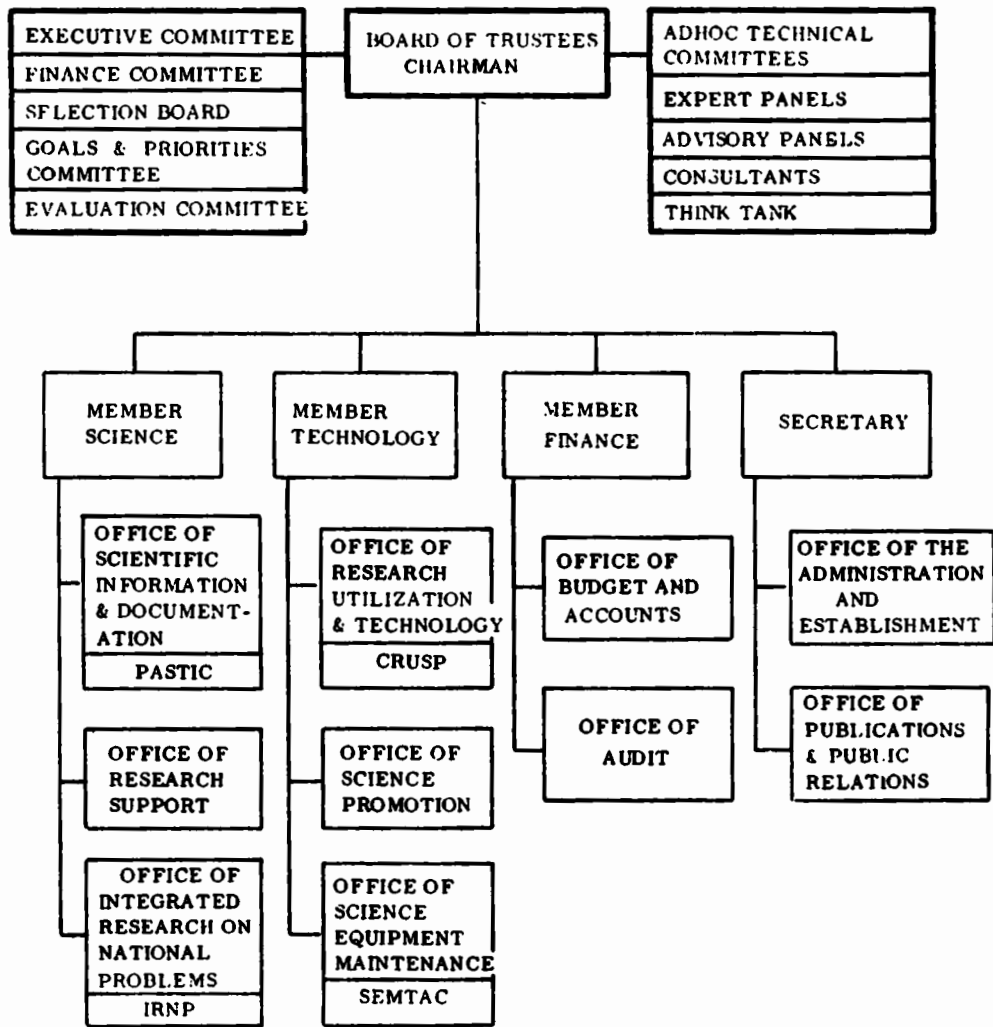
S. No.	Designation	Number
1.	Chairman	1 (w.e.f. 8.6.1980)
2.	Member (Science)	1
3.	Member (Finance)	1
4.	Secretary	1
5.	Deputy Director (Finance & Accounts)	1
6.	Senior Scientific Officer	1
7.	Scientific Officers	2
8.	Assistant Scientific Officer	1
9.	Placement Officer	1
10.	Administrative Officer/Asstt. Secretary	1
11.	Accounts & Audit Officer	1
12.	Public Relations Officer	1
13.	Supporting Clerical Staff	19
	Total	32

In addition to the whole-time staff members of the Foundation, there are about 200 scientists and technologists in various universities/research organizations who are acting in an honorary capacity as reviewers of the research proposals and as members of the technical committees or Principal Investigators of PSF supported projects.

PAKISTAN SCIENCE FOUNDATION ADMINISTRATIVE STRUCTURE 1975



PROPOSED ORGANIZATION
PAKISTAN SCIENCE FOUNDATION



PASTIC : PAKISTAN SCIENTIFIC AND TECHNOLOGICAL INFORMATION CENTRE

CRUSP : CENTRE FOR RESEARCH UTILIZATION AND SPECIAL PROJECTS

IRNP : INTEGRATED RESEARCH ON NATIONAL PROBLEMS

SEMTAC : SCIENCE EQUIPMENT MAINTENANCE TECHNICAL ASSISTANCE CENTRE

CHAPTER – 4
AUDITORS' REPORT

The report of the Auditors M/S A. F. Ferguson & Co., Chartered Accountants, appointed by the Foundation in consultation with the Auditor General of Pakistan, is reproduced below.-

**AUDITORS' REPORT TO THE CHAIRMAN AND
BOARD OF TRUSTEES OF PAKISTAN SCIENCE FOUNDATION**

We have examined the annexed balanced sheet of Pakistan Science Foundation as at June 30, 1980 and the annexed receipts and expenditure account for the year ended June 30, 1980 and subject to the contents of paragraphs 2 and 3 of our letter 36 dated January 9, 1983, we report as under:

The receipts of the Foundation during the year ended June 30, 1980 comprise of grant received from the Federal Government.

We are satisfied that the grant so received has been spent on the objects for which it was made, within the specified time limit. There was no un-spent balance after taking into consideration expenses incurred but not paid at June 30, 1980

We have also satisfied ourselves about the propriety of the disbursements made from the grant.

Rawalpindi, April 20, 1983

Sd/– (A. F. FERGUSON & CO.)
CHARTERED ACCOUNTANTS

PAKISTAN SCIENCE FOUNDATION

BALANCE SHEET AS AT JUNE 30, 1980

FUNDS AND LIABILITIES	Note	1980 Rs.	1979 Rs.	PROPERTY AND ASSETS	Note	1980 Rs.	1979 Rs.
GENERAL FUND				FIXED ASSETS	4	3,131,860	2,990,728
Balance as at July 1, 1979		3,082,641	2,996,419	RESEARCH PROJECTS IN PROGRESS	2	22,004,396	18,948,695
Prior year adjustments		—	105,896	CURRENT ASSETS			
Receipt and expenditure account surplus (deficit) for year		165,700	(19,674)	Sundry debtors		4,066	4,066
		<u>3,248,341</u>	<u>3,082,641</u>	Advances deposits and prepayments	5	271,700	135,594
				Cash and bank balances	6	<u>4,167</u>	<u>40,703</u>
RESEARCH SUPPORT GRANTS	2	22,004,396	18,948,695			279,933	180,363
CURRENT LIABILITIES	3	<u>163,452</u>	<u>88,450</u>				
		<u>25,416,189</u>	<u>22,119,786</u>			<u>25,416,189</u>	<u>22,119,786</u>

Note: These accounts should be read in conjunction with the annexed notes.

Sd/— (A. F. FERGUSON & CO.)
Chartered Accountants

Sd/—
Chairman

(Dr. M. D. Shami
Chairman
Pakistan Science Foundation
Islamabad.

Sd/—
Trustee

(S. M. Afzal)
Director/Member Finance
Pakistan Science Foundation
Islamabad.

PAKISTAN SCIENCE FOUNDATION

RECEIPT AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED JUNE 30, 1980

	Note	1980 Rs.	1979 Rs.
Grants received	1.1	5,500,000	4,078,100
Less: Grants paid			
Research and institutional support	7	3,055,701	2,082,039
Scientific societies and professional bodies		443,150	457,900
Scientific seminars and conferences		124,209	101,863
Travel grants for science conferences and seminars		49,945	—
Scientist pool subsistence allowance		39,703	67,824
Other functions	8	213,197	91,392
		<u>3,925,905</u>	<u>2,801,018</u>
		1,574,095	1,277,082
Administrative expenses	9	<u>1,411,101</u>	<u>1,303,502</u>
		162,994	(26,420)
Miscellaneous receipts		<u>2,706</u>	<u>6,746</u>
Net surplus (deficit)		<u><u>165,700</u></u>	<u><u>(19,674)</u></u>

These accounts should be read in conjunction with the annexed notes.

Sd/— (A. F. FERGUSON & CO.)
Chartered Accountants

Sd/—
Chairman

(Dr. M. D. Shami)
Chairman,
Pakistan Science Foundation
Islamabad

Sd/—
Trustee

(S. M. Afzal)
Director/Member Finance
Pakistan Science Foundation
Islamabad

PAKISTAN SCIENCE FOUNDATION

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED JUNE 30, 1980

1. **Significant accounting policies**

1.1 *Grants received*

Grants received from the Government of Pakistan are accounted for on receipt basis.

1.2 *Fixed Assets*

Fixed assets are stated at cost less accumulated depreciation except leasehold land which is valued at cost. Fixed assets acquired for specific research projects are treated as research project expenditure.

1.3 *Depreciation*

Depreciation on fixed assets has been charged on reducing balance method

2. **Research support grants**

The grants paid for the performance and execution of the research projects are being carried forward in the accounts of the Foundation and have not been adjusted for completed projects.

3. **Current liabilities**

These consist of the following:

Liabilities for expenses	1980 Rs.	1979 Rs.
Audit fee	17,000	11,000
Scientific pool officers pay	7,500	6,000
Salaries and other benefits	44,531	44,568
Unpaid salaries	425	-
Other administration expenses	77,220	9,506
	<u>146,676</u>	<u>71,074</u>
Liabilities for other finance		
Excess recoveries in respect of advance	-	600
Man and biosphere programme	14,707	14,707
Punjab barani commission	1,631	1,631
P.C.S.I.R	438	438
	<u>16,776</u>	<u>17,376</u>
	<u>163,452</u>	<u>88,450</u>

4. Fixed Assets

	As at July 1, 1979	C O S T Additions/Dele- tions during the year	As at June 30, 1980	Accumulated depreciation as at June 30, 1980	Written down value as at June 30, 1980	Depreciation for the year
	Rs.	Rs.	Rs	Rs.	Rs.	Rs.
Lease hold land	2,683,333	170,417	2,853,750	—	2,853,750	—
Furniture & Fixture	199,695	900	200,595	56,518	144,077	9,196
Office Equipment	130,847	4,695	135,542	80,167	55,375	9,772
Air Conditioners	74,764		74,764	49,752	25,012	4,414
Motor Vehicles	148,823		148,823	102,451	46,372	11,593
Bicycles	359	(359) 680	680	136	544	136
Library Books	9,217		9,217	2,487	6,730	354
		176,692				
Rupees	<u>3,247,038</u>	<u>(359)</u>	<u>3,423,371</u>	<u>291,511</u>	<u>3,131,860</u>	<u>35,465</u>
1979 Rupees	<u>3,227,693</u>	<u>53,423</u> <u>(34,077)</u>	<u>3,247,039</u>	<u>256,311</u>	<u>2,990,728</u>	<u>40,475</u>

Sd/—
(A. F. Ferguson & Co.)
(Chartered Accountants)

5. Advances, deposits and prepayments

	1980 Rs.	1979 Rs.
Advances to staff	6,801	8,906
Deposits	3,700	3,700
Prepayments	261,199	122,988
	<u>271,700</u>	<u>135,594</u>

6. Cash and bank balances

	1980 Rs.	1979 Rs.
In hand	4,015	3,372
With bank	152	37,180
UNESCO coupons	—	151
	<u>4,167</u>	<u>40,703</u>

	1980 Rs.	1979 Rs.
7. Research and institutional support		
Maths and computing sciences	10,557	11,361
Physical sciences	239,690	429,676
Chemical sciences	894,964	473,300
Biological sciences	611,075	489,996
Earth Sciences	69,920	43,220
Environmental sciences	165,732	142,704
Engineering sciences	—	79,142
Agricultural sciences	297,266	195,255
Medical sciences	187,877	180,215
Institutional support	98,730	15,000
Oceanography	119,780	15,720
Utilization	353,760	—
Honoraria	6,350	6,450
	<u>3,055,701</u>	<u>2,082,039</u>
8. Other functions		
Scientific centres and herbaria	142,000	60,900
Information and documentation	41,197	20,000
Awards and Prizes	18,000	4,992
Scientific surveys and collection of statistics	2,000	500
Man and biosphere programme	10,000	5,000
	<u>213,197</u>	<u>91,392</u>
9. Administrative expenses		
Salaries and other benefits	855,139	801,355
Travelling local	8,871	16,211
Rent office	118,777	133,450
Water electricity and gas	16,297	12,501
Postage, telephones and telegrams	249,299	129,275
Printing and stationery	15,636	40,724
Vehicle running and maintenance	52,732	54,852
Newspapers and periodicals	5,652	4,099
Liveries and uniforms	4,914	2,494
Entertainment	12,926	6,290
Benevolent fund	—	241
Repair and maintenance	6,474	17,542
Depreciation	35,465	40,475
Travel abroad	—	4,753
Miscellaneous	4,388	31,750
	<u>1,386,570</u>	<u>1,296,012</u>
Audit fee	12,500	6,125
Advertisement	6,187	1,365
Legal expenses	5,844	—
	<u>1,411,101</u>	<u>1,303,502</u>

10. Prior year's figures have been rearranged for the purpose of comparison, wherever necessary.

Sd/–
(A. F. Ferguson & Co.)
Chartered Accountants

Sd/–
Chairman
(Dr. M. D. Shami)
Chairman
Pakistan Science Foundation
Islamabad.

Sd/–
Trustee
(S. M. Afzal)
Director/Member Finance
Pakistan Science Foundation
Islamabad.

PAKISTAN SCIENCE FOUNDATION ACT 1973

National Assembly of Pakistan

Islamabad, the 2nd February, 1973

The following Acts of the National Assembly received the assent of the President on the 31st January, 1973, and are hereby published for general information:

Act No. III of 1973

An Act to provide for the establishment of the Pakistan Science Foundation.

WHEREAS it is expedient to provide for the establishment of the Pakistan Science Foundation and for matters ancillary thereto.

It is hereby enacted as follows:

1. **SHORT TITLE, EXTENT AND COMMENCEMENT.**—(1) This Act may be called the Pakistan Science Foundation Act, 1973.

(2) It extends to the whole of Pakistan.

(3) It shall come into force at once.

2. **DEFINITIONS.** In this Act, unless there is anything repugnant in the subject or context.—

(a) "Board" means the Board of Trustees of the Foundation.

(b) "Chairman" means the Chairman of the Foundation; and

(c) "Foundation" means the Pakistan Science Foundation established under this Act.

3. **ESTABLISHMENT OF THE FOUNDATION.**—(1) As soon as may be after the commencement of this Act, the Federal Government may, by notification in the official Gazette, establish a Pakistan Science Foundation to promote and finance scientific activities having a bearing on the socio-economic needs of the country.

(2) The Foundation shall be a body corporate by the name of the Pakistan Science Foundation, having perpetual succession and a common seal, with power, subject to the provisions of this Act, to acquire, hold and dispose of property, both movable and immovable, and shall by the said name sue and be sued.

(3) The head office of the Foundation shall be at Islamabad.

4. **FUNCTIONS OF THE FOUNDATION.** (1) The Foundation shall function as a financing agency for.

(i) the establishment of comprehensive scientific and technological information and dissemination centres;

(ii) the promotion of basic and fundamental research in the universities and other institutions on scientific problems relevant to the socio-economic development of the country;

(iii) the utilization of the results of scientific and technological research including pilot plant studies to prove the technical and economic feasibility of processes found to be promising on a laboratory scale;

- (iv) the establishment of science centres, clubs, museums, herbaria and planetaria;
- (v) The promotion of scientific societies, associations and academies engaged in spreading the cause of scientific knowledge in general or in the pursuit of a specific scientific discipline or technology in particular;
- (vi) the organization of periodical science conferences, symposia and seminar;
- (vii) the exchange of visits of scientists and technologists with other countries;
- (viii) the grant of awards, prizes and fellowships to individuals engaged in developing processes, products and inventions of consequens. to the economy of the country; and
- (ix) special scientific surveys not undertaken by any other organization and collection of scientific statistics related to the scientific effort of the country.

(2) The Foundation shall also---

- (i) review the progress of scientific research sponsored by it and evaluate the results of such research;
- (ii) maintain a National Register of highly qualified and talented scientists of Pakistan, including engineers and doctors, in or outside the country and to assist them, in collaboration with the concerned agencies in finding appropriate employment; and
- (iii) establish liaison with similar bodies in other countries.

(3) In the performance of its functions the Foundation shall be guided on questions of policy by the Instructions, if any, given to it by the Federal Government which shall be the sole judge as to whether a question is a question of policy.

5. **BOARD OF TRUSTEES.** (1) The general direction, conduct and management of the affairs of the Foundation including administration of its funds, shall vest in a Board of Trustees consisting of the following members, namely:

Whole-time members

- (i) the Chairman;
- (ii) one eminent scientist;
- (iii) the Director of Finance;

to be appointed by the President;

Part-time members

- (iv) the Chairman of the National Science Council;
- (v) four scientists to be nominated by the National Science Council; and
- (vi) eleven eminent scientists to be nominated by the President.

(2) The remuneration and other terms and conditions of service of the Chairman and the two other whole-time members of the Board shall be such as may be determined by the President.

6. **CHAIRMAN OF THE FOUNDATION.**-(1) The Chairman of the Board shall be the Chairman of the Foundation and shall be appointed from amongst eminent scientists of the country having experience of research

and scientific administration.

(2) The Chairman shall, subject to sub-section (3), hold office for a term not exceeding three years and shall be eligible for reappointment.

(3) The President may at any time terminate the appointment of the Chairman without notice and without assigning any reason.

7. MEMBERS OF THE BOARD. (1) The members of the Board, other than the ex-officio member shall, subject to sub-section (3), hold office for a term not exceeding three years and shall be eligible for re-appointment or re-nomination, as the case may be.

(2) A member, other than an ex-officio member, may at any time resign his office by writing under his hand addressed to the President but shall continue to perform his functions until his resignation has been accepted.

(3) The President may at any time terminate the appointment or as the case may be, nomination of any member of the Board without notice and without assigning any reason.

8. MEETINGS OF THE BOARD.-(1) The meeting of the Board shall be held at least twice a year and shall be presided over by the Chairman or, in his absence, by its whole-time scientist member.

(2) All decisions at a meeting of the Board shall be taken by a majority of the votes of the members present and voting.

9. QUORUM AT THE MEETING OF THE BOARD To constitute a quorum at a meeting of the Board not less than nine members shall be present.

10. EXECUTIVE COMMITTEE. There shall be an Executive Committee consisting of the Chairman and the two whole-time members of the Board.

11. DELEGATION OF POWERS. The Board may, from time to time, delegate to the Chairman or the Executive Committee such of its powers and functions as it may consider necessary.

12. ADHOC COMMITTEE. The Foundation may set up ad-hoc committees consisting of university professors and other leading scientists and experts to scrutinize applications for financial assistance for carrying out scientific research submitted to the Foundation by the universities or other institutions or by individual scientific workers or groups of scientific workers and to review and evaluate the results of research sponsored by the Foundation.

13. FUNDS.-The funds of the Foundation shall consist of –

- (a) grants made by the Federal Government and the Provincial Governments,
- (b) donations and endowments, and
- (c) income from other sources

14. BUDGET. The Foundation shall cause to be prepared and approve a statement of its receipts and expenditure for each financial year.

15. ACCOUNTS AND AUDIT.-(1) The funds of the Foundation shall be kept in a personal ledger account of the Foundation with the State Bank of Pakistan or with any Branch of the National Bank of Pakistan acting as an agent of the State Bank.

(2) The accounts of the Foundation shall be maintained in such form and manner as the Auditor-General of Pakistan may determine in consultation with the Federal Government.

(3) The accounts of the Foundation shall be audited by one or more auditors who are chartered accountants within the meaning of the Chartered Accountants Ordinance, 1961 (X of 1961), and are appointed by the Foundation in consultation with the Auditor-General of Pakistan.

16. **APPOINTMENT OF OFFICERS AND SERVANTS.** (1) The Foundation may appoint such officers and servants, and engage such consultants or experts, as it may consider necessary for the efficient performance of its functions, on such terms and conditions as it may deem fit.

(2) In fixing the terms and conditions of service of its officers and servants, the Foundation shall, as nearly as may be, conform to the scales of pay, allowances and conditions of service applicable to the corresponding class of employees of the Federal Government

17. **ANNUAL REPORT.** (1) The annual report of the Foundation, which shall among other things clearly bring out the benefits accruing to the nation as a result of the activities sponsored by the Foundation, shall be prepared by the Chairman and submitted, through the Board, to the Federal Government alongwith the audited accounts of the Foundation.

(2) The annual report alongwith the audited accounts of the Foundation shall be laid before the National Assembly.

18. **REGULATIONS.**—The Foundation may make Regulations for the efficient conduct of its affairs.

19. **REPEAL.**—The Pakistan Science Foundation Ordinance, 1972 (LII of 1972), is hereby repealed.

LIST OF SANCTIONED RESEARCH GRANTS 1979-80

S.No.	List of Schemes	Amount sanctioned	Name of the Principal Investigator and organization supported.
		Rs.	
1. Agricultural Sciences			
(i)	Genetic Investigation supported by Cytological Derivatives in Wheat P-PU/Agr (31/1).	65,198 (2-Years)	Dr. Muhammad Aslam, Dean Faculty of Agriculture, University of Agriculture, Faisalabad.
(ii)	Eco-Physiological Studies on some important weeds of wheat P-PU/Agr (64).	1,88,660 (3-Years)	Dr. S. Razi Abbas Shamsi, Department of Botany, University of the Punjab, New Campus, Lahore.
2. Biological Sciences			
(i)	Control of some Avian and Mammalian Pests. P-AU/Bio (40/1).	71,970 (2-Years)	Dr. Mirza Azhar Beg, Department of Zoology, University of Agriculture, Faisalabad.
(ii)	Biological Control of Plant Diseases caused by Root infecting pathogenic Fungi. P-PU/Bio (74).	47,328 (2-Years)	Dr. S.H. Iqbal, Department of Botany, Punjab University, Lahore.
(iii)	Epidemiological Survey and Serogrouping of type strains of Leptospirosis in the vertebrate animal in Pakistan P-AU/Bio (86/1).	1,53,100 (2-Years)	Dr. Muhammad Jamil, College of Animal Husbandry, Lahore.
(iv)	Studies on the occurrence, Bionomics and Epidemiology of Hydatid in Lahore Division and its effects on the host tissues. P-PU/Bio (91).	85,210 (2-Years)	Dr. Daler Khan Department of Zoology, University of the Punjab, New Campus, Lahore.
(v)	Majid Crabs of the Arabian Sea S-KU/Bio (92).	28,483	Prof. Nasima M. Tirmizi, Department of Zoology, University of Karachi.
(vi)	Morpho-physiological and metabolic hazards of chlorinated Insecticides on small mammals. P-PU/Bio (93)	2,31,518	Dr. Abdul Rauf Shakoori, Department of Zoology, University of the Punjab, New Campus, Lahore.
(vii)	Floating Raft cultivation of the green mussel (<i>perna viridis</i>) S-KU/Bio (98).	49,912	Dr. Muzzamil Ahmed, Institute of Marine, Biology, University of Karachi, Karachi.
(viii)	Catalogue/Records of the Karachi University Zoological Museum, S-KU/Bio (99)	92,580 (3-Years)	Dr. S. Hamid Mahmood, Professor of Zoology, Department of Zoology, University of Karachi.

S.No.	List of Schemes	Amount sanctioned	Name of the Principal Investigator and organization supported.
3. Chemical Sciences			
	Primary metabolites of Fungus Candida and their Biological activity S-KU/Cha (89/1).	27,234 (One-Year)	Dr. Zafar H. Zaidi, Post Graduate Institute of Chemistry, University of Karachi, Karachi
	Fisher-Tropsch Synthesis-Production of liquid fuels from Coal. P-GCL/Chem (90).	1,78,600 (3-Years)	Dr. Zawar Hussain Shirazi, Department of Chemistry, Government College, Lahore.
	Production of various types of enamels, P-PCSIR/Chem (93).	37,128 (One-Year)	Dr. M.A Beg, PCSIR Laboratories, Lahore.
	Effect of Snake Venom on cancerous cells and other proteins, S-SU/Chem (98).	67,472 (One-Year)	Dr. Din Muhammad Shaikh, Department of Physiology and Biochemistry, University of Sind, Jamshoro.
	Investigation of the Hydrolysis Mechanism of Lactones. C-QU/Chem (99).	31,772 One-Year	Dr. (Mrs) Mashooda Hasan, Prof. of Organic Chemistry, Quaid-e-Azam University, Islamabad.
	New Medicinal derivative from Santonin, P-CSIR/Chem (105).	47,240	Dr. Yousuf Ahmed, PCSIR Laboratories, Lahore.
	Synthetic and catalytic aspects of new transition metal alkyls and aryls, P-PU/Chem (106).	1,16,818	Dr. Muhammad Zafar Iqbal, Associate Professor and Director, Institute of Chemistry, University of Punjab, Lahore.
	Pilot Plant production of butanol by fermentation, PCSIR/Chem (107).	42,718 (2-Years)	Dr. M.A. Qadeer, Food Technology & Fermentation Division, PCSIR Labs., Lahore-16.
	A study on removal of industrial pollutant gases by absorption, P-PU/Chem (112).	1,26,428 (2-Years)	Dr. M.N. Romani, Dean, Faculty of Science and Engineering, Punjab University, Lahore.
4. Earth Sciences			
	Geochemistry and Mineralogy of speckled sand stone formation and the related rocks in Salt-range Punjab, P-PU/Earth (24).	54,460 (One-Year)	Dr. F.A. Shams, Department of Geology, University of Punjab, Lahore.
5. Environmental Sciences			
	Ecological studies on Fresh water Hyphomycetes, P-PU/Envr (3/1).	69,722 (2-Years)	Dr. S. H. Iqbal, Department of Botany University of Punjab, Lahore.
	Mutagenicity testing of children's consumable, P-NIAB/Envr (18).	1,16,044 (3-Years)	Dr. Sheikh Riazuddin, PSO. Biochemistry, Natural Products Division, NIAB, P.O. Box. 128, Faisalabad.

S.No.	List of Schemes	Amount sanctioned	Name of the Principal Investigator and organization supported.
	Hydrobiological studies of the lakes of Punjab, P-GC/Envr (23).	89,004 (2-Years)	Prof Syed Rashid Ali, Zoology Department, Gordon College, Rawalpindi.
6. Medical Sciences			
	Investigations on the therapeutic value of indigenous plants used in traditional medicine for the control of diabetes, S-JPMC/Med (44).	48,900 (2-Years)	Prof M Aaur Rehman, Department of Biochemistry, J.P.M.C Karachi
	Haemoglobin structural changes & their impact on functions, S-KU/Med (45).	52,548 (One-Year)	Dr. Z H Zaidi, HEJ Postgraduate Institute of Chemistry, University of Karachi.
7. Oceanography			
	Shore Erosion Studies of Pakistan Coast in the Vicinity of Karachi. (S-KU/Ocean (4).	2,77,317 (3-Years)	Dr. S.M.A. Tirmizi, Department of Physics, University of Karachi, Karachi.
8. Physical Sciences			
	Measurement of electrical conductivity of some Solids at and below room temperature. (S-KU/Phys 24).	1,05,672 (2-Years)	Dr. S.M.A. Tirmizi, Department of Physics, University of Karachi, Karachi.
	An investigation of the weak and electromagnetic with particular reference to high energy neutrino scattering and electron positron annihilation. (C-QU/Phys (33).	31,232 (One-Year)	Dr M.S.K. Razmi, Department of Physics, Quaid-e-Azam University, Islamabad.

UTILIZATION OF RESEARCH RESULTS

S.No.	List of Scheme	Amount Sanctioned	Name of Principal Investigator and Organization supported
1.	Cement from Rice Husk (ATDO/UTZ (38).	1,14,880 (one year)	Dr. Riaz Ali Shah PCSIR, Peshawar.
2.	Conversion of petrol engine to bio-gas. (ATDO/UTZ (41).	46,000	Mr. A.H. Chotani, HDIP Karachi.
3.	Low cost rural roads. (ATDO/UTZ (45).	1,92,880 (one year)	Dr. Riaz Ali Shah, PCSIR, Peshawar.

GRANTS SANCTIONED TO SCIENTIFIC SOCIETIES AND LEARNED BODIES FOR ACHIEVEMENT OF THEIR OBJECTIVES.

No.	Agency	Amount Rupees
(A) ALL PAKISTAN SCIENTIFIC SOCIETIES/LEARNED BODIES:		
1.	Pakistan Academy of Sciences.	50,000/-
2.	Pakistan Association for the Advancement of Science.	40,000/-
3.	Pakistan Association of Scientists and Scientific Professions.	40,000/-
4.	Scientific Society of Pakistan.	40,000/-
5.	Pakistan Engineering Congress.	30,000/-
(B) DISCIPLINE SOCIETIES.		
1.	Pakistan Medical Association.	20,000/-
2.	Pakistan Botanical Society.	10,000/-
3.	Society for the Advancement of Agricultural Sciences.	10,000/-
4.	Biological Society of Pakistan.	10,000/-
5.	Zoological Society of Pakistan.	10,000/-
6.	Pakistan Society of Biochemists.	10,000/-
7.	Pakistan Institution of Electrical Engineers.	15,000/-
8.	Pakistan Institute of Metallurgical Engineers.	10,000/-
9.	Chemical Society of Pakistan.	10,000/-
(C) PROVINCIAL SOCIETY:		
1.	Sind Science Society.	25,000/-
		3,30,000/-

GRANTS SANCTIONED FOR PUBLICATION PROGRAMME

S.No.	Agency	Name of Publication	Amount Rupees
1.	Pakistan Association for the Advancement of Science.	(i) Pakistan Journal of Science. (ii) Pakistan Journal of Scientific and Industrial research.	20,000/-
2.	Scientific Society of Pakistan	(i) Science Bachoon Keliay. (ii) Science Magazine.	30,000/-
3.	Pakistan Botanical Society.	Pakistan Journal of Botany.	10,000/-
4.	Society for the Advancement of Agricultural Sciences.	Pakistan Journal of Agricultural Sciences.	5,000/-
5.	Biological Society of Pakistan.	(i) Biologia (ii) Jubli-Number of Biologia.	10,000/- 15,000/-
6.	Zoological Society of Pakistan.	Pakistan Journal of Zoology.	10,000/-
7.	Pakistan Society of Biochemists.	Pakistan Journal of Biochemistry.	5,000/-
8.	Gordon College Rawalpindi.	Bulletion of Hydrobiological Research.	13,000/-
9.	Pakistan Forest Institute, Peshawar.	Pakistan Journal of Forestry.	10,000/-
10.	Chemical Society of Pakistan.	Journal of Chemical Society of Pakistan.	10,000/-
			<hr/> 1,28,150/- <hr/>

**GRANTS SANCTIONED FOR ORGANIZING SCIENCE
CONFERENCE/SYMPOSIA/SEMINAR**

Title of the Conference	Organizing Institutions	Amount Rupees
19th Annual Science Conference held at Quaid-e-Azam University, Islamabad.	Scientific Society of Pakistan.	40,000/-
First Annual Conference of Zoology.	Zoological Society of Pakistan.	20,000/-
3rd National Seminar on Solid State Physics.	University of Karachi.	10,000/-
International Conference on Recent advances in Earth Sciences.	Quaid-e-Azam University, Islamabad.	20,000/-
Science Policy Seminar	National Science Council, Islamabad.	15,000/-
	Total –	<u>1,05,000/-</u>

TRAVEL GRANTS

S No.	Name	Purpose of Visit	Amount Rupees
1.	Dr. Mrs. Akhtar Ansari, Department of Chemistry, University of Karachi.	International Congress on Catalyst, Tokyo, Japan.	14,968/-
2.	Dr. Munawar Hussain, Mathematics Department, Govt. College Lahore.	Summer Seminar on 'Complex Analysis' Trieste, Italy.	3,977/-
3.	Mr. Abdul Rauf Nowshervi, Chemistry Depart- ment, University of Peshawar.	International Symposium on "Solar energy Utilization" Ontario, Canada.	16,000/-
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			34,945/-
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