ANNUAL REPORT

FOR THE YEAR 1977-78

Pakistan Science Foundation
Islamabad

PAKISTAN SCIENCE FOUNDATION

ANNUAL REPORT
1977-78

LETTER OF TRANSMITTAL

Islamabad

Dear Mr. Secretary,

I have the honour to transmit herewith the Fifth Annual Report of the Pakistan Science Foundation for the Fiscal Year 1977-78, 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,

(DR. Z.A. HASHMI)
Chairman
Pakistan Science Foundation

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

PAKISTAN SCIENCE FOUNDATION

Chairman

Dr. Z.A. Hashmi, M.Sc.,D.V.M.,D.Sc. (Michigan State)
D.Sc. (Faisalabad), F.P.A.S.

Executive Committee

Dr. Z.A. Hashmi	Chairman
Mr. A.G. Mufti	Member (Science)
Mr. M.S. Athar	Member (Finance)

Board of Trustees

(Whole-time Members)

Dr. Z.A. Hashmi	Chairman
Mr. A.G. Mufti	Member (Science)
Mr. M.S. Athar	Member (Finance)

Sixteen part-time Members appointed as follows:

Chairman, National Science Council, Ex-officio
Dr. Z.A. Hashmi

Dr. Salimuzzaman Siddiqui, FRS, Director, Hussein Ebrahim Jamal Post-graduate Institute of Chemistry, University of Karachi, Karachi.

Dr. M.A. Kazi, Secretary to the Federal Government, Ministry of Education, Islamabad.

Dr. Amir Muhammed, Vice-Chancellor, University of Agriculture, Faisalabad/Adviser to the CMLA.

Mr. A.M. Akhund, Vice-Chancellor, NED University of Engineering and Technology, Karachi.

Dr. M. Yaqoob Bhatti, Additional Secretary to the Federal Government, Ministry of Agriculture, Co-operatives and Land Reforms, Islamabad.

Prof. M.A.Z. Mohyuddin, Chairman, Pakistan Medical Research Council, Post-graduate Medical Institute, Lahore.

Dr. M. Aslam Khan, Chief Scientist and Scientific Adviser to the Government of Pakistan, Ministry of Defence (DESTO), Rawalpindi.

Prof. Abdul Hashim Khan, Vice-Chancellor, Quaid-i-Azam University, Islamabad.

Dr. Ishfaq Ahmad, Member (Technical), Pakistan Atomic Energy Commission, Islamabad.

Dr. M.H. Kazi, Chairman, Biological Sciences Department, Quaid-i-Azam University, Islamabad.

Mr. S. Irshad Ahmad, Chairman, NESPAK, Lahore.

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

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

Mr. Asif Ali Sheikh, Joint Secretary to the Federal Government, Ministry of Science & Technology, Islamabad.

Sardar Habib Khan, (Ex-Additional Secretary and Development Commissioner, Azad Kashmir), Rawalpindi.

Note: The Director-General, Agricultural Research Council will be requested by Special invitation to participate in the meetings of Board of Trustees of the PSF.

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF ABBREVATIONS

Provinces:

B	Baluchistan
C	Centre
F	Frontier
P	Punjab
S	Sind

Sponsoring Institutions:

AC	Agricultural College
AU	Agricultural University
EU	Engineering University
IU	Islamabad University
KU	Karachi University
MH	Mayo Hospital
PU	Peshawar University/Punjab University
SU	Sind University
KMC	Khyber Medical College
NHL	National Health Laboratories
CSIR	Council of Scientific & 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 Pakistan Science Foundation was established on June 30, 1973 under the Pakistan Science Foundation Act III of 1973 (annexure - I) "to promote and finance scientific activity having a bearing on the socio-economic needs of the country". Under the Act, the Foundation has been entrusted with the following functions:-

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

ii) 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) 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) establishment of science centres, clubs, museums, herbaria and planetaria;

v) development of learned bodies, scientific societies, associations and academies engaged in spreading the cause of scientific knowledge in general or in pursuit of a specific scientific discipline or technology in particular;

vi) organization of periodical science conferences, symposia and seminars;

vii) exchange of visits of scientists and technologists with other countries;

viii) 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 shall also:

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 the country, 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 progress made by the Foundation for the performance of above statutory functions is given in the following chapters:

CHAPTER - I

ACTIVITIES AND PROGRAMMES

The salient features of the progress made by the Foundation during 1977-78 in the discharge of the functions entrusted to it under the Charter, is summarised as follows:

I. ESTABLISHMENT OF THE PAKISTAN SCIENTIFIC AND TECHNOLOGICAL INFORMATION CENTRE (PASTIC).

The Pakistan Scientific and Technological Information Centre (PASTIC), according to the scheme sanctioned by ECNEC, was established on 14.9.1974 to provide the following facilities to the Scientific Community:

i) National Science Reference Library;
ii) Documentation Service;
iii) Scientific and Technological Information Transfer Services;
iv) Facilities for Scientific Publications; and
v) Facilities for Compilation of Scientific Statistics.

National Science Reference Library

During the period under report, 84 reference books and 537 periodical issues against 62 different titles were received in the Library. The present holdings of the National Science Reference Library, covering various Scientific and Technological disciplines, are as follows:

Book/Reference Books	6367
Periodical Issues	3598
Periodical Titles	322

Letters of credit were opened during the shipping period January-June, 1978 with the Foreign Firms for the purchase of books and periodicals costing Rs. 2.26 lakh.

NASDATA - DATA BASE Union Catalogue System

Under the guidance of Dr. R.S. Karni, UNESCO consultant to the PASTIC Library, a system was developed for computer handling of bibliographic data for the purpose of cataloguing and classifying documents held by the National Science Reference Library. The main objective of developing this system was to: (i) provide up-todate information of documents and periodicals available in PASTIC and other Science Libraries in the PASTIC net-work,

(ii) facilitate rapid dissemination of information to the users, (iii) establish links with foreign data bases such as International Information System for Agricultural Sciences and Technology; International Nuclear Information System; Development of Sciences Information System; Integrated set of Information System; etc. and (iv) avoid duplication of accessions, thus saving funds for their utilization elsewhere.

Information Transfer Service

In response to the current trends of goal-oriented research in the country, items of information were gathered from various sources and provided regularly to the research organizations in the country. The patent information cell at the PASTIC sub-centre of Karachi provided current awareness services for patent information.

Documentation Service

This service includes supply of bibliographies, translation and document reproduction, which were provided by PASTIC on demand from the users.

UNEP/International Referral System (IRS) National Focal Point

The feasibility report regarding the setting up of UNEP/IRS National Focal Point in PASTIC was approved by the Government and an allocation of Rs. 15,000/- was made in the budget (1977-78) for its immediate establishment. The focal point started functioning in April, 1978.

PASTIC Building

The services of an architect/consultant Mr. Michael Brawne were obtained from UNESCO for the preparation of building designs of the PASTIC permanent building. The Pakistan Environment Planning and Architect Consultants (PEPAC) Ltd., a Government sponsored Agency was appointed by the PSF for consultancy and overall supervisory responsibilities involved in the construction of the building. However, in persuance of the Cabinet Division's O.M. No. 104/31/78-MIM, dated 5-3-1978, the construction of the PASTIC building was entrusted to the Pak P.W.D., and necessary funds were released in favour of the Executive Engineer, Civil Projects Division No. I, Pak P.W.D., Islamabad for taking up the construction as a deposit work

Purchase of Equipment

An IBM electronic composer and five micro-film readers have been obtained by PASTIC against the order previously placed with IBM company. Furthermore, an import licence for a micro-film reader and printer costing Rs. 1,94,000/- was obtained from the CCIE and letter of credit opened with M/S Bell & Howell Co., U.S.A. Efforts are being made to instal a teleprinter at the PASTIC National Centre, Islamabad in order to establish links with foreign data base for the procurement of latest information in the field of Science and Technology.

Workshop on National and International Scientific Information System

A workshop on National and International Scientific Information System, sponsored by PSF, was organised by PASTIC and was attended by the representatives of UNEP/ IRS, UNESCO, and IRDC. On the conclusion of this workshop a large number of recommendations were made for the development of Scientific Information infrastructure in the country which, interalia, included the following:-

i) A minimum of 5% of the R & D budget of the institution should be allocated to the acquisition of scientific and technical literature.

ii) To facilitate the acquisition of scientific and technical literature Government should make adequate provision of foreign exchange for purchase of books and periodicals commensurate with the needs of respective institutions.

iii) Government may be requested to consider the possibilities of waiving off customs duties, sales tax, etc., on reprographic equipment and its accessories for use in libraries, documentation and information centres and institutions engaged in similar activities.

iv) Information scientists/librarians should be treated at par with all other scientists in respect of status and general terms of employment.

v) S & T Information Policy, within the general frame-work of UNISIST System, should form part of National Science and Technology Policy.

Plate 1 : Mr. Manzoor Ahmad Sheikh, Secretary, Ministry of Science and Technology and Dr. Z.A. Hashmi, Chairman, Pakistan Science Foundation, addressing the participants of the Scientific Information Workshop.

vi) In view of the fact that at present very little capability exists for the processing of large amounts of data (Data-bases, Data-banks) in Pakistan, it is recommended that PASTIC acquire appropriate computing system to efficiently handle Pakistan's requirements of referral, document retrieval and specific scientific information.

vii) To provide rapid communication between the libraries taking part in the PAKSTI-Network and between these libraries and the national centre in Islamabad, access to telex facilities should be ensured.

Information Course:

A 12-week course on information handling and management was organised by PASTIC under the guidance of Dr. R.S. Karni, from December, 1977 to February, 1978. Thirtyfive candidates nominated by different S & T Institutions attended this course, which enabled the trainees to up-date their professional knowledge in the field of Information Science.

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 following programmes:

1. Grants of research projects submitted by individuals or groups of scientists in the universities and research institutions.

2. Institutional Support - provision of equipment literature, staff training facilities, etc., to build institutional capability for conducting research.

3. Organization of Integrated Research Programme.

4. Support for participation in regional and international research programmes.

A. Grants of research projects submitted by individual research workers or groups of scientific workers.

The Principal activity 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 as under:-

Forty one (41) projects requesting for funds costing Rs. 1.07 crore were received by the Foundation during the report period and forty one (41) project proposals at various stages of their processing, were brought forward from the previous year. Thus, in all, 82 project proposals remained under active consideration of the Foundation during 1977-78. These proposals were examined by experts in the relevant fields in the light of their scientific merits and relevance to national needs according to the criteria laid down by the Foundation. 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 report, is placed before the Technical and other committees of the Foundation. During the year, only 16 projects could, however, be sanctioned at an estimated cost of Rs. 14.3 lakh, the reason being paucity of funds with PSF.

SCIENTIFIC RESEARCH PROJECTS SANCTIONED DISCIPLINE-WISE FROM JULY, 1973 TO JUNE, 1978.

DISCIPLINE	1973-74		1974-75		1975-76		1976-77		1977-78	
	No. of Schemes	Amount Sanctioned	No. of Schemes	Amount Sanctioned	No. of Schemes	Amount Sanctioned	No. of Schemes	Amount Sanctioned	No. of Schemes	Amount Sanctioned
Agricultural Sciences	1	3,61,551.00	6	16,36,346.00	8	11,63,966.00	3	4,29,566.00	2	2,52,382.00
Biological Sciences	9	14,70,069.00	13	21,62,504.00	2	74,373.00	9	9,99,842.00	3	1,39,460.00
Chemical Sciences	7	14,09,038.00	9	12,62,804.00	8	10,36,757.00	11	13,18,656.00	6	3,72,272.00
Earth Sciences	1	3,00,000.00	3	3,91,628.00	3	78,845.00	3	3,39,118.00	-	-
Engineering Sciences	1	57,520.00	1	35,000.00	1	30,000.00	1	2,67,325.00	-	-
Environmental Sciences	-	-	-	-	3	3,79,206.00	6	6,86,236.00	-	-
Mathematical Sciences	1	69,395.00	1	1,00,000.00	1	44,835.00	-	-	-	-
Medical Sciences	1	14,000.00	7	1,85,071.00	2	2,70,968.00	5	4,46,504.00	2	1,22,500.00
Oceanography	1	1,46,237.00	-	-	1	53,940.00	-	-	-	-
Physical Sciences	4	4,41,174.00	1	5,14,855.00	-	-	3	9,33,980.00	3	5,37,930.00
Total:	26	42,68,984.00	41	62,89,208.00	29	31,32,890.00	41	56,73,727.00	16	14,24,884.00

Discipline-wise distribution of grants made by the Foundation during the past five years, is shown in table-I.

Research Projects

Summaries of the research proposals sanctioned during the year 1977-78 are given below:-

1. AGRICULTURAL SCIENCES P-AU/AGR(55)*

Title: Pathology of Trees

The proposal aims at preparing the manuscripts of two more volumes, namely 'Diseases of Fruit Trees' and 'Diseases of Hard Wood' of the book entitled; "Pathology of Trees".

The manuscript will incorporate the results of 30 years of research on Pathology of Indo-Pak trees and will serve as a reference book for the countries in the region.

Three volumes namely: (i) Pathogens-Fungi, Bacteria and viruses in relation to Tree Diseases, (ii) Pathogenisis and Pro-phylaxis totalling to 1041 types and 192 illustrations have already been completed by the same author under a PL-480 scheme. The compilation of two more volumes will complete the series on "Pathology of Trees". This publication will be of great help to the researchers, Agriculturists, Foresters and Horticulturists.

S-AU/AGR (58)

Title: Role of Predacious Arthropods in Mite Pests Control

Insecticides have come with mixed blessings. On the one hand, they have protected the crops, vegetables and fruit trees from the pest damage; but on the other, they have created a number of problems such as, insect resistance, health hazards, outbreaks of pests of secondary importance, undesirable side effects on non-target organisms, etc. The mites being pests of secondary importance are an outcome of the repeated use of insecticides (due to killing of their parasites and predators); and now, they have posed a serious problem to the crop production industry. The situation of the crop health further worsens when duel attack by insects and mites occurs, causing heavy damage to the crop. In such situations, the farmers get puzzled with the problem and start applying insecticides over and again ruthlessly, resulting only in a wearisome work but with no economic gain.

*For names of the Principal Investigators and sponsoring institutions, refer to Annexure-II.

These pests are rather to be controlled biologically i.e. by regulating their populations and holding the same below economic injury level. This would be accomplished by favouring the parasites and predators to develop their population and permitting them to operate in the field.

The proposed study aims at investigating the predacious arthropodes present in this region with a view to studying their biology, and predacious behaviour.

The results would provide data as well as basic information on predacious arthropodes present in the biomass/ Agro-ecosystem of the Sind area to the plant protectionists for initiating programmes of integrated pest management.

2. BIOLOGICAL SCIENCES

C-QU/BIO (84)

Title: Studies on the breeding biology and behaviour of Mahsher fish (Barbus tor).

Fresh water fishes of Pakistan have significant economic importance because of their nutritive value especially as major source of animal protein. Attempts have been made in the past to update the fresh water fisheries management programme for the proliferation, survival, spread and economic use of some of these fishes. Inspite of concerted efforts, little progress has been made to achieve these objectives. This has been in part due to unsystematic application of the available knowledge and the lack of in-depth studies on the biology of these fishes.

This study aims at investigating the breeding activity, endocrine physiology and behavioural aspects of an economic fresh water Mahsher fish in the Rawal Lake.

This study, when completed, is expected to contribute to the management and the development of this fish in the fresh water bodies/streams of Northern Punjab and N.W.F.P.

P-AU/BIO(86)

Title: Epidemiological Survey and Serogrouping of Type Strains of Leptospirosis in the Vertebrate Animal in Pakistan.

Leptospirosis is a disease which is transmitted naturally between vertebrate animals and man. This is caused

by a pathogenic organisms usually found in animals. Man acquire them by accidental contact with infected animals or through the environment which is contaminated by animal shedders. The disease however has been investigated to a very limited extent.

The project aims at studying the incidence, extent and host range of leptospirosis in the vertebrate animals under different environmental conditions and identifying the serogroups involved in its infection.

The results of this study will help undertaking (i) preventive measures against the human contamination and (ii) control measures for reducing economic losses in Livestock.

F-HC/BIO(89)

Title: A Study of the Phenomenon of Taste Aversion.

The Wild-life protection laws prevent extermination of predators. The best way to control the predators would be to change their food habits. Experimentally it has been observed that if the consumption of a particular substance is followed by some poisonous material on a subsequent exposure, the animal decreases the consumption of that substance.

The present study aims at conducting 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 controlling the predation in nature.

3. CHEMICAL SCIENCES

P-PU/CHEM(83)

Title: Isolation, Purification and Structural Determination of Biologically and Pharmacologically Active Alkaloids from Indigenous Plants.

The Northern areas of Pakistan abound in plants of medicinal value and a number of biologically and pharmacologically active alkaloids have been isolated

from these plants. However, there is still a large number of plants which have not so far been investigated.

The proposed study aims at isolating the active alkaloid from the plants belonging to the genus Rhamnaceae. The expected results would make a significant contribution to the products of potential pharmaceutical value.

S-KU/CHEM(84)

Title: Isolation and Structural Studies on the Chemical Constituents of some indigenous flowering plants.

Pakistan, like many other tropical countries, is rich in medicinal plant resources. Preliminary work on some flowering plants growing abundantly in and around Karachi has yielded encouraging results and a number of new alkaloids and triterpenoids have been isolated.

The present work aims at isolation and structural determination of the constituents of the plants namely (i) Prosopis juliflora (ii) Morinda citrifolia (iii) Bougenvillea glabra and Euphorbia lactae growing abundantly in and around Karachi.

The study has a dual purpose of bringing up new medicinally important substances and providing a basis for chemotherapeutical studies directed towards the synthesis of useful drugs modelled on the chemical structure of natural products.

P-MU/CHEM(85)

Title: Development of method for the improvement of clays for pottery and other purposes.

Multan pottery and glazed wares have been known for their quality since early times. Pottery making is still practised as a family trade. However, due to unblamization and lack of patronage, this industry has received a set-back.

The scheme aims at surveying the available clay resources in Multan and to study the feasibility of setting up a pilot plant for the production of clay of a uniform consistency for the local pottery. The development of clay will give a boost to the cottage industry and utilization of local resources.

S-KU/CHEM(86)

Title: Investigation of fungal metabolites of Fusarium chlamydosporum and Fusarium moniliforme:

Fungal contaminants in common food stuffs contain highly toxic and carcinogenic metabolites and lot of work has been done on many of the Fusarium species. However, two of the most common fungi namely Fusarium moniliforme and Fusarium chlamydosporum have not so far been investigated.

The project aims at growing the cultures of these fungi for isolation, structural elucidation and toxicity determination of their fungal metabolites. Discovery of toxic metabolites on these species will lead to co-relate the consumption of relevant contaminated cereals with specific diseases occuring in various regions of the country.

F-GU/CHEM(87)

Title: Transition Metal Complexes of Medicinal Compounds.

The complexation of medicinal compounds is well known for their uses e.g., Dimercaprol has been used for the treatment of arsenic poisoning as to forms a complex which is excreted in urine and has also been used as cure for mercury and gold poisoning. Similarly, pencillamine has been used for the regulation of copper balance in the body.

The present investigation envisages the preparation of a series of complexes of medicinal compounds with transition metals structures with the help of X-Ray diffraction analysis and magnetic methods.

The study will help understanding the activity of the medicinal compound as well as its role in the adjustment of trace elements in the body.

S-KU/CHEM(89)

Title: Isolation, characterization and biological activity of the proteins and polypeptides from Candida albicans and C. Tropicalis:

Candida albicans a known pathogen, capable of producing infections of various parts of the body under certain circumstances, has recently been shown to possess metabolites which have some therapeutical entiviral activity in the experimental animals. Some researchers have identified these fractions as polysaccharides and glycoproteins. Other have isolated some lipids, fatty acids, toxic compounds and a few enzymes from various species of candida. However, little work has been done on the proteins and polypeptide fractions.

During the present studies, two species namely Candida albicans and C. tropicalis would be studied to determine the protein content of the broth and ceil, to isolate the characterise glycoproteins and polypeptides and to determine their amino-acid composition and anti-viral activity.

4. MEDICAL SCIENCES

C-AFMC/MED(34)

Title: Mapping of the chemical constituents of water in Pakistan with a view to correlating them with some diseases.

Like oxygen, water is also essential for the maintenance of life. The quality of water is determined by the chemical constituents as the deficiency or excess of some chemicals in water effects digestion and absorption of the nutrients by Man. The present scheme aims at studying the chemical constituents of water specially from deep sources and to co-relate these with some disease. The determination of chemical quality of water would fill in a big lacuna in the basic data of the country as the data once collected will remain valid for a long period of time.

The result of this study will point to the measures like iodization of salt or floridization of water; removal of gastric irritants and prevention of the pollution of rivers with industrial water by formulating public health laws regulating the discharge of industrial water in rivers.

S-JPMC/MED(39)

Title: Studies on Insulin levels and its antagonism in diabetic patients.

Diabetes is the third most frequent illness after heart disease and cancer. The character of diabetes, as known in the tropical countries, differs from that encountered in temperate climate. The most insignificant peculiarities being the rarity of the juvenile type and infrequency of ketosis in diabetes and that it is usually of mild nature and prevails over a wide age group. The therapeutic response to oral hypoglycemic agents is also different and extra pancreatic factors seem to play an important role in the pathogensis of diabetes.

The present scheme aims at studying the role of liver, existence of insulin antagonism, the rate of glucose assimilation and the variation of bound carbohydrate in diabetic patients as compared with normal subjects.

5. PHYSICAL SCIENCES

C-QU/PHY(20)

Title: To study the various interactions in elementary particle Physics, in particular weak and electromagnetic interactions.

All the elementary particles with the exception of proton and electron are unstable and decay via weak interaction: This decay of particles is essentially a low energy phenomenon. Thus, it would be of interest to test the theory of weak interaction at high energy which has become possible with the construction of large accelerators.

The scheme envisages to study:-

i) Neutrino and anti-neutrino interactions with matter at high energy.

ii) Different models in unified gauge theory and comparison of theoretical results with the experimental data.

iii) Properties of recently discovered new particles namely Y/J & Y.

S-KU/PHY(23)

Title: Spectroscopy of Diatomic Molecules

Studies on the electronic spectra of metallic hydrides were undertaken by the same authors under the PSF project No. SU-PHY(3). The study yielded interesting results which had since been published in national as well as international journals. These investigations concluded that a lot of work could be done on diatomic molecules.

The present scheme aims at investigating the following aspects in diatomic molecules:-

i) Analysis of P-complex of BaH & BaD.

ii) Spectrum of $AL^{+}H$.

iii) System of SrH.

iv) Potential curves of experimentally determined states of hydrides of groups of elements.

v) Building of king-type furnace, formation of deuterion by electolysis of heavy water, setting up a still powerful background source (Xe arc, 900 W), replacing the present grating by a high angle blaxed grating in Ebert mounting to obtain high resolution, designing a suitable pre-disper to select the desired order and an able comparator all combined together will help undertake studies on (i) nd-complex in absorption; (ii) 5d complex in absorption at 2475 A and (iii) 7p and 6d complex for SrH in absorption with suitable experimental conditions.

C-QU/PHY(26)

Title: Non-linear Wave Propagation in Plasma:

The proposal aims at developing the important field of plasma physics. It intends to investigate theoretically, some aspects of Non-linear wave propagation in plasma and in turn possibly provide answers to the problems like:

i) the heating of plasma.

ii) the confinement of plasma.

iii) the anomalous diffusion of plasma etc.

B. Institutional Support

The Pakistan Science Foundation assists the universities in the provision of equipment, chemicals, literature 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. The emphasis is on (i) fostering and equipping multi-disciplinary research units directed towards the solution of areas of high research priority; (ii) provision of equipment, literature, staff training facilities and improvement of data processing, documentation and information systems and similar facilities which would build up research capability of selected research centres and units.

The grants sanctioned (Annexure III) during the current year to enhance the institutional capabilities, are as follows:-

i) A grant of Rs. 1,42,000/- was given to the Institute of Chemistry, Punjab University, Lahore, as Institutional Support for the purchase of a Refrigerated centrifuge.

ii) A grant of Rs. 1,50,000/- (in Foreign Exchange) was given to the Multan University, to equip their Chemistry Department with a U.V. Spectro-photometer.

iii) A grant of Rs. 1,50,000/- was given to the Centre for Solid State Physics, Punjab University, Lahore, for the purchase of accessories for the Monochromater. This grant was in addition to Rs. 4.0 lac given by the Foundation last year for the purchase of Monochromater.

iv) An amount of Rs. 10,900/- was given to the Zoological Survey Department,Karachi as an additional grant for the preparation of Manikin on the Blue Whale skeleton.

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 only project received and sanctioned by the PSF under this head during the report period is as follows:-

PSF/BIC/UTZ(36)

Title: To set-up model cottage industries at four rural development centres.

The project envisages setting up of model cottage industries such as match manufacturing, candle and chalk manufacturing, fibre extraction from cisstle, leather processing and vegetable dehydration etc. at four rural development centres namely: (i) Daultala, (ii) Choa-Saidan-Shah, (iii) Pindigheb and (iv) Bahtar. These industries will be based on the readily available raw agricultural and mineral materials like cisstle fibre plant, wood, pulses, vegetable, wool, leather, lime stone, gypsum, bauxite etc., abundantly available in these areas and would be utilized in the cottage industries. The un-explored rural labour i.e., children, women and old age men will be imparted training to work in these cottage industries.

These models will work as seats of example, training and transfer of technology and their popularization may bring socio-economic revolution in the Barani Areas of the country.

IV. SCIENCE CENTRES

Establishment of Science Centres, Clubs, Museum, Herbaria and Planetaria.

a) Pakistan Museum of Natural History:

The revised scheme for the establishment of "Pakistan Museum of Natural History" was submitted in the Pre-CDWP meeting held in September, 1977, wherein it was decided that due to severe constraints in resources, the PC-I be modified again, deferring the physical building part of the project while emphasising training of staff for the development of the Natural History Museum.

The project was accordingly, revised. It was proposed in the revised Scheme, that the total scheme be undertaken in phases, and its first phase be implemented immediately. This phase incorporates the hiring of appropriate building for the Museum, the recruitment of most essential staff and their training locally as well as abroad under various technical assistance programmes, and the setting up of three major sections namely; Zoological Sciences Division, Botanical Sciences Division and Earth Sciences Division.

The revised PC-I for the first phase of the scheme was submitted to the Government for approval in March, 1978.

b) PSF National Science Centre:

During the period under report, the PSF Science Centre arranged a number of talks/seminars/exhibitions/workshops etc. on scientific and technological topics in collaboration with and under the technical advice of the PAPSAT. Some of the important seminars organised by the Centre involved the following topics:

i) Solar Energy.
ii) Potential of Indus Basin.
iii) Transfer of Technology.

The Centre also screened scientific documentary films particularly for the student community.

The year 1977 was declared by the Government as the Allama Iqbal Centenary celebration year. The National Science Centre keeping in view its scope and field, arranged a series of talks on "Iqbal and Science". Prominent scholars on Iqbal were invited to deliver lectures at the Science Centre. Seminars on "Iqbal and Science" were organised at Lahore and Islamabad in addition to other activities such as essay competition on the topic of "Iqbal Ke Nizam-e-Fiqr Mayn Science Ka Muqam".

Plate 2 : (L-R) His Excellency, Gerardo Zampaglione, the Ambassador of Italy, Chief Guest. Dr. Gill, Dr. David Pilbeam, Yale Univ. USA and Dr. Taseer Hussain, Howard Univ. USA; addressing the participants of the Seminar on Palaeontological and Anthropological discoveries in Pakistan held under the auspices of the Pakistan Museum of Natural History.

Plate 3 : "Solar Energy Seminar".
Speaker (left to right) Dr. J. Taylor Beard, Dr. Lembit Lillileht.

Plate 4 : Dr. Z.A. Hashmi, Chairman, Pakistan Science Foundation and Dr. Alim Mian, Director, Soil Survey of Pakistan, addressing the participants of Seminar on Potential of Indus Basin.

Plate 5 : Symposium on World Environment Day held on 5th June at the National Science Centre, Islamabad.

Plate 6 : Dr. Robert E. Perdue, Chief Medicinal Plant Laboratories, Maryland, USA delivering a lecture on "Medicinal Plant" at the National Science Centre, Islamabad.

Plate 7 : Centenary Celebration of Allama Iqbal.
Dr. Manzoor Ahmad delivering a talk on "Iqbal and Islam".

V) SCIENTIFIC SOCIETIES/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. Two new learned bodies namely. "The Institute of Electrical Engineers", Pakistan, and All Pakistan Library Association" were registered with the Foundation during the year under report. Annual grants amounting to Rs. 3,00,000/- (Annexure-IV) were given this year to various scientific societies and learned bodies for the achievement of their approved objectives.

Special grants totalling Rs. 1,10,000/- were given to various scientific societies/institutions for their publication programmes (Annexure - V).

VI) SCIENCE CONFERENCES:

Organization of Periodical Science Conferences, Symposia, Seminars etc.:

During the year under report, grants totalling Rs. 2,03,000/- were given to various scientific organizations and institutions for holding seminars, symposia and conferences (Annexure-VI). These included the 18th All Pakistan Science Conference held at the University of Multan under the auspices of the scientific society of Pakistan and the Mathematics Conference at the University of Punjab sponsored by the Punjab Mathematical Society. A brief account of the seminars/workshops supported by PSF is as under:-

a) An international seminar on "Low Cost Farm Structures was organised from February 27, to March 3, 1978 by the Peshawar University in collaboration with the Colorado State University, USA and the Pakistan Science Foundation in order to:

   i) disseminate some of the latest findings of research in the field of agricultural structures;

   ii) discuss the development of research projects and methodology of research appropriate for the developing countries and

   iii) familiarise with the latest techniques and materials used in agricultural structures and identify tests of performance or quality control for their application.

b) Dr. I.H. Usmani, UNESCO Adviser on Science and Technology delivered a lecture on "Utilization of solar energy in the developing countries". The lecture was arranged by the Hydrocarbon Development Institute, Islamabad.

c) A workshop on "National and International Information System" was organised from 18-23 February, 1978 at the PASTIC National Centre, Islamabad, wherein representatives from India, UNEP, UNESCO, participated.

d) A workshop of Membrane Biophysics and Development of Salt Tolerance in Plants was organised by the Agriculture University, Faisalabad. It was attended by a number of national and international scholars.

Plate 8 ; Dr. M.A. Kazi, Education Secretary, Government of Pakistan inaugurating the Mathematic Conference.

Plate 9 : Participants of the All Pakistan Mathematic Conference.

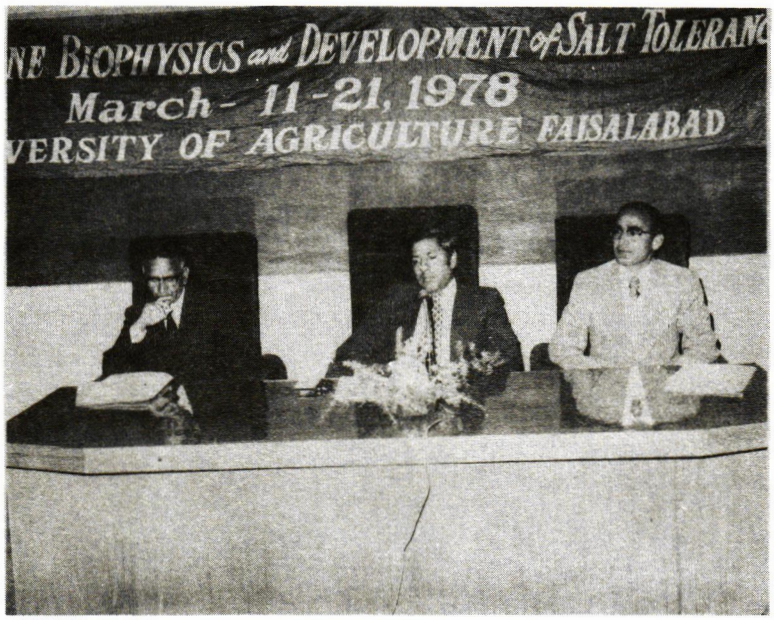


Plate 10 : Dr. Amir Mohammad, Agriculture Advisor to the CMLA, presiding the International Workshop on Memberance Biophysics and Development of Salt Tolerance.

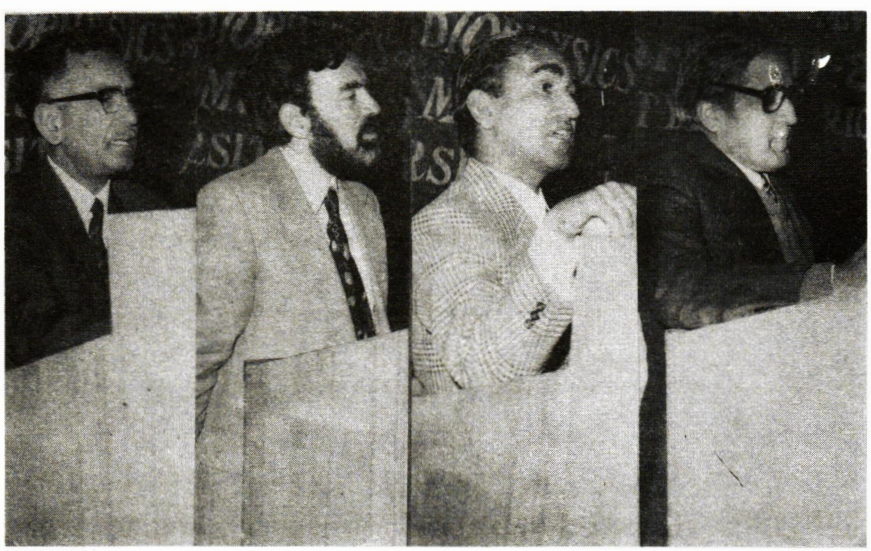


Plate 11 : Some of the speakers at the above workshop.

VII EXCHANGE OF VISITS:

Exchange of visits of scientists and technologists with other countries:

Grants totalling Rs. 27,012/- were given to five scientists (Annexure VII), to attend International Conferences/Symposia and to meet their counterparts in institutions of higher learning in advanced countries. Two of these scientists, however, did not avail of the PSF grants as their visits were financed by the foreign funding agencies.

VIII AWARDS AND FELLOWSHIPS:

A) In order to provide an incentive for the scientific research of merit, the PSF Board of Trustees, in its 9th meeting held on 8th April, 1978, approved the proposal for the grant of monetary awards to the researchers, working on PSF supported projects, if their research results were published in International Scientific Journals or Local Journals of International repute.

The Board decided that for each published paper, the concerned research workers shall be awarded an amount upto Rs. 500/-. The Board authorised the PSF Executive Committee to take decisions as to the merit of the cases and the amount payable in each case.

A circular was, accordingly, issued to all the Principal Investigators inviting reprints of the papers published by them in Journal of International repute. These reprints, as and when received, shall be processed for the grant of the above award.

B) An amount of Rs. 3,247/- was given as fellowship to 7 participants from various universities and research establishment to enable them to attend the "Sixth Post-graduate Training Course on Nuclear and other Techniques in Agriculture and Biological Research" held at the Nuclear Institute of Agriculture and Biology, Faisalabad.

IX SURVEYS AND STATISTICS:

The project for the "review of research work done so far as well as of current research in major fields such as Agriculture, Medicine, Irrigation, Housing and Works, and Industry" sanctioned to the National Science Council was initiated w.e.f. 1st July, 1977.

Out of the fields mentioned in the original proposal, Agriculture was taken up first and a Directory of Current Research in Agriculture, including animal husbandry, fisheries and forestry was compiled and is being sent to the press. The directory contains a list of 1213 current research projects in agriculture, animal husbandry, and forestry underway at various research establishments in the country. A name-index and an analytical subject-index have been appended to the Directory, which provides ready reference to the required information. The Directory also includes 30 coloured charts, which depict an analysis of the current research on the basis of a number of variables alongwith the relevant statistics.

X. RESEARCH EVALUATION:

Since scientific work lies in unchartered areas a central problem has been not only to establish a sound initial research plan but to ensure that the research supported by the Foundation at various institutions/research establishment is implemented properly for the achievement of objectives and efficient corrective feed back process. Accordingly, two types of reports i.e technical and fiscal are invited from the investigators of the PSF-supported projects and the following mechanism has been developed for the review of these reports:

a) Technical Reports:

- Six monthly reports are invited after the initiation of the project and submission of annual reports. These reports, being brief, serve as a continuing means of learning about the progress of the projects, and are scrutinised by the Science Wing of the PSF.

- Annual reports are invited each year after the initiation of projects. After initial scrutiny, these are sent for detailed evaluation to active scientific workers in the concerned fields of study. The evaluation reports received from these experts are subsequently submitted to the relevant Technical Committees for consideration and acceptance alongwith the remarks of the investigator if any on the evaluation report.

b) Fiscal Reports:

- The fiscal reports are required to be submitted alongwith semi-annual as well as annual reports. These reports after their evaluation by the Science Wing are sent to the Finance Wing of the Foundation for the release of due instalments.

- The project accounts are audited by the auditors of the respective institutions annually and the audited account statement of the project funds are submitted to the PSF at the end of each project year. These statements are then compared with the fiscal evaluation carried out by the Science Wing. The errors, if any, are referred back to the Investigators for necessary action. Audit fee upto 2% of the total expenditure incurred in any project is paid to the auditors as per decision of the PSF Board of Trustees.

XI. SCIENTISTS' POOL:

Five scientists were placed on the Scientists' Pool of the Foundation during the year. Out of these, two have succeeded in securing permanent employment in Universities through the assistance of PSF.

Since the establishment of the Scientists' Pool, the Pool Officers were being paid a stipend of Rs. 1,000/-p.m (fixed) at Karachi and Islamabad and Rs. 900/- elsewhere. In view of the rising cost of living in the country and the recent revision of the National Pay Scales, the PSF Board of Trustees decided to enhance the Scientists' Pool allowance to Rs. 1,500/- p.m (fixed for all places in the country). The Pool Officers are now being paid the revised allowance.

In pursuance of the Board's decision, the University Grants Commission was requested to forward proposals for inviting eminent scientists to undertake work aimed at strengthening carefully selected specific academic/ scientific programmes. Names of two scientists: one in the field of Physics and the other in Agriculture were received for financial support. The U.G.C was requested to furnish detailed programmes of the proposed scientists during their visit to Pakistan. The requisite information, however, was not received by the Foundation. Further action, therefore, could not be taken in this regard.

XII. INTERNATIONAL LIAISON:

There are and would be numerous scientific problems, which it will be possible to solve only within the framework of world-wide international cooperation. Scientific establishments in different countries were, accordingly, contacted to share knowledge, exchange information; undertake collaborative research and foster cooperation for the achievements of common goal. Moreover, representatives of several foreign organisations paid visits to the Pakistan Science Foundation in order to explore possibilities of collaboration in programmes of mutual interest.

During the past years a number of projects were sent to the U.S. National Science Foundation, U.S. Environmental Protection Agency, US National Institute of Health etc., for financial support under their Special Foreign Currency Programme. Of these, a project entitled: "Problems of Eutrophication and control of aquatic weeds in Fresh Water Lakes of Sind" has now been approved by the US-EPA. Work on the above project, costing Rs. 8,91,762/- will be done at the Zoology Department of the Karachi University.

CHAPTER - 2

PROGRESS OF THE PSF SUPPORTED PROJECTS

An account of the progress reports of PSF-supported projects, received during the year 1977-78, is given below:

a) Final Reports

During the year under review, 25 final reports were received. Particulars of their schemes and brief summaries of the achievements made are as under:-

Project No. : S-AC/AGR(18)

Project Title : Survey, collection and study of mites attacking different crops in Sind and their control.

Project Particulars:

Duration of project : Three years

Date of commencement : 15th February, 1975

Date of termination : 14th February, 1978

Location of Scheme : Sind Agricultural University, Tandojam.

Total expenditure: Rs. 1,59,830/-

Main objectives : To make a survey of the mite pests on various crops with a view to studying their incidence, population fluctuation and damage to the host plant, and to undertake control experiment.

Summary of the work done:

During the course of investigation on farms of University campuses in particular and of Sind in general were surveyed. The commonly occuring mites, both phytophagous and predacious ones, were collected and identified to the species level. Besides chemical control experiments on a mite, namely Tetranychus urticae koch, were also carried out. The findings of this survey are briefly summarised below:-

i) Nine species of phytophagous mites, belonging to three families Tetranychus, Tenuipalpidae and Tarsonemidae, were recorded. These included Tetranychus urticae (koch); Tetranychus cinnabarinus (Boisduval); Eutetranychus orientalis (Mc Gregor); Schizotetranychus reticulatus n.sp., Oligonychus (Rookiella); Pratensis (Banks); Porcupinychus abutiloni (Anwarullah); Brevipalpus karachiensis n.sp., Brevipalpus obovatus (Donadieu); and Tarsonemus latus (Banks).

Studies on their hosts range distribution in Sind, damage and symptoms, occurrence and incidence, population growth, and control were made.

ii) Sorghum rust mite O. (Reckiella) pratensis seriously attacked sorghum crop causing red rust of leaves. Correlation studies at the time of harvest revealed that:

a) average number of mites per leaf were positively and significantly correlated with the red rusted area of the leaf;

b) the red rusted area of the leaf was negatively correlated with the grain yield;

c) the average number of mites per leaf was negatively correlated with the grain yield;

d) the average number of mites per leaf was negatively (not so significant) correlated with stalk weight (fodder);

e) the average number of predators was positively and significantly correlated with the average number of mites per leaf; and

f) the average number of predators was positively correlated with the grain yield.

iii) Thick webbing produced by the tetranychid mites particularly T. urticae and T. cinnabarinus caused serious retardation in growth and stoppage of fruit formation.

iv) White papery mite. S. reticulatus produced papery capsules, equivalant to rice short grain, on the upper surface of the leaves of sugarcane and other host plants.

v) Among tetranychid mites, T. urticae occuring on Hibiscus esculentus (Lin); E. orientalis on Ricinus communis (Lin); and O., pratensis on Sorghum vulgare (prey) preferred high

temperatures (averagely from 33.5° - 34.6° c) and low relative humidites (averagely from 32.5 - 34.7%). While B. karachi-ensis on Seasamum indicum (Lin), preferred comparatively low temperatures (averagely from 56.3 - 67.0%).

vi) Among natural enemies of phytophagous mites, five predacious mites were recorded. They were identified as Agistemus impavidus n.sp., Phytoseius sp., Amblyseius sp., and Cunoxid sp. The insect predators were Stethorus pauperculus wse., Brumus suturalis (F), Menochilus sexmaculatus (F), and Chrysopa sp. The observations made on their host, distribution, occurence and abundance, and predatory behaviour made.

vii) While studying predatory behaviour, two kinds of relationships between Typhlodromus sp., (Predator) and O. pratensis (prey) were observed in a single period from August 30, to October 19,. In the first kind of relationship during September 1, to September 14, the predator was positively correlated with the prey; while in the second kind during September 14, to October 19, the predator was negatively correlated with the prey.

viii) Stethorus beetles were predators of phytophagous mites, viz O. pratensis, T. urticae, E. orientalis. etc.

ix) Under natural field conditions, particularly when the rainfall occurred during vegetative growth of the plant (H. esculentus), S. pauperculus was not so effective in controlling T. urticae. The rainfall seemed to have more adverse effect on the predator than the pest.

x) Chemical control experiment showed that almost all the eight pesticides were effective in controlling T. urticae on okra crop. However among the Chlordimeform, Monocrotophos, Dicrotophos and Dicofol were found more effective than the other pesticides. Methyl demetion was the least in effect against the mite, followed by Formothion. Among all the pesticides Formothion degenerated very quickly and lost its toxic effect one week after its application; while methyl demetion persisted for longer time.

xi) In the experiment on pesticide doze level, carried out in the year 1977, it was found that Methidathion was very much effective in all its concentrations at 0.12 (low), 0.25 (medium) and 0.5 (high) percent levels in controlling the T. urticae. However, it showed better results at high doze level (0.5%). This was followed by Monocrotiphos and Dicofol at medium and high doze levels. Chlorobensilate at almost all doze levels was least effective in controlling the mite.

xii) Methidation was less persistent in toxic effect than Monocrotophos. Therefore for protection of vegetables, such as okra, from mite attack application of Methidathion at 0.25 - 0.5% was suggested.

Published as a result of these investigations:

A paper entitled; "Some Acarines of Agricultural importance at Tandojam" was presented at the seminar held by the Entomological Society of Karachi.

Degrees Awarded :

Ph.D degree would be awarded to the Principal Investigator - Mr. Abdul Hayee Soomro.

Project No. : C-IU/AGR(22)

Project Title : Studies and evaluation of the physiological changes induced in the biotic community of the Agricultural land by use of pesticides.

Project Particulars:

Duration of project: Two years

Date of commencement : February, 1975

Date of termination : January, 1977

Location of Scheme: Department of Biological Sciences, Quaid-i-Azam University, Islamabad.

Total expenditure : Rs. 1,96,342.85

Main Objectives : To study the behaviour of pesticides inside the bodies of plants and animals and their direct and indirect influences on metabolic activities and reproduction.

Summary of the Work done

Recently there has been an increasing awareness about the affect of pesticides on organisms other than those against which they are being used. While spraying of crops and trees with appropriate chemicals may effectively destroy the pests, they tend to produce undesirable sublethal or lethal effects on other organisms including both animals and plants. Similarly spraying of fields with pesticides may induce an appropriate quantitative and/or qualitative change in the soil microflora, which in turn may alter the total soil fertility, crop yield, incidence of disease and colonisation by other organisms.

Under these investigations, an attempt was made to study the effects of a commonly used insecticide, trichlorphon on the growth and morphological characteristics of laboratory maintained culture of a fungus namely Trichoderma psendokohingii. An effort was also made to define some of the physiological and biochemical changes induced in the fungus following treatment with this insecticide. Influence of the same insecticide was also observed on some of the vertebrates which include: a fresh-water fish, a reptile, and a mouse. The species of fish, Barilius Vagra, used in the present study profusely inhabits the small streams of Rawalpindi District. These in the semi hidy tracts of this region frequently ramify the small agricultural fields. Similarly, the spiny tailed lizard, Uromastix hardwicki coloni,is found in many other parts of the country which may be semi arid and not cultivated. In the present study the albino mouse has been used as a representative of mammals as it was expected that the results obtained on its study can well be extrapolated to the field mice.

Morphological and physiological changes induced with trichlorphon were compared with those obtained with other pesticides like DDT, Folimat, Propineb and Onethoate.

Project No.	:	RES/35(3)
Project Title	:	Veterinary disease investigations in Northern Areas.
Project Particulars	:	
Duration of project	:	Three years
Date of commencement	:	1st July, 1974

Date of termination : 30th June, 1977

Location of Scheme : Animal Husbandry Department, Northern Areas, Gilgit.

Total expenditure : Rs. 5,12,903.84

Main Objectives : To study the epizootological profile of the Northern Areas in order to plan disease prevention programme.

Summary of the work done :

The livestock and poultry diseases in Northern Areas were surveyed under the above scheme. The findings of the survey are as under:-

Among the viral diseases, foot and mouth disease was widespread and remained epizootic during most part of the year. However severe epizootics were also recorded during the months of February, March and April, every year.

Besides, a dreadful animal disease communicable to humans appeared as an epizootic in Diamer district during the year 1975-76. The disease in 3rd year of its prevalence was continuously widening its zone of infection and had spread to the entire district of Diamer and Gilgit sub-divisions. More than 200 persons and over 1000 animals were reported to have received animal bites.

Pox among sheep and goats, also a widespread disease in the Northern Areas, was causing loss of productivity among adults and deaths in lambs and kids. No efforts were being made for its control although the magnitude of this disease demands a methodical approach to reduce the losses.

Among the bacterial diseases Contagious Caprine Pleuropneumonis (CCPP) ranked premier among goat diseases. The disease prevalence was high in sub-divisions of Hunza, Naga, Astore, and Gilgit. Curative treatment was being done by inoculation of oxyteracycline. A vaccine against CCPP, procured from VRL, did not provide a satisfactory protection. It is believed that the local isolates, if used for vaccine production, will enhance the immunogenicity of the product.

Except in the districts of Ghanche and Hunza, Black Quarter disease was observed throughout Northern Areas. Huge losses to young bovines were on record. Control efforts against Black Quarter disease were found much below the requirements as only a few thousands of cattle were being immunized out of 2.6 lakh of susceptible population.

Anthrax out-break was recorded among the goats in a few villages surrounding Gilgit during the 2nd year of this project. After this, no fresh incidence was reported/ noticed. The disease appeared to be highly localised.

Entrotoxaemia out-break was experienced among the sheep during the spring season every year. No attempts for its control were being made. Due to high mortality rates there was a need for vigorous entrotoxaemia control efforts.

Incidence of ecto and endoparasitic infestation was enormous among all species of livestock in Northern Areas. Ectoparasites were highly prevalent among sheep and goats, which harboured pediculosis, scabies and tick infestation. Gamaxene application as dips or sprays had shown excellent results for the control of all the three ectoparasites. The treatment was demonstrated at various places, after which the livestock owners could practise this technology themselves. For better disease control, Gamaxene supply needed to be increased as well as more demonstrations were required to be given. Goat population of a large area was found to be warble infested. Efforts are needed to control this disease.

Incidence of liverfluke disease was very high. Practically no ruminant in Northern Areas was free of fasciofasis. However only 2.6 per cent of the susceptable population was receiving fasciolacides against the recommended 4.0% twice a year.

Poultry project initiated by the Animal Husbandry Department was providing guidance on nutrition, management and diseases. A work plan for the up-lift of rural poultry had also been developed. Newcascle Disease was found to be the main cause of poultry mortalities throughout the Northern Areas. Losses due to this disease could be reduced through a proper immunization plan.

Coccidiosis and nutritional deficiencies were some of the other reasons for high rate of mortality.

From the above findings of survey there appeared a great need for the livestock development programming in Northern Areas with special emphasis on goat. There were two distinctly separate strains of goats in Northern Areas. Large bodied goats from Diamer district (Darel/ Tanger) having potential for milk, which could be further improved through better nutrition, selective breeding and, if necessary, by cross-breeding with high milk yielding

goats and the small sized goat, available all over the Northern Areas were fairly prolific. Agricultural Research Council was requested to include Northern Areas in their Co-ordinated goat development programme, to which they had kindly agreed.

The Northern Areas sheep has fine wool but its production is extremely low, mainly due to smaller size of the animal; heavy ecto and endoparasitic infestation and their genetic make up. Wool production and quality could be improved by cross breeding with exotic breeds like Ramboulet.

For cattle improvement, efforts at selective breeding are required. Because, cross-breeding with large animals would increase the size of native cattle rendering it further uneconomical to maintain. It will not be suitable for grazing in uphill pastures either.

Project No.	:	P-PU/BIO(5)
Project Title	:	Morphophysiological effects of gamma irradiation on growth and yield of agricultural crops.
Project Particulars	:	
Duration of project	:	Three years
Date of commencement	:	12th March, 1975
Date of termination	:	11th March, 1978
Location of Scheme	:	Department of Botany, University of Punjab, Lahore.
Total expenditure	:	Rs. 1,87,166/-
Main Objectives	:	To assess morphological, anatomical and physiological responses of crops like sunflower, wheat and sorghum to gamma irradiation and effect of growth stimulators and micronutrients in overcoming the radiation damage.

Summary of the work done:

The present project was undertaken with an aim to evaluate the consequences of heavy environmental contamination by radio-active fall-out which may impair the growth and yield of our major crops, wheat and sorghum.

Radiation sensitivity for two crops i.e., wheat and sorghum, was worked out. Three cultivars of wheat, i.e., yecora, chenab-70 and pari and three of sorghum, i.e., PQ.7. dwarf, KS. 12. medium dwarf and TS.100. tall were investigated.

The effects of irradiation were studied on different agronomic characters, i.e., survival, plant height, number of leaves on the main axis, number of tillers per plant, length of tillers, number of ears per plant, ear length on main axis and on tillers, seed yield per plant, and weight of 100 seeds. Radio-sensitivity was based on growth inhibition and reduction in seed yield at different exposures.

Among the three cultivars of wheat, yecora was found to be the most sensitive, while Chenab-70 the most resistant. LD50 (dose at which 50% of the seedling will be dead after irradiation treatment) for yecora was 2.5 KR at ear emergence and anthesis stages, while for chenab-70 at these stages was rather resistant in all three cultivars. Sensitivity of Pari was very close to yecora.

In Sorghum, during vegetative phase; cultivar TS-100 tall was most sensitive and dwarf most resistant. But, at anthesis stage the sensitivity co-relation was reversed i.e., dwarf proved to be most sensitive and tall the most resistant as regard reduction in seed yield. YD_{50} (dose at which yield is reduced to half) values for dwarf were 7.5 KR, while for tall it was about 10.0 KR.

Along with the effects on agronomic characters, histological analysis of cell damage and division rate (mitosis) in the shoot apices was also calculated (shoot aspices are the regions of the plant which are responsible for total growth, as well as for the formation of different organs of the plant, like leaves and buds. This data supported and supplemented the sensitivity pattern of the different cultivars of these two crops.

As a result of these investigations, it has been concluded that radiation released by high-level fallout from nuclear detonation would cause reduced vegetative growth, reduced yield and plant deaths. In addition to these, the germination of seeds could be considerably impaired. The responses of the crop exposed to radiation fallout, however, would depend on multiple factors such as exposure rate, developmental stage, cultivar differences interphase chromosome volume and climatic and growing conditions of the crop in different areas. Efforts were also made to determine the dose parameters for reduced vegetative growth, reduced yield and plant deaths in case of wheat and

sorghum. Although the results achieved under this project were only a partial measure of the extent to which the crops would be affected, yet these could be utilised in relation to the Civil Defence needs in case of a nuclear disaster.

The predictions of survival and yield, although based on a large amount of experimental data, were for stated experimental conditions. They could be expected to vary considerably and actual fallout conditions and should not be considered to be absolute for wheat and sorghum. However, they would be useful in damage assessment work, as the results so far achieved have given an indication of various irradiation levels at which a crop might survive and be available for human and animal consumption.

Publications as a result of these Investigations :

The following four papers have been submitted for publishing to the Journal of Environmental and Experimental Botany U.K"

Iqbal, J., - Effects of acute gamma irradiation, developmental stages and cultivar differences on growth and yield of wheat plants. (manuscript).

- Effect of acute gamma irradiation, developmental stages and cultivar differences on growth and yield of sorghum plants. (manuscript).

Iqbal, J., & Aziz, G., - Cellular damage in shoot apices of three cultivar of wheat and sorghum after acute gamma irradiation. (manuscript).

_____ - Effects of acute gamma irradiation on growth and yield of the second generation in wheat and sorghum. (manuscript).

Project No. P-PU/BIO(9)

Project Title Investigation into the occurrence biology and histochemistry of larval trematodes in Pakistan.

Project Particulars:

Duration of Project	Three years
Date of Commencement	Ist July, 1975
Date of termination	30th June, 1978
Location of Scheme	Department of Zoology, University of the Punjab, Lahore.
Total expenditure	Rs. 177,009/-

Main Objectives

i) To survey the occurence and biology of larval trematodes in fresh waters of Pakistan;

ii) histo-chemical studies on the glandular apparatus of trematode larvae; and

iii) biology of larvae in relation to the intermediate and definite hosts.

Summary of the work done:

Eighteen thousand five hundred snail specimens belonging to nine freshwater species obtained from fifty four localities from all over Pakistan were examined for the presence of larval trematodes. As a result of this survey, fifty seven species of cercariae were recovered, studied and identified. Out of these thirty eight are new to science and eleven are new records from Pakistan. For every cercaria its behaviour, emergence and the structure of the redia or the sporocyst, as the case may be, was also studied.

An attempt was made to study the life histories of five cercariae, however, life histories of only two species could be completed experimentally in the laboratory.

The histochemistry of five cercariae, three belonging to xiphidiocercous group, one to pleuroplophocercous group and one to echinostome group was studied. A comparative assessment of the histochemical nature of different glands were made and possible functions have been assigned to them.

Two species of cercariae and two species of snails were exposed to various concentrations of some of the commonly used insecticides. Some of these insecticides have highly toxic to both the cercariae and snails at very low concentrations.

The effect of PH and industrial wastes on cercariea and their snail hosts was also studied.

Project No: S-KU/BIO(13)

Project Title: Utilization of Brackish water for growing plants on sandy belts of Pakistan.

Project Particulars:

Duration of Project	Three years
Date of commencement	1st March, 1975
Date of termination	28th February, 1978

Location of Scheme — Department of Botany, University of Karachi, Karachi

Total expenditure — Rs. 1,84,280.45

Main Objectives — To study the soil analysis and composition of brackish water at different places with a view to grow salt tolerant plants in sandy belts of the country and to explore suitable methods for brackish water plantation with a view to evolving a new techniques for saline agriculture.

Summary of the work done:

Plants were raised from the seeds on desert sand and subjected to the 'Survival Test' by irrigating them with different dilutions of chemically amended sea water. Another lot of seedlings was pre-conditioned for salt tolerance by irrigating them with gradually increasing concentrations of chemically amended sea water reaching upto the maximum permissible limit determined through above mentioned experiments. These seedlings were later transplanted in drum pots filled with sand having a basal out-let for drainage. They were irrigated with the same concentration of amended sea water which they were receiving prior to transplantation. Plants like wheat, taramera, Maize, cotton, sugarcane and beet were grown upto maturity on sandy soil using various concentrations of sea water for irrigation. Plants showed luxuriant growth upto certain level of salinity. Though at higher concentrations the reproductive growth was adversely affected than vegetative growth. This technique was found quite useful for saline agriculture where vegetative parts are used as fodder or for human consumption. However, the reduction in reproductive growth may still be within compromisable limit in some other plants.

Publications as a result of these Investigations:

Ahmad, R. and Abdullah, S.,1978 - Prospects of saline Agriculture on sandy soils of Pakistan. Proc. Int. Workshop. Membrane Biophysics and Development of Salt Tolerance in plants. Agricultural University, Faisalabad. (in press)

- Maize as Forage Crop for Saline Agriculture. Irrigation Science, West Germany. (accepted for publication).

- Saline Agriculture under desert condition. Proc. Int Workshop, Application of Sc. & Tech. for Desert Development. Am. Univ. Cairo. Egypt. (in press).

- Beet Root as the most suitable crop for saline Agriculture. (submitted for publication in Plant and soils, Netherlands).

- Possibility of growing cotton plant through brackish water irrigation. (manuscript under preparation).

Project No : S-KU/BIO(16)

Project Title : Systematics, Biology and seasonal abundance of plankton in the Karachi coastal waters.

Project Particulars:

Duration of project	Three years
Date of commencement	10th March, 1975
Date of termination	9th March, 1978
Location of Scheme	Department of Zoology University of Karachi, Karachi.
Total expenditure	Rs. 1,28,568.26

Main Objectives: To study(a) planktons in relation to the physio-chemical factors operating in ocean, (b) role of plankton in food chains;
(c) seasonal variations of planktons;
(d) Biology of selected 300 planktons;
(e) effects of tides and currents on plankton population and (f) diurual and vertical migration of zooplankton.

Summary of the work done:

During a survey of the planktons in Karachi coastal waters following forty five (45) species of zooplanktons were recovered, identified and their seasonal abundance studied:

	Phylum	:	Arthopoda
	Class	:	Crustacea
	Sub-class	:	Branchiopoda
	Species	i)	Evadne Pergestina
		ii)	Penelia avirostris
	Sub-class	:	Ostracoda
	Species	i)	Asterope mariae
		ii)	Philomedes lilljebogi
		iii)	Pyrocypris sinuosa
		iv)	Cypridina megalops
	Sub-class	:	Copepoda
a)	Sub-order	:	Calanoida
	Species	i)	Acartia plumosa
		ii)	A. spinicauda
		iii)	A. pacifica
		iv)	Temora discaudata
		v)	T. stylifera
		vi)	Centropages dorsispinatus
		vii)	C. furcatus
		viii)	C. velificatus
		ix)	Iortonus forcipatus
		x)	Paracalanus parvus
		xi)	Calanus pauper
		xii)	Rhincalanus cornutus
		xiii)	Undinula vulgaris

b) Sub-order : Monstrilloida

Species i) Monstrillopsis dubia
ii) Cymbasoma rigidum
iii) C. tirmiziae
iv) C. williamsoni

Sub-class : Malacostraca

a) Sub-order : Cumacea

Species i) Cuma scorpiodes
ii) C. edwardsii
iii) Cumella pygmaea
iv) Leucon acutirostris

b) Sub-order : Decapoda

Species i) Licifer typus
ii) L. orientalis
iii) L. penicillifer
iv) L. henseni

Phylum : CHAETOGNATHA

Species i) Sagitta enflata
ii) S. hexaptera
iii) S. neglecta
iv) S. bedoti
v) S. regularis
vi) S. pulchra
vii) S. bipunctata
viii) S. robusta
ix) S. pacifica
x) Pterosagitta draco
xi) Krohnitta subtilis
xii) K. pacifica
xiii) Spadella cephaloptera

Phylum	:	PROTOZOA
Class	:	Mastigophora
Order	:	Dinoflagellata
Species	i)	Ceratium tripos

Besides systematics of zooplanktons, breeding and growth of Sagitta enflata (grassi), was also studied.

Seasonal abundance and distribution of biomass; settled volume and dry weight, and numbers of zooplankton in the Manora channel was studied. The study revealed a redical increase in the biomass and numbers of zooplankton during the peak period of South West monsoon season. The occurrence of certain off-shore Copepods and Euphausiid larvae confirms the earlier observations of Khan and Khan (1973); Khan (1973) and Khan and Zubairi (1974) regarding the onshore flow of plankton rich water during the south west monsoon season. There is further evidence of high values of biomass and numbers of zooplankton during the period of change from south west monsoon season to north east monsoon season.

Publications as a result of these Investigations:

Khan M.A., 1976	-	Luciferinae (censtacea- Decapoda-Sergestidae) collected from Manora channel (Northern Arabian Sea) Agriculture Pakistan, Vol XXVII, No.1
Khan, M.A. and Kamran, Wahaj: M., 1976	-	Cymbasoma tirmiziae sp - nov (Copepoda Monstrilloida - Monstrillidae) from Manora channel (Northern Arabian Sea), Journal of Science, Vol 3 Nos 1&2 pp 55-59
Khan, M.A., 1976	-	Cymbasoma williamsoni sp. Nov., (Copedode - Monstrilloida - Monstrillidae) from manora channel (northern Arabian Sea), Journal of Science Vol 4, Nos pp 48-51.

Project No.	:	S-KU/BIO(20)
Project Title	:	Taxonomic studies of some marine invertebrates of the Northern Arabian Sea.

Project Particulars:

Duration of project	:	Three years
Date of commencement	:	1st July, 1975
Date of termination	:	30th June, 1978
Location of Scheme	:	Department of Zoology, University of Karachi, Karachi
Total expenditure	:	Rs. 1,83,874.97
Main Objectives	:	Collection and study of the marine animals belonging to four classes of invertebrates viz, Curstacea, (Decapoda), Mollusca and Echinodermata for their preservation in the Invertebrate Reference Museum.

Summary of the work done:

The project was undertaken for carrying out taxonomic studies on some marine invertebrates of the Northern Arabian Sea viz. Crustacea (Decapoda) Mollusca and Echinodermata. Collection were made from various localities along the shore.

Crustacea, because of their economic value, were given more importance and studied in greater detail. The species

collected were identified and listed in systematic order, salient features of each family were given and one representative from each was illustrated.

A list of the common molluscs of shore and off-shore waters of Pakistan was prepared. The families of molluscs were briefly described and one representative from each illustrated. Several species were recorded for the first time. A good many remained unidentified and were preserved in museum for future studies.

The Echinodermates were described in greater detail. Systematic account including their location and distribution and photograph of each species was given.

Though the main object of the project was to collect the specimens of above mention groups however interesting specimens belonging to other groups were also collected and if possible identified.

Females specimens and egg spawns were brought alive to the laboratory and their development followed and the larval histories studied by researchers and students of marine zoology.

Specimens were kept in the laboratory. Behavioural studies on some of the invertebrates were made which included; 'escape movement of Pecten'; colour changes, swimming, ink secretion of Octopus; burrowing mechanism of razor shells and Emerita; feeding of brancles and sea fans (one was brought alive and studied under a binocular), spawning of Nudibranchs, sound production of pistol shrimps. Several species of crabs, prawns, bivalves and echinoderms were studied under laboratory conditions.

The collections obtained from the Karachi coast have been sorted, identified, catalogued and preserved in the Invertebrate Reference Museum.

Publications as a result of these Investigations:

Tirmizi, N.M., 1976 - A note on a new record of Solenocera alticarinata 'Kubo' recently recorded from Karachi coast, Pakistan, B(2): 236.

1977 - On Emerita nolthuisi Sankolli, 1965 from Pakistan (Decapoda, Hippidae) "Crustaceana" Vol. 32 (1): 108.

On the presence of Albunea steinitzi Holthuis in the Northern Arabian Sea (Decapoda, Hippidae). Accepted in Crustaceana Leiden.

Notes on Simocarcinus simplex (Dana) from the Northern Arabian Sea (Decapoda, Brachyura) Accepted in Crustaceana Leiden.

Tirmizi, N.M., & Ghani., N., 1977 - Upogebia guddusiae n.sp. from Indian Ocean. Accepted in Crustaceana Leiden.

Tirmizi, N.M., & Khan, B., 1976 - Two species of Chirostylus micheleae from the Indian Ocean with observation on the generic characters (Decapoda, Chirostylidae). Accepted in Crustaceana Leiden.

Tirmizi, N.M. & Siddiqui, F.A., 1976 - Range extension of Paguristes perspicax Nobili 1906 (Decapoda, Diogenidae) in to the Northern Arabian Sea. Accepted in Crustaceana Leiden.

Tirmizi, N.M., & Kazmi, Q.B., 1976 - Results of the study of the type material of some species of Upogebia (Decapoda, Thalassinida. Accepted in Crustaceana Leiden.

A new species of Mesacturoides from waters with notes on its first larva (Stomatopoda: Gonodectylidae). Accepted in Crustaceana Leiden,

Tirmizi, N.M., & Yaqoob, M., 1976 - Larval development of Pachycheles tomentosus Henderson 1893, (Anomura, Porcellanidae) with descriptive remarks on the adults from Karachi waters (Northern Arabian Sea). (under prepration).

Tirmizi, N.M., & Siddiqui, F.A., 1976 - The larval development of Clibanarius signatus Heller & C. virescens (Krauss) under laboratory conditions (Decapoda, Diogenidae). (under preparation).

Tirmizi, N.M., & Ghani, N.,	1976 -	Notes on two decapod crustacea new to Pakistani waters. (under prepration).
Tirmizi, N.M., & Kazmi, Q.B.,	1976 -	New decapod crustacean records for the Northern Arabian Sea.

Degrees Awarded

Degree from University of Karachi	Name of the Recepients	Year of Award
Ph.D	Mr. Mohammad Yaqoob	1977
Ph.D	Miss Feroz A. Siddiqui	Thesis in final stage.
M.Phil	Mr. Masood-ul-Hasan	1978
M.Phil	Miss Naseem Ghani	Thesis in advanced stages of completion.
M.Sc	Miss Naureen Aziz	1976
M.Sc	Mr. Waheed Ahmad	1977

Project No. : SU-BIO(52)

Project Title : Marine Molluscs of Pakistan

Project Particulars:

Duration of project : Three years and three months

Date of commencement : 1st May, 1974

Date of termination : 31st July, 1977

Location of Scheme : Invertebrate Reference Museum University of Karachi, Karachi.

Total expenditure : Rs. 1,15,228.71

Main Objectives : Collection of molluscs from the shores and coastal waters of Pakistan, their identification, biological studies and preservation in Invertebrate Reference Museum.

Summary of the work done:

The molluscs, because of their beautiful shells, successful invasion in various habitats, high nutritive value and general appeal to human palate, are the best studied group of animals after Mammals, birds, fish and some insects. However, nothing is known about the representation of this group in Pakistan. This project was undertaken to explore the molluscan fauna of Pakistani coastal areas.

Molluscs were collected at regular interval from as many as 23 localities. Out of this collection, a total of 2,500 specimens were selected for preservation and storage.

The preserved collection includes representative of all classes of Molluscs (except monoplacophora, recently discovered from Mexico). A pictorial key was devised for quick identification of molluscs from the local coast upto Family Level. Diagnostic features of families, genera and a list of species in each case were also given.

The shelled gastropodes and scaphopodes were selected for detailed studies. The description, distribution and colour pattern for one selected species, each in Gastropoda, Bivalvia and Cephalopoda was included in the report to show the pattern adapted for preparation of taxonomic account of identified species.

Scaphopods, a small group of marine molluscs, locally represented by nine species, was studied in detail and results published.

Gastropoda, the largest class of mollusca, includes shelled and shell-less forms. Studies were restricted to shelled Gastropodes mainly and seventy species belonging mostly to prosobranchs were identified, illustrated or photographed. Soft parts of some of the most abundant species were also studied.

It has also been observed that intertidal zone appears to be rich in Nudibranchs and harbours some of the most beautiful species. The nudibranchs were brought alive to the laboratory and kept in small acquaria where they surveyed well and several species spawned.

Egg Capsule and spawns of some of the gastropods and cephalopods were studied in detail.

The collection also included about 500 lamellibranchs such asclams, oysters, pearl oysters, scallops, cockles, razor clams and many others.

Ten species of Cephalopods from the local coast were identified, described and illustrated for the first time. Specimens of cuttle-fishes measuring 12 inches in body length were collected from the Fish Harbour. Two specimen remain unidentified.

Publications as a result of these Investigations

Zehra, Itrat., 1976 - Species of genus dentalium (Scaphopoda, Mollusca) from Pakistan coast (Northern Arabian Sea) Proc. Pak. Acad. Sci. Vol. 13, No. 1, pp.

1974 - "Sajilay Sadfay" Urdu Sci. Conf. Quetta.

Zehra, Itrat., & Hasan, Masood-ul. 1975 - (Violet Snails) Janthina Janthina Discovery of Janthina Janthina (violet snails) from the coastal areas and their detailed study. Urdu Sci. Conf. 1975 at Faisalabad.

Zehra, Itrat., - Murioids (Mollusca; Neogas-tropoda) from Northern Arabian Sea (under preparation).

- Taxonomy of Thaididae (Mollusca; Neogostro-poda) from the Northern Arabian Sea (under preparation).

Hasan, Masood-ul., - Studies on the spawn masses along with the development of cellane radiata (under preparation).

- Development of Bulla ampulla L. (under preparation).

Project No. : C-IU/BIO(61)

Project Title : Studies on glycoprotein Hormones.

Project Particulars:

Duration of project : Three years

Date of commencement : 1st May, 1975

Date of termination : 30th April, 1978

Location of Scheme : Quaid-i-Azam University, Islamabad.

Total expenditure : Rs. 5,30,951.97

Main Objectives : To obtain, in a selectively pure form, well characterized glycoprotein hormones for the use in medicines and biology with the possibility of commercial preparation.

To study the mechanism of action of luteinizing hormone (LH) and leutrotrophic hormone (LTH) in their target tissues to find out the genetic regulation dependent upon hormonal activation of the target cells.

Summary of work done

Human chorionic gonadotrophin (HCG) has a predominently leutinizing activity. It is used both in veterinary and medicine for clinical purposes. The hormone is available commercially in a very crude form. Under this project the hormone, in relatively pure form, was prepared by a simple method not hitherto employed by earlier workers who used ion exchange choromatography and gel filteration for the purification of H.C.G. The utility of this method is indicated by the fact that 250 mg of crude hormone costs $50 whereas 25 mg of purified material costs $5000. The purified material can now be obtained through this method at a much cheaper cost and used for the purpose of developing pregnancy tests viz; slide tests, micro-haemagluti-nine tests etc. The method can be used on commercial scale to obtain pure preparation of HCG with high biological activity and can be handed over to any pharmaceutical company of commercial exploitation. Furthermore a new, simple and rapid method was also developed for the preparation of very pure HCG alpha and Beta sub-units. These sub-units and their antisera can find further use in contraceptive methods.

The most challenging aspect of the project, however, was the study of machanism of action of Human chorionic gonadotrophin (HCG) on testis. The studies made evident some important aspects of at least one important component of the testis, namely, the Leydig cells, which are the target cells for this hormone. The isolated leydig cells were used for undertaking some of the basic molecular events at the level of the nucleus following its stimulation with L.H in Vitro. The sequence of biochemical events associated with action of HCG in testis was reported as under:-

i) In-vitro HCG stimulus, resulted in increased testosterone and cAMP synthesis. Increased testosterone production was preceeded by increase in cAMP.

ii) Phosphorylation of histone and acidic proteins took place in both HCG stimulated and non-stimulated cells, but the degree of phosphorylation and dephosphorylation were time dependent.

iii) Different histone and acidic proteins were acetylated and deacetylated at various time intervals.

iv) A more significant increase in the rate of RNA synthesis was found at 120 min after HCG stimulus.

v) The rate of DNA synthesis was the same in 60 min stimulated and non-stimulated cells but then increased from 120 min onward. This increase in DNA was probably responsible for the increase in RNA synthesis.

vi) HCG stimulus increased the rate of cytoplasmic protein histones and acidic proteins synthesis and this increase was manifested between 30 - 360 min of HCG stimulation.

vii) There was an enhancement in the activity of both Mg^{++} and Mn^{++} dependent RNA - polymerases.

viii) The cytoplasm and nuclei of leydig cells contained protein phosphokinase activity. The activity of cytoplasmic phosphokinase was stimulated by HCG giving a peak within 5 min. The nuclear protein phosphokinase was not effected by HCG stimulus.

As reported previously the response of LH appeared to be mediated by the action of cAMP (second messenger), beyond which there was the stimulation of protein kinase activity. During the acute phase of peptide hormone action the generation of short term responses like increased steroidegenesis (testosterone production) did not appear to operate directly through gene transcription but rather through the phosphorylation and activation or modification of existing gene products.

These results suggested that HCG might have two effects on the activity of the leydig cell. (a) a short term one involving the activation of cAMP and the synthesis of testosterone, and (b) a long term effect involving the genone and therefore increased synthesis of DNA and RNA and certain proteins.

Project No. : S-KU/CHEM(10)

Project Title : Structural and synthetic studies on some Beta Carboline Bases.

Project particulars:

Duration of project: Three years

Date of commencement: 7th May, 1975

Date of termination: 6th May, 1978

Location of Scheme : Post Graduate Institute of Chemistry, University of Karachi, Karachi.

Total expenditure : Rs. 2,90,056/-

Main Objectives : To study structural and synthetic studies on Beta Carboline Bases for developing new therapeutic agents for the treatment of cardo-vascular diseases and psycho-active drugs which could be used in the treatment of certain types of mental ailments.

Summary of work done :

A large number of B-carboline alkaloids occur in plants which are widely reputed for their medicinal value. For instance, the Rauwolfia alkaloids, reserpine and ajmaline, employed in the high blood pressure and cardiac arrhythmias respectively, have B-carboline moiety in their structures. A very rich source of the B-carboline alkaloids, harmine and harmaline, are the seeds of Peganum harmala (harmal) which grows abundantly in Pakistan and other neighbouring countries under wild conditions mostly in non-arable areas. Unfortunately no large scale commercial use has so far been found for these alkaloids.

A part of the overall programme of studies in the correlation of structure and activity, the present work was specifically undertaken to cover the alkaloidal bases carrying a B-carboline nucleus. As a result of investigations in this field nitro-derivatives of whole range of alkaloidal bases were prepared and their pharmacological activity tested out at the Jinnah Post Graduate Medical Centre and subsequently in a leading German pharmaceutical firm. Thus three nitro-derivatives were obtained under highly critical experimental conditions from reserpine. It is well known that this base, when used over a long period in the treatment of Hypertension,

produces heavy depressions leading to suicidal tendencies and schizophrenia in about 50% of the cases treated. Of its 3 isomeric monoitro derivatives it was found that 1-nitro-reserpine has the same order of hopotensive activity as reserpine when administered intravenously to cats and rabbits and was completely free from its undesirable side affects like tremor, ptosis (drooping of upper eyelids).

The study was extended to other B-carboline bases rescinnamine ajmalicine, serpentine, harmine and harmidine and various nitro-derivatives were prepared as described in detail in the following pages. In many cases, the nitro-derivatives could be reduced to amino compound with metal/acid. The position of the nitro group in the indole moiety was determined through NMR studies.

New procedures were developed for the synthesis of B-carbo-line derivatives through the generation of vilsmexier complexes of indolic amides and their reduction by borohydride. The successful use of this procedure was demonstrated with three examples.

Condensation of harmaline/harmidine with d-formyl-cyclohexanone and subsequent reduction led to the formation of a compound having 11-methoxy-5, dihydrosempervirine skeleton. Working on the same lines, a compounds containing the basic skeleton of reserpine could also be synthesized with harmaline and another intermediate which was itself prepared from cyclohexane and oxalyl chloride.

The reinvestigation of the alkaloidal constituents of Rauwolfia vomitoria has led to the isolation of 4 new alkaloids. The structure of one of them was elucidated as hydroxyajmaline mainly through spectroscopic studies.

In the course of the study of germination metabolites of Peganum harmala seeds, it was found that the alkaloidal constituents are wholly located in the husk of the seeds, to the extent of upto 7%. On the other hand the kernels which form about 5% of the whole seeds yield 20% of an oil which is completely free from the toxic alkaloids and compares in its physical data with cotton seed oil. Further work in this direction may well justify large-scale plantation of peganum harmala in non-arable areas for the production of oils which can be used for edible and industrial purposes resulting in the saving of about Rs. 160 crore currently incurred on the import of vegetable oils.

Publications based on these Investigations :

Salimuzzaman Siddiqui., & Ataullah Khan.,	1975 -	Nitration Studies in Reserpine, Pak.J.Sc. Ind. Res., 18 (5),199
S. Siddiqui., & S.I. Hameed.,	1975 -	Nitration studies in some B-carboline bases: Part I Mononitro derivatives of Rescinnamine. Pak.J.Sci. Ind. Res., 18 (6)243-46
S. Siddiqui., & S.I. Hameed.,	1975 -	Nitration studies in some B-carboline bases: Part II Mononitro derivatives of Ajmalicine and Serpentine. Pak.J.Sci. Ind. Res. 18, (6) 247-49
Atta-ur-Rehman., & N. Waheed.,	1977 -	A new B-carboline synthesis Ietrahedron Letters. 47, 4102
Atta-ur-Rehman., Anwer Basha., & Viqar Uddin Ahmad.,	1975 -	Reactions of Harmaline and its derivatives Part IV. Synthesis of pentacyclic System Isomeric with II- Methoxy-5, 6-Dihydro-sempervirine. Z.Naturforsch. 30b 653
Atta-ur-Rehman, Sadiqa Firdous., & Anwer Basha.,	1976 -	Reactions of Harmaline and its derivatives Part V. Synthesis of Reserpine Analogues. Z.Natur-forsch. 31b, 533
Salimuzzaman Siddiqui & S.I. Hameed.,	-	Nitration studies in some B-carboline bases part III. Mononitro derivative of harmidine. Submitted for publication in Zeitschriffuer Naturforschung

Degrees Awarded on the Bases of this Study

Dr. Muhammed Ataullah Khan	-	Ph.D
Dr. Anwar Basha	-	Ph.D
Dr. Saira Hameed	-	Ph.D
Mr. Abdul Malik (Ph.D Degree submitted)		
Miss Nighat Afza	-	M.Sc

Project No. : S-KU/CHEM(26)

Project Title : Structure of Biopolymers/Interaction of riboflavin with amino acids/protein.

Project Particulars :

Duration of Project: Three years

Date of commencement: 1st April, 1975

Date of termination: 31st March, 1978

Location of Scheme : Department of Biochemistry, University of Karachi, Karachi.

Total expenditure : Rs. 70,035.65

Main Objectives : To study the interaction of riboflavin with aminoacids for obtaining biological data such as free energy, entropy and stability constant for understanding various processes at the level of central nervous system.

Summary of the work done

The combination of flavin coenzyme with protein leads to a shift of absorption maxima of protein, and quenching of riboflavin with tryptophan has been studied by several workers. This binding is important regarding the combination of flavin (coenzyme) with protein (apoenzyme).

Tryptophan is also found in protein bound and free form, hence the binding of Riboflavin with tryptophan. Tryptophan with protein is important in view of the following:-

- Riboflavin, a vitamin is highly sensitive to light and is destroyed by it, the binding of riboflavin with tryptophan can preserve it against the destructive effect of light.
- Tryptophan, an essential aminoacid is the precursor of serotonin, which is found in brain in bound form with riboflavin.
- Change in tryptophan concentration in plasma and other tissues of rats and human alter the serotonin concentrations in brain too.
- Various drugs when injected to rats have been found to alter tryptophan concentration in various organs.

- The injection of drugs in this way may alter serotonin concentration through tryptophan pathway and explains the pharmacological behaviour of these drugs.

The problem was investigated in two phases:-

A) Interaction of flavin with aminoacids:

Interaction of flavin with aminoacids were studied in detail. Only tryptophan, tryosine and phenylalanine were found to form complexes with riboflavin and the extent of interaction was of the order tryptophan-tyrosine-phenylalanine. The extent of interaction was correlated with electron donating power of these aminoacids was also noticed. Interaction was studied at various PH values and neutral complexes were found to be most stable. Complex formation was found to be enhanced in presence of light. This finding is suggested to be valuable in regard to the electron transfer behaviour of the reaction. The binding of riboflavin with tryptophan can preserve it against destructive effect of light.

B) Interaction of tryptophan with protein:

Tryptophan is the only aminoacid bounded to plasma proteins the albumin. The concertation of free and protein bound tryptophan was estimated in the plasma of Uromastix hardwickii during and after hibernation. The data obtained in two periods was correlated with the mode of life of this animal:

i) The concentration of free and protein bound tryptophan was also determined in the plasma of various species belonging to three phyla of animal kingdom. The degree of tryptophan binding was shown to be an evolutionary feature.

ii) The concentration of free and bound tryptophan was estimated in plasma, liver and brain of Uromastix hardwickii (lizard) before and after the intraperitoneal administration of sodium to enhance free tryptophan concentration, also the animal became slightly active. The pharmacological action of the drug has been correlated with the increase in free tryptophan concentration. It is a preliminary step to examine the neuro pharmacological behaviour of salicylate. In this regard it will be important to determine actual serotonin concentration after administration of the drug. The neuropharmacological behaviour of other drugs like tetracyclines, phenothiazines, saccharin and penicillin might be investigated in a similar way.

iii) The binding of L-tryptophan with human serum albumin (HSA) was also investigated. The results indicate that there are two binding sites in albumin. Primary site gets saturated when the molarity of tryptophan in the reaction mixture is 10 times greater than the molarity of albumin. One molecule of tryptophan is bounded molecule of albumin at the primary site. Interaction of salicylate with albumin was also studied. Number of molecules bounded mole of albumin is always same, but binding constant varies for tryptophan and salicylate. One more aminoacid tyrosine which resembles structurally with salicylate was also found to bind with HSA but the binding constant in this case was very less.

Publication as a result of these Investigations:

Jabeen D., and Haleem, M.A.,

1976 - Interaction and Photostabilization of riboflavin with aromatic aminocids, Pak. J. Biochem. 9(1), 20

1976 - Hibervational changes in uromastix hardwickii, Pak. J. Biochem. (paper accepted)

1976 - The displacement of Tryptophan from its binding sites by Na-salicylate, Pak. J. Sc. Ind. Rs., (paper accepted)

Degree Awarded

M.Phil degree was awarded to the research officer working under this project.

Project No. : S-CSIR/CHEM(40)

Project Title : Effect of germination on the nutritive value and digestibility of gram and pea.

Project Particulars:

Duration of project	:	Three years and 2½ months
Date of commencement	:	15th April, 1975
Date of termination	:	30th June, 1978
Location of Scheme	:	PCSIR Laboratories, Karachi.
Total expenditure	:	Rs. 74,420.24

Main Objectives : To isolate protein and carbohydrate fractions of gram and pea for undertaking/studies on(i) their structural characteristics, (ii) the effect of germination on nutritive value and digestibility, and (iii) the nutritional properties of germinated and ungerminated gram and pea flour alone and admixed with wheat and corn.

Summary of the work done:

The object of this study was to observe the changes in germinating gram and pea and to determine optimum conditions for obtaining maximum advantage of nutritive significance. A simple method was developed for sprouting, which may be easily practiced in our homes. The seeds were sprouted and investigated after intervals, for the changes taking place in the protein and carbohydrate fractions, development of vitamin C, fate of flatulence causing oligosaccharides etc.

The results indicated that soaking alone (24 hrs) did not bring about any change in the protein and carbohydrate fractions. Hydration of the seeds obviously resulted in textural change, making the grain soft and easily chewable and reducing cooking time. The protein fraction might undergo some degree of splitting or hydration, which made it more sensitive to subsequent heat denaturation. There was slight increase in ascorbic acid or vitamin C content.

In order to ascertain that no loss of nutrients occured during soaking the seed with coat, the soaking water was analysed and found to contain only traces of simple sugars and non-protein nitrogenous substances which had leached out. The proteins and the non-protein nitrogenous fractions remained unchanged when the grains were soaked or kept under conditions unfavourable for germination at lower temperatures (8-9°C).

The degree of hydration of the grain reached a certain level quickly and did not change until conditions became favourable for germination. It was, therefore, clear that soaking for any length

of time brought about only preliminary hydration. Splitting or breakdown of the protein took place only when the grain became fully alive.

Legumes also contain factors which have the property of blocking the action of proteolytic enzymes. These antitryptic substances were found to increase all along until the grains matured. The function of these fractions was, therefore, infered to lock up and guard the proteins during the resting period or dormancy of the seed. A decrease in protein and increase in the hydrolytic products took place only when conditions became favourable for vegetative growth as a result of activation or generation of proteolytic enzymes and removal of antitryptic substances from the scene.

Seeds, after initial soaking for 24 hours, were kept for germination, covered with moist cloth allowing free access of air and at temperatures 20-22°c, and it was observed that as germination proceeded, the proteins were hydrolysed and the amino acid content increased. In view of the restricted and restrained conditions of germination employed in experiments (no nutrient and no sunlight), the requirements of the growing parts were also restricted. This explained the accumulation of amino acid generated as a result of the activity of proteolytic enzymes present or produced on activation of the dormant seed.

The increase in water soluble fraction of the protein on germination and subsequent cooking (heating for 1 hour) was therefore determined. The results according to expectations and particularly significant when seen as percentage of the total crude protein present in the seed.

No change in the total carbohydrate fraction (polysaccharides or simple reducing sugars) was noticed either on soaking or at different stages of germination under conditions employed in experiments. However, the three galactose containing sugars present in legumes namely raffinose, stachyose and verbascose which cause flatulence and tummy upsets, are progressively hydrolysed and disappear as germination proceeds. These galactosugars are not absorbed in the instestines, but utilized by intestinal microflora and as a result of fermentation cause gas production.

A very significant advantage of sprouting of pea and gram, is the generation of vitamin C in germinating seeds, much more pronounced in both the varieties of gram.

It was concluded that soaking alone, brings about a softening of hydration of the carbohydrate and protein fractions. The protein molecules as a result of hydration also open up and become more susceptible to the action of digestive secretions. Subsequent cooking takes this process a step further. Sprouted grams and peas become rich in antiscorbutic factor or Vitamin C, the protein are hydrolyzed into easily assimilable polypeptides and amino

acids, the flatulence causing oligosaccharides disappear and substances which interfere with trypsin or proteolytic enzymes by blocking or inactivating the digestive juices, decrease in quantity. Sprouted gram and pea seeds may, therefore, be consumed even raw, as an easily assimilable source of protein and high Vitamin C, content. Or, if subsequently cooked into various dishes admixed with cereals and seqsoning ingested without the normally expected difficulties of digestion.

Project No. : SU-CHEM(44)

Project Title : Chemical composition of hair root as a criterion of protein malnutrition.

Project Particulars

Duration of project	:	Three years and three months
Date of commencement	:	1st June, 1974
Date of termination	:	31st August, 1977
Location of Scheme	:	Department of Biochemistry, University of Karachi, Karachi
Total expenditure	:	Rs. 2,56,013.91

Main Objectives: To examine the DNA and protein of hair roots of children suffering from two types of malnutritions viz Kwashiorkor and Marasmus.

Summary of the work done:

Protein-calorie malnutrition is prevalent in the country affecting children from 4 months to 5 years. In severe conditions, death may also occur; however, those who survive may show some form of mental retardation of psychomotor disturbance as most of the brain growth is completed during this age.

Changes in hair colour and texture are amongst the more prominent features of protein-calorie malnutrition. Moreover the hair follicle has one of the highest rates of cell division and synthesis of DNA and protein. Hence morphological and chemical changes in hair roots have been examined in malnutrition. The aim of the

project was to determine the hair root protein and DNA content of children suffering from protein calorie malnutrition (P-C-M) and compare alterations from normal with those of other biochemical parameters, some of which have been suggested as diagnostic criteria for PCM or different types of PCM.

These studies have shown that changes in DNA and protein of the hair root of protein malnourished children were more marked than those of any other biochemical constituent analyzed. These values had fallen to half or less than half of the normal levels in most of the cases of PCM and to an even greater extent in kwashiorkor- the most severe form of this disease. Moreover the levels in kwashiorkor were significantly less than in marasmus.

These studies also confirmed the marked fall in albumin and A/G ratio particularly in kwashiorkor as reported by most workers in this field. However the total serum proteins were unaltered in PCM except in kwashiorkor, although the total proteins have been reported to be lowered in PMC in Africa and S. America. The nonessential essential amino acid ratio, proposed for detecting PMC, rose significantly in PMC but was about the same in all types of PMC. Serum zinc and copper declined but the fall was the primary condition of malnutrition. Serum vitamin E and esterified acid fell. However cholesterol rose in contrast to reports elsewhere.

The PCV and haemoglobin decreased in all of the malnourished children while the differential count was unaltered except for rise in the eosinophils. Anthropometric measurements show a marked decline in body weight and mid upper arm circumference especially in marasmus. The length or height was affected but to a lesser extent. The chest head ratio was less than one in all types of PMC.

These studies have also shown that hair root protein and DNA are markedly altered in PMC to different degrees depending upon the severity of the disease. A low serum albumin had been the one biochemical criteria upon which all investigators had so far agreed. However hair root offers a distinct advantage in that hair samples can be easily taken, epilation requires no special training and subjects offer less resistance to a hair pull than to a veni puncture. Hair roots could be stored or mailed without any difficulty. They could simply be kept in an envelop for weeks without any change in DNA and protein. This had distinct advantages for field work or surveys. Hence it was concluded that hair root protein and DNA might be useful chemical criteria in diagnosing and detecting various stages of PCM.

In addition to achieving the primary objective of the project the studies have also given both anthropometric and biochemical values for normal Pakistani children very little of which was recorded in the scientific literature. Some of the other parameters studied by the investigators were different qualitatively and quantitatively from those found in other countries indicating that there were regional differences in PMC.

Publication as a result of these Investigations:

Barbara K. Zain., A.H. Haquani., Naveed Qureshi and Iffat-el-Nisa., 1977 - Studies on the significance of hair root protein and DNA in protein calories mal-nutrition, Ame. J. of clinical Nutrition, pp. 1094-97.

Project No. : C-IU/CHEM(70)

Project Title : A study of factors influencing the stability of five-membered Lactone rings.

Project Particulars:

Duration of project : One year and one month

Date of commencement : 17th May, 1976

Date of termination : 14th June, 1977

Location of Scheme : Department of Chemistry, Quaid-e-Azam University, Islamabad

Total expenditure : Rs. 50,303.87

Main Objectives: To synthesize a series of differently substituted lactones and measuring the position of its equilibrium.

Summary of the work done:

An attempt was made to study the effect of substituents on the stability of five membered lactone rings. Lactones are cyclic esters formed by heating the open chain hydroxy acids. These compounds are of much importance from pharmacological point of view. So it was considered worth-while to study the stability of the lactone rings in detail. One of the special properties of the lactones is the establishment of equilibrium between the ring form and the open chain form in the presence of acid.

If the equilibrium is more towards the right hand side, the ring form is more stable and if the equilibrium is more towards the left hand side open chain form is more stable. Thus by the position of equilibrium, stability of the ring can be found. For this purpose nine different lactones having different substituents at different positions in the ring were synthesised and their equilibrium constants were determinedusing the method of direct titration of the open chain-hydroxy acid formed against standard sodium hydroxide. It was found that the electron donating groups stabilize the ring while the electron attracting groups destabilize it.

There were evidences that mechanism of hydrolysis of lactone depended on the number and the type of substituents present in the ring. The hydrolysis i.e. ring opening could take place in two ways i.e acyloxygen cleavage or alkyl oxygen cleavage. Under these investigation the mechanism of hydrolysis of only butyrolactone was studied which involved acyl-oxygen cleavage and it was concluded that the Mechanism of hydrolysis of other lactones, which had been synthesised, could be investigated on the same basis.

Publications as a result of these Investigations:

Mashooda Hasan, Naeema Khan & Farzana Latif., - Influence of substituents of the stability of five membered lactone rings (under preparation)

Project No. : C-QAU/CHEM(78)

Project Title : Terpenes From Cedrus deodara

Project Particulars:

Duration of project	:	One year and three months
Date of commencement	:	1st December, 1977
Date of termination	:	28th February, 1978
Location of Scheme	:	Department of Chemistry, Quaid-e-Azam University, Islamabad
Total expenditure	:	Rs. 49,995/-

Main Objectives: To study some of the unknown terpenes of Pinus deodara, their isolation, characterizations and synthesis by cheaper methods.

Summary of the work done:

The chemical composition of the steam volatile oils obtained from stem-bark and stem wood of Cedrus deodara was studied. Six pure compounds, not reported in the previous literature, were isolated using chromatographic methods. Their physical constants were measured and characterised by the study of their U.V., I.R., N.M.R., and mass spectra. Complete structure was assigned to one of these compounds. It has been named as a mixed anhydride, 2-nonenoic heptadecanoic anhydride.

Pharmacological studies of the steam volatile oils were also carried out. These oils were found to posses antibacterial activity.

The oils inhibit the growth of E.coli and Enterobactor which are known to be almost universal inhabitants of the intestinal tract of man and warm blooded animals. These bacteria cause diarrhoea, dysentry and infection of the blood system (bacteremia). The oils were however inactive against Mycobacterium tuberculosis.

Termite repellant property of these oils was also demonstrated by performing experiments on different species of termites and it was concluded that these oils could find a very good use for the processing of ordinary wood to save it from termites. Steam distillation of the powdered bark was suggested as the cheapest method for extraction of oils.

Publications as a result of these Investigations:

Naeema Khan., Ishrat Jehan., M.I. Burney., & J.I. Qazi., - Investigation of the antibacterial and insect repellant properties of the steam volatile oil from Cedrus deodara. (under preparation)

Naeema Khan., Mashooda Hasan. and Ishrat Jehan., - Terpenes from Cedrus deodare in three parts. (under preparation)

Part I Isolation and structure elucidation of a mixed anhydride from the steam volatile oil from stem bark.

Part II — Isolation and structure determination of a sesquiterpene hydrocarbon from the steam volatile oil from stem-wood.

Part III — Isolation and identification of a diterpene from the steam volatile oil from stem-bark.

Degrees Awarded

M.Phil degree was awarded to Miss. Ishrat Jehan Research Officer on the basis of this work.

Project No. : P-PU/EARTH(17)

Project Title : Geological investigation of the Chromite ore deposits of Malakand Agency, Pakistan.

Project Particulars:

Duration of Project	:	Three months
Date of commencement	:	3rd January, 1977
Date of termination	:	2nd April, 1977
Location of Scheme	:	Department of Geology, University of the Punjab, Lahore.
Total expenditure	:	Rs. 10,300/-

Main Objectives: To obtain scientific data for understanding the problems of chromite genesis so as to establish geological and structural criteria applied in locating and finding deeper extensions of chromite ore bodies.

Summary of the work done:

The research accomplishments during the course of present investigations are as under:-

- The geological field mapping of more than 125 square kilometers lying in the Southern Malakand Agency, was completed on a scale of six inches to a mile.

- All the chromite occurences were located, and geologically mapped.

- In all 62 chromite locations were reported, which included 18 locations discovered during the course of present investigations.

- Large scale detailed maps of all the chromite occurrences were prepared topographically and geologically with plane table survey techniques, using telescopic alidade and stadia methods.

- The geology of the host rocks of chromite deposits was described in detail. Genesis of these rocks had been discussed and important conclusions drawn.

- Complete chemical analyses of seven rock samples from different rock units had been carried out and reported.

- The structural layering of host rocks and planar structures in the country rocks had been measured, plotted and discussed.

- The tetures in chromite that were formed during the primary phase of chromite genesis had been recognized. Their implications on the distribution of chromite and its genesis were discussed.

- Zones of chromite distribution were recognized and places of possible future discoveries of chromite were shown on the accompanying map.

- Optical features of chromite in thin sections and polished sections were described.

- Physical and optical properties of chromite including its reflectivity, microhardness and unit cell edge were measured and discussed.

- Complete chemical analyses of seven samples of purified chromite were reported including four by the author.

- Present mining status of these deposits was described. Commercial grade of the available ore was determined.

- Important conclusions were drawn about the genesis of chromite deposits, in the light of recent geological literature.

Publication as a results
of above Investigations:

Chromite from Sakhakot - Qila area, Malakand Agency, Pakistan. The minerological Magazine, U.K. March, 1978.

Geology & Minerology of the Sakhakot - Qila chromite Deposits,

Malakand Agency, Pakistan. Journal of Scientific Research, University of Punjab, Lahore-Pakistan (accepted for publication).

Project No : C-IU/ENVR(5)

Project Title : Biological control of termites with pheromones and pathogenic fungi.

Project Particulars:

Duration of project	:	Two years
Date of commencement	:	1st February, 1976
Date of termination	:	31st January, 1978
Location of Scheme	:	Biological Sciences Department, Quaid-e-Azam University, Islamabad
Total expenditure	:	Rs. 1,86,566/-

Main Objectives: To isolate and purify different pheromones from termites; develop bioassays of these pheromones and biological control measures.

Summary of the work done:

Part 'A' (PHEROMONES)

Termites are one of the most devastating pests of cellulose materials. Until recently, insecticides have been employed to erradicate the pests, but these chemical compounds are liable to damage plantation, animal life and have a short term effect on beneficial insects. Recently, pheromones have been safely employed to erradicate harmful insects, as gypsy moth (Beroza, 1960; Beroza & Jacobson, 1963,1970; Beroza et al, 1971) and oak leaf roller Archips semiferanus (Hendry et al, 1973, 1974, 1975)

Termites have a sophisticated chemical communication system of defense, foraging (trail laying) and sex attractants. These chemicals when biologically, behaviourally evaluated and chemically isolated and synthesized, would offer an effective means of controlling the pests. The present study was conducted keeping in view the above mentioned facts.

The termites Odontotermes obesus (Rumbur) were collected from Chatter Bagh, University Campus and Nurpur Shahan. Workers were separated from the material using vacuum pump, were preserved in n-pentane 99% and stored at 10°C in a cooled incubator until 300 gms of insects were collected. The trail pheromone was

directly extracted in n-pentane and biologically evaluated. Both biological evaluations were made through behavioural tests using workers, which showed positive response indicating that a biologically active pheromone was present. Biochemical analysis of the trail pheromone was made by homogenizing 300 gms of workers, co-distillation/steam distillation of the supernatant, column chromatography of the distilate. Different fractions thus obtained from column chromatography were subjected to thin layer chromatography. The material was subjected to behavioural tests during each stage of chemical processing. The eluted bands were separately subjected to behavioural tests and the active bands were collected together and finally subjected to Gas-liquid chromatography, which showed that a highly purified, biologically active material has been obtained. The chemical analysis showed that this material was un-saturated hydrocarbons.

Part 'B' (PATHOGENIC FUNGI)

Alates and differently arranged batches of workers and soldiers were kept in sterilized petridishes over moist filter paper. Those externally occuring pathogens viz; Aspergillus niger, A. ustus and A. flavus were observed to cause mortality to termites.

A. niger caused mortality within 24 hrs. A. ustus and A. flavus caused mortality within 48 hrs. Scanning electro micrographs showed that mycellium penetrate through inter integumentary spaces, leg joints, and antennae segments. They also grow between the mouth parts. Behavioural studies indicated that after infection, grooming and allogrooming activities were accelerated. On the contrary feeding & colony formation activity declined. Similarly, in alates, courtship behaviour also declined considerably. The path-ogens were isolated and cultured in the culture cages for growth. Specific pathogenicity was confirmed by re-infection through spore wall of termites. It is speculated that mortality is caused by toxins excreted by the pathogens. This was confirmed by using extracts of mycellium and spores obtained from french press cell bracker.

Publication as a results of these Investigations:

- Biological evaluation of the trial pheromone of the termites, Odentotermes obesus (submitted to Biologia)
- Extraction and chemical analysis of the trial pheromone of the termites, Odentotermes obesus (under preparation)
- Studies on some externally occuring fungi of the termite, Odentotermes obesus (submitted to Invertebrate pathology) London.

Degress Awarded:

Ph.D	:	Miss. Farhat
Ph.D	:	Mrs. Mumtaz Qazi
M.Phil	:	Mr. Abdul Hamid

Project No : CU-MATH(7)

Project Title : Study of MHD and plasma physics

Project Particulars:

Duration of project	:	Three years
Date of commencement	:	1st July, 1974
Date of termination	:	30th June, 1977
Location of Scheme	:	Department of Physics, Quaid-e-Azam University, Islamabad
Total expenditure	:	Rs. 39,272.43

Main Objectives: To undertake theoretical studies in the field of magneto-hydrodynamics and plasma physics so as to explore the possibility of utilizing the energy stored in them on an industrial scale.

Summary of the work done:

a) NONLINEAR WAVES IN A TWO-COMPONENT HOT PLASMA

Nonlinear wave propagation in hot, collision less plasma consisting of electrons and ions were studied. It was assumed that the plasma was unbounded and that there was no ambient magnetic field. The model used was Boltzman n-Vlasov equation (B-V equation) in a lorentz frame of reference S in which the space- dependence was eliminated.

Transverse waves were investigated for the two cases: (i) the wave amplitude being small so that a purturbative expansion could be performed in terms of the amplitude. Truncating the series at an appropriate stage, a dispersion relation was obtained incorporating first order non-linear correction. There was no restriction on the temperature in this case. (ii) assuming that the plasma was not extremely hot so that the temperature effect could be treated as a small correction to the cold plasma case.

A dispersion relation describing a wave of finite amplitude was determined.

In both cases the dispersion relations followed the pattern of a one component electron plasma with ions forming a background of constant charge and current. The results were presented in a way

that the electron and ion effects stood out separately.

The result of this work has been accepted for publication in the journal of Physics A. Vol. 10. No. 7 (1977).

b) SOLITON AS A COHERENT STATE OF PHONONS

The soliton-solution- the special solution of nonlinear dispersive equations, in which non-linearity and dispersion balance each other so as to construct a constant profile solution, were studied. Such solutions seem to play an important role in many areas of physics including plasma physics.

In this regard investigations were also made on a one dimensional anharmonic lattice with N-particles equally spaced over a finite length. For such a model with cubic nonlinearity, it has been shown that the system satisfied a nonlinear differential equation(called kd equation) which has a soliton solution. Such a solution is a Coherent state of phonons. It was also tried to generalize this concept for an arbitary degree of non-linearity.

The problem of Landau damping of transverse waves in the presence of a uniform magnetic field using Bolt mann-Vlasov equation and assuming small amplitude waves was also studied. The effect of the magnetic field was introduced through the expansion.

Where "f" is the distribution function, the resulting dispersions relation gives the Landu damping term incorporating correction due to the presence of the uniform magnetic field.

Publications as a results of these Investigations:

Non-linear waves in a Two - component hot plasma.
J. Phys. A. Vol. 10 No. 7

Project No.	:	S-JPMC/MED(21)
Project Title	:	Effect of protein calorie mal-nutrition and Anemia in young children on their immune responses.

Project Particulars:

Duration of project	:	One year
Date of commencement	:	1st October, 1975
Date of termination	:	30th September, 1976

Location of Scheme : PMRC Research Cell, Jinnah Post Graduate Medical Centre, Karachi

Total expenditure : Rs. 23,084/-

Main Objectives : To study the delayed hyper-sensitivity and anti-body response to selected antigens in malnourished and anaemic pre-school children. The changes in immune response after recovery from the nutritional deficiency were also to be measured.

Summary of the work done:

Malnutrition has been shown to be associated with an increased predisposition to infection. This study was undertaken to evaluate some host defense factors in a group of pre-school children with varying degree of malnutrition.

It was found that cases with severe degree of malnutrition were significantly anaemic, had lower iron binding protein, and their immunoglobulin levels were also low.

This study provided the much needed data on immunoglobulin level in children of pre-school age and with different nutritional status. In addition to this relationship between the haemoglobin, iron binding protein (transferin) and plasma albumin was also studied. A significant correlation of serum albumin between haemoglobin and transferin.

Project No. : C-NHL/MED(24)

Project Title : Virological serological and electron-microscope studies on hepatitis in Rawalpindi and Islamabad area.

Project Particulars:

Duration of project : One year and nine months.

Date of commencement : 1st September, 1975

Date of termination : 30th June, 1977

Location of Scheme : National Health Laboratories, Islamabad.

Total expenditure : Rs. 19,898/-

Main Objectives: To study the epidemiology of viral Hepatitis by virological, serological and electron-microscope studies of specimens of blood, stool and liver bio-psies obtained from the patients of viral Hepatitis admitted in hospitals and health centres of Rawalpindi and Islamabad area.

Summary of the work done:

Viral hepatits is one of the most important public health problems specially in the tropical countries. It has variable morbidity mortality in different georaphical areas and Ethic and social groups. Accordingly a study was undertaken to find out the prevalence of HBs Ag in the urban and rural communities of Rawalpindi and Islamabad areas. Three main groups studied were as follows:-

i) Patients suffering from overt disease clinically compatible with the diagnosis of viral hepatitis and corraborated by the Biochemical tests such as Bilirubin, Transaminases, Alkaline phosphatase and Thymal Turbidity, Serum A:G. ratio. The patients were mainly out-door patients of Central Government Hospital, Rawalpindi, Central Government Polyclinic, Islamabad and also District Headquarter and Holy Family Hospital, Rawalpindi. The pertinent clinical and laboratory data was recorded on a proforma specially designed for this purpose.

ii) The patients suspected of liver disease but with normal liver function tests from the above sources.

iii) Rural Studies: A village Tarlsi Kalan, which is 14 kilometer from Rawalpindi and about 9 kilometer from National Health Laboratories, was selected for the purpose. The population is totally old settlers and local inhabitants of Potohar and belongs to same ethnic and social group. Nearly all are muslims. Nutrition survey team of National Health Laboratories had divided this village in six sectors, A,B,C,D,E,and F. Each house had been randomly selected. The population was about 3000 and consisted of 520 houses. There was inadequate sanitary system in the village, as was the water supply scheme. People obtain water from two wells with Bucket and role to meet all their needs. A pre-school child unit dispensary was serving the patients.

The integrated rural development authority had recently established a free dispensary near the village. There were 600 students in boys school, and 400 girls in girls middle school. One industrial school for ladies had also been established. There were a number of poultry farms around the village providing fresh vegetables, eggs and poultry to twin cities of Rawalpindi/Islamabad.

Study of the presence of hepatitis B antigen in different household and their contacts were undertaken in this community by obtaining blood samples of this community. Capillary blood samples were obtained from the person who refused to give venous blood. Presence of HBs Ag was detected by CIEP in the patients and normal population from rural areas.

Immunoglobulin levels in patients in group No. 1 (mentioned above) with liver disease were studied and their IgG and IgM levels were estimated. Redial immunodiffusion technique was applied for the quantitation. Overnight incubation at room temperature with W.H.O reference standard was selected for the test with a semilograthimic calculation of the percentage of the respective immunoglobulin. Hyland immunodiffusion IgG and IgM kits were used for the testing. Healthy Army recruits blood was taken and was considered as normal control for liver function as regards to IgG and IgM percentage in blood.

The results by CIEP on a total of 1213 specimens on the various groups indicate that in the urban communities of Rawalpindi/Islamabad 29% of patients (total patients 1375) with overt disease compatible with the diagnosis of viral hepatitis were due to HS, out of these 31% were males and 24% were females. Out of 838 cases suspected of liver disease 3.9% were positive for HBs Ag. Sex distribution was equal in all these cases. It can be considered that these cases were normal as far as liver disease is concerned. This can indicate the presence of HBs Ag in apparently normal population. So far a total No. 122 cases from Tarlsi Kalan have been studied and five were positive for HBs Ag (4%). Break up of the results from Tarlsi Kalan were tabulated. The results being significant would be of great help in the study of the epidemiology of the disease in rural community.

These results were similar to the findings of other workers in the country. However, a new dimension was given to these investigations by undertaking a planned study of prevalence HBs Ag in the rural community and it was concluded that the study be extended to other parts of country in rural communities. This would give an idea of the prevalence of HBs Ag in different ethnic and social groups in varied geographical areas. Same results were likely to be obtained for the sub-types of HBs Ag.

With the application of more sophisticated techniques, like those RIA, HA immune electron microscopy and Immune India ink microagglutination techniques, a more exact prevalance of the viral hepatitis will emerge and will elicit the immune status of the population also because RIA will be able to measure the Antibody against HBs Ag. Besides this the prevalence of Hepatitis A would also be ascertained.

Project No. : C-AFMC/MED(31)

Project Title : Studies on Nutritional problems of pregnant and nursing women among families of armed forces of Pakistan.

Project Particulars

Duration of project : Two years

Date of commencement : 1st September, 1976

Date of termination : 31st August, 1978

Location of Scheme : A.F.M. College, Rawalpindi.

Total expenditure : Rs. 19,331.75

Main Objectives : To investigate the effect of the intake of full amount of 80,000 K-calories, above the normal requirements during pregnancy and location and the effect on the total food requirements of the country. Beside the nature of deficiencies in terms of specific nutrient calories, protein, vitamin and minerals were also to be ascertained.

Summary of the work done :

450 serial cases of pregnancy of 20 weeks duration or less reporting for antenatal check up in a military hospital were registered with the project out of which 215 completed their pregnancy during the one year period under review. The socio-economic, physical, dietary, weight gain, haematological and bio-chemical parameters of the mothers who related to each other and to the birth weight of the baby in an attempt to evaluate the nutritional problems of pregnant women in Pakistan.

The studies clearly brought out the importance of maternal height in the reproductive performance. Tall mothers were shown to have a more spontaneous labour and higher birth weight of babies. The pregnancy weight of the mother however, did not show any correlation with reproductive performance. The average height in the series (mainly Punjabi women) came to 62" with a S.D of 2.1". This was only 1.5" less than the Harvard Standard of heights of adult women. The average weight was 107 lbs. with a S.D of 11.9 lbs. as against the Harvard Standard of average weight of 121 lbs. Compared to height, there was a great deficiency in weight showing caloric deficit in the diet. The birth weight of children was 7.1 lbs which was closely similar to the Harvard Standard of 7.4 lbs. This indicated the efficiency of human reproductive performance. The fertility, the birth weight and the growth rate during the first few months of life in the poor developing countries were closely similar to those seen in advance countries. However, the growth and mortality rate got woefully adverse within a few months after the child had left the womb.

The average dietary intake was found to have calories 72%, proteins 120%, calcium 33%, iron 41%, Vitamins B 114%, B_2 41%, Niacin 100% and C 64% of the recommended intake. The diet therefore was adequate only in proteins, vitamins B and Niacin content and was grossly in-adequate in all other ingredients. The crucial deficiencies were in calories, ca & Fe. The caloric deficiency was due to low caloric density of traditional Pakistani diet due to low fat intake. The extensive shortages which were brought out in dietary intake tended to indicate that the current recommendations were too high and needed to be scaled down. However, more data was needed to come to a firm conclusion on this point. There was a positive correlation of + 0.3 between the caloric intake and birth weight of baby and of 0.5 between the protein intake and birth weight. Both the correlations were significant.

This average weight gain in pregnancy was found to be 12 lbs with range of 0-24 lbs. Thus the weight gain was just 50% of the reported weight gain in western world. No correlation could be seen between the weight gain and the birth weight of the baby except in the cases where the women actually lost weight.

The average serum calcium of Pakistani women during pregnancy is 10 + 1.5 mg/dl which is well within the normal limits. However, as many as 25% of cases had serum Ca less than 8 mg/dl. However, the biochemical evidence of occult osteomalacia, based on values of serum Ca X P less than 40 and serum Alkaline phosphate more than 20 K A Units was seen in 6% to 9% cases only. These figures pertain to the families of troops only.

The data collected so far brought out the importance of adequate prepubertal nutrition of females to permit the full realization of the growth potential of our women. There was also an unequivocal evidence of the need for fortification of atta with calcium and iron in order to over come the shortage of these two important minerals.

Project No.	:	SU-OCEAN(2)
Project Title	:	Studies on the settlement and control of marine organisms in cooling systems of coastal installations.
Project Particulars	:	
Duration of project:		Four years
Date of commencement:		1st March, 1974
Date of termination:		28th February, 1978
Location of Scheme	:	Institute of Marine Biology, University of Karachi, Karachi.
Total expenditure	:	Rs. 2,01,139.67
Main Objectives	:	To study scientifically the nature of fouling organisms, their seasonal abundance in the neighbouring waters and conducting experiments to ascertain their settlement in the tubing of the cooling system of Karachi Nuclear Power Plant.

Summary of the work done:

Many organisms, such as the larvae of branacles and molluscs tend to settle and grow in the tubings of the heat-exchanger and the cooling system during circulation of sea water through them. The resulting mass-scale pitting and blocking of the coolant tubes affect the smooth flow of sea water through the cooling system and finally leads to increase corrosion and subsequent leakage of tubes. The periodic damages caused to the system and to the replaced tubing and accessories cost heavily. The present investigations were carried out to study the biological aspects of fouling problems and to determine ways and means to control settlement of fouling organisms in the cooling system of KANNUP at a minimum cost.

The results obtained from the study of the composition, distribution and abundance of fouling organisms showed that the dominant foulers in the cooling system are barnacles, serpulioysters and hydroids. The main fouling centres in the cooling system are ducts, pipes intake tunnel, bay-walls and heat-exchange tubings. It was also found that dense population of fouling organisms along the coast of Karachi were located in the backwater, creeks and rocky shores.

Results obtained from the studies of seasonal distribution of planktonic larval stages of major fouling groups and the seasonal settlement patterns of the larvae of fouling organisms occuring on exposure panels suggested that a majority of the foulers breed alround the year whereas the peak increase in the breeding activity was observed during September to November and January to March. Minimum breeding was observed in the South West Monsoon period (June through September). Similar trends were noticed in the settlement of alga spores and diatoms on the exposure panels. The fouling communities developing on the substrates for long periods were usually composed of a diverse fauna dominated by 2 to 3 species. These communities were found to be least affected by seasonal changes in the larval settlement of various fouling organisms.

Observations on chlorination and heat treatment of the fouling organisms indicated that a low level of chlorination on continuous basis was useful in controlling larval settlement in the cooling system. It was also found that the use of hot water (by re-circulation of hot water discharge from the condensors through the intake) to attain a temperature of 45°C for one hour also causes mortalities of adult foulers. From the above results it was concluded that in order to achieve good results low level continuous chlorination and hot water re-circulation should be practiced. However, in case of non-availability of chlorine, the frequency of hot water re-circulation might be increased for the effective control of fouling in the cooling system of the power plant.

Publications as a results of these Investigations:

Haq, S.M., M. Moazzam & S.H. Niaz Rizvi.,	Studies on marine fouling organisms from Karachi coast 1-Preliminary studies on the intertidal distribution and ecology of fouling organisms at Paradise Point. Karachi. Pak. J. Zool. (In press)
	Studies on marine fouling organisms at Karachi coast II. Observations on the larval settlement and seasonal changes in the composition of fouling communities at Paradise Point. Karachi. (submitted)

Studies on marine fouling organisms at Karachi coast. III-Sub-strate preference in larval settlement of fouling organisms. (under preparation)

Studies on marine fouling organisms at Karachi coast IV-Fouling of intake system of a power plant at Karachi coast (under preparation).

Degrees Awarded:

Mohammed Moazzam Khan : M.Phil thesis being submitted.

Syed Hussain Niaz Rizvi : M.Phil thesis being submitted.

Project No. : S-KU/PHY(5)

Project Title : Fundamental and applied research in experimental solid state physics at and below room temperatures.

Project Particulars :

Duration of Project Three years

Date of commencement : Ist July, 1975

Date of termination : 30th June, 1978

Location of Scheme: Department of Physics, University of Karachi, Karachi.

Total expenditure : Rs. 5,03,308.34

Main Objectives : To study the (i) measurement of resistances and (ii) mechanical and elastic properties of some solids. Reliable and comprehensive data on the elastic module, elastic co-efficients, tensile strength, creep and

fatigue properties and hardness are of great importance for studying defect structures and defect mechanisms responsible for mechanical behaviour.

Summary of the work done:

This project was undertaken to set up research facilities for work below room temperature. This objective has been achieved and necessary facilities have been created to undertake research work up to 77°K for studying thermal, electrical and magnetic properties of solids in bulk material. For creating these facilities the following work was undertaken:-

i) Installation of Liquid Nitrogen Plant.

ii) Installation and calibration of electromagnet.

iii) Designing circuitary and obtaining equipment for measuring electrical properties of solids.

iv) Actual measurement of magnetoresistance of some alloys at and below room temperatures.

i) Installations of Liquid Nitrogen Plant

This work has been completed except for non-availability of chilling plant without which the efficiency of plant and its life will be reduced. The plant has to be kept in an air-conditioned room but funds are not available for this purpose.

ii) Installation and calibration of Electromagnet

This work has been completed satisfactorily. The magnet has been calibrated both with plane and conical pole pieces. The calibration charts are attached, and reliable measurement can be made upto 23 K.

iii) Designing Circuitary and Obtaining Equipment

The circuitary has been designed and necessary equipment has been obtained. This consists of precision potentiometer type-P^{-7}_{-9} by M/S Croydon Instruments London having sensitivity 10^{-9} volts, DC current stabilizer by Tinsely Company London. Reversing switch by Tinsely Company London.

iv) Actual Measurement of Magneto-resistance

Measurements were undertaken primarily to test the equipment and then to measure the available samples of

steel and copper alloys. Locally only four samples of steel alloys and two samples of copper alloys were available but measurements were made on three samples of steel alloys and two samples of copper alloys.

Project No.	:	PU-PHY(11)
Project Title	:	High energy phenomenology
Project Particulars	:	
Duration of project	:	Three years
Date of commencement	:	1st July, 1974
Date of termination	:	30th June, 1977
Location of Scheme	:	Department of Physics, University of Punjab, Lahore.
Total expenditure	:	Rs. 31,102.75
Main Objectives	:	To use a modified form of Regge theory to explain the freshly available experimental data concerning particle-particle and particle - nucleus interactions.

Summary of the work done

The project was undertaken to investigate the nature of elementary particles at high energy as it was considered that two-body hadronic reactions at high energies could give an insight into the nature of these particles. As there was no dynamical theory of elementary particles, moreover the phenomenological picture of high energy two-body or quasi-two body processes being strongly dominated by Regge theory, efforts were therefore made to explain various experimental results concerning the angular distribution and give piecemeal explanations of there experimental results. The analysis of scattering amplitudes in terms of the quantum numbers, exchanged in the crossed channel, provided a deep insight into the high energy behaviour of these reaction mechanisms.

The Dual Absorptive Model, the Eikonal Model and the Reggeon Calculus was used to explain the differential cross sections for $pp \rightarrow pp$, $K^+p \rightarrow K^+p$, $\pi^-p \rightarrow p\pi^-$ and many other reactions. Every effort was made to interpret the most recent data on these models. The results of these investigations would provide some help in having a better understanding of the nature of hadronic interactions.

Publications as a result of these Investigations:

M. Saleem., M. Rafique., Khalid L. Mir., J.S. Mirza., and S.H. Tirmizi.,	pp elastic scattering and the pomeron periphery: Aust. J. Phys. 28, 265 (1975)
M. Saleem., Javaid Irshad., and Ghulam Rasul.,	Dual absorptive model and π^- p backward elastic scattering: Aust, J. Phys. 29, 227 (1976)
M. Saleem., Javaid Irshad., Sanaullah Bhatti., and Manzoor Hussain.,	A note on π^-p backward elastic scattering: Pak, J.Sc. Res (1976)
Manzoor Hussain., M. Saleem., and M.A. Shaukat.,	Dual absorptive model and π^+p backward elastic scattering: 15th International Cosmic Ray Conference, Sofia (Bulgaria), August, 1977.
Mujahid Kamran., and Mohammad Saleem.,	Energy dependence of dip in pp elastic scattering: Aust. J. Phys. 30, 355 (1977)
M. Saleem and M.A. Shaukat.,	Compton scattering of deuterons: Aust. J. Phys. 28, 475 (1975)
M. Saleem.,	Reggeon calculus and K^+p elastic scattering: 14th International Cosmic Ray Conference, Munchen, Germany (1975)
Mohammad Saleem., M. Rafique., and Manzoor Hussain.,	Eikonal model and pp elastic scattering at ISR energies: 15th International Cosmic Ray Conference, Sofia (Bulgaria), August, 1977.
M. Saleem., M. Rafique., and Sanaullah Bhatti.,	Compton scattering of protons: Pak. J. Sc. Res. (1977).

Project No. : F-CSIR/UTZ(28)

Project Title : Utilization of pine needles for paper and jute manufacture.

Project Particulars :

Date of commencement : July, 1977

Date of completion : December, 1978

Duration of project : One year and six months.

Location of Scheme : PCSIR Laboratories, Peshawar.

Total expenditure : Rs. 20,000/-

Main Objectives : To utilize pine needles as raw material for the manufacture of textile as a substitute of jute and the manufacture of paper.

Summary of the work done :

In Pakistan three raw material from Agriculture residue i.e. sugar cane bagass, wheat straw and rice straw are being used for paper making. They are however insufficient to fulfil the growing needs of the paper industry. This require the search for new raw materials which may be available in abundance. During a survey of such materials it was observed that pine needles are found abundantly in North West Region of Pakistan and presently, not being put to any use. In fact, their presence in the forests hinders the growth of new plants thereby arresting the expansion of forests; causes fire thus resulting in destruction of forests; prevents the growth of grasses thereby reducing the land available for pasture.

With a view to utilize these needles for paper industry, the pine needles were analysed chemically and it was observed that they contain 31.5% of cellulose, 25.6% lignin and 10.2% pentosan as compared to sugar cane bagass and Kahi grass which contain about 35% cellulose.

The ash percentage of pine needles was found to be 3.3% which is lower than wheat and rice straw and almost equal to Kahi grass. The low percentage of ash facilitates bleaching and cooling the pulp.

After the chemical analysis the cooled pine needle were bleached for the preparation of pulp. The ratio of fibres length to diameter was found to be 63 which is greater than most of the raw material for paper production. The yield of pulp varied from 18-20%. Multistage bleaching of pine needle pulp with 10% chlorine produced brightness of 70%.

The physical properties of the hand made sheets indicated that at 45°SR freshness, the tear factor, bursting strength, folding endurance and breaking length of pine needle were superior to those of bagasse, which mixed with imported pulp is widely used for the production of paper. The pine needle pulp being superior to bagass would thus require mixing of comparatively lesser percentage of imported pulp to get a strong fibre.

Most of the raw materials, which are used at present for paper and board making in the various mills, are also used for other useful purposes such as rice straw and wheat straw are being used as animal feed, bagasse as fuel and Kahi grass in the construction of houses, but the pine needles are not used for any useful purpose. Another aspect which imparts unique value to pine needles is that it does not require cultivated land.

The work on utilization of pine needles for manufacturing jute fibre is in progress.

Project No. : P-AU/UTZ(34)

Project Title : Design and fabrication of multi-purpose self propelled low cost reaper.

Project Particulars :

Date of commencement : 1st July, 1977

Date of completion : 30th June, 1978

Duration of Project : One year

Location of Scheme : University of Agriculture, Faisalabad.

Total expenditure : Rs. 15,000/-

Main Objective : To design and fabricate a cheap multipurpose self propelled harvestor for harvesting wheat/rice/forage crops and for planting cereals and spreading fertilizer in the field by attaching some additional accessories.

Summary of the work done :

Background

Harvesting of wheat conventionally with sickle is the most labour intensive operation in the production of grain. The socio-economic and agroclimate conditions of the country have prevented the adoption of western type mowers and combines for harvesting grain crop. In order to save labour as well as foreign exchange

there is felt a great need for the development of Agro-machinery which will suit to our local conditions. Accordingly a project was sanctioned by the Pakistan Science Foundation to the Agricultural University, Faisalabad, for designing and fabricating a multipurpose self propelled low cost reaper.

After careful investigations into the agricultural practices with special reference to average farm size in Pakistan, the proposed reaper called Uni-reaper has been prepared and successfully applied to grain-crop harvesting.

Salient Features:

The main frame is supported on two front driving wheels and one rear supporting wheel with pneumatic tyres. The cutting unit consists of the conventional mower-cutter bar, mounted at a distance of 5-cm at the back of front wheel. To avoid swinging of the cutter-bar and ensure easy running of the machine in uneven fields a supporting wheel of 20-cm dia is provided at the right hand side of the cutter bar (Fig.1).

The power for cutting operation and for forward travel of the machine is provided by a 6-7 h.p. light weight gasoline engine, fixed to the rear of the machine. A V-belt drive and bevel gear machine provides the necessary reduction of the engine speed from 2500 r.p.m. to 350 r.p.m. at the crank wheel to which the Pitman head is fixed (Fig.2). This produces 700 strokes per minute of the cutter bar. A roller chain and spur gear reduction mechanism has been provided to avoid slippage losses and to run the front driving wheel at 30 r.p.m. (Fig.3).

The dog clutches are provided one on each of the front wheels (Fig.3). These dog clutches work simultaneously to engage or disengage engine power for forward travel. These clutches work independent of each other and help in easy turning of the machine. The expensive differential gear mechanism has been replaced by this simple arrangement. One dog clutch is provided to engage and disengage engine power from cutter bar (Fig.3).

Four adjustable screws are used for raising and lowering the cutter bar to cut the crop at desired height maximum upto 30-cm. (Fig.3). For transportation purposes the cutter bar can be lifted up at an angle of 80 degrees with the horizontal and tied with the frame of the machine. Thus the machine occupies only one meter space while travelling on a road or moving from one field to the other. The cutter bar is detachable and the rest of the machine can be used as a small power tiller of 6-7 h.p. for other farm operations as sowing of cereals and spreading fertilizers in the field.

Only one operator is required to control and operate this machine in the field. Two control levers accessable to operator one for cutter bar control and the other for forward travel control, have been provided (Fig.4). The operator can walk or sit on

the seat provided for this purpose. Two additional workers are necessary for tying bundles of the cut crop or removing it from the field and taking it to thrashing centre. One ha. of wheat/ rice and forage crop can be cut within 2.5 hours with an estimated cost of Rs. 75/- per ha. This cost includes fuel, labour and depreciation of the machine. At present to harvest wheat manually one man takes about ten days to cut one ha. of wheat working for eight hours a day with an expenditure of Rs. 250/- per ha. It can sow one ha. of cereal crop within 25 hours. The farmers are using the engine of this machine on a small thresher of capacity 500 kg/hour of wheat and 800 kg/hour of rice.

All the parts of this machine, except 6-7 h.p. gasoline engine were manufactured in Pakistan from the locally available material. The life of this machine has been estimated 8-10 years with care and maintenance. This is very cheap unit and it can be fabricated with an expenditure of Rs. 8,000/- only. The simplicity of design and the working of this machine have been appreciated by the farmers and national and international manufacturing agencies. The design of this harvestor has been sold to Pakistani Firm M/S Malbro International, Collaborator of an Australian Firm Toft, and now is produced commercially.

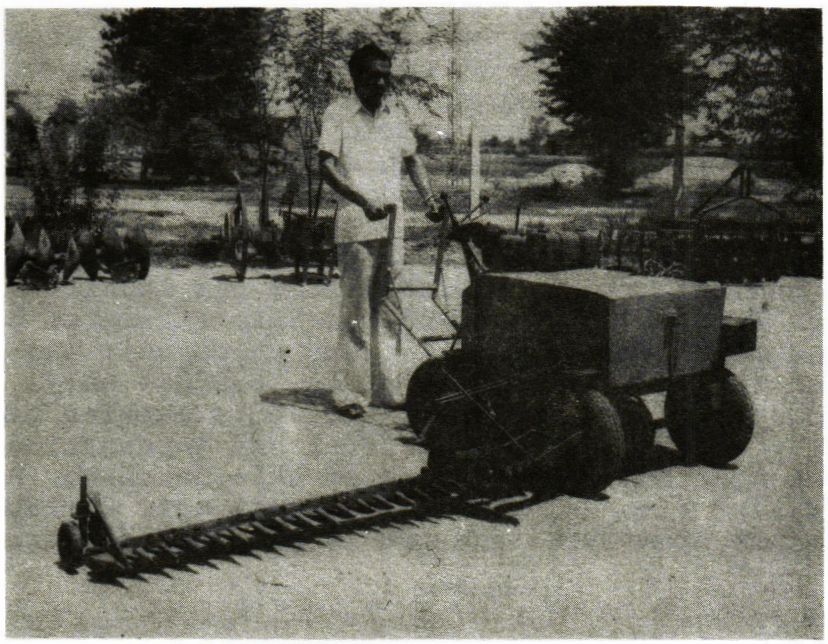


Plate 12 : Mr. A. D. Chaudhry, holding the Prototype Reaper designed and fabricated by him at the Department of Farm Machinary, Univ. of Agri. Faisalabad.

Plate 13 : Demonstration of the Prototype Reaper in wheat fields, Agri. University Faisalabad. The Vice Chancellor, Dr. Amir Mohammad is operating the device.

Plate 14 : Improved model of Prototype Reaper.

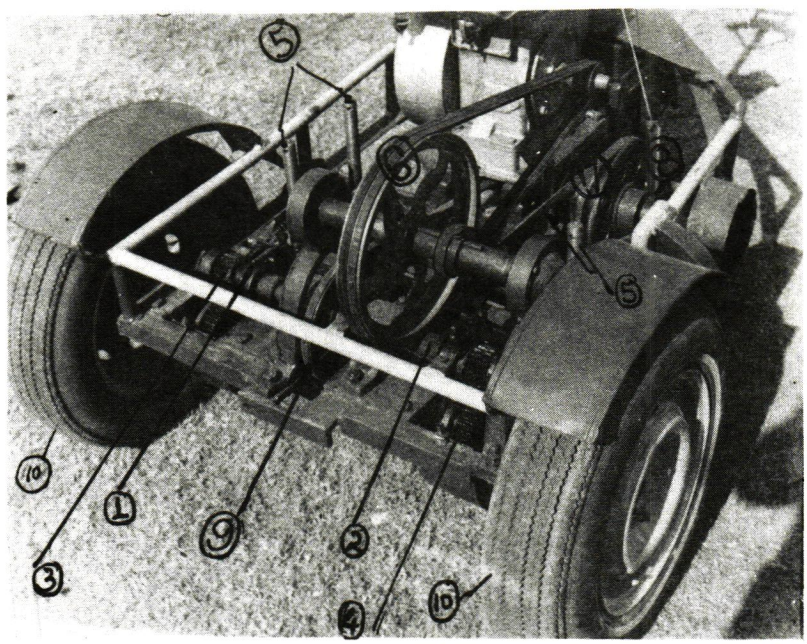


Plate 15 : Inside details of the University Reaper.

1-2. Dog clutches for forward travel control.
3-4 Final speed reduction gears for forward travel.
5 Cutting Blade height adjusting screws.
6 First speed reduction.
7 Second speed reduction.
8 Dog clutch to control cutting Blade operation
9 Roller Chain.
10 Front Pnewmatic Tyres.

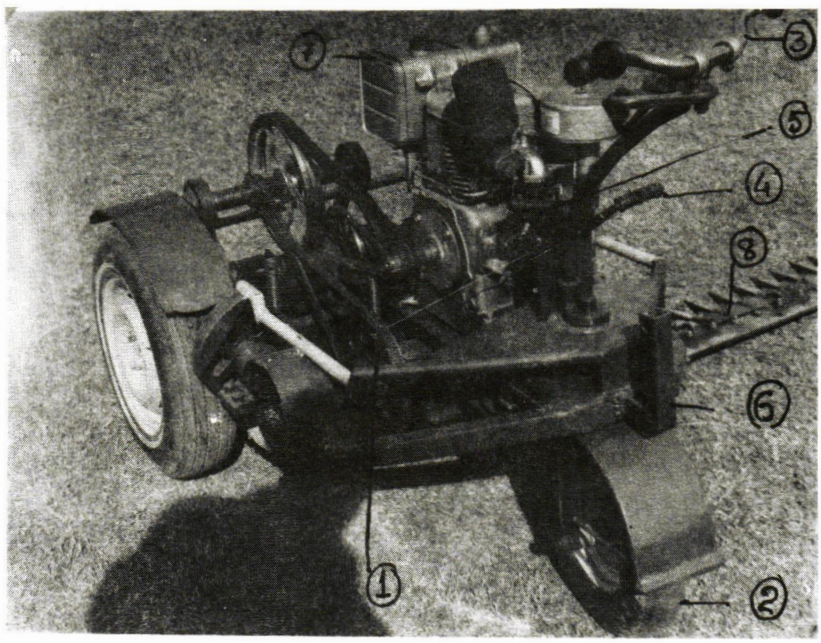


Plate 16 : Details of the Rear Section of the University Reaper.

1. Dog clutch to control cutting Blade operation.
2. Rear supporting wheel.
3. Steering.
4. Control lever for forward travel of the machine.
5. Control lever for cutting Blade operation.
6. Provision for attaching a seat with the machine.
7. Engine.
8. Cutting blade.

B) Second Annual Reports

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

Project No.	Title of the project
P-AU/AGR(31)	Cytogenetics studies of branched ear derivatives in wheat.
P-PU/BIO(6)	i) Palynological studies of plants growing in Punjab. ii) Seasonal variations in the frequencies of air-borne pollen and spores which cause allergies, with special reference to Central Punjab.
S-KU/BIO(20)	Taxonomic studies of some marine invertebrates of the Northern Arabian sea (Decapoda, Crustacea, Mollusca and Echinodermata).
P-AU/BIO(40)	Ecology of some avain and mammalian pests.
P-AU/BIO(38)	Collection and study of fish fauna of Pakistan.

C) First Annual Reports:

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

Project No.	Title of the project
S-SC/AGR(19)	Major crop weeds and their control.
S-AC/AGR(21)	Survey, identification and control of plant virus diseases in Sind.
S-AC/AGR(36)	Investigation on nematode diseases in Sind Region.
C-IU/AGR(40)	Preliminary studies on the breeding biology of teddy goat.
S-KU/BIO(14)	Investigation on wood anatomy of coniferious trees of Pakistan.

P-PU/BIO(50/I)	Control of disease of silk worm (B.mori) in Pakistan and Azad Kashmir.
S-KU/BIO(54)	A survey of phytoplankton of Sind Area and their utilization as food for animal/ man.
P-CSIR/BIO(69)	Production of amylolytic enzymes for industrial use.
P-PU/BIO(75)	Hetrotopic transplantation of entire muscles in mammals.
S-KU/CHEM(7)	New calorimetric techniques and measurement of heat mixing of organic liquids.
C-IU/CHEM(54)	Preparation of new medicinal compounds by structure modification and metal chelation of certain existing medicinal compounds and their study.
P-CSIR/CHEM(66)	Development of steroid chemistry because of its pharmaceutical as well as socio-economic impact.
F-PU/CHEM(60)	Molecular weight and size measurement of colloidal polymers and macromolecular materials by light scattering techniques.
S-SU/CHEM(65)	Reactions of Thionyl chloride with sucrose, Trehalose, Methyle-B-maltoside and methyl B-sactoside.
C-IU/CHEM(56)	Chemical investigation of the plants known to have significant pharmacological activities.
C-IU/CHEM(73)	Kinetics, Electrochemical and Optical investigation of the Herbicide: Methyl Viologen (Paraquat) and related compounds.
P-CSIR/CHEM(76)	Enzyme hydrolysis of raffinose for the improvement of sugar recovery in beet processing.
S-SU/EARTH(5)	Exploration and evaluation of the economic minerals potentials and deposits of Nagar Parkar, Southern Sind.
F-PU/EARTH(20)	Socio-demographic survey of Daudzai integrated development area.

P-CTT/ENG(14)	Dyeing problems in blended fabrics; study on Pakistan Textile Industry.
F-PU/ENVR(2)	Testing for mitotic gene conversion in yeast by food colours and other chemicals.
P-PU/ENVR(3)	Ecological studies on fresh water hyphomycetes.
S-KU/ENVR(4)	Problems of eutrophication and control of aquatic weeds in fresh water lakes of Sind.
P-PU/MATH(8)	Inclusive Reactions.
S-JPMC/MED(20)	Epidemlogical study of nutritional disorders in pre-school children in an Urban Community.

CHAPTER - 3

ORGANIZATION AND ADMINISTRATION

The ultimate organizational and administrative structure of the Foundation is represented in the chart on page 102 and 103 respectively. However only a small component of the proposed structure was inducted by the Foundation. The staff in position during the report period is as under:-

S.No	DESIGNATION	NUMBER
1.	Chairman	1
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.	Placement Officer	1
9.	Accounts/Audit Officer	1
10.	Public Relation Officer	1
11.	Administrative Officer	1
12.	Assistant Scientific Officer	1
13.	Supporting Clerical Staff	14

In addition to the whole-time members of the Foundation, there are about 250 scientists and technologists in various universities/research organizations, who are acting in an honorary capacity as reviewers of the research proposals or serving on the technical/other committees and expert/advisory panels of the Foundation.

PAKISTAN SCIENCE FOUNDATION, ISLAMABAD

BALANCE SHEET AS AT JUNE 30, 1978

FUNDS AND LIABILITIES	NOTE	1978 Rs.	1977 Rs.	PROPERTY AND ASSETS	NOTE	1978 Rs.	1977 Rs.
FUNDS							
General	2	29,96,418.73	29,11,619.00	FIXED ASSETS			
RESEARCH SUPPORT GRANTS	3	1,68,66,656.42	1,35,26,646.00	(As per schedule annexed)		29,88,947.72	30,26,672.00
				RESEARCH PROJECTS IN PROGRESS	6	1,68,66,656.42	1,35,26,646.00
CURRENT LIABILITIES				CURRENT ASSETS			
Pastic	4	-	24,94,372.00	Accounts receivable	7	7,916.00	66,097.00
Other creditors	5	1,01,542.62	65,560.00	Advances, deposits and prepayments	8	53,800.10	65,372.00
		1,01,542.62	25,59,932.00	CASH AND BANK BALANCES	9	47,297.53	23,13,410.00
						1,09,013.63	24,44,879.00
		1,99,64,617.77	1,89,98,197.00			1,99,64,617.77	1,89,98,197.00

The above balance sheet should be read in conjunction with the annexed notes on account set out from pages (iv) to (vi).

AUDITORS' REPORT

(See annexed report of date)

RAWALPINDI 21 - 8 - 1979.

PAKISTAN SCIENCE FOUNDATION, ISLAMABAD

SCHEDULE OF FIXED ASSETS AS AT JUNE 30,1978

PARTICULARS	COST			DEPRECIATION			WRITTEN DOWN VALUE AS AT JUNE 30,1978	RATE %
	As at July 1, 1977	Additions during the year	As at June 30,1978	As at July 1, 1977	Provided during the year	As at June 30,1978		
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
Lease hold land	26,83,333	-	26,83,333	-	-	-	26,83,333.00	-
Furniture and fixture	1,53,910	-	1,53,910	30,172	7,424.28	37,596.28	1,16,313.72	6
Office equipment	1,14,870	8,340	1,23,210	48,524	11,202.90	59,726.90	63,483.10	15
Air-conditioners	74,764	-	74,764	34,036	6,109.20	40,145.20	34,618.80	15
Motor vehicles	1,82,900	-	1,82,900	78,370	20,906.00	99,276.00	83,624.00	20
Cycle	359	-	359	212	29.40	241.40	117.60	20
Library books	9,217	-	9,217	1,367	392.50	1,759.50	7,457.50	5
	32,19,353	8,340	32,27,693	1,92,681	46,064.28	2,38,745.28	29,88,947.72	
1977	31,43,594	75,759	32,19,353	1,39,305	53,376.00	1,92,681.00	30,26,672.00	

PAKISTAN SCIENCE FOUNDATION, ISLAMABAD

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED JUNE 30,1978

EXPENDITURE	NOTE	1978 Rs.	1977 Rs.
Grant	10	43,14,871.74	53,76,495.00
Administration and others	11	10,89,760.12	8,79,613.00
Travel grant for Scientific surveys, science conferences and seminars	12	68,191.32	40,279.00
Scientists pool	13	3,67,012.96	15,461.00
		58,39,836.14	63,11,848.00
INCOME			
Interest received		-	102.00
Miscellaneous income		90.75	581.00
		90.75	683.00
NET EXPENDITURE FOR THE YEAR		58,39,745.39	63,11,165.00
Less: Adjustments in respect of previous years	14	2,18,523.12	-
EXPENDITURE CARRIED FORWARD		56,21,222.27	63,11,165.00

The above income and expenditure should be read in conjunction with the annexed notes on accounts set out from pages (vi) to (viii).

RAWALPINDI 21 - 8 - 1979

AUDITORS REPORT
(See annexed report of the date)

PAKISTAN SCIENCE FOUNDATION, ISLAMABAD

NOTES ON ACCOUNTS - JUNE 30,1978

ACCOUNTING POLICIES

1. The principal accounting policies which have been adopted in the preparation of the Foundation's accounts are as follows:

GRANTS RECEIVED

1.1 Grants from the Government of Pakistan have been accounted for on receipts basis, which is consistent with the previous year's practice.

RESEARCH SUPPORT GRANTS

1.2 Research support grants have been accounted for on payment basis. This is in conformity with the previous years practice.

FIXED ASSETS

1.3 Fixed assets have been valued at cost less accumulated depreciation except lease hold land, which is valued at cost. This is in conformity with the previous years practice.

1.4 Depreciation on fixed assets has been charged on reducing balance method.

GENERAL FUNDS	1978 Rs.	1977 Rs.
2. This is made up of		
Balance as at July 1,1977	29,11,619.00	39,01,684.00
Add: Grants sanctioned and received during the year	56,24,000.00	54,21,100.00
	85,35,619.00	93,22,784.00
Less Expenditure during the year	56,21,222.27	63,11,165.00
Amount granted to museum	-	1,00,000.00
	56,21,222.27	64,11,165.00
	29,14,396.73	29,11,619.00
Add: Grants not paid Pastic	82,022.00	-
	29,96,418.73	29,11,619.00

RESEARCH SUPPORT GRANTS

3. In accordance with the principles out lined in the charter grants totalling Rs.33,40,010.42 have been paid by the Foundation during the year for the conduct of various approved scientific research projects. The movement in this account is given below:

Balance as at July 1, 1977	1,35,26,646.00
Add: Grants paid during the year for finalised agreements	33,40,010.42
	1,68,66,656.42

3.1 The grantees have under taken to incur the grants as per the provision of the agreement and for the performance and execution of the research project for which the grant has been paid. Accordingly these grants are being carried forward in the accounts of the Foundation and shall be written off or reduced as and when the expenditure is incurred and the proper account thereof is rendered to the Foundation on the conclusion of the projects.

PASTIC

4. The movement in this account during the year has been as follows:

Balance as at July 1, 1977		
Add: i. Non-development grant received from the Government of Pakistan	28,25,000.00	
ii) Development grant received from the Government of Pakistan	14,75,825.00	
		43,00,825.00
Less Expenses and advances paid		43,00,825.00
Balance as at June 30, 1978		-

OTHER CREDITORS

5. These may be reclassified as under:	1978 Rs.	1977 Rs.
Creditors for expenses	78,995.14	42,337.00
Creditors for other finance	22,547.48	23,223.00
	1,01,542.62	65,560.00

RESEARCH PROJECTS IN PROGRESS

6. This represents the expenditure incurred on various research projects which are still in progress (Refer Note - 3.1).

ACCOUNTS RECEIVABLE

7. These consist of:	1978 Rs.	1977 Rs.
Provident Fund	3,491.00	3,491.00
Others	4,425.00	425.00
Museum	-	62,181.00
	7,916.00	66,097.00

ADVANCES, DEPOSITS, PREPAYMENTS

8. These are made up of:		
Advances to staff	9,359.00	27,578.00
Deposits:		
For telephone	2,700.00	2,700.00
For suigas	1,000.00	1,000.00
	3,700.00	3,700.00
Prepayments	40,741.10	34,094.00
	53,800.10	65,372.00

CASH AND BANK BALANCES

9.		
In hand	2,026.36	5,249.00
With bank	45,120.18	11,336.00
With Government Treasury	-	22,96,825.00
Unesco Coupon	150.99	-
	47,297.53	23,13,410.00

GRANTS

10.		
Research support	33,40,010.42	41,13,917.00
Scientific societies and professional bodies	4,05,000.00	5,35,191.00
Utilization	29,100.00	1,56,000.00
Others (Note - 10.1)	3,02,733.65	4,61,910.00
Science Seminars, conferences	2,38,027.67	1,09,477.00
	43,14,871.74	53,76,495.00

10.1 Others

	1978 Rs.	1977 Rs.
Scientific Centres and Herbaria	1,84,181.00	50,000.00
Information and documentation	34,824.00	1,41,968.00
Awards and prizes	28,000.00	-
Scientific surveys and collection of statistics	55,728.65	2,59,176.00
International Liaison	-	10,766.00
	3,02,733.65	4,61,910.00

ADMINISTRATIVE AND OTHERS

11. These comprises of:

Salaries	5,13,628.62	3,75,891.00
Honorarium	2,200.00	4,800.00
Overtime	1,792.24	2,700.00
Provident fund	26,081.00	23,748.00
Leave salary and pension contribution	16,726.10	12,713.00
Medical	46,338.50	53,557.00
Rest and recreation allowance	4,766.50	7,391.00
Travelling (local)	20,824.20	19,359.00
Rent office	83,924.00	42,500.00
Water,electricity and gas	7,235.43	6,044.00
Rent residential accommodation	94,578.37	81,497.00
Postage,Telegram and Telephone	1,00,187.61	75,452.00
Printing and stationery	8,616.15	36,297.00
Vehicle running and maintenance	54,330.28	39,878.00
News paper and periodicals	1,635.61	3,561.00
Liveries and uniform	6,299.80	4,796.00
Entertainment	15,318.60	12,895.00
Insurance	4,822.15	2,476.00
Repair and maintenance	7,817.36	4,871.00
Depreciation	46,064.28	53,376.00
Group life insurance	261.08	412.00
Travel abroad	11,148.00	-
Miscellaneous	7,257.15	4,630.00
	10,81,853.03	8,68,844.00
Other expenditure		
Audit fee	3,000.00	2,250.00
Advertisement	1,938.84	8,344.00
Bank charges	2,968.25	175.00
	7,907.09	10,769.00
	10,89,760.12	8,79,613.00

TRAVEL GRANTS FOR		1978 Rs.	1977 Rs.
12.	SCIENCE CONFERENCES AND SEMINARS		
	Foreign	68,191.32	40,279.00
		68,191.32	40,279.00
SCIENTIFIC POOL			
13.	Salaries	3,67,012.96	15,461.00
		3,67,012.96	15,461.00

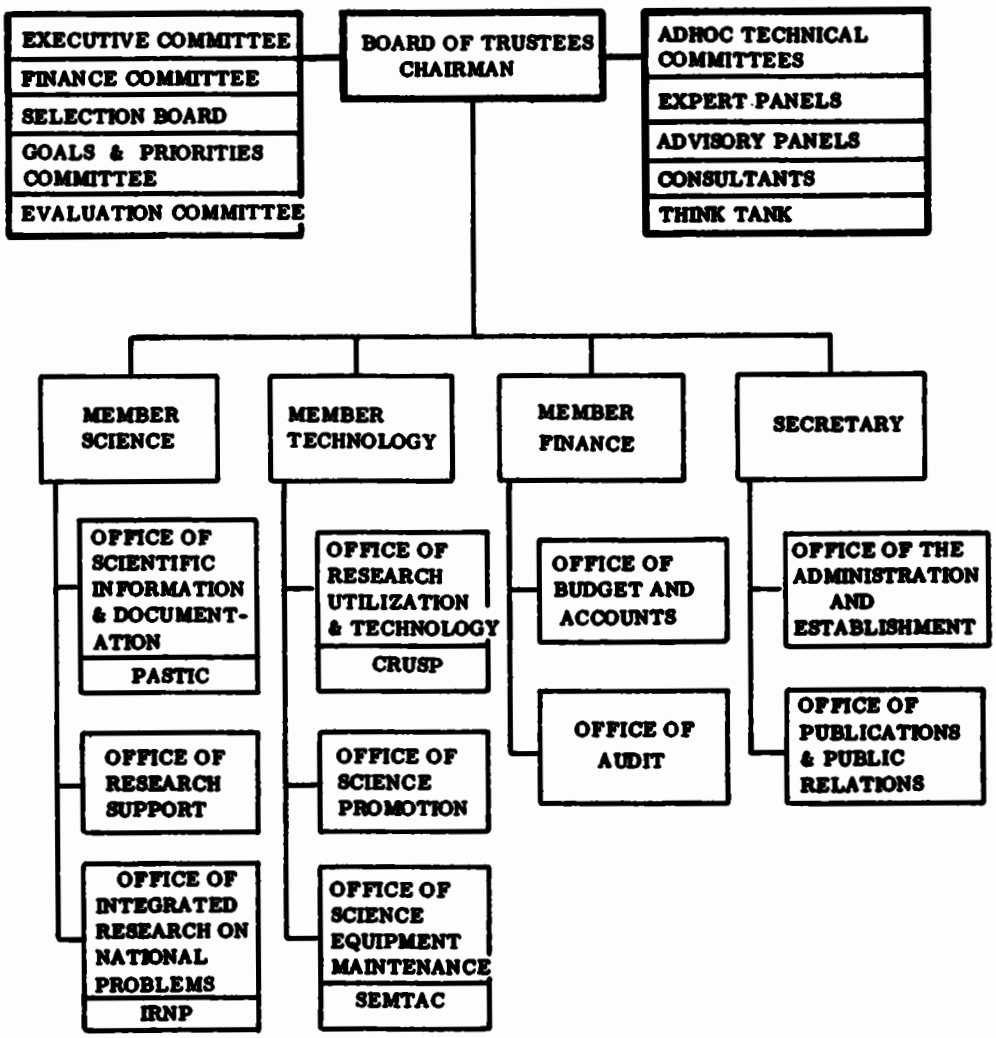
PRIOR YEAR ADJUSTMENT

14. This represents the cancelled cheques which relate to 1976-77 which are not issued subsequently.

FIGURES

... of the previous year have been rearranged where ever necessary for the purpose of comparison.

PROPOSED ORGANIZATION
PAKISTAN SCIENCE FOUNDATION



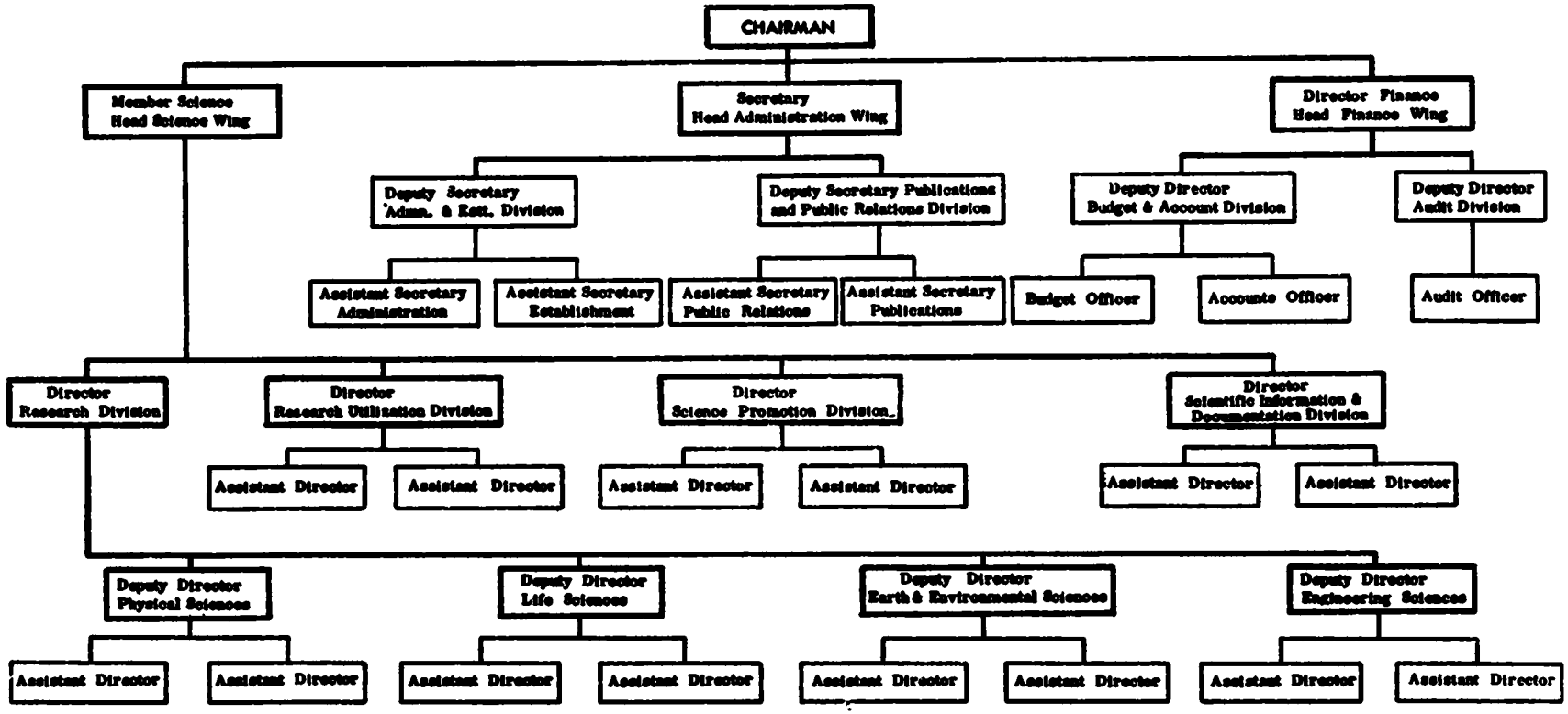
PASTIC : PAKISTAN SCIENTIFIC AND TECHNOLOGICAL INFORMATION CENTRE

CRUSP : CENTRE FOR RESEARCH UTILIZATION AND SPECIAL PROJECTS

IRNP : INTEGRATED RESEARCH ON NATIONAL PROBLEMS

SEMTAC : SCIENCE EQUIPMENT MAINTENANCE TECHNICAL ASSISTANCE CENTRE

PAKISTAN SCIENCE FOUNDATION
ADMINISTRATIVE STRUCTURE
1975



The report of the Auditors, Messers Riaz Ahmad & Co., Chartered Accountants, appointed by the Foundation in consultation with the Auditor General of Pakistan, is reproduced below:-

AUDITOR'S REPORT TO THE CHAIRMAN AND BOARD OF TRUSTEES OF PAKISTAN SCIENCE FOUNDATION

We have examined the annexed Balance sheet of Pakistan Science Foundation as on June 30, 1978 and the Income and Expenditure Account for the year then ended and subject to our separate report addressed to the Board of Trustees, we report that:

a. We have obtained all the information and explanations we required; and

b. Such balance sheet exhibits a true and correct view of the state of the Foundation's affairs according to the best of our information and explanations given to us and as shown by the books of the Foundation.

Sd/-
(RIAZ AHMAD AND CO.)
CHARTERED ACCOUNTANTS

RAWALPINDI, 21-8-1979.

Annexure I

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 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 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.

(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 BOARD.- The Chairman of the Board shall be the Chairman of the Foundation and shall be appointed for a term of three years from amongst the eminent scientists of the country having experience of research and scientific administration.

7. TERM OF MEMBERS OF THE BOARD.- The members of the Board, other than the ex-officio member, shall hold office for a term of three years and shall be eligible for re-appointment or re-nomination, as the case may be.

8. MEETINGS OF THE BOARD.- (1) The meetings 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. AD-HOC 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 according 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.

Annexure II

LIST OF SANCTIONED RESEARCH GRANTS 1977-78

No.	List of schemes	Amount sanctioned	Name of the Principal Investigator and Organization Supported.
1.	**Agricultural Sciences**		
	i) Pathology of Trees. S-AU/AGR(55)	1,52,148.00	Dr. Abdul Hamid Khan, Advances Studies & Research, Agricultural University, Faisalabad.
	ii) Role of Predacious arthropods in mite pests control. S-AU/AGR(58)	95,724.00	Mr. Abdul Hayee Soomro, Department of Entomology, Sind Agriculture University, Tandojam.
2.	**Biological Sciences**		
	i) Studies on the breeding biology and behaviour of Barbus tor (Mahsher). C-QU/BIO(84)	33,360.00	Dr. Qazi Javed Iqbal, Department of Biology, Quaid-i-Azam University, Islamabad.
	ii) Epidemiological Survey and Serogrouping of Type Strains of Leptospirosis in the vertebrate Animals in Pakistan. P-AU/Bio(86)	1,01,784.00	Dr. Mohammad Jamil, College of Veterinary Sciences, Lahore.
	iii) Taste Aversion. F-HC/Bio(89)	15,000.00	Dr. Saeed-ul-Islam, Government College, Haripur Hazara.
3.	**Chemical Sciences**		
	i) Isolation, Purification and Structural Determination of Biologically and Pharmacologically Active Alkaloids from indigenous plants. P-PU/CHEM(83)	27,300.00	Dr. M.I.D. Chughtai, Institute of Chemistry, University of the Punjab, Lahore.

ii)	Isolation and structural studies on the chemical constituents of some indigenous flowering plants. S-KU/CHEM(84)	29,800.00	Prof: Viqar-ud-Din Ahmad, H.E.J. Post Graduate Institute of Chemistry, University of Karachi, Karachi.
iii)	Development of methods for improvement of local clays for pottery and other purposes. P-MU/CHEM(85)	1,31,520.00	Dr. Mohammad Tayyib Malik, Department of Chemistry, University of Multan, Multan.
iv)	Investigation of fungal matabolities of Fusarium chlamydosporum and Fusarium monilliforme. S-KU/CHEM(86)	26,450.00	Dr. Atta-ur-Rahman, H.E.J. Post Graduate Institute of Chemistry, University of Karachi, Karachi.
v)	Transition Metal Complexes of Medicinal Compounds. F-GU/CHEM(87)	85,600.00	Dr. Abdul Rauf, Department of Chemistry, Gomal University, D.I. Khan.
vi)	Isolation, characterization and biological activity of the protein and polypeptides from Candida albicans and C. tropicalis. S-KU/CHEM(89)	32,032.00	Dr. Zafar H. Zaidi, Post Graduate Institute of Chemistry, University of Karachi, Karachi.

4. Medical Sciences

i)	Mapping of the chemical constituent of water in Pakistan with a view to correlate it with some of diseases. C-AFMC/MED(34)	35,900.00	Colonel Ashfaq Ahmad, Department of Experimental Research, A.F.M. College, Rawalpindi.
ii)	Studies on Insulin levels and its antagonism on diabetic patients. S-JPMC/MED(39)	73,950.00	Prof. M. Atta-ur-Rehman, Department of Medicine, Jinnah Post Graduate Medical Centre, Karachi.

5. Physical Sciences

i)	To study the various inter-actions in elementary particle physics in particular weak and electromagnetic interactions. C-QU/PHY(20	1,69,680.00	Prof. Fayyaz-ud-Din, Department of Physics, Quaid-i-Azam University, Islamabad.

ii)	Spectroscopy of diatomic Molecules. S-KU/PHY(23)	2,83,090.00	Dr. M. Rafi, Department of Physics, University of Karachi, Karachi.
iii)	Nonlinear wave propagation in Plasma. C-QU/Phy(26)	94,649.00	Dr. G. Murtaza, Department of Physics, Quaid-i-Azam University, Islamabad

6. Utilization of Research Results

i)	To set up model cottage industries at four rural development centres. BIC/UTZ(36)	49,860.00	Raja Mansoor Ahmad, Chairman, Agency for Barani Areas Development, Rawalpindi.

Annexure III

PSF GRANTS GIVEN AS INSTITUTIONAL SUPPORT

Equipment	Institution	Amount Rs.
Refrigerated centrifuge	Institute of Chemistry University of the Punjab, Lahore.	1,43,000.00
U.V. Spectrophotometer	Department of Chemistry, University of Multan, Multan.	1,50,000.00 (in foreign exchange)
Monochromator (accessories)	Centre for Solid State Physics, University of the Punjab, Lahore.	1,50,000.00
Manikin on the Blue Whale Skeleton	Zoological Survey Department Karachi.	10,900.00

Annexure IV

B) GRANTS SANCTIONED FOR SCIENTIFIC SOCIETIES AND LEARNED BODIES FOR ACHIEVEMENT OF THEIR OBJECTIVES

No.		Agency	Grant in Rupees
	A)	ALL PAKISTAN SCIENTIFIC SOCIETIES/ LEARNED BODIES:	
1.		Scientific Society of Pakistan.	40,000.00
2.		Pakistan Association for the Advancement of Sciences.	40,000.00
3.		Pakistan Association of Scientists and Scientific Professions.	40,000.00
4.		The Institute of Engineers.	40,000.00
	B)	DISCIPLINE SOCIETIES:	
1.		Pakistan Medical Association.	20,000.00
2.		Pakistan Botanical Society	10,000.00
3.		Biological Society of Pakistan.	10,000.00
4.		Pakistan Society of Biochemists.	10,000.00
5.		Pakistan Engineering Congress.	30,000.00
6.		The Institute of Electrical Engineers, Pakistan.	15,000.00
7.		Pakistan Library Association	10,000.00
8.		Zoological Society of Pakistan.	10,000.00
	C)	PROVINCIAL SOCIETY:	
1.		Sind Science Society	25,000.00
			3,00,000.00

Annexure V

GRANTS SANCTIONED FOR PUBLICATION PROGRAMME

No.	Agency		Grants in Rupees
1.	Scientific Society of Pakistan.	i) *Science Bachoon Kay Liay*	30,000.00
		ii) Science Magazine	
2.	Society of the Advancement of Science.	i) Pakistan Journal of Science.	20,000.00
		ii) Pakistan Journal of Scientific and Industrial Research.	
3.	Pakistan Botanical Society.	Pakistan Journal of Botany.	10,000.00
4.	Biological Society of Pakistan.	Biologia.	10,000.00
5.	Pakistan Society of Biochemists.	Pakistan Journal of Biochemistry.	5,000.00
6.	Pakistan Forest Institute.	Pakistan Journal of Forestry.	10,000.00
7.	Mehran University of Engineering & Technology, Nawabshah.	Journal of Engineering Technology.	15,000.00
8.	Zoological Society of Pakistan.	Pakistan Journal of Zoology.	10,000.00
			1,10,000.00

Annexure VI

GRANTS SANCTIONED FOR ORGANIZING SCIENCE CONFERENCE/SYMPOSIA/SEMINAR

No.	Agency	Object	Amount Rs.
1.	PASTIC National Centre, Islamabad.	Workshop on National and International Information System.	50,000.00
2.	University of Agriculture, Faisalabad.	Workshop on membrance Biophysics & development of salt tolerance in plants.	20,000.00
3.	University of Peshawar, Peshawar.	"International Seminar on Lowcost Farm Structures".	20,000.00
4.	Hydrocarbon Development Institute of Pakistan, Islamabad.	Lecture of Dr. I.H.Usmani, on 'Third Option For Third World .	3,000.00
5.	University of Multan, Multan.	18th All Pakistan Science Conference.	50,000.00
6.	University of Engineering & Technology, Lahore.	26th All Pakistan Science Conference.	50,000.00
7.	Punjab Mathematical Society, Lahore.	Mathematics Conference.	10,000.00
			2,03,000.00

Annexure VII

TRAVEL GRANTS FOR VISITS ABROAD

No.	Name and Address	Conference/Seminar	Amount sanctioned
1.	Dr. F.H. Shah, Principal Scientific Officer, PCSIR Laboratories, Lahore.	Inter Government Conference on Mycotoxines, held in Kenya.	7,869.20 (Not availed)
2.	Dr. I.H. Khan, Institute of Chemistry, University of Punjab, Lahore.	Visit to Universities, Lab. & Corrosion Control Centre in UK.	2,682.90 (Not availed)
3.	Dr. Noor Ahmad, Institute of Physical Chemistry, Peshawar University, Peshawar.	The 52nd Colloid and Surface Science Symposium, held in USA.	1,440.00
4.	Mr. Abdul Hamid Chotani, Manager (Operation), Hydrocarbon Development Institute of Pakistan, Karachi.	To attend "Indian National Workshop on Preparation of National Paper on UNCSTD held at Banglore, India.	7,500.00
5.	Dr. M. Akram Khan, Professor, Mechanical Engineering Department, University of Engineering and Technology, Lahore.	To study the development of solar energy and its application in China.	7,520.00

Annexure VIII

Date of Visit	Foreign Visitors to PSF
12.7.1977	Dr. John C. Cool, Representative, Ford Foundation, Islamabad.
4.8.1977	Mr. Michel Brawne, UNESCO Architect
16.8.1977	Dr. Yogesh Atal, Regional Advisor, Social Sciences in Asia, Bangkok - II.
22.9.1977	Dr. Aung Gyi, Program Specialist in Applied Sciences, UNESCO.
29.9.1977	Mr. Curt Carnemark, Regional Development Adviser, World Bank.
6.10.1977	Dr. John Naogele, Advisor, Agricultural Research Council, Islamabad.
11.10.1977	Mr. Araoz, Consultant, IDRC.
11.10.1977	Dr. S.D. Bennett, Director, Commonwealth Institute of Biological Control
19.10.1977	Dr. Horst B.K. Geuting, F.A.O. Representative
23.10.1977	Dr. David Lundhert, USAID.
25.10.1977	Mr. William I. Allem, Mr. Douglas Masteron, and Mr. Kitane, Officials of FAO/World Bank Coop Program.

1.11.1977	Dr. Horst B.K. Geuting, FAO Representative.
16.11.1977	Dr. O. Chinaishin, Incharge Africa & Asia Section, US National Science Foundation, Washington D.C.
24.1.1978	Dr. V.G. Podoinitsin, Director, UNESCO Regional Office, New Dehli, India.
26.1.1978	Dr. A. Boettcher, West German Solar Scientist
5.2.1978	Technical Advisory Mission ESCAP comprising of: - Dr. Reddy ESCAP - Mr. Kim UNIDO - Wijeratne UNCTAD
11.2.1978	Professor Turgut Gonul, Ege University, Azmir.
12.2.1978	Mr. & Mrs. Dalton E. Gandy, President, International Sunflower Association Tennessee, USA.
14.2.1978	UN-RECTT Technical Advisory Mission led by Mr. Wijeratne.
16.2.1978	Mr. S. Minowa, Chief of Academic Services and Director of UN University Tokyo.
20.3.1978	Romanian Ambassador in Pakistan.
6.4.1978	Mr. Clyde Adams, CENTO.
30.4.1978	Dr. B. Sorensen, Dr. Hasibullah, of Joint Research Centre, ISPRA, Italy.
2.5.1978	Sir Harrie Massey, Physical Secretary, Royal Society, London.