

Centres of Advanced Study  
in  
Indian Universities

**UNIVERSITY GRANTS COMMISSION**  
**NEW DELHI**  
1972

Revised Edition, October 1972  
First Edition, 1967

Published by the University Grants Commission, New Delhi  
Printed at the Indraprastha Press (CBT), New Delhi-1 (India)

## Contents

	<i>Page</i>
INTRODUCTION	1
BRIEF NOTES ON THE CENTRES OF ADVANCED STUDY	
SCIENCES	
<i>Subject</i>	<i>Department</i>
<b>Physics</b>	1. Department of Physics & Astrophysics, University of Delhi 9
	2. Institute of Radiophysics & Electronics, University of Calcutta 16
	3. Department of Physics, Madras University 21
<b>Chemistry</b>	4. Department of Chemical Technology, University of Bombay 24
	5. Department of Chemistry, University of Delhi 26
<b>Botany</b>	6. Department of Botany, University of Delhi 29
	7. Department of Botany, University of Madras 33
<b>Zoology</b>	8. Department of Zoology, University of Delhi 35
	9. Department of Marine Biology, Annamalai University 39
<b>Geology</b>	10. Department of Geology, Panjab University 43
	11. Department of Geology and Applied Geology, University of Saugar 45

SCIENCES

<i>Subject</i>	<i>Department</i>	
<b>Mathematics</b>	12. Department of Mathematics, University of Bombay	48
	13. Department of Applied Mathematics, University of Calcutta	50
	14. Department of Mathematics, Panjab University	52
	15. Department of Mathematics, University of Madras and Ramanujan Institute of Mathematics	54
<b>Astronomy</b>	16. Department of Astronomy and Nizamia Observatory, Osmania University	56
<b>Biochemistry</b>	17. Department of Biochemistry, Indian Institute of Science	59

HUMANITIES AND SOCIAL SCIENCES

<b>Economics</b>	18. Department of Economics, University of Bombay	63
	19. Department of Economics, University of Delhi	65
	20. Gokhale Institute of Politics and Economics, University of Poona	67
<b>History</b>	21. Department of Ancient Indian History and Culture, University of Calcutta	70
	22. Department of History, Aligarh Muslim University	72
<b>Philosophy</b>	23. Department of Philosophy, Banaras Hindu University	74
	24. Department of Philosophy, Madras University	76
	25. Department of Philosophy, Visva-Bharati	78
<b>Sanskrit</b>	26. Department of Sanskrit, University of Poona	80
<b>Linguistics</b>	27. Deccan College Postgraduate and Research Institute, University of Poona	83
	28. Department of Linguistics, Annamalai University	85
<b>Education</b>	29. Department of Education, M.S. University of Baroda	86
<b>Sociology</b>	30. Department of Sociology, University of Delhi	90

## APPENDICES

I	University Grants Commission	93
II	Committee on Centres of Advanced Study	94
III	Centres of Advanced Study Receiving Unesco Assistance under U.N. Development Programme	96
IV	Centres of Advanced Study Receiving British Assistance	97
V	Centres of Advanced Study Receiving Unesco Assistance: Visits of Scientists from the USSR during 1966-71	99
VI	Unesco / UNDP Technical Assistance Programme for Centres of Advanced Study Project in Indian Universities: Visits of Indian Scientists Abroad	104
VII	British CAS Visitors to India	106
VIII	Indian CAS Visitors to the U.K.	113

## List of Plates

<i>Sl. No.</i>	<i>Title</i>	<i>Facing Page</i>
1.	Microwave bridge for the study of semiconductors and artificial dielectrics (Centre of Advanced Study in Radiophysics and Electronics, University of Calcutta)	18
2.	Analogue Computer in the Centre of Advanced Study in Radiophysics and Electronics, University of Calcutta	18
3.	IBM-1130 Computer in the Centre of Advanced Study in Physics, University of Madras	22
4.	Workshop of the Centre of Advanced Study in Physics, University of Madras	23
5.	A view of the X-ray laboratory of the Centre of Advanced Study in Physics, University of Madras	23
6.	Electron Microscope model (Centre of Advanced Study in Chemistry on Textile Fibres and Dyes, University of Bombay)	24
7.	Figure showing the growth inhibition of rice seedlings by <i>Pyricularia</i> toxins (Centre of Advanced Study in Botany, University of Madras)	34
8.	Figure showing simulation of foliar symptoms with the toxins (Centre of Advanced Study in Botany, University of Madras)	34
9.	Immuno-serological studies with phytopathogens. Demonstration of antigens using Ouchterlony double diffusion technique: (A) antigenic comparison of isolates of the rice blast fungus <i>Pyricularia oryzae</i> , and (B) common antigen between host and parasite in <i>Fusarium</i> wilt of cotton (Centre of Advanced Study in Botany, University of Madras)	35
10.	Expedition to Leh in 1969 (Centre of Advanced Study in Geology, Punjab University)	44

<i>Sl. No.</i>	<i>Title</i>	<i>Facing Page</i>
11.	A view of the Teaching Section of the Museum of the Centre of Advanced Study in Geology, Punjab University	44
12.	X-ray plant in the Centre of Advanced Study in Geology, Punjab University	45
13.	Differential thermal analysis of clay minerals (Centre of Advanced Study in Geology, Saugar University)	46
14.	The New Astronomical Observatory building at Rangapur housing the 48-inch telescope (Centre of Advanced Study in Astronomy, Osmania University)	56
15.	The 48-inch reflecting telescope at the Rangapur Observatory of the Centre of Advanced Study in Astronomy, Hyderabad	56
16.	Dual channel photoelectric photometer attached to the cassegrain focus of the 48-inch telescope (Centre of Advanced Study in Astronomy, Osmania University)	57
17.	Tissue culture experiments (Centre of Advanced Study in Biochemistry, Indian Institute of Science)	60
18.	<i>In vivo</i> experiments (Centre of Advanced Study in Biochemistry, Indian Institute of Science)	60
19.	Gas-liquid chromatography (Centre of Advanced Study in Biochemistry, Indian Institute of Science)	61
20.	Automatic amino acid analyser (Centre of Advanced Study in Biochemistry, Indian Institute of Science)	61
21.	Simulation of stress conditions (Centre of Advanced Study in Biochemistry, Indian Institute of Science)	60
22.	Refrigerated centrifuge (Centre of Advanced Study in Biochemistry, Indian Institute of Science)	60
23.	Reading room of the Library of the Centre of Advanced Study in Philosophy, Visva-Bharati, Shantiniketan	78





# CENTRES OF ADVANCED STUDY IN INDIAN UNIVERSITIES

## INTRODUCTION

An urgent need in the field of higher education in India is the strengthening of post-graduate teaching and research and channelling the existing rather limited resources effectively for the purpose. The University Grants Commission has therefore undertaken in consultation with the universities a scheme for developing a limited number of university departments for advanced training and research in certain selected fields. The scheme is intended to encourage the pursuit of 'excellence' and team-work in studies and research and to accelerate the realisation of 'international standards' in specific fields. With this object in view it is proposed to give active support and substantial assistance to promising departments in the universities carefully selected on the basis of quality and extent of work already done by them, their reputation and contribution to research, and their potentiality for further development.

A beginning has been made by providing assistance to certain university departments for getting competent and promising teachers and research workers and procuring essential equipment. To be viable, such 'centres of advanced study' have to exceed a certain 'critical' size as regards their staff. The departments concerned would therefore have a fairly large staff of professors, readers and research associates or fellows of outstanding ability and qualifications who are actively engaged in research and advanced training. A substantial proportion of the team would be a kind of 'floating staff' coming to these centres for long or short periods on deputation from their universities or institutions and possibly from abroad. Adequately staffed and properly organised, these departments are expected to make an appreciable impact, direct and indirect, in raising the standards of teaching and research in our universities.

As they would be functioning on an all-India basis, they would attract teachers and scholars from all over the country and help in maintaining and strengthening the corporate

intellectual life in the country. Another additional advantage accruing from the scheme would be that the personnel trained in the centres would in course of time be available for strengthening the staff of other university departments—thus helping to meet to some extent the present difficult position experienced by the universities in securing qualified and competent teachers in adequate numbers.

The implementation of such a programme is no doubt not easy; it would need much serious thought and boldness in approach and planning. It would demand cooperation and team-spirit from the participants. In actual working many difficulties are likely to be faced, but these would have to be overcome through determined efforts.

The University Grants Commission, on the advice of a committee consisting of eminent educationalists and scientists, has invited in the first instance 30 university departments in certain specific subjects to operate as centres of advanced study. The subjects and the major fields to be intensively developed in the various centres are given below:

## I. SCIENCE

### Physics

- |   |   |
|---|---|
| 1. Theoretical Physics and Astrophysics | Department of Physics and Astrophysics, Delhi University, Delhi.          |
| 2. Radiophysics and Electronics         | Institute of Radiophysics and Electronics, Calcutta University, Calcutta. |
| 3. Crystallography and Biophysics       | Department of Physics, Madras University, Madras.                         |

### Chemistry

- |   |   |
|---|---|
| 4. Chemistry of Textile Fibres and Dyes | Department of Chemical Technology, Bombay University, Bombay. |
| 5. Chemistry of Natural Products        | Department of Chemistry, Delhi University, Delhi.             |

### Botany

- |                                    |   |
|------------------------------------|---|
| 6. Plant Morphology and Embryology | Department of Botany, Delhi University, Delhi.      |
| 7. Plant Pathology and Mycology    | Department of Botany, University of Madras, Madras. |

### Zoology

- |                                   |   |
|-----------------------------------|---|
| 8. Cell Biology and Endocrinology | Department of Zoology, Delhi University, Delhi. |
|-----------------------------------|---|

9. Marine Biology  
Department of Marine Biology, Annamalai University, Annamalainagar.
- Geology**
10. Himalayan Geology and Palaeontology  
Department of Geology, Panjab University, Chandigarh.
11. Structural Geology, Geomorphology, Petrology and Mineralogy  
Department of Geology and Applied Geology, University of Saugar, Sagar.
- Mathematics**
12. Pure Mathematics  
Department of Mathematics, Bombay University, Bombay (in collaboration with the Tata Institute of Fundamental Research, Bombay).
13. Applied Mathematics  
Department of Applied Mathematics, Calcutta University.
14. Pure Mathematics  
Department of Mathematics, Panjab University, Chandigarh.
15. Pure Mathematics  
Ramanujan Institute of Advanced study in Mathematics, Madras University.
- Astronomy**
16. Experimental Astronomy  
Department of Astronomy and Nizamia Observatory, Osmania University, Hyderabad.
- Biochemistry**
17. Proteins, Lipids, Vitamins  
Department of Biochemistry, Indian Institute of Science, Bangalore.

## II. HUMANITIES AND SOCIAL SCIENCES

- Economics**
18. Public Finance and Industrial Economics  
Department of Economics, Bombay University, Bombay.
19. Economics of Development and Economic History  
Department of Economics, Delhi University, Delhi.
20. Agricultural Economics  
Gokhale Institute of Politics and Economics, University of Poona, Poona.

- History**
21. Ancient Indian History and Culture Department of Ancient Indian History and Culture, Calcutta University, Calcutta.
22. Medieval Indian History Department of History, Aligarh Muslim University, Aligarh.
- Philosophy**
23. Philosophy (Indian) Department of Philosophy, Banaras Hindu University, Varanasi.
24. Advaita and Allied Systems of Philosophy Department of Philosophy, Madras University, Madras.
25. Metaphysics Department of Philosophy, Visva-Bharati, Santiniketan.
- Sanskrit**
26. Sanskrit Literature Department of Sanskrit, University of Poona, Poona.
- Linguistics**
27. Applied Linguistics Deccan College Postgraduate and Research Institute, University of Poona, Poona.
28. Dravidian Linguistics Department of Linguistics, Annamalai University, Annamalainagar.
- Education**
29. Educational Research Department of Education, M.S. University of Baroda, Baroda.
- Sociology**
30. Sociology Department of Sociology, University of Delhi, Delhi.

The Commission hopes that these centres would make important contributions to the advancement of knowledge, and influence to a large extent the standards of research and teaching at the postgraduate and undergraduate levels in the Indian universities. The importance of this scheme, has been recognised not only in India but by several foreign scientists and scholars.

The Commission has sanctioned grants to the Centres for improving their laboratories and library facilities as also to appoint necessary academic and non-academic staff for enabling the Centres to undertake expanded programmes of teaching and research.

The additional staff has helped the Centres to strengthen their teaching and research

activities and to initiate new programmes of training and research. The scholarships and fellowships have encouraged merited students and teachers from other universities to receive advanced training and research in the Centres. The funds provided for the visiting fellows helped the Centres to invite scientists and scholars of repute from India and abroad. A number of publications resulted from the research activities, seminars and symposia etc., organised by the Centres.

The Centres function as all-India Centres for training and research in the subject concerned. The centres have been requested to formulate suitable schemes and programmes as would make an impact on an all-India basis.

The Centres of Advanced Study in Mathematics at the Universities of Bombay, Panjab, Madras and Calcutta have enabled a small number of teachers from the affiliated colleges to spend a full academic year to improve their subject matter competence, learn and participate in the new teaching methods, as well as, get initiated into research so that on return to their respective colleges, such teachers could act as focal points for improving the standards of instruction. The programme has been found to be of real value to the teachers. Such teachers fellowship programme has also been recently taken up by the Centre of Advanced Study in Education, M.S. University of Baroda. A few other centres are likely to provide for such Teacher fellowships in the near future.

The centres also organised symposia at the National as well as, international level. Some international seminars organised by the Centres in the past few years are:

1. International Symposium on 'Morphogenesis in Plant Cell, Tissue and Organ Cultures during November 17-23, 1971 at Delhi-Botany.
2. International Symposium on Lipids during December 2-8, 1971 at the Centre of Advanced Study in Biochemistry, Indian Institute of Science, Bangalore.
3. International Symposium on "Taxonomy and Biology of Blue Green Algae" at the Centre of Advanced Study in Botany, University of Madras during January 26-31, 1970.
4. International Symposium on 'Pathological Wilting in Plants' during January 18-25, 1971 at the Centre of Advanced Study in Botany, University of Madras.
5. International Symposium on 'Conformation of Biopolymers' during January 18-21, 1967 at the Centre of Advanced Study in Physics, Madras University.

The Centre of Advanced Study in Physics, Delhi University organised a short-term course in Solid State Physics on all-India basis. The lecture notes by invited lecturers were published and were made available as a textbook on the subject for the participants. The Centre of Advanced Study in Chemistry, Delhi University organised a regional short-term training programme in the Chemistry of Natural Products with UNESCO Assistance. A number of participants including from foreign countries attended the course.

The seminars/symposia organised by the Centres have attracted scientists from India and abroad, several of them outstanding specialists in their disciplines. A number of eminent scientists from U.S.S.R., U.K., U.S.A. and other countries were associated for short and long terms with some of these Centres.

The Centres have to continuously earn their recognition. Advisory Committees consisting of the Vice-Chancellor, Professors of the Centres, and experts from outside have been constituted to help in the work of the Centres. The Centres have been requested to hold meetings of such advisory committees at least twice a year.

The Centres have brought out publications indicating the facilities available and the research programmes in progress and also the fellowships/scholarships available in the Centres in order to provide opportunities for talented students and teachers from all over the country to come to the Centres for advanced training and research.

Some of the centres are receiving assistance through UNESCO and the British Council. The assistance provides the services of foreign scholars and scientists from the Institutes of the Academy of Sciences of the U.S.S.R. and the British universities/institutions as also training facilities for teachers from the centres in the institutions of the U.S.S.R. and in U.K. and also other countries under UNESCO Programme. Assistance also provides sophisticated equipment required by the Centres for their teaching and research programmes.

The participation of the foreign scientists and scholars in the teaching and research programmes of the centres has been found to be extremely useful. Most of the distinguished scientists expressed their appreciation of the work in progress in the centres concerned. Several new research programmes were initiated by the centres in association with the visiting scholars and scientists.

Under the British Programme of Assistance 58 scholars and scientists from U.K. visited the centres during 1966-71. Similarly teachers from the centres visited U.K. during this period. Sophisticated equipment, books and journals etc., were also made available to the Centres under the Programme.

Under UNESCO Programme of Assistance 56 consultants from the U.S.S.R. visited India. Similarly 47 teachers from the centres visited U.S.S.R. and some other countries. A fairly large number of sophisticated items of equipment were also made available to the centres. Services of the Soviet technicians for the installation of the major items of equipment were also made available; similarly technicians from the Centres were sent to the U.S.S.R. and U.K. for further training under the Programme. The Commission has recently revised the Programme of UNESCO Assistance and replaced five centres/departments by new centres. The upto date list of the centres receiving UNESCO Assistance is indicated in the Appendix (III).

Dr. V. Parail, Chief of the Mission of International Cooperation in Scientific Research, UNESCO, Paris visited India during January, 1971 and held discussions with the Head of the Centres and the University Grants Commission on the role of the centres in promoting scientific activities on International level. The proposals made by Dr. Parail to organise short and long term programmes at the Centres with UNESCO Assistance have been accepted by the Commission. It has been agreed that the Centre of Advanced Study in Botany, Madras University will organise a short term programme in 1972-73. Other proposals from the Centre are under the consideration of the UNESCO authorities.

The Centre of Advanced Study in History, Aligarh Muslim University and the Centre of Advanced Study in Philosophy, Madras University received special assistance from UNESCO for undertaking studies on the civilisation of the peoples of the Central Asia during the Fourth Plan. The Commission also provided special funds to the Centres for undertaking these studies.

The centres of advanced study are the focal points of excellence in the subjects concerned and attract students of high quality. This does not mean that all excellence is exclusively in these departments only. The other departments are in different stages of growth and development and are constantly reaching a stage when they should be recognised as centres of advanced study or provided with special assistance. For a programme of this type aiming at the highest quality and operated on an entirely selective basis of merit, it is necessary to safeguard that these departments do not impinge upon or compete for the resources to be generally made available for development of higher education on a broad basis. The University Grants Commission had taken this precaution to see that the expenditure on the centres of advanced study and related supporting activities is kept within 10% of the total budget of the University Grants Commission in any plan period. The academic community has willingly accepted this part of the budget to be utilised for the highest quality programme, which would help ultimately in building corporate intellectual community in the country. In order that the salient point for quality programmes of this type to be successful, really effective leadership and involvement of the entire group was fundamental and accordingly the programme must aim at identifying and nurturing dynamic leadership at different levels within the departments.

At a Conference of scientists sponsored jointly by the Indian National Science Academy and the Royal Society, London held in New Delhi during 8-10 March 1971, Prof. P.M.S. Blackett, President of the Royal Society during the course of discussions, observed that the Indian Government and the Indian University Grants Commission had been successful in formulating and implementing the Programme of Centres of Advanced Study. He felt that in his view there were three reasons why it was exceedingly important that all developing countries should attempt as soon as possible to create facilities in the major subjects for first class higher degree work, so that normally a student takes his higher degree in his own country. First, the present widespread practice of sending most bright students overseas to take a higher degree

makes it difficult to build up native research schools in the universities, because an adequate supply of research students is the lifeblood of a creative university postgraduate department. Following from this, it will be difficult to keep good staff unless they have an adequate number of postgraduate students. Secondly, the loss of trained people to the developing countries, by overseas students not returning to their homeland after taking their higher degree abroad, will be reduced. Thirdly, it will save much foreign exchange. A three-year Ph.D course will cost some £3,000, taking fees, maintenance and fares into consideration, and this is a direct drain on foreign exchange, whether the money is provided by the state or privately.

Once these centres of advanced research have reached a high level, it can become the practice in general for India to send her bright young people abroad only after taking their Ph.D's in India, and then only to get some special experience directly relevant to their future job. In fact, it would clearly be generally most efficient for such people to be first appointed to a job and then to be sent abroad for such postgraduate training with a definite job to return to.

The programme of Centres of Advanced Study in Indian Universities has made an appreciable impact in strengthening teaching and research programmes in Indian Universities. During 1966-71 over 2,000 students took their M.A./M.Sc. degrees and nearly 1,600 were in the science subjects. Similarly about 400 Ph.D. degrees were awarded of which 300 were in science subjects. About 3,000 research publications have been brought out by the Centres—nearly 2,000 in science subjects and about 800 in humanities and social sciences. Over 130 seminars of all-India character and a few of an international nature were also organised.

The Centres have been requested to initiate programmes which would make an impact on an All-India basis. It has been observed that during the course of 1966-71 nearly 275 visiting fellows visited the centres from other universities from the various parts of the country. This is exclusive of short-term visits made by the other teachers.

The centres have been given due recognition by the International academic community, nearly 750 distinguished visitors from abroad came to the centres and took part in the research and other activities of the Centres. Over more than 100 teachers from the centres went abroad under various programmes. The centres continued their collaboration with institutions and universities abroad.

Besides the Programme of Centres of Advanced Study the University Grant Commission has taken up concurrently other supporting quality programmes which would help in sustaining excellence in the centres and also act as the necessary feeder going for quality students. These programmes relate to (a) Providing special assistance to selected depths in order to help them strengthen and consolidate their teaching and research programmes and encourage special areas of study and multidisciplinary courses and (b) College science improvement programme aimed at qualitative improvement and modernisation of science instruction at undergraduate level.



## Centre of Advanced Study in Physics, University of Delhi

The Centre has a staff of seven professors, 25 readers, 23 lecturers and four research associates. Besides these regular members, the Centre has the honour of the association of Dr. D.S. Kothari, Chairman, U.G.C., and Dr. R.C. Majumdar as Emeritus Professors. The phenomenal increase in enrolment for the physics courses in recent years has resulted in a very important change in the teaching activities of the Centre. From the year 1970, the University decided to transfer the teaching of B.Sc. (Hons.) classes to some selected colleges so that the Centre could take proper care of the large number of students admitted in the M.Sc. and Ph.D. courses. Later, however, it was decided to keep one B.Sc. (Hons.) group in the Centre so that an active link with the problems of undergraduate teaching could be maintained.

Staff members are actively engaged in research in the diverse fields of theoretical and experimental physics.

### I. Theoretical Groups

#### (i) *Particle Physics and Nuclear Physics*

The activities of a group working on nuclear theory and high energy physics, have been confined to two major areas (a) investigations of the properties of bound three-nucleon systems and (b) classification and interactions of higher hadron resonances.

Another group carried out researches pertaining to various problems in the symmetries and weak and electromagnetic interactions of elementary particles.

#### (ii) *Statistical Physics and Solid State Physics*

A group is working on the manybody theory for a system of bosons interacting via

a potential consisting of a short ranged repulsive part and a long ranged attractive part has been extended to non-zero temperatures by employing temperature dependent field-theoretical techniques.

The statistical mechanics of some superfluid models have been worked out exactly by extending to non-zero temperatures the concept of irreducible representations introduced by Haag for the ground state of the BCS model.

The statistical (TF) model of the atom has been investigated further by taking into account various refinements such as exchange and correlation effects.

Another group is working on the quasi-thermodynamic theory of  $\text{He}^3$  and  $\text{He}^4$  solutions. Attempts are being made for obtaining theoretically the complete phase diagram.

In the field of high polymers an important part of the programme has been the study of molecular size distribution in anionic polymers.

The earlier results of the equation of state studies in connection with amorphous-polymers have now been applied for calculating the degree of crystallinity as a function of temperature in polyethylene.

Another group is engaged in the study of neutron wave propagation in crystalline and amorphous media and the problem of lattice dynamics.

The group working on atomic dynamics in classical liquids has calculated the scattering cross section in the non-Gaussian approximation by taking the solid state behaviour into account

### (iii) *Quantum Mechanics*

A group has been working on the analytic properties of perturbation series in quantum mechanics. As an example one dimensional anharmonic oscillator has been discussed thoroughly.

### (iv) *Plasma Physics*

A complete derivation of the moment equations of a collision free plasma are derived to include the effect of finite Larmor radius for the three density domains viz. high, moderate and low-density regions.

Some work concerning the instability brought about by electrohydrodynamic forces has been undertaken.

The work on plasma instability of interest in astrophysical and space physics is being continued.

The instability arising in contraststreaming gravitating fluids is also studied in view of the possible role in star formation.

Earlier work on solar ion streams and active solar regions has been continued and a model for the time variation of the interplanetary field has been proposed.

A model for solar flare electromagnetic radiation has also been proposed.

## 2. Experimental Groups

### (i) Nuclear Physics

The work in low energy nuclear physics in the Centre here progressed mainly on the following lines:

- (a) Study of decay schemes of radio nucleades with solid state detectors ( $E\gamma$ ,  $I\gamma$ ,  $\gamma$ - $\gamma$  —coincidence).
- (b) Nuclear Level properties through  $\gamma$ - $\gamma$  angular correlation measurements.
- (c) Measurement of half-life of nuclear excited states by time-to-amplitude converter technique.
- (d) Study of the hyperfine interactions and other properties of solids and liquids through perturbed time differential alpha-gamma angular correlations.
- (e) Positron annihilation studies in molecular media, ionic crystals and metals and its usefulness in solid state and high polymer physics.
- (f) Study of internal fields in metallic single crystals and crystal field effects and relaxation mechanism in Laue's phase intermetallic compounds using integral perturbed  $\gamma$ - $\gamma$  angular correlation.

### (iii) High Energy Physics

The high energy group in the Centre is mainly concerned with the phenomena in the GeV-range and the properties of 'elementary particles'.

The problems studied are:

- (a) Accurate binding energies of the  $\Lambda$  -hyperon in hyper nuclei.
- (b) A new method of charge identification of stopping particles in nuclear emulsion was developed.
- (c) A new approach for the analysis of shower particles produced in high energy interactions was developed.

- (d) Characteristics of particle production in the interactions of 22.8 GeV/c protons with light and heavy nuclei of emulsion was studied in detail.
- (e) A study of interactions of 5 GeV/c antiprotons using nuclear emulsions was undertaken.
- (f) The 50 GeV/c $\pi^-$  interactions with emulsion nuclei are being studied currently.
- (g) Particle production in  $\leq 1000$  GeV range is presently studied by analysing the jets produced by cosmic ray a-particles in nuclear emulsion.

(iii) *Solid State Physics*

(a) *Mossbauer Effect*

This group is concerned with applications of Mossbauer effect in solid state physics such as the measurement of isomer shifts (I.S.) and the hyperfine structure of Fe<sup>57</sup> nuclei in magnetic materials.

(b) *Low Temperature Physics*

The low temperature group has been working on the following problems:

1. Determination of energy in superconductors by ultrasonic attenuation method.
2. Influence of impurity and strain on the energy gap of superconductors.
3. Ultrasonic attenuation in superconductors in the intermediate state.
4. Transport properties of superconductors and semiconductors.

(iv) *Microwave and Laser Physics group has been working on*

- (a) The study of the transport mechanism and other related phenomena in s-conductor were investigated by measuring the Faraday rotation in low conductivity crystals and conducting crystals.
- (b) The dielectric relaxation studies in liquids and semiconducting powers at microwave frequencies.
- (c) The study of two photon absorption process.
- (d) Gunn effect microwave oscillations.

(v) *Ionospheric Physics*

- (a) Collision frequency of electrons in the F layer.
- (b) The study of propagation of internal gravity waves in the atmosphere as developed by Hines has been applied successfully to explain many observed ionospheric phenomens.

The Centre organises visitors' programme almost every year at which distinguished physicists from all over the country are invited for discussion and delivering seminar lectures on important fields.

Amongst the distinguished visitors to the Centre during 1971-72 were Professors H.A. Bethe, S. Chandrasekhar, F. Hoyle, N.N. Bogolubov and C.F. van Weizsacker, Kumaria, R.N. Sudan, Arthur C. Clark, Tetsuya Arizumi, Havylawn Y. Eisenberg and P.K. Kabir.

In order to keep up the standards of honours teaching, it has been decided to organise summer institutes for the college teachers concerned for a few years. The first institute of this kind was held in 1971. A Summer Institute for meritorious M.Sc. students is also being held in the current year.

The Centre has been receiving scientific equipment for research work under a number of aid programmes including the Ford Foundation and UNESCO Aid Programmes.

### 3. Facilities

#### (ii) *Library*

The Centre Library which supplements the main University Library, has over 2,000 books of current interest and subscribes to 16 periodicals. The University Library receives in addition about 70 periodicals pertaining to physics.

#### (iii) *Electronic Computer*

The Centre had the facility of IBM 1620 electronic computer for over eight years. Due to the ever increasing demand for computer time by the various departments, the University of Delhi decided to have a centralised computer centre in which IBM 360-44 will be housed. This fast computer, is already available for use in the Delhi School of Economics and is equipped with fast card read punch and printer facility. The central processing unit memory is 128 thousand words with auxiliary memory in the form of disk storage drive units and twenty five magnetic tapes having nine tracks and 1600 bytes per inch. The total usable capacity of the machine exceeds seven million bytes. It is planned to add the dual density feature of the magnetic tapes and on-line-plotter after the computer has been housed in the permanent building.

#### (iii) *Liquid Helium Plant*

The liquid helium plant received under UNESCO programme has been in operation for the last two years and has an output of six litres per hour. The liquid nitrogen plant, necessary for the liquefaction of helium, has a capacity of fifteen litres per hour and provides as its byproduct liquid oxygen as well. The Centre has now the facility for low temperature work down to about 1 K.

#### (iv) *Centre Workshop and Centralised Electronic Workshop*

The Centre Workshop is well equipped and has the facilities for repairing and fabrication of most of the instruments required for teaching and research.

A Centralised Electronic Workshop is being set up for the maintenance and servicing of the sophisticated electronic equipment being used by the various Science Departments of this University. The Physics Department has been given the responsibility of organising this facility. A sum of \$70,000 has been released by the Ford Foundation to cover the cost of the imported equipment needed for the Workshop.

(v) *Nuclear Physics Laboratory*

The Nuclear Physics Laboratory has the following specialised facilities for carrying out research in low energy nuclear physics and solid state physics using the nuclear techniques.

- (a) High resolution Li-drifted germanium detectors for low and high energy photon spectrometry.
- (b) Surface barrier detectors for  $\alpha$ —and  $\beta$ —ray high resolution spectrometry.
- (c) Transistorised linear and fast timing systems.
- (d) A Transistorised multi-channel analyser (having 4096 channels).
- (e) An electromagnet with fields upto 35 Kilo-Gauss suitable for the study of perturbation of  $\gamma$ - $\gamma$  angular correlations in nuclides.

(vi) *Solid State Physics Laboratory*

The equipment for the study of Mossbauer effect consists of:

- (a) Mossbauer Spectrometer
- (b) NaI gamma ray detector fitted with a photomultiplier tube
- (c) a 512 Multichannel analyser and associated electronics is in use.

(vii) *Laboratory for Ionospheric Research*

Ionospheric studies were initiated in this Department about five years ago. Unfortunately sufficient space was not available for setting up the high aerial systems on the campus. It was therefore decided to set up a field station outside the city. Now a laboratory building covering about 2,200 sq. ft. plinth area has been completed. The aerial installation consisting of 100 feet high masts and several folded dipole antennas has been started.

(viii) *Electronics Laboratory*

Complete facilities for carrying out research in the microwave region from 1 GHz to 4 GHz exists. There are four microwave bridges for studying the neto-microwave effects in semiconductors. Microwave spectrometer for studying collision broadening and rotational spectrum is also in operation. TRG ruby laser (power  $10^8$  watts in Q switch mcde) along-with accessories for studying nonlinear effects is also available. He-Ne laser giving output upto 5m watt is also in operation.

(ix) *Scholarships and Fellowships*

The Centre has provision for several scholarships and fellowships from funds sanctioned by the U.G.C. In addition to this several scientific organisations in the country

make their awards to the students studying in the Department.

#### 4. Distinctions Conferred -

1. Professor A.N. Mitra was given S.S. Bhatnagar award for the year 1969.
2. Professor F.C. Auluck, delivered National Lectures for the year 1971-72, at a number of universities in India.

During the period 1968-71, Professor, S.N. Biswas was elected a Fellow of the National Academy of Sciences; Professor L.S. Kothari was elected a member of the IUPAP Commission on Physics Education; Dr. S.C. Pancholi was elected a member of the International Group on Nuclear Structure Data. Besides this Professor A.N. Mitra was elected Chairman for one of the sessions at the two International Conferences at Trieste and Budapest on different aspects of Particle Physics.

Centre of Advanced Study in Radiophysics  
and Electronics,  
University of Calcutta

The Institute of Radiophysics and Electronics, University of Calcutta was recognised as a Centre of Advanced Study in February 1963. The research activities of the Institute cover the fields of Ionosphere and the Upper Atmosphere, Radio Wave Propagation, Solar Radio Astronomy, Solid State and Microwave Electronics, Plasma, and Quantum Electronics, Networks, Digital Techniques and Computers, Control Systems, and Communication Theory and Systems.

The present staff of the Centre consists of three professors, four readers, five research associates and a number of research scholars. Four senior, eight junior research fellowships and two research scholarships are available at the Centre for advanced study and research. Besides, 12 research fellows of the C.S.I.R. and the U.G.C. also do research work in the Centre.

The Centre has well-equipped laboratories in the various fields of study mentioned above, It also owns an Ionosphere Field Station at Haringhata, 56 Km from Calcutta where facilities exist for round-the-clock ionosphere sounding and for measurement of various ionospheric data and of solar and galactic radio noise. The library of the Centre possesses about 5,200 books and 1800 complete volumes of journals and regularly subscribes to 60 journals.

The extended facilities made available due to the establishment of the Centre have made a perceptible impact on the progress of the research activities of the Institute. During the last five years, 155 research papers were published and 22 D.Phil (Sc.) and one D.Sc. theses were accepted by the University of Calcutta.

The major programmes of research in the various fields are:



*(i) Ionosphere and Upper Atmosphere*

Researches in this group mainly comprise studies on the ionosphere in the following lines: (a) Study of the Lower Ionosphere by partial reflection and other techniques; (b) Measurement of Ionospheric drift at Haringhata; (c) Study of sporadic E at Haringhata in relation to thunder squalls; (d) Observation and study of Faraday fading and scintillation of beacon satellite signals; and (e) Theoretical studies on the scattering of radiowaves from the anisotropic ionosphere.

*(ii) Radio Wave Propagation*

This group is mainly concerned with study of integrated field intensity and waveform of atmospherics in the VLF propagation using CW signals.

*(iii) Solar Radio Astronomy*

Research activity in this group mainly relates to theoretical studies on the various components of solar radio and X-ray emissions and on their association with different types of solar and geophysical events.

*(iv) Solid State and Microwave Electronics*

Research efforts of this group are directed to the study of electrical transport properties of semiconductors, study of the physics and characteristics and semi-conductor devices and development of practically useful devices exploiting the peculiarities of bulk properties of semiconductors.

*(v) Plasma and Quantum Electronics*

The laboratory on Plasma electronics is currently engaged in studying the properties of a mercury D.C. glow discharge plasma column at 3 GHz both in the presence and absence of a magnetic field using cavity and waveguide techniques. The quantum electronics section is now concerned with a study of the emission properties of semiconductor lasers and their application in the investigation of the band features of semiconductors.

*(vi) Networks*

Work in this section is mainly related to investigations on a generalised mathematical theory of synthesising all possible active network elements belong to different classes, development of a general theory of synthesising filters with pre-assigned sensitivity and transfer characteristics and investigations on non-linear circuit synthesis.

*(vii) Digital Technique and Computers*

Construction of practical digital equipment and theoretical investigations in the field of switching circuits are carried out by this group. Regarding practical work, design and development of digital instruments, e.g., digital frequency meter, timer, phase meter, Q-meter, voltmeter, capacitance and power factor meter are in progress.

Progress of work in switching theory includes studies on multithreshold and cellular arrays and their application for synthesis of arithmetic unit and sequential machines. Extension of the methods developed to other types of gates, e.g., negative gates, is in view.

(viii) *Control Systems*

The main emphasis of this section is on non-linear and optimal systems. The major programmes in progress are: (a) Investigations on the time domain characteristics of higher order and man-machine systems; (b) Development of methods for generating Lyapunov functions for study of system stability and application of such functions for optimal system design; (c) Studies on de-coupled systems; and (d) Application of functional analysis and game theory for the synthesis of optimal control systems;

(ix) *Communication theory and Systems*

In this section, investigations on techniques of generation of good aperiodic correlation codes and sequential decoding are in progress.

In addition to the above, the following research schemes are currently in operation at the Centre:—(a) Scheme entitled “Studies on Total Electron Content and Irregularities of Electron Density in the Ionosphere with Beacon and Synchronous Satellites” under the PL 480 programme, and (b) Scheme entitled “Gunn Effect Devices” sanctioned by the Department of Atomic Energy, Government of India for the development of Gunn oscillators.

The Centre offers a three-year B. Tech. course in Radiophysics and Electronics which is followed by a two-year postgraduate course leading to the M. Tech. degree in the same subject. In the M. Tech. course, there is scope for specialisation in any one of the four branches viz., (a) Radio Communication and Microwave Electronics, (b) Quantum and Solid State Electronics, (c) Control Systems and Digital Techniques, and (d) Physics of the Upper Atmosphere and Space Communication. Besides, a one-year Postgraduate Diploma Course is offered in Computer and Control Engineering. The annual intake for the B. Tech. M. Tech. and the Diploma courses is 30, 25 and 10 respectively out of which in the B. Tech. course, 6 seats are reserved for candidates from outside West Bengal and four seats, for best candidates who are awarded National Scholarships on an all India basis with the proviso that at least two must go to candidates from outside West Bengal. In addition there is provision for admitting two students in the B. Tech. course from foreign countries. All the students for the M. Tech. and the Diploma courses are eligible for a scholarship of Rs. 250 p.m.

During the last few years, symposium on ‘Computation and Control’, ‘Some Recent Advances in Ionospheric Research in India’ and ‘Electromagnetic Probing of the Upper Atmosphere’ were organised by the Centre. Besides, a number of seminar lectures on topics of current interest were also organised. A summer school for teachers in undergraduate colleges and in universities was held to provide a refresher course in Radiophysics and Electronics. Also, programmes for orientation in research methodology for National Science Talent



**Microwave bridge for the study of semiconductors and artificial dielectrics  
(Centre of Advanced Study in Radiophysics and Electronics, University of Calcutta)**



**Analogue Computer in the Centre of Advanced Study in Radiophysics and Electronics, University of Calcutta**

Search scholars were undertaken at the request of the National Council of Educational Research and Training. During the next two or three years, the Centre proposes to hold symposia on recent developments in solid state electronics, switching circuits and control and computation.

The programme of exchange of personnel between the Centre and the U.K. has been in operation for the past few years. During 1966-71, four British scientists visited the Centre and 10 staff members visited U.K. Scientific equipment worth Rs. 2.00 lakhs has also been received under the Colombo Plan and it is expected that further equipment worth £10,000 will be available shortly.

A three-year research contract between the Centre and the U.S. Air Force Cambridge Research Laboratories for intensifying the Centres' research on the ionosphere by the use of transmission from active satellites terminated recently. This has been followed by another project under the PL 480 scheme. There is regular exchange of information between the different research groups of the Centre and the University College of London, University of Sheffield and the Clarendon Laboratory of the University of Oxford.

A booklet incorporating abstracts of all published work done at the Centre is brought out annually. Booklets containing abstracts of papers read at every symposium held at the Centre are also published. In 1968, a book on 'Fundamentals of Electronics and Radio Engineering' written by two members of the Centre staff was published. Another book entitled 'Theory of electrical transport in semiconductors' written by a member of the Centre staff is now in course of publication.

Some of the outstanding research works done at the Centre during the last five years are indicated below:

In the field of Solid State and Microwave Electronics, new microwave techniques have been developed for the study of semiconductors; Faraday rotation has been discovered in artificial dielectrics; Hot-electron galvanomagnetic coefficients of germanium and silicon have been determined for the first time and new modes of oscillation have been discovered in cadmium sulphide acousto-electric oscillators and in Gunn oscillators.

On the theoretical side of the above field, detailed expressions for hot-electron galvanomagnetic coefficients have been derived and infrared methods for the measurement of carrier population in different valleys have been suggested.

In the field of combinational and sequential switching circuits, a new approach for finding out all irredundant and minimal covers of a switching function has been developed by introducing for the first time the concept of connected cover term matrix. A new concept of utilising the complementary function for minimal synthesis of NAND networks has been

introduced and an elegant method for flow table minimisation has been developed.

In the field of Control System, algorithm for finding out the Liyapunov function for stability study of non-linear systems has been developed.

Centre of Advanced Study in Physics,  
University of Madras

1. The Centre of Advanced Study in Physics specialises in advanced research in the two disciplines of X-ray Crystallography and Molecular Biophysics. In both these fields, the research work of the Centre is well-known and several methods and techniques of fundamental importance have been produced as a result of the activities of the members. The Centre has produced more than 300 research publications and several books in these fields. Some of these volumes are the result of two international symposia conducted by the Centre, one in 1963 on Protein Structure and Crystallography and the other in 1967 on Conformation of Biopolymers, in which several distinguished scientists participated including a number of Nobel Laureates. The Centre has produced so far 37 Ph.D. Degrees in these fields and also trained a number of post-M.Sc. diploma students. The total strength of the Centre at present is 10 in the academic staff, about seven post-doctorals and fifteen research scholars working for the Ph.D.

2. In the field of Molecular Biophysics the activity of the Centre is towards the evolution of physical methods of study of biological materials and the possible explanation of the specific behaviour of biological systems in terms of physico-chemical principles. Most of the studies at present are of a theoretical nature, namely on the conformation, or folding, of the molecular chains of biologically important substances, such as proteins, nucleic acids and polysaccharides. On the experimental side, X-ray diffraction methods are being employed for verifying the theoretical predictions regarding the molecular structure of these polymeric compounds. Facilities will be available for optical and physico-chemical studies on these materials. Over 150 papers have been published by the Centre in this field.

3. In X-ray crystallography, crystal structure determination is the dominant feature of the investigations being carried out by the Centre. The compounds studied are mostly simple ones mainly of the organic and biologically important varieties. Parallel studies involving

optical activity and conformations of molecular systems are also being carried out. As a result of this, considerable activity in theoretical investigations involving X-ray diffraction principles have been developed. Several new techniques in the use of X-ray diffraction methods have been successfully worked out and are being applied. Over 150 papers have been published by the Centre in this field including a book on Fourier Methods in Crystallography by Professor G.N. Ramachandran and Professor R. Srinivasan.

4. The Centre has a well equipped modern X-ray laboratory consisting of X-rays units, X-ray cameras and Powder cameras for crystal structure and other X-ray diffraction work. A double beam automatic recording microdensitometer (Joyce Loebel) is available for accurate intensity measurement on photographic films. The Centre has also acquired a Picker Single Crystal X-ray Diffractometer. For Biophysical work, facilities exist for infrared, ultraviolet, optical rotatory dispersion and circular dichroism studies. The Centre has a medium sized electronic digital computer (IBM-1130 system-8K memory) with all accessories. A good modern workshop is available for fabrication.

5. Most of the important journals required for the type of research in this Centre are available in the University. A Library with good collection of books and technical journals satisfying the needs of the research workers in molecular biophysics and crystallography is located in the Centre.

6. The Centre is essentially of a research type. Students are admitted for the Ph.D. Programme. The Centre conducts a one-year post-M.Sc. diploma course in Molecular Biophysics. Six students are admitted every year and the students are provided scholarship of Rs. 250 p.m. The course is intended for orientation of the M.Sc. students towards the lines of specialisation, namely X-ray crystallography and Molecular Biophysics.

7. As a part of the academic programme of the Centre, several seminars and symposia have been held in the past. The annual All-India Seminars are usually conducted during December-January every year, the subject being Crystallography or Biomolecular Structure. So far six such annual seminars have been conducted. One or two distinguished scientists from outside India also participated in each of these seminars. The abstracts of the papers presented are usually printed out for distribution.

8. Two International Symposia have been held by the Centre so far, one in 1963 on Protein Structure and Crystallography and the other in 1967, on the Conformation of Biopolymers. Both these symposia attracted about 100 participants, nearly 40-50 of whom were from all over the world, including the Nobel Laureates Professor Sir Lawrence Bragg, Professor Severo Ochoa, Professor M.H.F. Wilkins, Professor Linus Pauling, and Professor D.C. Hodgkin. Over 60 papers were presented in each symposia. Four volumes of books as proceedings of the symposia have been published by the Academic Press, London and edited by Professor G.N. Ramachandran. A Winter School in Crystallography was organized in 1963



**IBM-1130 Computer in the Centre of Advanced Study in Physics, University of Madras**





Workshop of the Centre of Advanced Study in Physics, University of Madras



A view of the X-ray laboratory of the Centre of Advanced Study in Physics, University of Madras

immediately following the International Symposium and several foreign scientists lectured in that. The lectures delivered during the School were produced in the form of a book. The Centre has organised three summer Institutes so far. These were on Quantum Chemistry, Molecular Structure and Diffraction on Physics respectively.

9. The Centre has earlier received assistance from the U.S.S.R. under the UNESCO Programme. This enabled the Centre to receive scientists from U.S.S.R. Also equipment for X-ray diffraction work was received from the U.S.S.R. At present the Centre is receiving assistance under the U.K. Assistance Programme. Four scientists from U.K. have visited the Centre and also one staff member from the Centre visited U.K. in the Medical Research Council Laboratory of Molecular Biology, England. The Centre has a number of junior Fellowships and Scholarships made available by the U.G.C./C.S.I.R. etc.

10. During the past five years, the Centre has published 122 research publications, three review articles and five books viz., Treatise on Collagen, Volumes I & II (Editor G.N. Ramachandran), Conformation of Biopolymers, Volumes I & II (Editor: G.N. Ramachandran) published by the Academic Press and a monograph on Fourier Methods in Crystallography (by G.N. Ramachandran and R. Srinivasan)—published by John Willey and Sons, U.S.A.

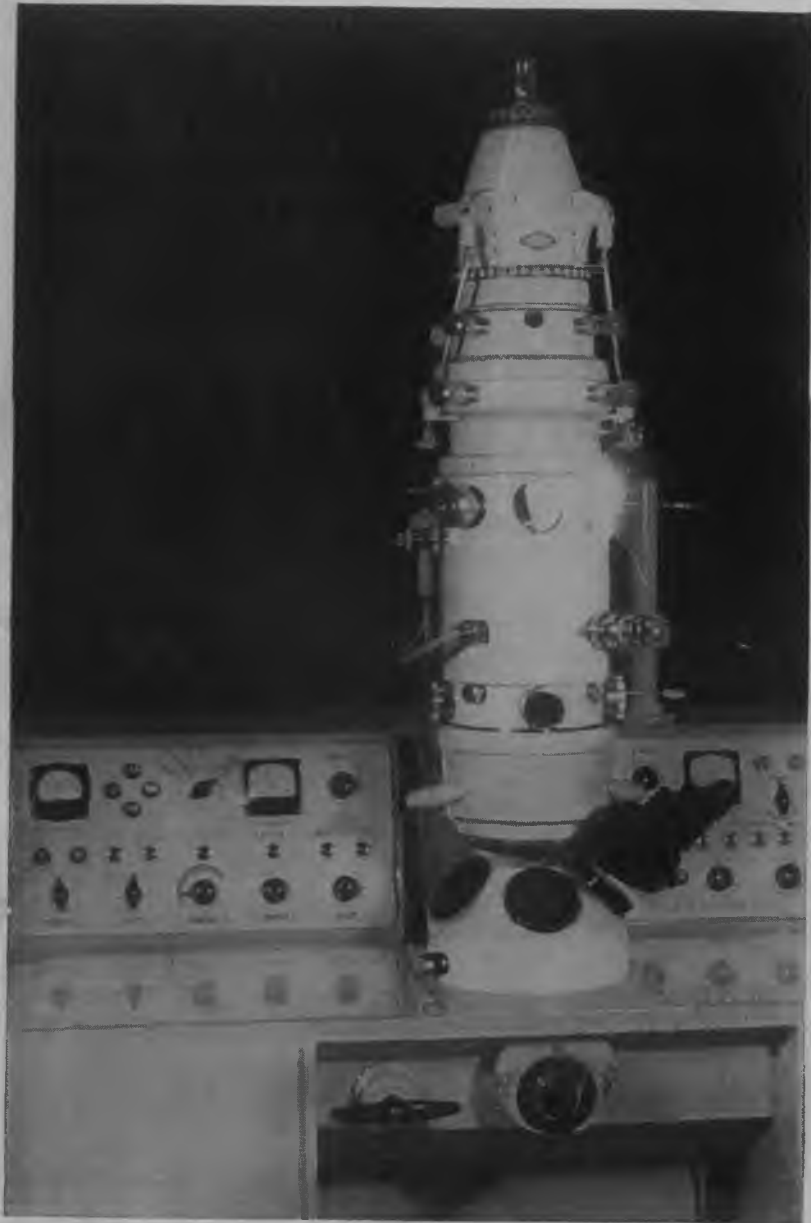
11. During 1966-71 in the field of Molecular Biophysics, the Theoretical studies in conformation of biopolymers were intensively pursued. Similarly in the field of X-ray Crystallography, theoretical and practical aspects were thoroughly investigated.

Centre of Advanced Study in  
Chemistry of Textile Fibres and Dyes,  
Department of Chemical Technology,  
University of Bombay

The Centre of Advanced Study in Textile Fibres and Dyes in the Department of Chemical Technology, University of Bombay started functioning in 1964. The department has specialised sections for seven technologies, namely Textile Chemistry, Food Technology, Technology of Intermediates and Dyes, Technology of Plastics, Technology of Pigments, Paints and Varnishes, Technology of Oils, Fats and Waxes, and Technology of Pharmaceuticals and Fine Chemicals. It has also an extensive section of Chemical Engineering. The sections of Textile Chemistry and Dyestuff Technology provide the basic framework for the field work of the Advanced Centre. The facilities, recruitment of qualified staff and addition of modern sophisticated equipment have enabled the Centre to function effectively and to expand its activities.

The Centre has a staff of two professors, one reader, one research associate and a number of senior and junior research fellows and scholars. The department has laboratories equipped with sophisticated equipment. Some of the major items of equipment available in the department include Infra-red and visible-ultraviolet spectro-photometers; Electron microscope; Differential thermal analysis apparatus with thermogravimetric analysis; Spectrograph (prism and grating) to study spectra in visible and ultraviolet region; Optical polarising microscope; and "AMINCO" spectrophotofluorimeter. The department has a well equipped library having all the essential journals needed for the teaching and research programmes of the department. At present 96 students are working for the Doctor's Degree and 128 students doing their Master's in the department. Most of the students receive fellowships and scholarships.

The research programme of the Centre falls into four major areas, viz., Physics of Dyes



**Electron Microscope model (Centre of Advanced Study in Chemistry of  
Textile Fibres and Dyes, University of Bombay)**

and Polymers, Chemistry of Fibres and Textile Processing, Chemistry of Synthetic Dyes, and Allied Subjects.

The Centre has been organising a symposium every year. The Symposia arranged so far were very well attended and were highly appreciated by workers in other research organisations and by scientists and technologists employed in industry. The Centre has the unique position of being located in an area wherein the synthetic fibre and dyestuff industries are concentrated.

The Centre has been receiving assistance from the UNESCO under United Nations Development Programme and from U.K. through the programme of British Assistance. Professor Krichevsky of the Moscow Textile Institute during his stay at the Centre for the period of six months during September 1968—March 1969 delivered a series of lectures on dye-fibre interaction. Professor I.D. Rattee, University of Leeds spent four weeks at the Centre in January 1971. The Centre has been collaborating with ATIRA (Ahmedabad), BTRA (Bombay) and NCL (Poona). During the last five years 87 research papers have been published by the Centre. Six Ph.D. degrees were also awarded.

Centre of Advanced Study in Chemistry,  
University of Delhi

The Department of Chemistry is one of the largest departments in the University of Delhi. It provides facilities for teaching, training and research in the following branches: (i) Chemistry of Natural Products and Organic Chemistry. (ii) Physical chemistry, (iii) Inorganic chemistry, (iv) Theoretical chemistry. The staff consists of six professors, 28 readers and 19 lecturers apart from 60 research scholars and post-doctoral fellows working in the department.

The teaching facilities consist of instruction to the B.Sc. (Honours) and two-year M.Sc. degrees. Fifty students are admitted to the Honours class and 150 in the M.Sc. class every year. The research programmes of the department cover a wide area with the object of creating an atmosphere where interaction between different fields is possible. While importance is given to training and research in the fundamental and basic aspects, emphasis is laid on projects which have bearing on problems of national importance. The major areas of research being investigated are:

**(1) Chemistry of Natural Products**

(a) Flavonoids, isflavonoids, neoflavonoids, biflavonoids, (b) anthocyanins, proanthocyanins, colour bases, (c) coumarins, chromones, photodynamically active compounds, (d) quinones of various types, (e) chemical components of Indian lichens, (f) plant and synthetic insecticides, (g) alkaloids, (h) non-protein amino acids of plants, peptides and proteins, (i) chemical components of Indian medicinal plants, fruits, conifers and heartwoods.

**(2) Organic Chemistry**

(a) Chemistry of free radicals in solution, (b) synthetic alicyclic chemistry, (c) sulphad drugs, (d) mechanism of organic reactions.

**(3) Physical Chemistry**

(a) Theories of strong electrolytes (b) physicochemical studies of molten salts, (c) polarography, (d) chemical kinetics, (e) electrochemical and ion-exchange properties of synthetic polymers, (f) polyamino acids and polypeptides, (g) X-ray and electron optical studies of polypeptides, silicates and calculi, (h) quantum chemical and spectroscopic studies of amino acids and steroids.

**(4) Inorganic Chemistry**

(a) Coordination chemistry and studies of complexes of metals with organic ligands employing UV, IR, NMR, EPR, Mossbauer spectra and X-ray diffraction, (b) Analytical chemistry and development of new techniques for detection and estimation of cations.

**(5) Theoretical Chemistry**

Molecular orbital calculations of coumarins, chromones, flavonoids, and unsaturated organic molecules.

The following research schemes are in progress in the department:

<i>S.No.</i>	<i>Scheme</i>	<i>Sponsored by</i>
1.	PL-480 Scheme on 'Investigation of the phenolic constituents of certain woods and barks etc.'	PL-480
2.	Composite Drug Research Scheme (Chemical Research Unit)	ICMR
3.	'Project for the investigation of the Constitution of Shellac'	ILRI
4.	'Investigation of Non-fatty constituents of non-edible oils'	ICAR
5.	'Chemicals investigation of Indian Lichens and heartwoods with reference to potential therapeutic agents'	CSIR
6.	'Radio chemical separation of traces of certain ionic species'	CSIR
7.	'Studies on organo-metallic compounds of transition elements'	CSIR
8.	'Complex formation in molten salts'	CSIR
9.	'Preparative coordination chemistry'	CSIR
10.	'Micro analytical technique in Inorganic analysis'	CSIR
11.	'Electrochemistry of proteins, polypeptides and ionogenic complexes'	CSIR
12.	'Physico-chemical studies on poly--amino acids'	INSA
13.	'Metal chelates with phenanthrenequinone derivatives'	CSIR
14.	'Physico-chemical studies on Urinary calculi'	ICMR

Twelve research scholars have been awarded Ph.D. degrees of the Delhi University during 1971-72. The Centre regularly organises a number of lectures and seminars by active

research workers and distinguished scientists from India and abroad. The following have been conducted in recent years.

- (i) UNESCO Training Programme in the Chemistry of Natural Products.
- (ii) Summer Institute on the Thermodynamics and Electrochemistry of Molten salts.
- (iii) ACS Short Course on Spectrometric Identification of Organic Compounds, 1971.
- (iv) Summer Research Training Project for Science Talent Search Scheme Scholars of NCERT, 1972.
- (v) Summer Refresher course for Teachers of Higher Secondary Schools in Delhi, 1972.



## Centre of Advanced Study in Botany, University of Delhi

The Department of Botany, University of Delhi, was recognised by the University Grants Commission as a Centre of Advanced Study in Plant Morphology and Embryology in 1963.

The department conducts a three-year undergraduate course leading to B.Sc. (Hons.) Degree in Botany, a two-year M.Sc. Degree course, and three to four-year programme leading to the Ph.D. Degree. Facilities for research are offered in nearly every discipline of plant science. It has on its staff personnel who have specialized in various branches of botany, a majority having had advanced training in several leading universities of the world. The academic staff consists of three professors, 11 readers, 11 lecturers, and three research associates.

The major areas of research in which the Department is presently engaged are:

(i) Comparative, developmental and phylogenetic embryology of angiospermous taxa of disputed systematic position; (ii) Anatomy, and histochemistry; (iii) Floristic and vegetational studies of Delhi and neighbouring areas; (iv) Cyto- and chemotaxonomy; (v) Control of fertilization and overcoming incompatibility; (vi) Morphogenesis in tissue and organ cultures; (vii) Physiology and biochemistry of flowering and seed development; (viii) Genetics of microorganisms; (ix) Algal biology; (x) Experimental studies on mosses and ferns; (xi) Hormonal control of flower development and sex-expression; and (xii) Taxecology of soil fungi and their agricultural importance.

At present 41 Ph.D. and six Postdoctoral fellows are engaged in these research projects in collaboration with the teaching staff.

An Electron Microscope (Philips EM 300) has been installed in the department, and

a team of investigators who have already received training in the techniques of ultra-structural studies have launched new research projects on the fine structure of reproductive tissues and organs. Another area of application of the technique of tissue culture which is being introduced is genetics. Production of haploids by another culture, intraovarian pollination for hybridization, and isolation and fusion of plant protoplasts are some of the new lines of research recently started in this direction.

The laboratories are fairly well-equipped with modern instruments and appliances. The Tissue Culture Laboratory provides facilities for culturing excised plant parts under controlled environmental conditions. The Plant Physiology Laboratory is equipped with Spectrophotometers, Microbalances, Ultracentrifuges, Fraction Collectors, Geiger-Muller Counter, and other appliances. In addition to these facilities, Phase-contrast and Fluorescence Microscopy, and Ultra-microtomy are also available. The department also has a well-laid out Botanical Garden, a Herbarium, and a Museum, each with a large collection of plant specimens.

The Library of the Centre of Advanced Study has a collection of about 2,000 recently published books. In addition, the Panchanan Maheshwari Memorial Library is also available for consultation.

To facilitate the exchange of ideas and to disseminate advanced knowledge, training courses, seminars and symposia are regularly organised under the auspices of the Centre of Advanced Study. A large number of botanists from India and abroad also lecture in the Department from time to time.

An all-India Seminar on 'Plant Morphogenesis' was organized in December 1968. There were five sessions in which 34 papers were read.

Another all-India seminar on 'Morphology, Anatomy and Embryology of Land Plants', held from December 23 to 28, 1969, provided a common forum for the investigators engaged in the study of various aspects of land plants.

The Department was the venue for the celebration of the Golden Jubilee Session of the Indian Botanical Society, from December 24-26, 1970.

An International Symposium on 'Morphogenesis in Plant Cell, Tissue and Organ Cultures' was held from November 19 to 23, 1971. In all 18 experts from abroad and 45 from the country attended the symposium. There were nine paper-reading sessions in which 55 papers were presented. Seven plenary lectures were delivered by experts. The concluding session dealt with the "appraisal of progress and future outlook on plant morphogenesis".

The Centre is in collaboration with numerous botanical institutions the world over,

with the objective of promoting the advancement of Botany. Many distinguished botanists from U.S.A., U.K., Fiji, Nigeria, Poland, Israel, Argentina, Czechoslovakia, Netherlands, France, and various parts of India have visited and worked in the department for varying periods, during the past ten years.

The financial support for teaching and research activities comes from the University Grants Commission. The Council of Scientific and Industrial Research, The National Council of Educational Research and Training, and The Indian Council of Agricultural Research provide additional grants for research and scholarships.

The department has also received assistance from the Rockefeller Foundation, Ford Foundation, United Nations Development Programme and the British Council. Several useful instruments, spare parts, and chemicals have been Procured under the Foreign-aid Programmes.

Under the auspices of UNDP Technical Assistance Programme, three members of the staff visited and worked in botanical institutions in Soviet Russia, and four Soviet Scientists visited the department. Three staff members received advanced training in the United States of America, and one in France. Under the British Council Exchange Programme, three teachers of the department visited the United Kingdom, and two British scientists visited the department.

Many significant research contributions have been made by the department in the various branches of plant science. Some of the recent findings are:

A detailed study of over 100 members of angiosperm families have provided valuable embryological data, particularly on the taxa of disputed systematic position. Using pollination as marker, characterization of seed development has been made in crop plants, at various stages. Seeds have been successfully obtained in self-incompatible plants through a new technique termed 'placental pollination'.

Employing the technique of another culture, it was possible to demonstrate, for the first time, the potentiality of pollen grains to form haploid plants. With the use of growth regulators it has been possible to include specific organs such as shoots and haustoria from callus tissues; control the sexuality in dioecious forms; and regulate the differentiation of gametophytic and sporophytic generation in lower plants. Even the endosperm tissue, which is basically a source of nutrition for the embryo and lacks morphogenesis, has been made to proliferate and organise triploid shoots and roots. Hormones occurring in the seeds and fruits have been isolated and characterized. Metal chelates have been demonstrated to induce flowering in duck-weeds under non-inductive conditions; and, contrary to the presumption, the non-essentiality of insect proteins for growth and flowering of insectivorous angiosperms has been demonstrated.

Since 1953, 97 theses have been accepted for the Ph.D. degree, and 104 theses for the M.Sc. degree (in partial fulfilment). During the last five years over 250 scientific articles, reviews and monographs have been published in national and international journals.

*Phytomorphology*, official organ of the International Society of Plant Morphologists, is edited and published from the department. It is devoted to studies on all aspects of plant morphology, anatomy, embryology, and morphogenesis, including histochemistry and ultra-structure. *Phytomorphology* is widely circulated in India and abroad. Another quarterly, *The Botanica*, is also issued from the department and is managed by the Delhi University Botanical Society. This also has a wide circulation in India.

Centre of Advanced Study in Botany,  
University of Madras

The Centre of Advanced Study in Botany, Madras University specializes in the fields of Mycology, Plant Pathology and Algology. Several aspects of host-parasite relationships of soil-borne and foliicolous fungal diseases, fungal enzymes, plant viruses and fungal toxins have been studied both at cellular and sub-cellular levels. The Centre has a good culture collection of Algae, Fungi and Actinomycetes. The major diseases studied are the blast disease last mentioned disease, in addition to the fusariosis disease, *Verticillium* disease of cotton is also currently under investigation. Much of the work is now narrowing down to a critical study of deranged host physiology under pathogenesis. In fact, specialisation in the biochemistry of the infected plant is one of the major attractions to this Centre from many foreign visiting scientists. These visits have augmented the thinking in these areas.

The Field Laboratory and Farm at Maduravoyal with its five acres of cultivable land and a well-fitted laboratory is playing a very useful role in extending the frontiers of knowledge in applied plant pathology with basic knowledge acquired in the Main Laboratory.

With assistance received from the UNESCO and the British Overseas Development Ministry, instrumentation has improved immensely. The Centre has now an ultracentrifuge, many isotope equipments, chromoscan, recording spectrophotometer and a mass spectrophotometer in addition to an electron microscope and other equipment. There is also a well-equipped workshop and glass-blowing unit, and a good animal house for developing problems of production of antisera with fungal antigens.

The library subscribes for over 90 journals of a specialist nature. Many of the back volumes of important journals in Mycology, Plant Pathology and Algology have also been purchased.

The Centre has started a new one-year Post-M.Sc. Diploma course in Mycology and Plant Pathology during the academic year 1967-68 and two years later a similar diploma

course in Algology was started. Six students are admitted to these courses every year with stipends given by the University Grants Commission. These courses have strengthened the fundamental knowledge of these students and they are able to embark on a doctoral thesis problem with greater confidence than soon after the M.Sc. The number of research students working for the Ph.D. at a time has been 18-20 every year. The output has been about three taking their Ph.D. every year. Their areas of specialisation are Mycology, Plant Pathology (including Virology), and Algology. Many new techniques such as thin-layer, chromatography, immunoserology, ultra centrifugal analysis etc., are used by these students in their research work.

The Centre has organised two major symposia at Madras: (a) International Symposium on the Taxonomy and Biology of Blue-green Algae, January 1970, and (b) International Symposium on Pathological Wilting of Plants, January 1971. An International Symposium on the Taxonomy of Fungi is proposed to be held during January 1973. The texts of the original articles of these 1970 and 1971 International symposia are now being printed. When ready, these two publications will form important reference materials as they will contain the thinking of many experts in the two areas on a global basis.

The Centre collaborates in India with the Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore, the Department of Plant Pathology, Andhra Pradesh Agricultural University, Hyderabad, the Department of Botany, Bristol University, Bristol, U.K., and the Institute of Microbiology of the USSR Academy of Sciences, Moscow. A number of visiting scientists from these institutes come over for short periods. Members are expected to go to the U.S.A. also for long range training under the UNESCO Programme.

A large number of UGC scholarships and fellowships, are available at the Centre. Staff from other Indian Universities also come over here for one to two years for advanced work. Six university studentships for Ph.D. work are also available. In addition to these, some fellowships from the C.S.I.R. are also available. There are two special fellowships offered to very senior workers on retirement (Emeritus Scientists Fellowship from I.C.A.R.). New work is being developed under these two fellowships in the field of agronomy and in the field of breeding high yielding varieties of alkaloid bearing medicinal plants. These problems which involve field work are handled at the Maduravoyal Field Research Station of the Centre.

More than 120 original research contributions and reviews have been published during the last five years.

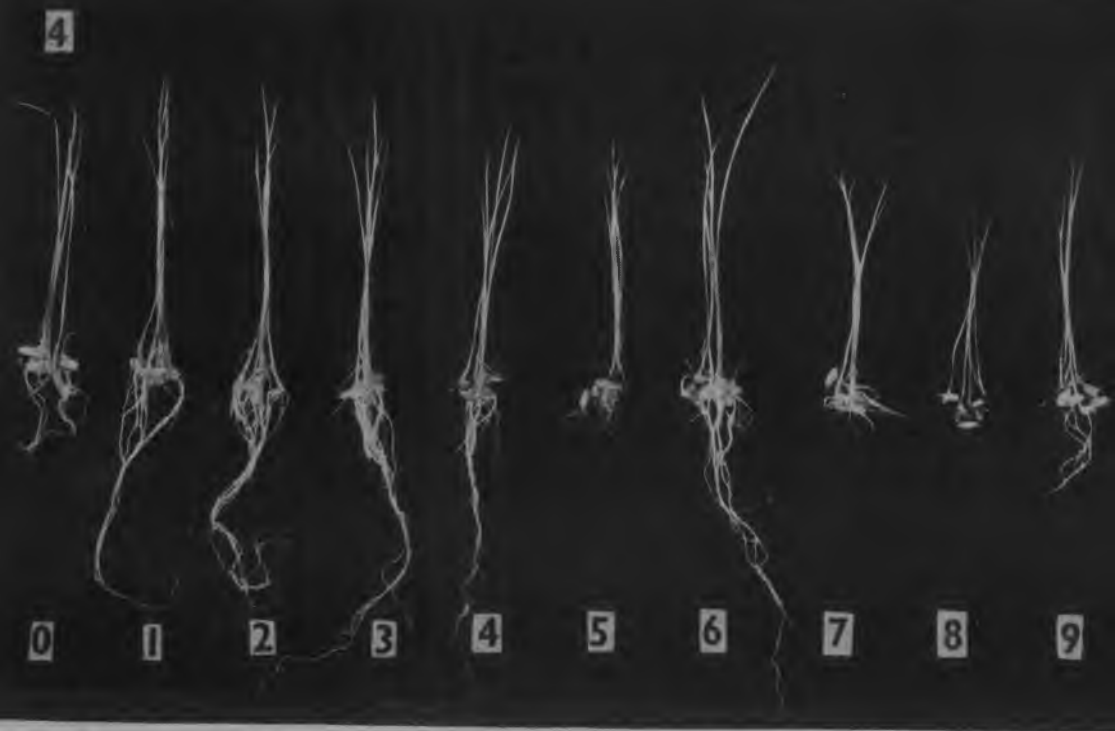


Figure showing the growth inhibition of rice seedlings by *Pyricularia* toxins  
(Centre of Advanced Study in Botany, University of Madras)

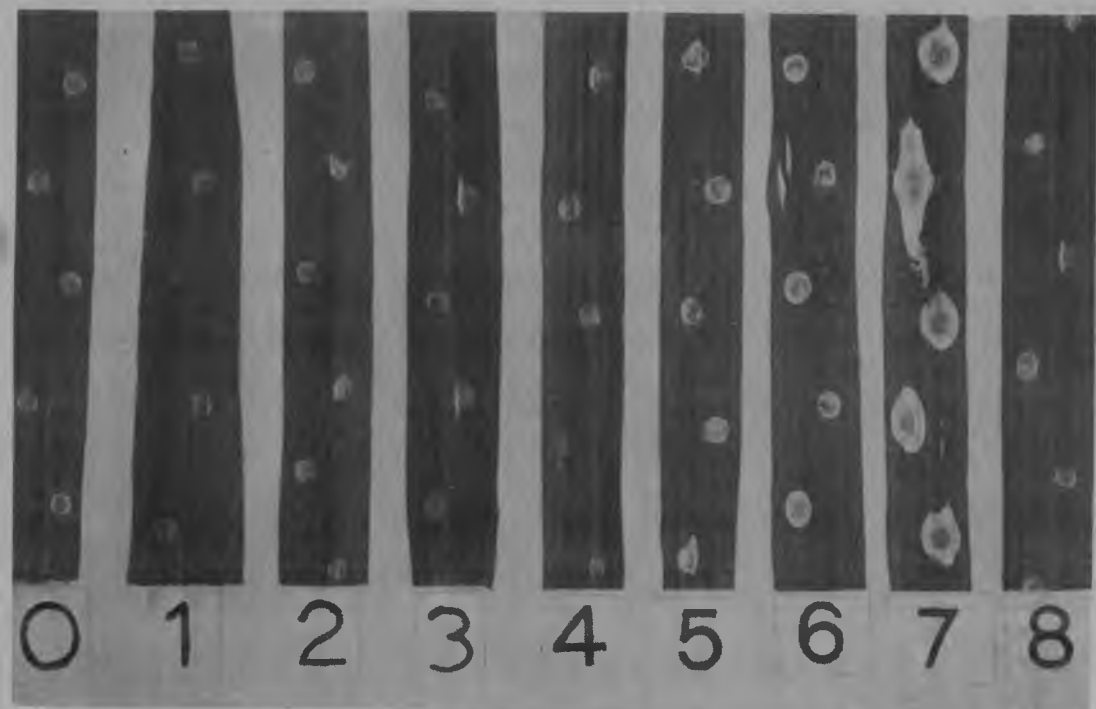
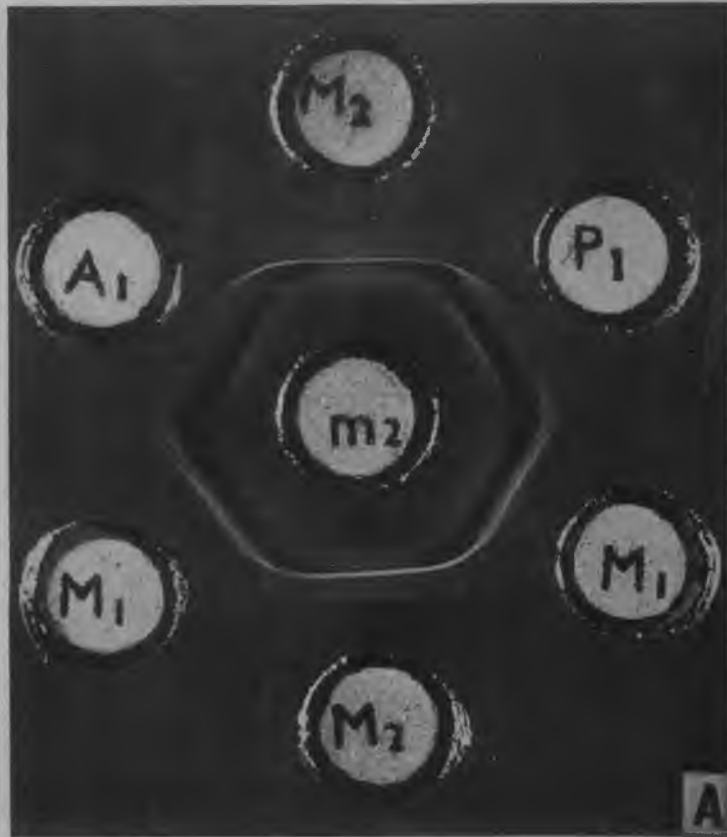


Figure showing simulation of foliar symptoms with the toxins  
(Centre of Advanced Study in Botany, University of Madras)



Immuno-serological studies with phytopathogens. Demonstration of antigens using Ouchterlony double diffusion technique:  
 (A) antigenic comparison of isolates of the rice blast fungus *Pyricularia oryzae*, and (B) common antigen between host and parasite in *Fusarium* wilt of cotton  
 (Centre of Advanced Study in Botany, University of Madras)



Centre of Advanced Study in Zoology,  
University of Delhi

The Department of Zoology, University of Delhi, was recognized as a Centre of Advanced Study in Cell Biology and Endocrinology in 1963 and since then has made significant progress both in teaching and in research in these two disciplines. The research work currently in progress in the Centre is wide-ranging. The following lists the specific projects being pursued by the various groups.

*Ultra-structural studies*

1. Electron microscope studies on growth and differentiation of oocytes.
2. Cytochemical and ultra-structural studies on the salivary gland chromosomes of *Chironomidae*.
3. Cytochemical and ultra-structural studies on the ciliate macronucleus.
4. Effects of drugs on ultra-structure in *Entamoeba histolytica*.

*Cytogenetics*

1. The evolutionary cytology of Indian fishes, amphibians, rodents and primates.
2. Studies on rodent serum transferrins.
3. Human cytogenetics.
4. Aspects of structure and replication of mammalian chromosomes.

*Reproductive physiology and fertility control*

1. Hormonal control of implantation.
2. Mechanisms of anti-implantation action of anti-estrogens.
3. Hormonal control of the initiation and maintenance of spermatogenesis in mammals—rodents and primates.

4. Physiology of the epididymis and control of fertility in the male.
5. Chemical control of reproduction in the male field rodents.
6. The physiology of the pineal gland in relation to hypophyseal activity and to reproduction.
7. Factors controlling the onset of puberty.

#### *Comparative endocrinology*

1. Neural control of reproduction in birds and mammals.
2. Comparative physiology of reproduction in reptiles and mammals.
3. The endocrinology of reproduction in fishes, reptiles and birds.

#### *Biochemical endocrinology*

1. Studies on the biochemistry and immunology of gonadotropins.
2. *In vivo* and *in vitro* studies on the effects of gonadotropins on macromolecular synthesis in the juvenile rat ovary.
3. Studies on the molecular mechanisms of estrogen-antiestrogen interactions.
4. The role of hormones in cellular regeneration in the rat liver following partial hepatectomy.

#### **Facilities available for teaching and research**

The department is well equipped to train students and research workers in the fields of cell biology and endocrinology. The Electron-microscope laboratory has, in addition to a Siemens Elmiskop IA, an Edward's high vacuum shadowing unit and three ultramicrotomes. Packard Liquid Scintillation spectrometer, Nuclear Chicago Gamma Scintillation Counter, Beckman spectrophotometer and preparative ultra centrifuge are available for radioactive tracer studies, biochemical and autoradiographic investigations.

The departmental library has 4,500 volumes in its accession list of which a major proportion represents advanced monographs and serial publications such as the "International Review of Cytology" and "Recent Progress in Hormone Research". In addition, most of the journals pertaining to these two areas are being subscribed to. Most of the investigators have excellent reprint collections relevant to their own research interests. The Centre is thus in a position to keep up with the latest advances in the pertinent areas of research.

#### **Research schemes in progress**

<i>Title of scheme</i>	<i>Sources of support</i>
1 Physiology of Reproduction	Ministry of Health and Family Planning
2 Reproductive Endocrinology of Fishes	PL-480
3 Biochemistry of Gonadotropins	Indian Council of Medical Research
4 Cytogenetics of Rodents	Indian National Science Academy
5 Studies on the sex steroids	Indian Council of Medical Research

## Seminars

A number of seminars in Cell Biology & Endocrinology were organised under the auspices of the Centre in the department. The latest in the series of biennial Cell Biology Conferences organized under the auspices of the Centre was held in December 1971. About 70 scientists representative of the various universities as well as research establishments participated in the Conference.

Earlier, in 1967, the department had organised the IV International Symposium on Comparative Endocrinology in New Delhi. About 250 scientists from all over the world participated.

## Exchange programme

The Centre has an Exchange Programme with the Institute of Animal Genetics, University of Edinburgh. Members of the Faculty of the Centre have visited Edinburgh for short and long term research projects. Visitors from Edinburgh have contributed to the Centre's programme by conducting workshops and seminars in areas of special research interests.

## Out turn of Postgraduates and Ph.D's

<i>Year</i>	<i>No. of M.Sc's</i>	<i>No. of Ph.D's</i>
1966-67	13	(upto) (66-67) 25
1967-68	16	4
1968-69	25	5
1969-70	17	4
1970-71	21	11
1971-72	26	2

## Scholarships

Every research student admitted to the department is eligible for the award of scholarships.

At present the Centre has provision for:

- (1) Six junior research fellowships @ Rs.300 p.m.
- (2) Four senior research fellowships @ Rs.500 p.m.
- (3) Four National scholarships @ Rs.150 p.m.
- (4) Two research associates in the pay scale of Rs.400-950 (equivalent to the post of lecturer).

Junior fellowships are awarded to students who are working for the Ph.D. with the University after their postgraduate studies. These are awarded for a period of two years in the first instance and extended for another year subject to satisfactory progress of research. Each of these fellowships carries an additional contingent grant of Rs. 1,000 per annum.

Senior fellowships are awarded to candidates who have completed their Ph.D. or have sufficient published work in the relevant field of research. This fellowship also carries an additional grant of Rs. 1,000 per annum for contingent expenses.

National scholarships, tenable for two academic years are awarded to meritorious students studying for M.Sc. degree at the Centre of Advanced Study. Atleast 50% of these scholarships are awarded on merit to students coming from other universities. There is also a grant of Rs.200 per annum to the scholar for purchase of books and travel grant to cover actual 2nd class railway fare (once a year) from Delhi to the place of residence of the candidates and back (i.e. Rs. 100+100). Each scholar is entitled to a sum of Rs. 100 to cover his incidental expenses. Students holding the National scholarships will be required to opt for either of the two groups i.e., Cell Biology or Endocrinology during the M.Sc.

Research associates are generally appointed for a period of two years in the pay scale of Rs. 400-40-680-50-950. Candidates who have obtained their Ph.D. in either Cell Biology or Endocrinology and have sufficient published work are eligible for these posts.

## Centre of Advanced Study in Marine Biology, Annamalai University

The Centre of Advanced Study in Marine Biology located at Porto Novo has, in recent years, developed into one of the finest Marine Biological Stations and is noted for its contributions in estuarine and marine biology and for ecological, biochemical and cytogenetical studies.

The central theme for the 'CAS in Marine Biology' is "Experimental Marine Ecology" with special reference to shallow water environments. Biological investigations of the shallow waters, which are most productive, ought to be governed by the fundamental concept of the overall biological structure of that environment. To understand the ecology of the coastal and estuarine environments, it is necessary to study very intensively the biological and chemical conditions and the relationships between the various communities, the sediments and those of overlying waters. The research programme for the 'CAS in Marine Biology' is therefore very broad-based with emphasis on the following lines of research and chiefly relate to the inshore, estuarine and backwaters and the mangrove environments.

The broad-based programme of work for the 'Centre' is as follows:

1. Descriptive ecological aspects like distribution, zonation, communities and ecosystems.
2. Experimental ecological (physiological) aspects like adaptations, tolerances, metabolism, growth and reproduction and regulation (ionic and osmoregulation).
3. Dynamic ecological aspects like Production, biomass, transformations and decomposition of organic matter; Energy flow and pollution.
4. Aspects of microbial ecology like antibiotics in marine environment; role of bacteria in nutrient regeneration; role of bacteria in the nutrition of marine animals and marine toxicological studies (microbial and general).
5. Cultivation of marine organisms (aquaculture); Laboratory-farming of fish and

shell-fish and algae; nutritional and environmental requirements; parasites and other diseases; life-histories.

Areas under investigation at present:

1. Qualitative, quantitative and biochemical studies of phyto-plankton and zooplankton; productivity of the waters—seasonal variations in hydrographical conditions and in biomass and nutrients.
2. Bioecology-distribution, habitats, food and feeding, reproduction and life-history-serological, cytological and biochemical studies in relation to the taxonomy of marine animals.
3. Ecology of the Intertidal, Interstitial and benthic environments.
4. Environmental chemistry-nutrient cycle, exchange and regeneration; studies on estuarine pollution.
5. Physiological adaptations in the estuarine environment-studies on metabolism, respiration and regulation; proximate composition and seasonal variations.
6. Larval ecology-life-history, development and laboratory culture of larvae of estuarine animals.
7. Marine microbiology of waters and sediments-bacteria-distribution, participation in nutrient regeneration and their role in nutrition of marine animals; fungi-actinomycetes of shallow waters-their antibiotic properties.

In view of the fact that marine biology is typically an interdisciplinary science, it is proposed to organise the 'Centre' into five functional units, all of them to work in coordination and to collect information bearing on the central theme. The proposed working units are as follows:

1. Marine microbiology unit
2. Marine ecology unit
3. Environmental chemistry unit
4. Hydrobiology unit
5. Physiology and comparative biochemistry unit

The location of the Centre of Advanced Study in Marine Biology affords a wide range of excellent opportunities for estuarine and marine biological studies. The estuary, backwaters, neritic waters and the freshwater head of the estuary are all easily accessible from the laboratories. The region is also interesting on account of the dense and extensive mangrove swamps and the presence of sub-marine canyons at about fifteen miles from the laboratory.

The biological potential of the locality is rich and varied, and available for study practically throughout the year. The plankton and the intertidal and the interstitial fauna are particularly rich.

The other facilities available at the Centre include two sea worthy 33' boats, fitted with diesel engines; two smaller boats with out-board motors and a dug-out canoe for work in backwaters. The equipment available at the Centre include spectrophotometers, electrical balances, stereoscopic microscopes, Bausch and Lomb microscopes and ordinary microscopes; Gas analysis apparatus; Salinity-Temperature Measuring Bridge; International refrigerated centrifuge; Bausch and Lomb-Spectronic-20 Colorimeter; Bacteriological sampler; Van Dorn water sampler; Productivity kit; Photofluorometer; Oxygen analyser; strip recorder and other essential oceanographic and biochemical equipment.

Besides, the Centre is making arrangements to have a fully equipped microbiology laboratory and a tracer laboratory. A furnished modern guest house for visiting scientists, a students' hostel and sufficient laboratory accommodation are available at the Centre.

The Centre possesses an up-to-date library and subscribes, every year, to almost all the Indian and foreign journals, which have direct bearing on the subject. The backvolumes available in the library of the Centre include-Marine Biology (Springer-Verlag), Deep Sea Research, Limnology and Oceanography, Biological Reviews, Journal of Experimental Biology, Journal of Experimental Marine Biology and Ecology, Journal of Animal Ecology, Hydrobiologia, Siboga Expedition Reports, Journal of the Marine Biological Association of U.K. and India, and Indian Journal of Fisheries.

Apart from giving necessary facilities for research work leading to Ph.D. degree and post-doctoral research, the Centre offers postgraduate course in Marine Biology on all-India basis.

The Centre has organised two all-India seminars and two symposia and also two summer special institutes for college teachers from all parts of India. The second all-India symposium on 'Estuarine Biology' was held between 20th and 24th January, 1972. The Centre has also proposed to conduct a refresher-cum-laboratory and workshop course every year for staff and research scholars from different parts of India.

Under the programme of British Assistance the Centre has so far deputed six of its staff members for visits to U.K. and nine British Scientists had visited the Centre so far.

The Centre has been provided a large number of scholarships and fellowships by the UGC, to be awarded on an all India basis.

The Centre has so far published about 200 research papers, which are extensively quoted. The Centre has also published a book on 'Marine Animals' besides, two monographs ready for publication.

A number of distinguished scientists visited the Centre including Professors J.E.G.

Raymont, R.B. Clark, C.H. Waddington and J.B. Burch.

During the past five years the Centre has strengthened its formal link with the Department of Marine Biology and Oceanography, Southampton University and will initiate joint programmes of research as a scientific enterprise to compare the biological processes in temperate and tropical waters.



## Centre of Advanced Study in Geology, Panjab University

The Centre of Advanced Study in Geology, Panjab University, came into existence in 1963. The Centre provides facilities for training and research in Palaeontology and Himalayan Geology. At present, the staff consists of three professors, four readers, eight lecturers/ research associates and about 25 research scholars/fellows doing research on various problems connected with the Palaeontology and Himalayan Geology.

Members of the staff and research scholars/fellows are actively engaged in investigations in different fields, viz., Vertebrate Palaeontology, Invertebrate Palaeontology (including Micropalaeontology), Stratigraphy, Structural Geology, Sedimentology, Igneous and Metamorphic Petrology. Eleven persons have already been awarded Ph.D. Degree by the Panjab University and five have submitted their theses to the University for the award of Ph.D. Degree this year. About 275 research papers have been published in Indian and Foreign Journals. A monograph entitled "Indian Palaeozoic Fossils" has also been published by the Centre.

The following expeditions were organized by the Centre with a view to study in detail the geology of remote areas and a valuable collection of fossils, rocks and minerals has been made by the members of the expeditions.

1. Spiti Valley in 1965 and 1966.
2. Kargil-Leh area in 1969 and 1970.

The Centre has been receiving assistance from U.K. under the programme of British assistance. Under the said programme, eminent geologists have been invited from the U.K. and staff members of the Centre were also deputed to U.K. The Centre also made contacts with the People's Friendship University, Moscow, in the proposed collaboration between the

Centre and the aforesaid University.

Professor G.D. Ashgirei, Head of Geology Department, Peoples' Friendship University, Moscow, visited the Centre in 1970-71. Four Indian research scholars doing research at the aforesaid university visited the Centre twice for the field work in India in connection with their Ph.D. Degree.

The Centre organizes Seminars on Himalayan Geology and Palaeontology every year with a view to make an effort to coordinate the research activities of the other universities in India and Geological Organizations interested in Himalayan Geology/Palaeontology and their proceedings are published accordingly.



Expedition to Leh in 1969 (Centre of Advanced Study in Geology, Punjab University)



A view of the Teaching Section of the Museum of the Centre of Advanced Study in Geology, Panjab University



X-ray plant in the Centre of Advanced Study in Geology, Punjab University

Centre of Advanced Study in Geology,  
University of Saugar

The Centre of Advanced Study in Geology and the Department of Applied Geology, University of Saugar have at present an academic staff of two professors, five readers and 10 lecturers and research associates. There are over 30 research fellows in the department.

The Centre has been specialising in the following fields:

1. *The Deccan Trap igneous activity:* This is a major field of specialisation in the Centre. The theme of study is mainly to understand the nature of the lava flows and the differentiation of the Deccan Trap magma. The plutonic igneous activity associated with the Deccan Trap lavas, the compound nature of some of the flows, and the relation of the dykes to the lava flows also form an important aspect.

2. *The Precambrian rocks of Narbada and Son valleys:* This includes the study of the Vindhyan, Bijawars and Archaean gneisses along this line from a structural, sedimentological and geomorphic point of view.

3. *Ground water potential and exploration in Madhya Pradesh:* It is one of the important fields of specialisation of the Department of Applied Geology. At the M. Tech. level, it is taught as a special paper and a lot of useful work has been done in collaboration with the Agriculture Department of Madhya Pradesh. Several areas from different districts have been selected for intensive studies.

4. *The Precambrian rocks of Rajasthan:* Structural studies on modern lines on the Precambrian rocks of Rajasthan. The studies include uncovering the structure of the area and establishing a sequence in the tectonic events. The present programmes in progress are mainly concerned with the Delhi rocks. It is proposed to cover representative areas of Delhi, Aravalli and Banded Gneissic complex and verify the Precambrian succession in Rajasthan.

5. *Manganese and Iron-Ore deposits of M.P.:* This includes mineragraphic and chemical studies of the ores from the point of view of their genesis and exploitation potential. The work done till now is on the Kajli Dongri and Shivrajpur manganese-ore deposits and the Bailadilla iron-ore deposits in Bastar district. The present programme is concerned with the iron-ore deposits of Rajhara. It is proposed to extend these studies so as to cover as much as possible other manganese and iron-ore deposits of the State.

6. *Vindhyan Sedimentation:* A study of the Vindhyan from the point of view of their sedimentation has been taken up since such a study has an excellent scope by virtue of the location of the Centre at Sagar.

7. *The Gondwanas and their economic potential:* Gondwanas have a wide distribution in Madhya Pradesh. They are well known for their economic deposits such as coal, clay, etc. One of the research programmes undertaken is a study of the Gondwanas near Umaria from the point of view of the sedimentation of the Gondwanas and the coal they contain.

The clays of Madhya Pradesh which occur at different geological horizons have been studied.

The Centre has an X-ray laboratory, geochemical laboratory, a sedimentological laboratory and mineralogical laboratories for both transmitted and reflected light microscopy. The equipment includes X-ray diffractometry, large quartz spectrograph, spectrophotometer, flame photometer and Vickers microscope for transmitted and reflected light.

The library gets about 60 journals and has back volumes for the more important ones.

The postgraduate course is a three-year integrated course. The main emphasis at this level is on the applied aspects and includes teaching programmes in Mining Geology, Ground-water Geology, Photogeology and Geochemistry. Intensive field training in all three years is a major feature of this course.

The graduate course attempts at building up a sound basic knowledge which should serve as a useful spring board for higher studies. Besides the normal 10-day tour, single-day field trips are a feature of this course.

An important scheme which has been undertaken by the centre is a study of the Deccan Traps in the Malwa region. This scheme is an experiment in coordinated research. Banaras, Saugar, Vikram and Bombay Universities and also the National Geophysical Laboratory, Hyderabad are participating in it. The scheme's purpose is to attempt integrated studies of the different aspects like Petrology, Geochemistry, Ground Waters, Geomorphology etc., of the Malwa region basalts, and to determine the structure of the Narmada valley. When



**Differential thermal analysis of clay minerals (Centre of Advanced Study in Geology, Saugar University)**

the work is completed, it is expected to present a full picture of the traps of the Malwa Plateau and the Narmada valley to the south of it.

In the last five years two symposia, one on the 'Deccan Traps and other flood eruptions' in January, 1969, and the other on 'The Purana formations of Peninsular India' in December, 1970 have been organised by the Centre. A summer Institute in Geology was conducted in 1966 during May and June.

The Centre is shortly going to take up another scheme on the Deccan Traps with PL-480 aid.

The Centre has eight junior fellowships and four senior fellowships for deserving Master degree and Doctorate degree holders. It has also facilities for geologists employed by other organisations to come to the Centre on short periods of deputation to pursue problems of their interest which otherwise is not possible in their own institutions.



**Centre of Advanced Study in Mathematics,  
University of Bombay**

The Centre of Advanced Study in Mathematics, Bombay University has been functioning since 1963 in close collaboration with School of Mathematics of the Tata Institute of Fundamental Research, Bombay. At present the Centre has on its staff, five professors (including two on deputation from the Tata Institute of Fundamental Research and a Visiting Professor), three readers and two lecturers.

The major areas of research are : (i) Algebra and Number Theory (ii) Combinatorial Mathematics and Graph Theory (iii) Functional Analysis (iv) Topology and Topological Groups and (v) Probability and Mathematical Physics.

Apart from the excellent library facilities of the university the centre has its own library. The Centre also subscribes to 30 journals.

The members of the centre participate in the M.A./M.Sc. instruction in mathematics and also guide students for Ph.D. degree. The areas of specialisation for research are Algebra and Number Theory, Combinatorial Mathematics and Graph Theory, Functional Analysis, Topology and Topological Groups and Probability and Mathematical Physics.

The Centre has a programme for training teachers from universities and colleges in India. Under this programme, the teachers come to the centre for a period of one year and attend lectures and participate in seminars. They are also encouraged to attend lectures at the school of mathematics of the Tata Institute of Fundamental Research.

The Centre arranged summer schools in mathematics jointly with the school of mathematics of the Tata Institute of Fundamental Research during summers of 1968, 1969 and 1970. A summer school is proposed to be held in the summer of 1972.

The Centre has been receiving assistance from U.K. under the programme of British Assistance. Professor D. Rees visited the centre during the year 1966-67 and Professor B.J. Birch in 1970-71.

The centre awards national scholarships for prosecuting M.A./M.Sc. course in mathematics at the university. It also awards junior and senior research fellowships.

During the last five years the members of the centre published 32 research papers.

The centre proposes to hold short-term refresher courses in Modern Mathematics for local college teachers. It is also proposed to bring out from time to time lecture notes on various topics in mathematics. The centre welcomes short visits of mathematicians from other universities in India for lectures and exchange of ideas.

**Centre of Advanced Study in Applied Mathematics,  
University of Calcutta**

The Department of Applied Mathematics of the University of Calcutta has made during the last fifty years significant contributions in different branches of Applied Mathematics particularly in Statistical Physics, Fluid Mechanics, Theory of Elasticity, Quantum Mechanics, Relativity, Cosmic Ray Physics, Astrophysics, Geophysics, Functional Analysis, Mathematical Methods, and Basic Mathematics for application.

The Centre of Advanced Study in Applied Mathematics started functioning early in 1964 and has been trying to develop training and research facilities in the different branches of Applied Mathematics, special emphasis at present being given on Basic Mathematics for applications, Mathematical Methods (Analytical & Numerical), Statistical Methods and Information Theory, Mathematics of Technology and different branches of Mathematical Physics, like Physics of Continuum (Fluid Mechanics and Theory of Elasticity), Theory of Relativity, Statistical Physics, Quantum Mechanics, Plasma Physics and Computer Mathematics. It is also decided to organise units for Biomathematics and for Mathematics for Social Sciences in the near future.

The Department of Applied Mathematics (with the Centre) at the University of Calcutta has at present one professor, six readers, eight lecturers (wholetime and part-time), 10 research fellows (senior & junior). At present, there are vacancies in two posts of professors, one post of reader, four of research associates and eight of research fellows (one senior and the rest Junior).

Instructive courses of lectures and seminars, research seminars, symposia, special lectures, invited and memorial lectures, and physico-mathematical colloquium lectures are organised at the Centre regularly. Proceedings of symposia, reports of academic activities of the Centre containing abstracts of research papers completed and of different lectures delivered at Centre are published regularly. Books, monographs and treatises are to be published soon.

A high speed Computer has been installed in the University College of Science, Calcutta University and a Computer Centre has been organised in the University. The Centre of Advanced Study in Applied Mathematics has initiated a unit for advanced study and research in Computer Mathematics and a course in Programming is going to be given regularly from this year to train all in the Centre, in other departments of the University, and in affiliated Colleges and in neighbouring Universities, interested in the use of Computers. Individual academic members of the Centre are using the Computer, whenever it is necessary. Initiation has been taken to organise a linguistic unit to train research fellows and other academic members of the University in foreign languages for scientific studies.

The Department has a Numerical Laboratory for students, a Geophysical Laboratory and a Hydrodynamical Laboratory for the purpose of demonstration. Attempts have been made to reorganise the Hydrodynamical Laboratory and set-up a well-equipped Numerical Laboratory for research and a Laboratory for Stress and Strain Analysis.

## Centre of Advanced Study in Mathematics, Panjab University

The Department of Mathematics, Panjab University, was recognized by the University Grants Commission as a Centre of Advanced Study in October 1963. The staff strength of the Department and the Centre together has increased since 1963 from three professors, four readers, four lecturers to five professors, 10 readers and 10 lecturers. A large number of research fellowships, research assistantships and research scholarships have been made available by the University Grants Commission, the C.S.I.R. and the University.

The staff of the Centre have been actively engaged in research work relating to Theory of Numbers, Geometry of Numbers, Discrete Geometry, Measure Theory, Functional Analysis, Algebra, Algebraic Number Theory, Statistics, Magnetohydrodynamics and Plasma Kinetic Theory. Besides the teaching programmes for M.A. (Mathematics), M.A. (Statistics), M.Sc. Honours School and B.Sc. Honours School, the Centre is also engaged in the teacher-training scheme of the U.G.C. Under this scheme, the Centre invites ten teachers from colleges all over the country to spend a full academic year to improve their subject-matter competence as well as to learn new methods of teaching and get initiated into research.

A number of distinguished mathematicians, including Professors Bass, Oort, Rees, Birch, Svec, and Ramanathan, visited the Centre and gave talks in the colloquium. The Centre has been organizing seminars and refresher courses for research workers and college teachers.

The department has been selected for the University Leadership Project in Mathematics (College Science Improvement Programme). Under this programme, the department has taken various steps to improve the teaching of mathematics in the colleges; in particular text books have been written for the undergraduate classes and efforts have been made to make the examination papers more meaningful.

The Centre has been participating in the programme of assistance and collaboration from the Government of United Kingdom/British Council to the University Grants Commission Project of Centres of Advanced Study in Indian Universities and also in the 'Unesco Assistance to the Centres of Advanced Study Project in Indian Universities'.

Staff members at the Centre continue to be associated with research publications in various countries editorially as well as in the capacity of reviewers and referees. The department has been actively collaborating with the Indian Mathematical Society.

The Centre has a well equipped library having about 15,000 books on the subject and subscribes to about 180 journals. An IBM-1620 Computer was installed at the Centre in December 1966. Regular courses are given in programming etc., to train the scientific workers in the use of computers.

Centre of Advanced Study in Mathematics,  
University of Madras

The Ramanujan Institute, named after the luminary, Srinivasa Ramanujan is the Centre for Fundamental Research in Mathematics in the University of Madras. It initiates students who have completed the Master's degree in Mathematics into fields of research in pure mathematics and prepares them for the Ph.D. degree. The Institute has academic contacts with research centres in India and abroad.

In 1967 the University Grants Commission of India came up with the concrete proposal of making the Ramanujan Institute into one of its Centres of Advanced Study. The University Department of Mathematics was coalesced with the Ramanujan Institute to form the Centre of Advanced Study in Mathematics in the University of Madras.

The Centre has at present a staff strength of two professors, three readers and three lecturers, besides a number of junior and senior research fellows. The library has a collection of 800 books and subscribes for 45 Mathematical journals. It has also acquired Seminaire Bourbaki Reports, the publications of the Mathematische Seminaire of Aarhus University, and some of the non-serial publications of Brandeis and Kansas Universities.

The Centre conducts every year advanced courses for research scholars and visiting college teachers in the basic disciplines: Analysis, Algebra, Topology etc. It has also been organising the Teachers Training Programme in Mathematics. The Centre has been receiving assistance from U.K. under the Programme of British Assistance. This enabled the Centre to receive a number of distinguished scientists/specialists from U.K., such as, Professor I.G. Macdonald (Oxford), Professor R.L.E. Schwarzenberger (Warwick), Dr. K.D. Elworthy (Warwick), Professor D. Rees (Exeter) and Professor R.A. Rankin (Glasgow). Several members of the Centre also visited U.K. under the Programme. The Centre has been recently included in the programme of Unesco Assistance from the U.S.S.R. During 1967-71, twelve Ph.D. degrees were awarded and 36 research papers were published.

The Centre has a publication series under which so far the following monographs and lecture notes have been published.

*Monographs*

- (1) Ananda Rau Memorial Volume (This contains papers dedicated to the memory of K. Ananda Rau on various branches of Analysis).
- (2) I.G. Macdonald: Spherical functions and fourier analysis over p-adic fields.
- (3) R.L.E. Schwarzenberger: Topics in Differential Topology (In Press, will be released soon).

*Lecture notes*

- (1) R.A. Rankin: On the modular groups and its subgroups (Cyclostyled).
- (2) K. Ramachandra: Lectures on Transcendental Numbers (Cyclostyled).

Other volumes are under preparation.



## Centre of Advanced Study in Astronomy, Osmania University

The Nizamiah Observatory was originally established in 1908, and later transferred to the Osmania University in 1919. It has been developed on modern lines and a new 48-inch reflecting telescope was added at the Rangapur site during the Second, Third and Fourth Five Year Plans with financial support from the University Grants Commission. A full-fledged Astronomy Department was established in the Osmania University in 1959-60. In 1964 the above Osmania University institutions became recognized as an all-India Centre of Advanced Study in Astronomy. At the present time, this Centre comprises the Department of Astronomy in the University Campus, the Nizamiah Observatory at Begumpet about 10 kilometers from the University Campus, and the Rangapur Observatory located near Rangapur village about 60 kilometers south-east of Hyderabad.

The present academic staff consists of two professors, three readers/associate astronomers, four lecturers/assistant astronomers, one research associate and four junior research fellows.

The Library of the Centre has a large collection of about 27,500 publications, 2,500 volumes of journals and about 3,000 books on Astronomy, Mathematics, Physics and allied subjects.

The 48-inch reflecting telescope, largest of its kind in South-East Asia, is located at the Rangapur Observatory. This telescope consists of a primary parabolic mirror of 48-inch aperture, having a focal length of 16 feet at the Newtonian focus and 60 feet and 120 feet respectively for the Cassegrain and Coudé foci. So far this telescope has been used primarily for photoelectric photometry of selected variables stars, using a dual channel photometer which has provision of making offset observations to observe faint stars.

The installation of the 48-inch telescope was completed through the grants made avail-



The New Astronomical Observatory building at Rangapur housing the 48-inch telescope  
(Centre of Advanced Study in Astronomy, Osmania University)



The 48-inch reflecting telescope at the Rangapur Observatory of the Centre of Advanced Study in Astronomy, Hyderabad



Dual channel photoelectric photometer attached to the cassegrain focus of the 48-inch telescope  
(Centre of Advanced Study in Astronomy, Osmania University)

able by the American National Science Foundation and the U.S. Air Force Cambridge Research Laboratories, Bedford, Massachusetts, U.S.A. The satisfactory working of the 48-inch telescope and the accessory equipment was carried out through the helpful suggestions from the Fecker Company engineers, and Dr. A.B. Meinel of the University of Arizona, U.S.A.

At Nizamiah Observatory, an 8-inch photo-visual astrograph and a 15-inch visual Grubb refractor are located. The 8-inch astrograph, which had been used from 1915 onwards for the preparation of Astrographic Catalogues is now being used for photographing the selected Astrographic Catalogue zones once again to determine the proper motions of stars. It is also being used for the study of light variations of an optically faint X-ray source Sco X-1. The 15-inch Grubb refractor is being used with a photo-electric photometer for study of light variations of selected variable stars.

The Centre has been actively engaged in research in the following areas:

(a) *Observational research*

- (i) Photoelectric observations and analysis of variable stars
- (ii) Interferometric studies of gaseous nebulae and atmospheric emissions
- (iii) Observations of Sco X-1 with astrograph
- (iv) Determination of proper motions of stars
- (v) Visual and spectroscopic studies of meteors

(b) *Theoretical research*

- (i) Dynamics of interacting galaxies and clusters of galaxies
- (ii) Theoretical studies of planetary atmospheres

The Centre organised an International School for Young Astronomers with financial support from UNESCO during October-November 1969. The main purpose of the School was to acquaint young astronomers from several participating countries with the latest developments in certain fields of astronomy and to give them practical training. It is planned to hold a Symposium at this Centre on 'Spectroscopic Studies of Astrophysical Interest' in August 1972 under the joint sponsorship of the University Grants Commission and the Indian National Science Academy, New Delhi. The Symposium will cover observational, theoretical and laboratory studies being done currently or during the recent past in the entire electromagnetic spectrum from X-ray to radio frequencies.

The Centre has been collaborating with the Department of Astronomy of Manchester University, U.K. under the programme of British Assistance. Four astronomers from the Centre have worked at the Manchester University. In collaboration with the Tokyo Astro-

nomical Observatory, a programme of studying the X-ray source Sco X-1 has also been undertaken. A few distinguished astronomers from abroad including Professors Z. Kopal, A.B. Meinel, S. Chandrasekhar, S.M. Silverman, M. Golay, and J. Kleczek visited the Centre.

During 1966-71, optional courses on Radio Astronomy, Astronomical Techniques, Astrophysical Plasmas and Magneto-hydrodynamics, Galactic Structure and Interstellar Matter, and Advanced Celestial Mechanics were introduced and taught. With the 48-inch telescope, a research project on photoelectric observations and analysis of variable stars was started. Seven research papers were published by the Centre during 1966-71.

Centre of Advanced Study in Biochemistry,  
Indian Institute of Science

The Department of Biochemistry, Indian Institute of Science, Bangalore, established in 1921, is the oldest department in the country in the subject. The Department provides advanced instruction and conducts original investigations in different branches of biochemistry and functions as an all-India institution attracting the best students from all over the country.

The areas in which the Department has made significant contributions in the past and in which work is in progress are:

1. Lipid and Vitamin Metabolism
2. Proteins & General Nutrition
3. Plant Biochemistry
4. Endocrine Biochemistry
5. Nucleic Acids
6. Cytogenetics
7. Antibiotics and Chemotherapy
8. Sanitation Biochemistry

The five major areas of research pursued in the Department at present are as follows:

1. *Proteins*: The role of blood brain barrier to  $\beta$ -N-oxalyl-L- $\alpha$   $\beta$ - $\gamma$  diaminopropionic acid in the etiology of neurolathyrism, structural alterations of ribonuclease and development of chemical methods useful in determination of structure of proteins, and alterations in enzyme proteins, particularly, the regulatory and rate-limiting enzymes, during adaptation to high altitude conditions.

2. *Lipids and vitamin metabolism:* Elucidation of the metabolic functions of carotenoids and vitamins; metabolism of carotenoids, vitamin A and phospholipids in chicken; role of lipids and vitamins in health and disease; structure and function of carotenoids and vitamins A<sub>1</sub> and A<sub>2</sub>; and study of the regulation of branched pathways leading to the synthesis of complex lipids.

3. *Plant Biochemistry:* The pathways for the biosynthesis and degradation of anthranilic acid, catechol and other aromatic compounds in higher plants and fungi; mechanism of methionine biosynthesis in soybean roots, the formation of cinnamic acid in plant callus tissues grown *in vitro*, trehalose metabolism in thermophilic fungi, regulation of the metabolism of flavin nucleotide coenzymes in plants and biosynthesis of phenolic amines in plants belonging to the citrus family.

4. *Endocrine Biochemistry:* The use of specific gonadotropic hormone inhibitors in understanding the mode of action of luteinizing and follicle-stimulating hormones at physiological and biochemical levels. In particular, biochemical events taking place during follicle maturation, ovulation, corpus luteum function and implantation are under investigation.

5. *Nucleic acids:* Chemical synthesis of deoxyribonucleotides of known sequence, the study of the antigenic properties of nucleic acids; isolation and characterization of t-RNA from different organisms; study of the changes in t-RNA during the development of chick embryo; control of gene expression during germination of seeds and during phage infection of bacteria.

A staff of five professors, nine assistant professors, five lecturers and about 80 research workers in the Department are actively engaged in research relating to the above disciplines.

Normally, this Department admits 10 students every year for doing research for Ph.D. degree of the Indian Institute of Science. A one-year Post M.Sc. Diploma course in Molecular Biochemistry was started in August, 1969 with an intake of six students. The candidates are required to undergo a lecture course in fundamental and advanced topics in Biochemistry. During this period they attend a course on biochemical research techniques and also take part in seminars on advances in Biochemistry arranged every month.

It is proposed that in future admission to the Diploma course be restricted to teachers in universities and other research organisations. The salary of such teachers may be paid by the University Grants Commission and steps taken to protect their seniority in their respective organisations. During the five year period 1966-1971, 63 scholars received their research training and of these 41 have obtained the Ph.D. degree of the Indian Institute of Science. About 180 publications have appeared in recognised Indian and foreign scientific journals during this period.





Tissue culture experiments (Centre of Advanced Study in Biochemistry, Indian Institute of Science)



*In vivo* experiments (Centre of Advanced Study in Biochemistry, Indian Institute of Science)



**Gas-liquid chromatography (Centre of Advanced Study in Biochemistry, Indian Institute of Science)**



**Automatic amino acid analyser (Centre of Advanced Study in Biochemistry, Indian Institute of Science)**



Simulation of stress conditions (Centre of Advanced Study in Biochemistry, Indian Institute of Science)



Refrigerated centrifuge (Centre of Advanced Study in Biochemistry, Indian Institute of Science)

The Department is well equipped for biochemical research work having such special equipment as high speed refrigerated centrifuges, analytical ultracentrifuge, automatic amino acid analyser, electrophoresis apparatus, freeze drying equipment, fraction collectors, spectrophotometers, radioactive counters, etc. Furthermore, there is excellent facility for carrying out experiments on animals.

The Department is in receipt of research grants from the Ford Foundation, Wellcome Trust, National Institutes of Health, Agricultural Research Service of the U.S. Department of Agriculture (PL-480), Office of Naval Research, Council of Scientific and Industrial Research, Indian Council of Medical Research and Ministries of Defence and Health, Family Planning and Urban Development, Government of India.

Scientists, both foreign and Indian, who happen to pass through Bangalore are invited to deliver lectures on their current research. Normally, about 25 such lectures are arranged every year.

Special lectures on advanced topics by well-known Indian scientists are arranged at the Centre every year under special lectures and symposia and the University Grants Commission Scheme for exchange of Teachers/Experts. Normally, two series of lectures each under the above schemes are arranged every year.

In order to have growing interaction with the various research groups at the Centre, visiting scientists from abroad are invited to spend a few weeks to a few months at the Centre.

Research workers who possess the minimum qualifications prescribed for admission to the Institute and who are sponsored by Universities, Institutes or other public or industrial organizations may be permitted by the Director on the recommendation of the Professor-in-Charge to work in the Department for periods of not more than four months at a time. They can take advantage of auditing the courses in Advanced Biochemistry and allied subjects given in the Department or undergo training in specialized techniques. A number of research scholarships and fellowships are available in the Centre for advanced research work.

An International Convention of Biochemists was held in Bangalore in 1967 jointly sponsored by the Society of Biological Chemists (India) and the Biochemical Society, U.K. The convention was attended by 45 foreign and 300 Indian biochemists.

To commemorate the Golden Jubilee of the Department, three Symposia were arranged during December 2-7, 1971 on the subjects of Lipids, Plant Sciences and Environmental Biochemistry. The Society of Biological Chemists (India) and the Biochemical Society, U.K., held a joint Scientific Meeting on December 2, 1971 to mark the occasion. About 50 foreign scientists inclusive of a number of F.R.S.'s from U.K. and over 450 Indian Biochemists participated in the Symposia and Scientific meetings. A large number of alumni of the Department

also participated on this occasion. The other activity of the Golden Jubilee year was in June/July, 1971 of the Organisation of the Bi-National Conference in Life Sciences. Several distinguished scientists gave lectures at the Department as a part of the Golden Jubilee Programme. On this occasion an exhibition aimed at popularizing science was organized at the Department, when exhibits on several aspects of biological interests were prepared and displayed. The Exhibition proved extremely popular.

The Centre has been included under the programme of assistance and collaboration with the Government of the U.K. and the British Council from the year 1970-71 onwards. In this connection, Prof. T.W. Goodwin, F.R.S. of the Department of Biochemistry, University of Liverpool, U.K. visited the Department in January 1971.

Substantial grants for purchase of equipment have been made by the UNESCO to the Centre of Advanced Study. Furthermore, a provision has been made for exchange of senior and junior scientists from abroad.

Centre of Advanced Study in Economics,  
University of Bombay

The Department of Economics, University of Bombay was recognised as a Centre of Advanced Study in August 1963 by the University Grants Commission. The department provides instruction for the M.A. degree in Economics by papers and research as also research facilities leading to the Ph.D. degree in Economics. The department has done pioneering work in the areas of—General Economics, Agricultural Economics, Industrial Economics, Monetary Economics, Demography, Mathematical Economics and Econometrics, Planning and Development, Industrial Economics and Public Finance, Transport Economics, and Educational Economics. The department has a staff of eight professors, six readers, two lecturers, seven junior and two senior research fellows, eight national scholars and six research assistants/investigators, etc. The scholarships have been made available to the department by the UGC, the university and by some other agencies.

The department has a well equipped library. The department subscribes to almost all the important journals in the field of Economics. During 1964-71, members of the faculty have published more than 300 papers of which about 60 were in the areas of industrial economics and public finance. Twenty-nine books were also published during this period of which seven were in industrial economics or public finance.

Six visiting scholarships are offered by the Centre to scholars from other universities. The scholars work for a period of 1-1½ months at the Centre. The library of the Centre contains an excellent collection of works in social sciences including bound volumes of periodicals, UNO and Government Reports and References works.

The Centre arranges discussions and seminars on subjects falling in the broad areas of Industrial Economics and Public Finance. The Centre held three symposia—one on “Inventory Control in August, 1964”; the second on “The Census of Indian Manufacturers and the Annual Survey of Industries” in September, 1964 and the third on “Emerging Institu-

tional Structure of the Capital Market" in October, 1964. A number of outside experts also participated in these symposia. Six all-India seminars were also held by the Centre. The subjects of these seminars were: (1) "Foreign Collaboration" (1965), (2) "Metal and Machinery Industries" (1966), (3) "Wages Policy and Wage Determination in India" (1969), (4) "Monopoly and Public Policy in India" (1970), (5) "Industry and the Fourth Plan" (1971) and (6) "Indian Economy—Performance and Prospects" (1972). Papers and proceedings of the seminars on "Foreign Collaboration" and "Wage Policy and Wage Determination in India" have already been published.

The Centre acts in close collaboration with other institutions engaged in similar work in India and abroad in various ways. It invites about 20 experts from other institutions at its all-India seminars. It also invites visiting fellows to spend 1-1½ months at the Centre and experts to deliver a series of lectures. Of the lectures delivered, two have been published. The names of these publications are—(1) "Industrial Growth since 1950—an Assessment" and (2) "Size and Capital-intensity in Indian Industry". The Centre has been collaborating with the British Council under the Programme of British Assistance. A large number of distinguished Economists from all over the world including Professor Geston Leduc (a French Economist), Professor Colin Clark (Oxford University), Sir John Hicks, Lady Hicks, Professor Wallace Smith (University of California), Professor Walter Isard (University of Pennsylvania), Dr Romesh Diwan (New York University), Professor Henry Schlos (South California University), Professor John W. Mellor (Cornell University), Mr Lewis Carter-Jones (M.P., U.K.), Professor Duncan Burn (formerly of the Manchester University and Mr. L.J. Handy (Cambridge University) visited the Centre. Some staff members visited U.K. under the Programme of British Assistance.

Centre of Advanced Study in Economics,  
University of Delhi

The Department of Economics of the Delhi School of Economics, Delhi University was recognised as a centre of advanced study in 1963 with a view to developing advanced training and research in the fields of economic history and economic development.

The department has a highly qualified staff specialised in economic theory, economic history and econometrics. The members of the staff are engaged in research both in these fields and in problems of applied economics. The department has also an Area Studies Unit for specialised study of the economic problems of neighbouring countries (Pakistan to begin with). The Area Studies Unit is staffed by a professor and a research associate/senior research fellow and a documentation officer. The Transport Economics Unit of the Department has a professor in charge and also a junior research fellow.

The staff of the department consisting of nine professors, twelve readers, six lecturers, four research associates, and research fellows/assistants have engaged themselves in research work in areas, such as, Indian economic growth, monetary policy, fiscal economics, economic history and planning etc. The research work done by the members of the department in the different fields of economics have resulted in the publication of a large number of books, special reports and research papers in well known journals both in India and abroad. The research work of the department brings into close collaboration economic historians, statisticians and theorists, and sometimes sociologists and members of sister disciplines in social science, thus promoting an inter-disciplinary effort in research work. Apart from the research projects undertaken by the staff, the department organises regularly research seminars for the staff and research scholars of the department and also special lectures and seminars by inviting specialists both from India and from abroad.

The main function of the department of economics is training of students at the post-graduate level in the techniques of theoretical analysis and applied work. Accordingly, the



three areas where emphasis is laid relate to economic theory, statistics and econometrics and economic history. The department is now well staffed in economic theory and in theoretical and applied statistics.

The department admits students for M.A. and Ph.D. courses in Economics. The M.A. course in Economics offers training in economic theory, statistical analysis, and economic history to all students and they have the option, in addition, to choose six courses out of a total of 48 courses for specialising in any field of their choice from out of a large number of options made available by the department. Students registered for the Ph.D. are guided in their work by members of the department as well as by scholars from outside the department invited by it. Nearly 90 students are currently on the rolls of the Ph.D. course. A large number of seminars are organised by the department for the benefit of those registered for the Ph.D. course. The department is considering the institution of course work at the Ph.D. level.

The department has so far organised two summer schools on mathematics for economists for a period ranging from one to two months, first in May, 1965 and again in May, 1969. The summer school was designed primarily to meet the requirements of teachers of economics in colleges and institutions attached to the University of Delhi and neighbouring universities.

The services of the members of the staff has been made available to the Government of India, from time to time, as Members of the Planning Commission, as Economic Advisors to the Government or Chairman of Special Commission on aspects of Economic Policy.

Centre of Advanced Study in Economics,  
Gokhale Institute of Politics and Economics,  
University of Poona

The Gokhale Institute of Politics and Economics, Poona, is a constituent institution of the University of Poona. Ever since its beginning in 1930, the Institute has devoted special attention to research in agricultural economics. A number of studies were also devoted to other fields such as demography, city survey, transport, wages, handicrafts and sociology. Since 1948, the Institute has developed a full fledged section in demography and population studies. Since 1954, the agro-economic research centre for Maharashtra and Mysore States has been located at the Institute by the Ministry of Food and Agriculture. Later, under a grant from the U.G.C. during the Second Five Year Plan the Institute set up four more sections to organise its work in (i) national income and development planning; (ii) applied statistics; (iii) urban economics; and (iv) rural sociology. The Ford Foundation made a four year grant in 1963 to the Institute to carry out a programme of training and research in planning and development in cooperation with the Planning Commission. The programme is now carried out under a grant from the Planning Commission. During the Third Plan period under the grant received from the U.G.C. the Section in Structure of Indian Economy was established. The U.G.C. established a Centre of Advanced Study in Economics at the Institute in January 1964.

The Institute publishes the results of its research work in a series of publications of its own. The series at present contains more than 60 titles. The Mimeograph Series contains 12 other reports containing the results of research work done by the research staff and research fellows. These have all been reviewed in important journals in the field. In addition, the Institute brings out a quarterly journal 'Artha Vijnana' which is contributed in major part by its own research staff.

The Institute has participated in major all-India surveys and studies. In 1950, the Institute actively collaborated in the planning and conduct of the National Sample Survey.

The staff of the Institute was also actively associated with the planning and execution of the All-India Rural Credit Survey of the Reserve Bank of India in 1951.

The statistical section of the Institute is fully equipped with modern tabulating equipment and is capable of tabulating large-scale statistical data. The section processed considerable quantities of the 1961 population census material. From the year 1965-66 the Institute also uses the IBM 1620 Electronic Computer located at the University of Bombay.

The Institute has approximately an area of 35,000 sq. ft. for its library, office and statistical unit. The number of volumes in the library is about 1,40,000 and the library receives currently over 900 periodicals, both Indian and foreign. The Centre received in the year 1967 from the British High Commission in India microfilming equipment as technical assistance under the Colombo Plan.

The research staff in the Institute specialises in economics, sociology, demography, statistics and mathematics. The staff of the centre consists of two professors, three readers and two lecturers. Besides, under the three senior and six junior fellowships and two Ph.D. fellowships, a number of research scholars work at the Centre. The Centre is establishing contacts to have visiting professors from India and abroad to work as visiting fellows at the Centre.

In the Centre since its establishment in January 1964 the following studies have been carried out:

- (1) Trends in land utilization since 1950-51 on a district-wise basis. The work in respect of land utilisation was completed for five States in India. The study on cropping pattern was completed in respect of Mysore State.
- (2) Problems of number in livestock in India (based on the 1961 Livestock Census).
- (3) Trends in the relative rates of agricultural wages and cereal prices in different regions of India during the pre and post-war years.
- (4) Bibliography of the land legislation in India.
- (5) A comprehensive note on problems of dry farmers and small farmers in Maharashtra State.
- (6) A report on Community Costs of Industrial Location in Bombay and Nasik prepared for the Maharashtra Industrial and Investment Corporation.
- (7) An Input-Output Model for Educational Planning.
- (8) Assam Finance, 1947-1966.

The following work is currently in progress:

- (1) Origins of Entrepreneurship in India.
- (2) Terms and Terminology in Indian Land Reforms.

- (3) Annotated Bibliography of Indian Land Reforms.
- (4) Empirics of the Model Based on Family Budget Data.
- (5) Empirics of an Alternative Model on Time Series Data.
- (6) Distributive Margins: Trade, Transport and Taxes—a Commodity-wise Study.

In the Forestry Economics Section established in the Centre in the year 1968 the work on the following topics is in progress:

- (1) Compendium of Forests in Maharashtra.
- (2) Economics of Forest Exploitation by Forest Labourers' Cooperative Societies.

In February 1965 the Centre organised a Seminar on the research work in agricultural economics then being done in the several agro-economic research centres in India with a view to finding ways and means of (i) integrating the same in a national perspective and (ii) integrating the same with similar work done at other centres of research in India. About 25 persons from various agro-economic research centres as well as from Directorate of Economics and Statistics, Ministry of Food and Agriculture, Government of India, attended the seminar which was held on February 8, 9 and 10, 1965. The seminar proved useful in bringing together research staff to evolve an integrated programme of research in agricultural economics.

Although the major attention of the Centre of Advanced Study in the initial years was confined to agricultural economics, the Centre is now expanding its scope to cover economics in general to cover major fields in economics with special concentration on the study of Indian economy.

Recently work has been started on the preparation of "A Comprehensive Annotated Bibliography on the Economic History of India (1500 A.D. to 1947 A.D.)". The Indian Council of Social Science Research, New Delhi has sanctioned a grant for a period of three years for the bibliography project.

It is proposed to start a programme of intensive teaching in Economics. The Centre for Postgraduate Teaching in Economics presently located in the University Campus is proposed to be located at the Institute beginning with June 1972.

Centre of Advanced Study in Ancient Indian History and Culture,  
University of Calcutta

The Centre of Advanced Study in Ancient Indian History and Culture, Calcutta University, was established in August, 1964. It has a staff strength of two professors, five readers, five lecturers and four research associates. A number of research scholars and fellows are also working in the Centre. The staff of the Centre participate in the postgraduate teaching in Ancient Indian History and Culture of Calcutta University.

As a part of the research programmes, the Centre undertook two schemes (i) A Geographical Dictionary of Ancient and Medieval India and (ii) A Glossary of Technical Terms in Indian Art and Aesthetics. The Geographical Dictionary is now ready for printing. The Glossary scheme is also progressing. Besides these two schemes, the research associates and fellows are given encouragement and opportunity to carry on individual studies. Most workers at the Centre have published research papers in learned periodicals while others have published some books such as Buddhism in Central Asia, Indian Mother-Goddess, Indian Puberty Rites, History of Indian Cosmogonical Ideas, Cult of Skanda-Karttikeya.

The Centre has been organising series of lectures by eminent scholars who have so far delivered 51 lectures. Inter-University seminars are also held in the Centre. The proceedings of the Inter-University seminars were edited by Prof. D.C. Sircar and published by the Centre. The names of the works, so far published are (1) Land System and Feudalism in Ancient India; (2) The Sakti Cult and Tara; (3) Bharata War and Puranic Genealogies; (4) The Bhakti Cult and Ancient Indian Geography; (5) Foreigners in Ancient India and Lakshmi and Saraswati in Art and Literature; (6) Early Indian Indigenous Coins, (7) Social Life in Ancient India, (8) Religious Life in Ancient India, and (9) Early Indian Political and Administrative Systems.

In the 57 Monthly seminars so far conducted by the Centre, 214 papers have been read

and discussed. Many of the papers have been published while discussions on all of them have been noticed in the Journal of Ancient Indian History.

A number of distinguished scholars have visited the Centre. The lectures delivered by the distinguished scholars have been published either in separate volumes or in the Journal of Ancient Indian History. Among the series of lectures published, mention may be made of the following: (i) 'Indian Feudalism, C300-1200' by Prof. R.S. Sharma, (ii) 'Pauranic and Tantric Religion' by the late Dr. J.N. Banerjea, and (iii) 'Krishna in History and Legend' by the late Dr. B.B. Majumdar. Exchange relations of the publication of the Centre have been established with (1) Harvard College Library, Cambridge, Massachusetts, U.S.A., (2) Institute Francaise, Pondicherry; (3) Department of Ancient Indian History, Baroda, (4) Kannada Research Institute, Karnatak University, Dharwar, and several other institutions.

Centre of Advanced Study in History,  
Aligarh Muslim University

The Department of History, Aligarh Muslim University is one of the most important Centres of Research in Medieval Indian History in the universities in India. The department has organised its programme of training and research on modern scientific lines giving due recognition to the need for training in allied disciplines in the field of social sciences and also humanities subjects.

*Medieval Indian History*

The major areas of active interest and research are:

- (i) Political and administrative history
- (ii) Economic history
- (iii) Cultural history
- (iv) Critical editions of historical texts and records
- (v) Historical Geography
- (vi) Hindi translations with annotations of Persian texts
- (vii) Preparations of works of reference, such as descriptive list of periodical literature, calendars of documents etc.
- (viii) Biographical studies

*Other Studies*

The department is also engaged in studies in Ancient Indian History and Archaeology; study of cultural sequence from period of Protohistory down to recent; research in Modern Indian History of an 'intensive' type (with special reference to impact of British Rule on Indian Society); instructions in European—British and American History; instruction in Islamic and West Asian History; research in history of foreign countries which were in very close

contact with India during medieval period; Historical Geography; Economic History; History of Persia and Central Asia with reference to its political, administrative, economic, social and cultural developments.

The department possesses one of the largest collections of books numbering over 20,000 journals and source material including documents in original in Persian, Rajasthani and Marathi on several important phases of the Medieval Indian History. It has back numbers of most of the journals. Rotographs of important manuscripts relating to Medieval Indian History, not available in India, have been obtained from abroad. The department has brought out large number of publications, some of which have received international recognition.



Centre of Advanced Study in Philosophy,  
Banaras Hindu University

The Department of Philosophy of Banaras Hindu University has been well-known in India and abroad. The department has attracted scholars and students from different parts of the world, e.g. United States, Japan, Thailand, Ceylon, Israel, Turkey, United Kingdom, Italy, Austria, Burma, Indonesia, South Korea etc. In recent past, the department has been conducting research work on Buddhism, Advaita Vedanta, Comparative Philosophy, Saiva Siddhanta, Kashmir Saivism, Philosophy of Language, Philosophy of Science, Aesthetics, Dialectic of Indian Religious Thought etc. The department has a well-equipped library which at present has 9,000 books and numerous journals in stock, and is growing rapidly for purposes of advanced teaching and research. In December, 1970, the Department of Indian Philosophy and Religion was merged with the Department of Philosophy, and as a result of the merger, the strength of the department has gone up and its academic staff now consists of four professors, six readers, five lecturers, two research associates, five senior research fellows and five junior research fellows, together with a large number of research scholars working in the department.

Since the establishment of the Centre in 1964, nine All-India Seminars on "The Concept of Philosophy", "Language and Reality", "Vedanta and Buddhism", "East and West in Philosophy", "Philosophical Foundations of Education," "Meaning of Freedom," "Gandhian Concept of Man and Society," "Religion and the Changing Values" and "The Role of Pre-suppositions and Assumptions in Philosophy" have been held. A joint seminar on "The Problem of Method in Philosophy, jointly sponsored by all the three Philosophy Centres, was held in Madras. Besides the All-India seminars, two symposia on "Non-Speculative Metaphysics" and "Reasoning in Indian Philosophy" have been held. Visiting Professors from the universities of Harvard (Professor Emeritus R.H.L. Slater), Texas (Prof. Charles Hartshorne), Amsterdam (Prof. Julius F. Staal), Harvard (Dr. John B. Garman) and McMaster (Prof. J.G. Arapura) gave courses of lectures on "Philosophy of Religion and Modern Comparative Studies", "Non-classical Metaphysics" and "Some problems in Com-

parative Religion” respectively. Senior members of the department conducted seminars for teachers and research scholars on such subjects as: “Religious Language” and Textual studies of Gitasukhi and Advaita Siddhi. Special seminars for postgraduate students are also held as part of the routine teaching work.

Since its establishment, the Centre has published the following books: The Philosophy of Martin Heidegger by Prof. J.L. Mehta, Readings on Yoqacara Buddhism by Dr. A.K. Chatterjee, A Source Book of Sankara by Prof. N.K. Devaraja and Problems of Philosophy and Religion by Dr. R.K. Tripathi. Since 1968 the Centre has been publishing a quarterly Bulletin, entitled Anviksiki which apart from printing the proceedings of the All-India Seminars and Symposia, also includes articles from members of the staff, visiting professors etc. The journal aims to initiate discussions and review of work done by Indian scholars—an aspect of philosophical activity, vital for the promotion of creative and constructive philosophising largely neglected so far.

The Centre intends to carry on intensive research work in philosophical texts in original in Indian and European thought, and stimulate thinking in creative and constructive philosophy. The Centre proposes to organise study and research on the following:

1. Preparation of source books pertaining to schools of Indian Philosophy and individual philosophers, e.g. Ramanuja, the Madhyamika, Saiva Siddhanta, Vaisnavism, Kashmir Saivism etc. These will contain authoritative selections with translations in English and/or Hindi, historical and expository introductions, and comments and notes.
2. Studies in the history and criticism of basic philosophical concepts in Indian Philosophy (e.g. causality, self, validity of knowledge, error, karma, grace etc.) both within the content of Indian Thought and in comparison with similar concepts in Western Philosophy.
3. Investigation of special fields hitherto neglected or little studied, e.g., Philosophy of Language, Linguistic analysis, Phenomenology, Existential Philosophy, Philosophy of Science and Philosophy of History.
4. Comparative research in logic, both classical and Navya Nyaya.
5. Research in Comparative Religion along with an intensive study of non-Indian religions, with theology and philosophy as an essential part of this discipline.

It is intended that the Centre will be a national and international forum for philosophical training and research.

## Centre of Advanced Study in Philosophy, University of Madras

The Department of Philosophy, University of Madras, was upgraded as Centre of Advanced Study in Philosophy by the University Grants Commission in August, 1964. The Centre has a sanctioned strength of one director, one professor, four readers and three lecturers, besides a number of research scholars and fellows. It has a well-equipped library. The Centre subscribes to a large number of important journals in the various branches of Philosophy.

The Centre promotes advanced studies in classical schools of Indian Philosophy, Contemporary Indian Philosophy, Contemporary Western Philosophy and Comparative Philosophy. Since the upgrading of the department into a Centre of Advanced Study in Philosophy, the activity of the department has become considerably broadened and intensified. The Centre now undertakes fundamental research in Metaphysics, Contemporary Analytic Philosophy, Philosophy of Language, Existentialism, Aesthetics, Philosophy of Religion and Social Philosophy. Some of the major areas of research are : (1) A Study of Sankara from his own works; (2) Suresvara's *Brhadaranyaka-Vartika*; (3) Study of *Tiruvacagam* and *Tiruvaimozhi*; (4) A Monograph on Manikkavacagar; (5) Studies in Vacaspati-Misra's *Bhamati* with translation and notes; (6) A Monograph on *Prakartarhavivarama*; (7) Translation into English of *Sphotosiddhi* of Mandana; (8) Suresvara's *Taittiriya-Vartika* with the text, translation and notes; (9) Sankara and the Modern Commentators on the Gita; (10) A Comparative Study of Sankara and Ramanuja on the *Catussutri*; (11) Existentialism of Sartre; (12) The *Sabda-nirnaya* of Prakasatman Yati with the commentary of Anandabodha, a critical edition; (13) The *Naishkarmya-siddhi* of Suresvara with the commentary of Akhilatman, a critical edition; (14) A Monograph on Culture; (15) A Critical Study of Jaina thought and culture; (16) Indian Aesthetics (17) Ernst Cassirer's Philosophy; (18) Philosophy of Science; (19) Secularism and Democracy in India.

The Centre offers a course of lectures on a prescribed Advaita Classic to the Inter-collegiate students. It also provides instruction in Philosophy of Science to the postgraduate

students in Social Sciences. From the beginning of the academic year 1969-70, the Centre has been conducting, on its own, a course exclusively devoted to Indian Philosophy leading to M.A. Degree. The Centre has been organising Intra-mural Seminars as well as All-India Seminars. The proceedings of the All-India Seminars appear in the *Indian Philosophical Annual* published by the Centre. So far six volumes of the *Indian Philosophical Annual* have been published.

An International Seminar on World Philosophy was organised by the Centre during December 1970 in collaboration with the other two Centres of Advanced Study in Philosophy at Varanasi and Santiniketan. Nineteen foreign scholars and an equal number from India participated in the International Seminar. From time to time, eminent scholars are invited by the Centre to deliver courses of lecture on subjects of importance. The primary aim of these lectures is to acquaint the members of the Centre with the methods of research followed by specialists especially in other countries so as to maintain the standard of research obtaining at the Centre at the International level. A large number of distinguished philosophers have visited the Centre.

The Centres of Advanced Study in Philosophy at Madras, Banaras and Visva-Bharati Universities have mutually agreed to exchange members of the staff for specific periods.

The Centre has also undertaken a study on the civilisations of the Peoples of Central Asia with UNESCO Assistance. The main field of study assigned to the Centre is 'Studies on History of Ideas and Philosophy'.

Centre of Advanced Study in Philosophy,  
Visva-Bharati

The Department of Philosophy, Visva-Bharati was recognised as a Centre of Advanced Study in Philosophy in April, 1964. It has, at present, a staff strength of three professors, four readers, six lecturers, three research associates, two senior research fellows and six junior research fellows. The staff represents diverse fields of specialization ranging from genuine Metaphysics and the old-day Logic to modern Empiricism, Linguistic Analysis and Symbolic Logic. A notable feature of the Centre is that scholars representing such diverse stand-points are in continual dialogue with one another, and this has helped creating an atmosphere of honest criticism and freedom of thought. The Centre provides teaching facilities in B.A. (Hons.) and M.A. besides research leading to Ph.D. degree. A course in Comparative Religion at Honours level was introduced in 1964. The Centre has a well organised library of its own containing about 8,000 books on Philosophy, written in English language and 102 periodicals to which it regularly subscribes. Books on religion written in English and Philosophical treatises written in Sanskrit, Pali, Prakrit, Chinese, Tibetan, Japanese and in Modern Indian Languages are also available in the Central Library of the University. The total number of books on Philosophy and Religion is about 43,000. The library of the Centre has started compilation of an exhaustive index of articles published in Philosophical journals and pamphlets.

The Centre has been specializing in Theory of knowledge and Metaphysics, Indian Philosophy, Ethics, Philosophy of Religion, Comparative Religion, Indian Philosophy, Contemporary Epistemology, Symbolic Logic etc. It has been functioning in close collaboration with the other two Centres of Advanced Study in Philosophy at Banaras and Madras. The Centre organises bi-annual All-India and regional seminars in which scholars from other universities regularly participate. Scholars from other universities and colleges come over here for regular doctoral and post-doctoral study.

One of the principal activities of the Centre is the establishment of effective communication between the scholars of this Centre and others outside. This communication has



Reading room of the Library of the Centre of Advanced Study in Philosophy, Visva-Bharati, Shantiniketan

been established through the All-India Seminars organised by this Centre and also through the work of Visiting fellows.

During 1969-71, four All-India seminars were organised by the Centre. During 1969-71, seven distinguished Philosophers visited the Centre including Professor H.D. Lewis, Kings College, London, U.K., Professor H.H. Hicks, University of Birmingham, U.K., and Professor W.H. Walsh, University of Edinburgh, U.K. The scholars of this centre have been to different universities in India and outside as visiting professors and participated in different conferences.

## Centre of Advanced Study in Sanskrit, University of Poona

Poona is well known for its long and distinguished tradition of Sanskrit learning. Work of a fairly high order is being done in the field of Sanskrit studies and research by institutions like the Bhandarkar Oriental Research Institute, the Deccan College Research Institute, and the Vaidika Samsodhana Mandala. The *Critical Edition of the Mahabharata*, which was recently completed by the Bhandarkar Oriental Research Institute, has, for instance, been hailed by competent scholars all over the world as an outstanding monument of Indian scholarship. There are projects like the *Critical Edition of the Harivamsa*, the *Srautakosa* or the *Encyclopaedia of Vedic Ritual*, and the *Dictionary of Sanskrit on Historical Principles*, work on which is proceeding steadily at these institutions. The Department of Sanskrit of the University of Poona also has, from the very beginning, assiduously occupied itself with various research projects specially in the field of Veda. The Centre of Advanced Study in Sanskrit may therefore be said to have come into being with a very propitious background.

The academic work of the Centre of Advanced Study in Sanskrit began in the first quarter of 1965, when one professor and three readers joined their duties. The present staff of the Centre consists, besides the director, of three readers and three research associates. The staff of the University Department of Sanskrit and Prakrit Languages, which consists of one professor and three lecturers (one for Sanskrit, one for Prakrit and one for Pali), also actively participate in the various academic programmes of the Centre. Provision is available at the Centre also for three senior research fellowships, six junior research fellowships and eight national scholarships.

The centre is housed in a spacious building on the Campus of the University, and has its own specialised library. Workers at the Centre also have an easy access to the excellent libraries and manuscript collections located elsewhere in Poona.

The Centre is at present concentrating on higher research in the field of Veda and



Vyakarana, but courses in other branches of Sanskrit learning, such as Vedanta, Mimamsa, and Sahitya, are also taught at the M.A. level. Fortnightly meetings are held where research papers prepared by scholars and members of the faculty of the centre are read and discussed. Talks on various subjects by eminent scholars from outside are also arranged from time to time. Besides all this, regular classes in Ancient Iranian Language and Literature are held at the Centre. Workers at the Centre are further encouraged to attend courses in one of the three modern European languages, namely, German, French and Russian, which are conducted by the university.

Besides the individual research work by scholars, work is being collectively done on various research projects undertaken by the centre. Among such projects may be mentioned: (1) Real-Lexicon of the Veda; (2) Critical editions of the Brahmanas; (3) Critical editions of Grammatical Texts; (4) Lexicon of the Sruta literature; (5) Study of Verbal forms in the Rigveda; (6) A new concordance of the Upanishads; (7) Tape-recording of the Vedic ritual; and (8) Comprehensive Vedic bibliography. These projects are at present in various stages of progress. The publications of the Centre are being issued in the following six classes:

- Class A—Reprints
- Class B—Monographs
- Class C—Critical Editions
- Class D—Exegetical and Critical Studies
- Class E—Bibliographies, Indexes, etc.,
- Class F—Translations of Research Publications in foreign languages

As many as 50 titles in different classes have been published so far.

Even from its inception, the Centre has made it a point to establish active academic contacts with research institutions in India and outside working in Sanskrit and allied fields. Some of the workers at the Centre are actually collaborating in the research projects undertaken at other centres. For instance, the Director is actively associated with the projects of the *Historia-Religionum* (Netherlands), the *Mahabharata Epilogue* (Bhandarkar Oriental Research Institute), and the *Srautakosa* (Vaidika Samsodhana Mandala); Professor S.D. Joshi with those of the *Reader in the History of Linguistic Thought* (Columbia University) and the *Work-Book in Panini* (M.I.T.), Dr. C.G. Kashikar with that of the *Srautakosa*—(Vaidika Samsodhana Mandala), and Dr. S.D. Laddu with that of the Annotated English Translation of Bhartrhari's *Mahabhasya-Dipika* (Tilak Maharashtra-Vidyapeeth). Dr. G.B. Palsule has prepared a *Comparative and Historical Grammar of Sanskrit in Sanskrit* for the Kendriya Sanskrit Vidyapeetha, Tirupati. The Director is General Secretary of the All-India Oriental Conference, Vice-President of the International Union of Orientalists, Member of the Executive Committee of International Congress of Orientalists, and Member of the Executive Board of Sahitya Akademi.

Several scholars trained at the Centre are now employed in research institutes and university departments. Similarly, as many as six students who passed their M.A. examinations in Sanskrit have, at different times, secured admission as research scholars in American Universities.

A Seminar in Prakrit Studies was organised at the Centre on June 23-27, 1969, in which 42 scholars from all over India participated. Preparations are being made for two seminars—one on a Vedic subject and another on Vyākarna to be held in the course of the next two years.

Centre of Advanced Study in Linguistics,  
University of Poona

The Centre of Advanced Study in Linguistics of the University of Poona along with the University Department of Linguistics and the Linguistics Department of the Deccan College are located at the Deccan College Postgraduate and Research Institute, which is a constituent Institute of the University. Together they form a complex of Linguistic studies of wide scope and extent. As a result of a large scale activity over a period of more than 25 years and the intense activity of the Language Project over a period of six years, the Department of Linguistics as a whole has carried on extensive work in almost all the major branches of the subject. Besides instructions in theoretical aspects of historical, comparative and descriptive linguistics, it has developed the more practical and experimental sides of the subject like applied linguistics, teaching of languages, acoustic phonetics, linguistic surveys and Sanskrit and Indo-Aryan lexicography. With financial help from the Rockefeller and Asia Foundations and the University Grants Commission, the College has built up a first rate library in Linguistics and well equipped laboratories for phonetic research and language teaching. All the four major language families of India have been taken up for descriptive and comparative studies and special provision is made for Sanskrit, Marathi and Sindhi. Besides, close-cooperation with the Departments of Sociology, Anthropology and Archaeology of the College and the University, it is associated with the American Institute of Indian Studies, the Indian Institute of German Studies, a branch of the French School of Extreme East, the Linguistic Society of India and the Summer Institute of Linguistics. It has also carried on a number of linguistic projects on behalf of the Government of India, the Hindi Directorate, the Central Institute of Indian Languages and the State Board for Literature and Culture for the Government of Maharashtra.

The staff of the Centre consists of one professor, one reader, three research associates, three senior fellows and a number of junior fellows and research scholars. A number of visiting professors from Europe and India also give short-term courses at the Centre. A few students from Asian and Western countries are also doing research work in Linguistics at the Centre.

The following are some of the major fields of specialisation of the Centre:

General Linguistics (including descriptive, historical and comparative theory); Linguistic study of Indo-European; Indo-Iranian, Indo-Aryan, Dravidian, Astro-Asiatic, Tibeto-Burman; Laboratory and practical Phonetics; Statistical Study of the Languages; Lexicography; Linguistic Geography; Practical Study of Languages; Philological study of Sanskrit, Prakrit, Marathi; Interdisciplinary study of language phenomenon.

The academic programme covers not only courses in Linguistics and language teaching but also special lectures and sessions of the Linguistic Club of Poona and the following completed and ongoing activities:

- (a) Seminars such as—English teaching and Linguistics (1964), Winter Seminar (1964), Language teaching (1966), Language Planning (1967), Prakrit Studies (1969), Transformational Grammar (1971);
- (b) Frequency counts of phonemes, syllables, grammatical elements, and words completed for Marathi, Hindi, Kannada, Gujarati, Oriya and Malayalam;
- (c) Marathi Dialect Survey (seven monographs out, others in preparation), a Linguistic Survey of India (nine monographs out, and nine press-ready, covering dialects of Mysore State);
- (d) Bibliography of Indian Linguistics; and
- (e) Contrastive studies between pairs of Modern Indian Languages and preparation of materials for teaching Hindi to Marathi, Gujarati and Manipuri speakers.

This list, of course, does not include the considerable individual research of the staff and their publications.

The Centre has been receiving assistance from the U.K. under the programme of British Assistance. A number of distinguished language specialists from U.K. have visited the Centre, and senior and junior members of the Centre have visited U.K. for linguistic studies.

## Centre of Advanced Study in Linguistics, Annamalai University

The Department of Linguistics, Annamalai University was recognised as a Centre of Advanced Study by the UGC in 1963. It has, at present, a staff strength of one professor, four readers, four research associates besides a number of research scholars and fellows.

The Centre has a collection of about 4,000 books, 35 journals and more than 1,000 off prints, 230 mimeographed works, 300 back volumes of journals etc. in its library. It has a well equipped phonetic laboratory and also language laboratory. The Centre offers a two-year M.A. degree courses in Linguistics part-time certificate and Diploma courses in Linguistics. In addition the Centre has specialised in both literary and non-literary Dravidian languages. So far the Centre has trained 50 postgraduate students and nine Ph.D's in Linguistics.

The Centre is also engaged in the preparation of language teaching materials to teach Tamil to Hindi speaking students in collaboration with the NCERT.

### Major areas of research

1. Preparation of Grammar for both literary and non-literary Dravidian languages.
2. Preparation of Comparative and Historical Grammar of Dravidian languages.
3. Preparation of detailed and exhaustive studies of syntax of various Dravidian languages which have been hitherto neglected.
4. Preparation of Transformational and Generative Grammars for all the Dravidian languages.
5. Preparation of contrastive grammars for Indian languages and English and for various Indian languages.
6. Preparation of detailed Historical Grammar of Tamil.
7. Preparation of a detailed dialect atlas for Tamil Nadu.

Centre of Advanced Study in Education,  
M.S. University of Baroda

The Department of Education in the Faculty of Education and Psychology was recognized as the Centre of Advanced Study in Education by the University Grants Commission in November, 1963.

The objectives of the Centre are :

1. To undertake and carry out intensive and extensive studies and research with a view to improving the present techniques of classroom instruction.
2. To undertake studies in educational innovations and change.
3. To undertake studies in the area of teacher education with a view to suggesting measures for improving teacher preparation at the preservice and inservice levels.
4. To disseminate findings of educational research through appropriate publications.
5. To train research workers in methods of educational research.
6. To provide services to individual research workers and institutions engaged in research and to develop cooperative research projects.

The organization of the Centre is project based. Following are the major areas for intensive studies and sustained research :

1. Teaching and Teacher Behaviour
2. Educational Technology-Programmed Instruction
3. Educational Change Process.

Research in these areas will throw light on the teaching learning process and the diffusion of new practices in school systems.

*Teaching and Teacher Behaviour*

- (i) A study of the patterns of teacher classroom behaviour in Indian schools.
- (ii) Inquiry into the variables affecting teacher behaviour.
- (iii) Teacher behaviour and pupils achievement.
- (iv) Teacher behaviour and pupils attitudes.
- (v) Modifying teacher behaviour through feedback from different sources.

Six research workers including one professor are working in this area on a full time basis. Four persons who are located in other universities are also working with the centre in this area.

In addition to the above mentioned projects, the following studies are proposed to be started and continued during the next two years.

- (i) Instructional objectives and teacher classroom behaviour.
- (ii) A study of teacher classroom behaviour in the cognitive domain.
- (iii) Improving student teaching programme through a programme of immediate feedback—an exploratory study.

*Educational Technology-Programmed Learning*

- (i) Effectiveness of four response modes in programmed learning—an exploration.
- (ii) An investigation into the relative effectiveness of different forms of programmed learning material.
- (iii) A study of pupil's achievement on programmed learning materials in relation to some personality variables.
- (iv) An investigation into the effectiveness of programmed material in English for developing reading ability.

Four researchers in the Centre and two located outside the Centre are working in this area.

The following new projects are proposed to be continued in this area during the next two years.

- (i) Developing programmed instructional materials in elementary school mathematics.
- (ii) Use of programmed materials for teacher preparation.

*Educational Change Process*

- (i) Factors affecting adaptability of schools.

- (ii) Factors affecting adoption of innovations by teachers.
- (iii) An inquiry into the educational innovations in Rajasthan.
- (iv) Characteristics of innovative schools.

Five researchers in the Centre and one outside the Centre are working in this area.

New studies to be started in the area of Educational Change Process in the course of next two to three years are :

- (i) Studies in change proneness of school personnel.
- (ii) Innovations and change in the schools of Gujarat.

Besides these three major areas, the following research projects will be taken up in the area of Organisational Climate of Schools :

- (i) Administrative Behaviour and Institutional Climate.
- (ii) Developing on Organisational Climate Index.

The Centre has a rich library having collection of the latest books in the areas in which the Centre is working. There is a good collection of old and new journals in Educational Research.

The Centre has developed a library of about 450 research studies in the area of Teaching, Programmed Learning and Educational Change Process from Educational Research Information Centre (ERIC) of U.S.A. in form of micro-cards and micro-films. The Centre has a micro-card reader and facilities for use of a micro-film reader. The Centre is also developing a library of programmes to be used with CDC 36 computer.

The Centre offers postgraduate instruction leading to Master's degree in education as well as Ph.D. in education. This is in addition to the graduate and postgraduate programmes in teacher education, viz., B.Ed., Dip.Ed., and Diploma in Early Childhood Education.

The areas of specialization offered at Masters' level are as follows :

- (i) Experimental Education
- (ii) Comparative Education
- (iii) History of Education
- (iv) Educational Administration
- (v) Curriculum and Instruction
- (vi) Teacher Education
- (vii) Guidance and Counselling
- (viii) Community School and Rural Education.



The Centre provides four national scholarships offered by the UGC to meritorious students every year to pursue their studies for the degree of M.Ed. Not less than two of these scholarships are for students from other universities.

In addition to the projects mentioned above, the following studies are either going on or have been completed in the Centre :

- (i) Internal assessment at the preparatory science level assigned by the university. The report has been submitted.
- (ii) The Centre was asked to prepare a tentative plan of the development of the university. The report has been submitted.
- (iii) The trend of research in educational psychology assigned by the Indian Council of Social Science Research. The report has been submitted.
- (iv) To evaluate the textbooks of science and mathematics of Class V assigned by the Gujarat State Board of School Textbooks.
- (v) The Centre is planning to initiate a series of studies in the area of population education.

Since 1969, the Centre has been organising seminars and workshops in the area of Teaching, Teacher Behaviour and Educational Technology-Programmed Instruction. In the course of next three years the Centre will continue to organise the seminars and workshops in these areas and will also organise two seminars in the area of educational change process.

Under the programme of assistance/collaboration from the U.K. the Centre has been exchanging professors with the universities in U.K. with the assistance of the British Council.

The Centre is having collaborative programmes in the area of teacher behaviour with a number of colleges of education in India.

The Centre provides four junior research fellowships every year for outstanding students to do their doctoral work. In addition there is a provision for two teacher fellowships every year for the teachers of Education Departments of Indian Universities.

The Centre, from time to time, publishes books, research reviews etc. in the leading educational journals of the country. During 1966-71, a large number of research papers were published by the Centre.

The Centre has been receiving assistance from U.K. under the programme of British Assistance. A few distinguished scholars from U.K. including Dr. Brimer of the School of Education, Bristol visited the Centre. Similarly, six persons from the Centre visited U.K.

Centre of Advanced Study in Sociology,  
University of Delhi

The Department of Sociology at Delhi University was recognised as a Centre of Advanced Study by the U.G.C. in July 1968. At present there are four professors, six readers, and five lecturers in the department, besides a large number of research scholars and fellows.

The department has a coordinated programme of teaching and research. The teaching and research activities cover a variety of fields including some which are being developed for the first time in the country. Political Sociology is a relatively new field of research and members of the department have made a number of contributions to it. Studies have been published or prepared on community power structure, local level politics, the political systems of trade unions and cooperatives, and student politics. In the field of religion also various types of studies are being made. These include the textual and contextual studies of Hinduism, the structural analysis of *puranas*, the study of religious symbolism, and the study of social and religious movements. In the field of stratification, in addition to studies on the various aspects of caste, investigations are being made into the agrarian class structure. Studies have also been conducted in the fields of sociology of economic development, family and kinship, historical sociology, urban sociology, and medical sociology.

The Centre has an excellent collection of books and periodicals (including back numbers) which are lodged in the Ratan Tata Library of the Delhi School of Economics which is one of the best social science libraries in the country. The library has provisions for documentation services. The Centre is making special efforts to build up a collection of books and periodicals on Pakistan and on the North-Eastern Hill Areas.

The Centre provides for training of students for four courses, B.A.(Hons.), M.A., M.Litt., and Ph.D. The Centre took over from the colleges the teaching of the B.A. (Hons.) course in 1968, mainly with a view to restructuring the entire course of studies so as to integrate it with the more advanced courses generally taught in university departments.

A completely new B.A.(Hons.) syllabus has been designed and it is being taught from July 1971 at the colleges; the department will cease to teach the B.A.(Hons.) course in 1973.

The department has taught a two-year M.A. course from the very beginning. In 1968 it embarked on a major programme to revise the syllabus so as to raise the level of teaching and to include a number of new specialisations. The new syllabus was put into effect in July 1970. There are now sixteen courses at the M.A., eight for each year and four for each semester. Some of the courses introduced for the first time are Sociology of Education, Sociology of Economic Development, Industry and Society, and Symbolism and Society.

The Centre takes in students for two research courses, the M.Litt. and the Ph. D. The M.Litt. is a two-year programme and candidates are required to write a dissertation generally on the basis of library research. The M.Litt. programme was started in 1966 and so far ten M.Litt. dissertations have been completed.

Candidates working for the Ph.D. degree are generally expected to base their dissertations on intensive field research. The topics chosen by Ph.D. students in the department reflect a very wide range of interests. Tribal, peasant and urban communities have been investigated and practically every region in the country has been covered. Since the establishment of the Centre in 1968, twelve Ph.D. degrees have been awarded.

The Centre awards National Scholarships for M.A., M.Litt., and Ph.D. courses. It also awards scholarships for post-doctoral research. One half of the scholarships are awarded to students from universities other than Delhi University.

All the members of the staff are actively engaged in research. Since July 1968 members of the staff have published over forty-eight research papers and six books. Apart from their individual research, the Centre has undertaken studies of the two General Elections held in 1967 and 1971. The two studies have been financed by the U.G.C. and the I.C.S.S.R. respectively. Most of the papers have been published and the rest are nearing completion. It is proposed to bring out a collection of the papers of the two election studies. Various members of the Centre have been actively associated with the I.C.S.S.R. in preparing surveys of research in the different fields of sociology.

The Centre organized a summer school in March 1969 which was attended by twenty younger sociologists from different academic institutions in the country. The Centre has also been responsible for organising three summer schools relating to the study of the North-Eastern Hill areas; these were attended by academicians and administrators concerned specifically with the problems of these areas.

Several members of the Centre have been associated with the activities of the Indian Sociological Society and its journal *Sociological Bulletin*. The office of the society and the

journal are located in the Centre. The Centre along with the Department of Humanities and Social Sciences, Indian Institute of Technology, Delhi organised the Ninth Conference of the Indian Sociological Society at the I.I.T., New Delhi in November 1969.

During the last four years the Centre has been visited by a large number of distinguished scholars from India and abroad who have delivered lectures and presented papers to the students and staff; some of them have also held appointments as visiting professors. The Centre has also had a number of students from universities abroad, some of whom are formally registered as "casual students."

APPENDIX—I

UNIVERSITY GRANTS COMMISSION

The University Grants Commission Act, 1956, requires the Commission to take such steps as it may think fit for the promotion and co-ordination of University education and for the determination and maintenance of standards of teaching, examination and research in the Universities. The membership of the Commission as on 1.6.1972 is given below:

- |   |                  |
|---|------------------|
| 1. Professor D.S. Kothari   | <i>Chairman</i>  |
| 2. Dr. J.N. Bhan,<br>Vice-Chancellor,<br>Jammu University.  | <i>Member</i>    |
| 3. Dr. George Jacob,<br>Vice-Chancellor,<br>Kerala University.  | ”                |
| 4. Dr. Sarup Singh,<br>Vice-Chancellor,<br>Delhi University.  | ”                |
| 5. Shri M.R. Yardi,<br>Secretary,<br>Department of Expenditure,<br>Ministry of Finance,<br>Government of India. | ”                |
| 6. Shri T.P. Singh,<br>Secretary,<br>Ministry of Education and Social Welfare,<br>Government of India.          | ”                |
| 7. Professor Tapas Majumdar,<br>Jawaharlal Nehru University,<br>New Delhi.                                      | ”                |
| 8. Smt. Indumati Chimanlal,<br>'Borsali', Khanpur,<br>Ahmedabad-1.  | ”                |
| 9. Shri R.K. Chhabra  | <i>Secretary</i> |

**COMMITTEE ON CENTRES OF ADVANCED STUDY**

- |  |                 |
|--|-----------------|
| <p>1. Professor S. Chakravarty,<br/>Member,<br/>Planning Commission, Yojana Bhavan,<br/>Parliament Street, New Delhi-1.</p>  | <i>Chairman</i> |
| <p>2. Professor R.P. Bambah,<br/>Head of the Centre of Advanced Study in Mathematics,<br/>Panjab University, Chandigarh.</p>   | <i>Member</i>   |
| <p>3. Professor E.H. Daruwalla,<br/>Head of the Centre of Advanced Study in Applied Chemistry,<br/>Department of Chemical Technology, University of Bombay,<br/>Matunga Road, Bombay-19.</p> | ”               |
| <p>4. Professor A.R. Kidwai,<br/>Member,<br/>Union Public Service Commission, Dholpur House,<br/>Shahjahan Road, New Delhi-11.</p>   | ”               |
| <p>5. Professor S. Krishnaswamy,<br/>Head of the Department of Biological Sciences,<br/>Madurai University, Madurai.</p>   | ”               |
| <p>6. Professor Tapas Majumdar,<br/>Jawaharlal Nehru University, New Delhi.</p>  | ”               |
| <p>7. Professor R.C. Paul,<br/>Head of the Department of Chemistry,<br/>Panjab University, Chandigarh.</p>   | ”               |
| <p>8. Professor A. Ramachandran,<br/>Director,<br/>Indian Institute of Technology, Madras.</p>   | ”               |
| <p>9. Professor B.R. Seshachar,<br/>President,<br/>Indian National Science Academy,<br/>Bahadur Shah Zafar Marg, New Delhi-1.</p>  | ”               |

- |  |               |
|--|---------------|
| 10. Professor A.M. Shah,<br>Head of the Centre of Advanced Study in Sociology,<br>University of Delhi, Delhi.                              | <i>Member</i> |
| 11. Professor R.S. Sharma,<br>Head of the Department of History,<br>Patna University, Patna-5.   | ..            |
| 12. Professor C.V. Subramanian,<br>Centre of Advanced Study in Botany,<br>University of Madras,<br>University Botany Laboratory, Madras-5. | ..            |
| 13. Professor M.S. Swaminathan,<br>Director General,<br>Indian Council of Agricultural Research,<br>New Delhi-1.                           | ..            |
| 14. Professor A.R. Verma,<br>Director,<br>National Physical Laboratory,<br>Hillside Road, New Delhi-12.                                    | ..            |

**CENTRES OF ADVANCED STUDY  
RECEIVING UNESCO ASSISTANCE UNDER U.N. DEVELOPMENT PROGRAMME**

**1. SCIENCE**

<i>Subject</i>	<i>Area of Specialisation</i>	<i>Department University</i>
<b>Physics</b>	1. Theoretical Physics and Astrophysics	Department of Physics & Astrophysics, Delhi University, Delhi.
<b>Chemistry</b>	2. Chemistry of Textile Fibres and Dyes	Department of Chemical Technology, Bombay University, Bombay.
	3. Chemistry of Natural Products	Department of Chemistry, Delhi University, Delhi.
<b>Botany</b>	4. Plant Morphology and Embryology	Department of Botany, Delhi University, Delhi.
	5. Plant Pathology and Mycology	Department of Botany, University of Madras, Madras.
<b>Zoology</b>	6. Cell Biology and Endocrinology	Department of Zoology, Delhi University, Delhi.
<b>Geology</b>	7. Himalayan Geology and Palaeontology	Department of Geology, Panjab University, Chandigarh.
<b>Mathematics</b>	8. Pure Mathematics	Department of Mathematics, Panjab University, Chandigarh.
	9. Pure Mathematics	Ramanujan Institute for Advanced Study in Mathematics, Madras University, Madras.
<b>Biochemistry</b>	10. Proteins, Lipids, Vitamins	Department of Biochemistry, Indian Institute of Science, Bangalore.



**CENTRES OF ADVANCED STUDY  
RECEIVING BRITISH ASSISTANCE**

<i>Subject</i>	<i>Area of Specialisation</i>	<i>Department</i>
<b>1. SCIENCE</b>		
<b>Physics</b>	1. Radiophysics & Electronics	Institute of Radiophysics & Electronics, Calcutta University, Calcutta.
	2. Crystallography & Biophysics	Department of Physics, Madras University, Madras.
<b>Chemistry</b>	3. Chemistry of Textile Fibres and Dyes	Department of Chemical Technology, Bombay University, Bombay.
<b>Botany</b>	4. Plant Morphology and Embryology	Department of Botany, Delhi University, Delhi.
	5. Plant Pathology and Mycology	Department of Botany, University of Madras, Madras.
<b>Zoology</b>	6. Cell Biology and Endocrinology	Department of Zoology, Delhi University, Delhi.
	7. Marine Biology	Department of Marine Biology, Annamalai University, Annamalaiagar.
<b>Geology</b>	8. Himalayan Geology and Palaeontology	Department of Geology, Panjab University, Chandigarh.
	9. Structural Geology, Geomorphology, Petrology and Mineralogy	Department of Geology and Applied Geology, University of Saugar, Saugar.
<b>Mathematics</b>	10. Pure Mathematics	Department of Mathematics, Bombay University, Bombay.
	11. Pure Mathematics	Department of Mathematics, Panjab University, Chandigarh.
	12. Pure Mathematics	Ramanujan Institute of Advanced Study in Mathematics, Madras University, Madras.
<b>Astronomy</b>	13. Experimental Astronomy	Department of Astronomy, Osmania University, Hyderabad.

<i>Subject</i>	<i>Area of Specialisation</i>	<i>Department</i>
<b>1. SCIENCE (Contd.)</b>		
<b>Biochemistry</b>	14. Proteins, Lipids, Vitamins	Department of Biochemistry, Indian Institute of Science, Bangalore.
<b>II. HUMANITIES AND SOCIAL SCIENCES</b>		
<b>Economics</b>	15. Public Finance and Industrial Economics	Department of Economics, Bombay University, Bombay.
	16. Economics of Development and Economic History	Department of Economics, Delhi University, Delhi.
	17. Agricultural Economics	Gokhale Institute of Politics and Economics, University of Poona, Poona.
<b>Philosophy</b>	18. Metaphysics	Department of Philosophy, Visva-Bharati, Santiniketan.
<b>Linguistics</b>	19. Applied Linguistics	Deccan College Postgraduate and Research Institute, University of Poona, Poona.
	20. Dravidian Linguistics	Department of Linguistics, Annamalai University, Annamalainager.
<b>Education</b>	21. Educational Research	Department of Education, M.S. University of Baroda, Baroda.
<b>History</b>	22. Medieval Indian History	Department of History, Aligarh Muslim University, Aligarh.

**CENTRES OF ADVANCED STUDY RECEIVING UNESCO ASSISTANCE: VISITS OF SCIENTISTS FROM  
THE U.S.S.R. DURING 1966-71**

<i>S. No.</i>	<i>Name of the Soviet Expert</i>	<i>Address</i>	<i>Field of Specialization</i>	<i>University Visited</i>	<i>Period of stay</i>
<b>1966-67</b>					
1.	Academician N.A. Krasilnikov	Director, Institute of Microbiology of USSR Academy of Science	Biology of Micro-organisms	Botany— Madras	About two months A : 18.1.66 D : 17.3.66
2.	Dr. (Miss) I.V. Aseyeva	Member of Microbiological Society of USSR Senior Research workers Deptt. of Soil Biology, Moscow State University.	Soil Micro-organisms	Botany— Madras	About two months A : 18.1.66 D : 17.3.66
3.	Prof. V.F. Androsov	Pro-Rector, Instt. of Textile & Light Industries of Leningrad, U.S.S.R.	Chemistry of Textile Fibres	Chemistry— Bombay	About two months A : 11.1.66 D : 2nd week of March
4.	Prof. A. Kitaigorodski	Head of the Crystallographical Deptt., Institute of Element Organic Compounds, USSR Academy of Sciences, Moscow.	Crystallography	Physics— Madras	About six weeks A : 14.1.1966 D : 1st week of March
5.	Prof. M.V. Gorlenko	Head of the Deptt. of Lower Plants, Moscow State University.	Plant Pathology and Mycology	Botany— Madras	About two months March-April, 1966
6.	Mrs. L.M. Levkina	Asstt. Prof., Moscow State University.	Lower Plants	Botany— Madras	—do—
7.	Prof. A.S. Gritzaenko	Manager Chair of Geophysics Prospecting methods Saratov State University USSR	Geophysical Prospecting	Geophysics— Osmania	Seven months August '66—March '67
8.	Academician J. Resnichenko	Institute of Physics of the Earth, Academy of Sciences, Moscow	Geophysics	Geophysics— Osmania	March — April 1966 (about one month)

<i>S. Name of the No. Soviet Expert</i>	<i>Address</i>	<i>Field of Specialization</i>	<i>University Visited</i>	<i>Period of stay</i>
<b>1966-67 (Contd.)</b>				
9. Academician N.K. Kochetkov	Deputy Director of the Institute of Natural Products, Moscow	Chemistry	Chemistry— Delhi	Two months in 1966
10. Academician S. Mergelian	Corresponding Member of the Academy of Sciences of the USSR and Chief of the Deptt. at the Steklov Mathematical Institute, Moscow	Applied Mathematics	Applied Maths.— Jadavpur Univ.	March — April '66 (About two months)
11. Prof. L.D. Kudryavtsev	Vice-Director of the Steklov Mathematical Institute of the Academy of Sciences of the USSR, Moscow	-do-	-do-	March — April '66 (about two months)
12. Academician O.A. Reutov	Professor of Chemistry, USSR Academy of Sciences	Chemistry	Chemistry— Delhi	Dec. '66 — Jan. '67 (five weeks)
13. Prof. N.F. Wulfson	Head of the Laboratory Institute for Chemistry of Natural Products USSR Academy of Sciences, Moscow	Physics	Physics— Delhi	Dec. '66 — Jan. '67 (eight weeks)
14. Prof. V.I. Goldauskii	Head of the Laboratory of Nuclear Radiation Chemistry in the Institute of Chemical Physics of the USSR Academy of Sciences, Moscow	Physics	-do-	December 1966 (four weeks)
15. Prof. V.S. Lensky	Professor of Chair of Elasticity Mechanics & Mathematics Department, Moscow State University, Moscow	Mathematics	Mathematics —Jadavpur	April '66 — Oct. '67
16. Prof. A.G. Torkhov	Professor of Geophysical Faculty Moscow Institute of Mineral Prospecting, Moscow	Geophysical Prospecting	Geophysics —Osmania	February — May '67 (three months)
<b>1967-68</b>				
1. Prof. V.M. Gribov	Professor of Theoretical Physics Joffe Physical Technical Institute of the U.S.S.R. Academy of Sciences Leningrad	Theoretical Physics	Delhi	July — August 1967 (one month)
2. Prof. I.I. Gurvich	Professor of the Chair, Moscow Institute of Geological Survey, USSR	Scismic prospecting	Osmania	Jan. — April 1968 (three months)
3. Prof. G.E. Krichevsky	Docent of the Chair "Chemical Technology of Fibrous Materials," Moscow Textile Institute, Moscow	Physical Chemistry of Dying	Bombay	Sept. '68 — March '69 (six months)
4. Prof. A.N. Kost	Chief of Laboratory, Department of Chemistry, Moscow State University	Organic Pharmacological Chemistry	Delhi	Sept. — Dec. '68 three months

<i>S. No.</i>	<i>Name of the Soviet Expert</i>	<i>Address</i>	<i>Field of Sepcialization</i>	<i>University Visited</i>	<i>Period of Stay</i>
<b>1968-69 (Contd.)</b>					
5.	Prof. M.I. Plusnin	The Head of the Chair of Geophysics in Moscow Geological Prospecting Institute, U.S.S.R.	Geophysical prospecting with mineral deposits	Osmania	Dec. '68 — April '69 (three months)
6.	Prof. A. Gritzaenko	Director, Scientific Research Institute of Geology, Institute of Geology, Saratov, U.S.S.R.	Geophysics	Osmania	1.1.69 — 1.6.69 (five months)
7.	Prof. I.M. Khalathinkov	Director of the Institute of Theoretical Physics, Academy of Sciences (Moscow)	Theoretical Physics	Delhi	8th Dec. '67 to 21st Jan. 1968 (six weeks)
8.	Mr. V.A. Alexeev	X-ray apparatus and units engineer, Leningrad SkBRA Experimental Mill 'Burevestnik' USSR.	Repairing & setting up of X-ray equipment	Physics	Jan. — April '67 (ten weeks)
9.	Mr. A.A. Ostasov	Engineer, Moscow Oxygen equipment Mill, Moscow	Installation of liquid H. Plant	Physics— Delhi	February — August '67 (six months)
10.	Mr. A.V. Goncharov	Technician, Moscow Oxygen equipment Mill	—do—	—do—	—do—
11.	Mr. A. Kirianov	Technician, Moscow Oxygen equipment mill	Instalation of liquid H. Plant	Physics— Delhi	February—August '67 (six months)
12.	Mr. I.M. Guelikh	Mass spectrometer engineer of the sumy factory of Electron Microscope U.S.S.R.	Installation of Mass Spectrometer	Chemistry— Delhi	March — June '67 (fourteen months)
13.	Mr. B.I. Pilipenko	—do—	—do—	—do—	—do—
14.	Mr. Y.N. Ivanov	Engineer, Liquid Nitrogen Plant, Sverdlevsk Oxygen Engineering Work No. 1, U.S.S.R.	Installation of liquid Nitrogen Plant	Physics— Delhi	Nov. '67 — Aug. '68 about nine months
<b>1969-70</b>					
1.	Prof. N.P. Dubinin (Academician)	Director of the Institute for General Genetics of the Academy of Sciences of the U.S.S.R.	Genetics	Delhi	15.2.69 — 31.3.69 (six weeks)
2.	Prof. D.M. Goldfarb	Doctor of Medical Sciences, Head of the Laboratory for Molecular Genetics, Moscow (USSR)	Genetics	Delhi	15.2.69 — 31.3.69 (six weeks)
3.	Academician N.M. Emanuel	Head of the Section of the Kinetics of Chemical and Biological Processes of the Institute of Chemical Physics of the Academy of Sciences of the USSR	Kinetics of Chemical and Biological Processes	Delhi	26.2.69 — 27.3.69 (one month)

<i>S. No.</i>	<i>Name of the Soviet Expert</i>	<i>Address</i>	<i>Field of Specialization</i>	<i>University Visited</i>	<i>Period of stay</i>
<b>1969-70 (Contd.)</b>					
4.	Dr. N.N. Bogolionbov (Jr.)	Steklev Mathematical Institute of the Academy of Sciences of the USSR, Moscow	Statistical Physics	Delhi	22.3.69 — 26.8.69 (five months)
5.	Dr. B.I. Sadovnikov	Moscow State University	—do—	Delhi	22.3.69 — 26.8.69 (five months)
6.	Prof. V.A. Postnov	Leningrad Ship Building Institute	Theory of Plates and Shells	Jadavpur	26th July '68—26th Jan. 1969 (six months)
7.	Prof. M.I. Plusnin	The Head of the Chair of Geophysics in Moscow Geological Prospecting Institute, USSR	Geophysical prospecting for mineral deposits	Osmania	22.9.69 — 16.11.69 (two months)
8.	Prof. L.D. Bergelson	Corresponding Member of the Academy of Sciences of the USSR and the Head of the Laboratory of Lipid Chemistry of the Institute for Chemistry of Natural Products, Moscow.	Chemistry of lipids	Delhi	16.10.69 — 30.12.69 (ten weeks)
9.	Prof. A.N. Kholodilin	Ship Building Institute, Leningrad	Hydrodynamics	Jadavpur	Feb. — May '70 (three months)
10.	Prof. Y.I. Voitkounski	Ship Building Institute, Leningrad	Hydrodynamics	Jadavpur	Feb. — May '70 (three months)
11.	Prof. (Mrs.) C.N. Odintsova	Director of Biological Sciences, Institute of Biochemistry of the Academy of Sciences of the USSR, Lenin Prospects, 33, Moscow USSR	Bitominology	Madras	6.12.69 — April '70 (four months)
12.	Prof. V.D. Kuznetsov	Head of the Laboratory of Cultures of the Central Research Institute of Antibiotics, Moscow (USSR)	Microbiology	Madras	Feb. — April 1970 (three months)
13.	Prof. M.S. Khaikin	Institute of Physical Problems, USSR Academy of Sciences Moscow, USSR	Physics	Delhi	9.2.70 — 20.4.70 (ten weeks)
14.	Prof. I.K. Gavich	Head of the Dynamic underground water division of the Hydrogeological Faculty & Professor of Moscow Geological Prospecting Institute, Moscow	Geophysics	Osmania	23.9.70 to 22.12.70 (three months)
15.	Prof. L.A. Yonovskoya	Professor N.D. Zelinsky Institute of Organic Chemistry, Academy of Sciences of USSR, Moscow	Organic Chemistry	Osmania	10.10.70 — 9.2.71 (About four months)
16.	Mr. A.I. Goncharov	Technician, Moscow Oxygen Plant	Installation of liquid H. Plant	Physics Delhi	Jan. — April '69 (four months)

<i>S. No.</i>	<i>Name of the Soviet Expert</i>	<i>Address</i>	<i>Field of Specialization</i>	<i>University Visited</i>	<i>Period of Stay</i>
<b>1969-70 (Contd.)</b>					
17.	Dr. A.V. Kirianov	-do-	-do-	-do-	Jan. — April '69 (four months)
18.	Mr. M.E. Komolov	Mechanic Electron Microscopes, Kresnogorsk Mechanical Works, USSR	Installation of Electron Microscope	Chemical Technology, Bombay	Dec. '69 — March '70 (about three months)
19.	Mr. N.E. Smirnov	Engineer, Electron Microscopes, Kresnogorsk Mechanical Works, USSR	-do-	-do-	Dec. '69 — March '70 About three months
<b>1971</b>					
1.	Prof. I.I. Gurvich	Professor of the Chair, Moscow Institute of Geological Survey, USSR	Seismic prospecting	Osmania	From 19.1.71 to 1.4.71
2.	Academician N.N. Bogolubov	Institute of Physical Problems, Moscow	Theoretical Physics	Delhi	Arrived on 4.1.71 for one month
3.	Prof. L.V. Mikitin	Institute of Physics	Applied Math.	Jadavpur	Jan. — April '71 (three months)
4.	Prof. A.F. Bochkov	Institute of Organic Chemistry Moscow	Organic Chemistry	Delhi	From 17.1.71 to 18.5.71. (four months)
5.	Prof. M.S. Yakovlev	Head of the Deptt. of Morphology and Laboratory of Embryology Komarov Botanical Institute of the the USSR Academy of Sciences, Leningrad (USSR)	Embryology	Delhi	Arrived on 17.3.71 Dep: 15 June, 1971 (two months)
6.	Prof. M.S. Khaikin	Head of the Laboratory of Experimental Investigations of Electrons in Metals, Institute of Physical Problems, Academy of Sciences of the USSR	Low Temperature Physics	Delhi	Arr: 6.11.71 (For three months)
7.	Prof. A.L. Takhtajan	Komavov Botanical Institute, Leningrad	Botany	Delhi	Dec. '71 — Jan. '72 (two months)

**UNESCO/UNDP TECHNICAL ASSISTANCE PROGRAMME FOR CENTRES OF  
ADVANCED STUDY PROJECT IN INDIAN UNIVERSITIES:  
VISITS OF INDIAN SCIENTISTS ABROAD**

<i>Year</i>	<i>Name of fellow</i>	<i>University</i>	<i>Field of study</i>	<i>Country visited</i>	<i>Period of training</i>
1	2	3	4	5	6
1966-67	1. Dr. R.N. Kapil	Delhi	Botany	U.S.S.R.	3 months
	2. R. Narayanan Swami	Madras	Botany	U.S.S.R.	6 months
	3. Dr. W.B. Achwal	Bombay	Chemistry	U.S.S.R.	12 months
	4. Shri B.T. Lokhande	Bombay	Chemistry	U.S.S.R.	18 months
	5. Dr. A.C. Jain	Delhi	Chemistry	U.S.S.R.	6 months
	6. Dr. N. Krishnamurti	Delhi	Chemistry	U.S.S.R.	6 months
	7. Dr. S. Neelakantan	Delhi	Chemistry	U.S.S.R.	6 months
	8. Dr. Khaleel Ahmed	Osmania	Chemistry	U.S.S.R.	12 months
	9. Shri K.K. Reddy	Osmania	Chemistry	U.S.S.R.	12 months
	10. Shri S. Murali	Osmania	Geology	U.S.S.R.	12 months
1967-68	1. Shri V. Krishnan	Bombay	Chemistry	U.K.	9 months
	2. Dr. S.S. Chhibber	Delhi	Chemistry	U.S.S.R.	6 months
	3. Shri V.V.S. Murti	Delhi	Chemistry	U.S.S.R.	6 months
	4. Shri T.R. Rajagopalan	Delhi	Chemistry	U.S.S.R.	6 months
	5. Shri K.N. Rao Kallury	Osmania	Chemistry	AUSTRALIA	12 months
	6. Dr. G.S. Narayana	Osmania	Geology	DENMARK	12 months
	7. Shri S.N.V. Rao	Osmania	Geology	U.S.S.R.	18 months
	8. Mrs. Bandana Goswami	Jadavpur	Applied Mathematics	NORWAY	10 months
1968-69	1. Dr. N.N. Bhandari	Delhi	Botany	U.S.S.R.	10 months
	2. Dr. K.M.M. Dakshini	Delhi	Botany	U.S.S.R.	9 months
	3. Dr. C.B. Sehgal	Delhi	Botany	U.S.S.R.	6 months
	4. Dr. N.R. Bannerjee	Delhi	Chemistry	U.S.S.R.	2 months
	5. Dr. J.K. Grover	Delhi	Chemistry	U.S.S.R.	6 months
	6. Prof. V.R. Srinivasan	Osmania	Organic Chemistry	U.S.S.R.	3 months
	7. Prof. S.R. Sivaraja Iyer	Bombay	Physical Chemistry	U.S.S.R.	3 months
	8. Mr. H.J. Ephraim	Madras	Electron Microscope	U.S.S.R.	6 months
	9. Mr. S.B. Chandolia	Bombay	Chemical Engineering	U.S.S.R.	1 month
	10. Prof. V.L.S. Bhimashankaram	Osmania	Geophysics	U.S.S.R.	1 month
	11. Dr. S. Bannerjee	Jadavpur	Applied Mathematics	U.S.S.R. & FRANCE	16 months
	12. Dr. N. Rajagopala Iyer	Madras	Microbiology	U.S.S.R.	9 months
	13. Prof. N.R. Padhye	Bombay	Spectroscopy & Optics	U.S.S.R.	3 months
	14. Prof. R.N. Bhattacharya	Jadavpur	Ship Wave and Wave resistance	U.S.S.R.	3 months
	15. Prof. S.V. Suthankar	Bombay	Dye Stuff Technology	U.S.S.R.	2 months
	16. Prof. A.V. Patwardhan	Bombay	Chemical Technology	U.S.S.R.	2 months



## APPENDIX—VI (Contd.)

1	2	3	4	5	6
1970-71	1. Dr. V. Arjuna Rao	Madras	Botany	U.S.S.R.	8 months
	2. Dr. N.S. Rangaswamy	Delhi	Botany	U.S.A.	9 months
	3. Prof. B.Y. Mohan Ram	Delhi	Botany (Plant growth & development)	FRANCE	6 months
	4. Dr. N.R. Vijayaraghavan	Delhi	Plant Ecology	U.S.A.	9 months
	5. Dr. Raj Rup	Delhi	Physics	U.S.S.R.	10 months
	6. Dr. P.N. Dheer	Delhi	Physics	U.S.S.R.	2 months
	7. Dr. N.V. Bhat	Bombay	Chemical Technology	U.S.S.R.	12 months
1971-72	1. Dr. P.S. Ganapathy	Delhi	Botany	U.S.A.	9 months
	2. Mr. V.V. Naval	Bombay	Instrumentation	U.K.	6 months
	3. Dr. P.N. Raju	Madras	Microbiology	U.S.A.	9 months
	4. Dr. K.M. Rao	Madras	Microbiology	U.S.A.	9 months
	5. Dr. D.K. Chaudhuri	Delhi	Physics	U.S.S.R.	2 months
	6. Dr. P. Niyogi	Jadavpur	Transonic Gas Dynamics	F.D.R. (Germany)	2 months

## BRITISH CAS VISITORS TO INDIA

*1964-65*

Dr. L.H.N. Cooper  
Marine Biological Centre  
Plymouth

CAS in Marine Biology  
Annamalai University

Mr. M. Kidren  
Department of Economics  
Hill University

CAS in Public Finance & Industrial  
Economics,  
University of Bombay

Prof. J.E.C. Raymout  
Department of Oceanography  
Southampton University

CAS in Marine Biology  
Annamalai University

*1965-66*

Mr. J.O. Jones  
Editor of "World Agricultural Economic &  
Rural Sociology Abstracts"  
Oxford

CAS in Agricultural Economics  
Poona University

Dr. J.O.F. Fugh  
Mycologist & Senior Lecturer  
Department of Botany  
University of Nottingham

CAS in Botany  
University of Madras

Dr. F. Dixey  
Formerly Director  
Colonial Geological Survey

CAS in Geology, Saugar University &  
CAS in Geology, Panjab University

Professor S. Ullmann  
Professor of Philology  
Leads University

CAS in Linguistics  
University of Poona

Professor K.A. Birsch  
Head of Deptt. of Mathematics  
Queen Mary College  
London

CAS in Mathematics  
University of Bombay

Mr. A.D. McIntyre  
Department of Agriculture & Fisheries  
Scotland

CAS in Marine Biology  
Annamalai University

Dr. B.C. Stubbings  
Admiralty Materials Laboratory  
Dorset

CAS in Marine Biology  
Annamalai University

Prof. S. Korner  
Professor of Philosophy  
Bristol University

CAS in Metaphysics  
Visva-Bharati

Dr. W.R. Piggott  
Senior Principal Scientific Officer  
Radio & Space Research Station  
Slough

CAS in Radiophysics &  
Electronics  
University of Calcutta

1966-67

Dr. T.W. Rackham  
Project Officer  
Department of Physics  
Manchester University

CAS in Astronomy  
Osmania University

Mr. Peter Mathias  
Lecturer in Economic History  
University of Cambridge

CAS, Delhi School of Economics

Prof. H.A. Babakkuk  
Professor  
University of Oxford

CAS, Delhi School of Economics

Mr. M.A. Brimer  
Head of Education Research Unit  
Bristol University

CAS in Education  
M.S. University of Baroda

Mr. H. Gross  
Lecturer in Education & Modern Language  
Department of Education  
Bristol University

CAS in Education  
M.S. University, Baroda

Mr. M. Skilbeck  
Lecturer in Education  
University of Bristol

CAS in Education  
M.S. University of Baroda

Dr. E.J. Phillips  
Lecturer in Geology  
University College of Wales  
Aberystwyth

CAS in Geology  
Punjab University

Mrs. E.N. Whitley  
Senior Lecturer in Phonetics  
SCAS  
London.

CAS in Linguistics  
University of Poona

Professor D. Rees  
Professor of Pure Mathematics  
University of Exeter

CAS in Mathematics  
University of Bombay

Dr. D.T. Could  
Lecturer in Zoology  
University of Aberdeen

CAS in Marine Biology  
Annamalai University

Mr. K.R. Dyer  
Marine Geologist  
Department of Oceanography  
Southampton University

CAS in Marine Biology  
Annamalai University

Prof. J.E.G. Raymont  
Deputy Vice-Chancellor and Professor of  
Oceanography, Southampton University

CAS in Marine Biology  
Annamalai University

## 1967-68

Prof. L.E. Roker  
 Professor of Psychology  
 Department of Botany  
 University of Bristol

CAS in Botany  
 University of Madras

Prof. M.N. Postan  
 Professor of Economic History  
 Massachusetts Institute of Technology  
 Cambridge

CAS in Economic History  
 University of Delhi

Mr. A. Grayson  
 Forest Economist  
 Forestry Commission

CAS in Agricultural Economics  
 University of Poona

Dr. J.B. Burton  
 Lecturer  
 Department of Oceanography  
 University of Southampton

CAS in Marine Biology  
 Annamalai University

Mr. P.O.V. Savage  
 Assistant Lecturer  
 Department of Oceanography  
 University of Southampton

CAS in Marine Biology  
 Annamalai University

Professor R. Wollheim  
 Professor in Philosophy  
 University College of  
 London

CAS in Philosophy  
 Visva-Bharati

## 1968-69

Prof. Z. Kopal  
 Professor of Astronomy  
 University of Manchester

CAS in Astronomy  
 Osmania University

Dr. F.E. Round  
 Reader in Botany  
 University of Bristol

CAS in Botany  
 University of Madras

Prof. A.R. Jahn  
 Department of History  
 School of Political Science and Economics  
 University of London

CAS in Economics  
 Delhi University

Dr. O.P.L. Malkar  
 Reader in Geology  
 Imperial College of Science and Technology  
 London

CAS in Geology  
 Saugar University

Prof. J.G. Ramsay  
 Department of Geology  
 Imperial College of Science and Technology  
 London

CAS in Geology  
 Panjab University

Mr. J.A. Aitken  
 Chief Editor  
 "Old Scottish Tongue on Historical Principles"  
 Edinburgh

CAS in Linguistics  
 University of Poona

Prof. W. Hess  
 Professor of General Linguistics  
 University of Manchester

CAS in Linguistics  
 Poona and Annamalai  
 Universities

Dr. J. Austin  
Research Fellow  
University of Southampton

CAS in Marine Biology  
Annamalai University

Prof. R.A. Rankin  
Professor of Mathematics  
University of Glasgow

CAS in Mathematics  
University of Madras

Dr. J.W.R. Griffiths  
Professor and Head of the  
Department of Electrical Engineering  
University of Technology  
Loughborough

CAS in Radiophysics  
University of Calcutta

Prof. C.H. Maddington  
Department of Genetics  
University of Edinburgh

CAS in Zoology  
University of Delhi

*1969-70*

Sir John Macks Drummond  
Professor of Political Economy  
University of Oxford

CAS in Economics, Delhi,  
Aligarh, Bombay and  
Osmania Universities and  
A. N. Institute, Patna

Lady Ursula Ricks  
Lecturer in Public Finance  
University of Oxford

CAS in Economics, Delhi,  
Aligarh, Bombay and  
Osmania Universities and  
A. N. Institute, Patna

Mr. A.D. Greenwood  
Senior Lecturer  
Imperial College of Science  
London

CAS in Botany  
University of Madras

Dr. K.W. Jones  
Institute of Animal Genetics  
University of Edinburgh

CAS in Zoology  
University of Delhi

Professor Z. Kopal  
Head of Department of Astronomy  
University of Manchester

CAS in Astronomy  
Osmania University

Dr. J. Maaburn  
Lecturer in Astronomy  
University of Manchester

CAS in Astronomy  
Osmania University

Mr. I.G. MacDonald  
Mathematical Institute  
University of Oxford

CAS in Botany  
University of Madras

Mr. M.P. Medelieg  
Reader in Botany  
University of Bristol

CAS in Botany  
University of Madras

Mr. P.H. Matthews  
Reader in Linguistics  
University of Reading

CAS in Linguistics, Poona &  
Annamalai Universities and  
Central Institute of English

*1970-71*

Dr. Iver Isaac  
Department of Botany  
University College of Swansea

CAS in Botany  
University of Madras

Dr. R. M. Jackson Department of Biological Sciences University of Surrey	CAS in Botany University of Madras
Prof. W.G. Keyworth National Vegetable Research Station Warwick	CAS in Botany University of Madras
Dr. G.F. Pegg Department of Biological Sciences University of London	CAS in Botany University of Madras
Prof. T.W. Goodwin Department of Biochemistry Liverpool University	CAS in Biochemistry Indian Institute of Science
Prof. Duncan Dura Emeritus Professor Department of Economics University of Manchester	CAS in Economics University of Bombay
Dr. J. N. Moode Fellow Christ's College University of Cambridge	CAS in Economics University of Delhi
Dr. N.J. Flouty Lecturer School of Geology Kingston Polytechnic Surrey	CAS in Geology University of Saugar
Dr. D. Powell Assistant Lecturer in Geology Bedford College London	CAS in Geology University of Chandigarh
Prof. R. W. Southern President St. John's College Oxford	CAS in History Aligarh Muslim University
Dr. J.N. Anderson Department of Mathematics University College London	CAS in Mathematics University of Madras
Prof. R.L.E. Schwarzen-berger Professor of Mathematics University of Warwick	CAS in Mathematics University of Madras
Dr. B.J. Birch Reader Department of Mathematics University of Oxford	CAS in Pure Mathematics Universities of Bombay, Madras and Chandigarh
Prof. J.R. Hick Department of Theology University of Birmingham	CAS in Philosophy Visva-Bharati
Prof. W. H. Walsh Professor of Philosophy University of Edinburgh	CAS in Philosophy Visva-Bharati

Mrs. E. Uldall  
Department of Linguistics  
University of Edinburgh

CAS in Applied Linguistics  
University of Annamalai

Dr. D.N. Blow  
Medical Research Council  
Molecular Biology Research Unit  
Cambridge

CAS in Physics  
University of Madras

Prof. D. Regers  
Professor of Chemical  
Crystallography  
Imperial College of Science  
London

CAS in Physics  
University of Madras

Prof. I.D. Rattee  
Prof. Colour Chemistry  
University of Leeds

CAS in Chemical Technology  
University of Bombay

Dr. A.V. Crimstone  
Assistant Director of Research  
Department of Zoology  
University of Cambridge

CAS in Zoology  
University of Delhi

*1971-72*

Prof. R. Brown  
University of Edinburgh

CAS in Botany  
University of Madras

Dr. D.N. Butcher  
Department of Botany  
University of Cambridge

Visitor to CAS Departments of Botany  
Also attended International  
Symposium on Morphogenesis  
in Plant Cell Tissue and Organ  
Culture

Dr. G.G. Henshaw  
Department of Botany  
University College of Swansea

Dr. G. Tait  
Department of Chemical Pathology  
St. Mary's Hospital Medical School  
Norfolk Place  
London

CAS in Biochemistry  
Indian Institute of Science

Dr. C.B. Cowey  
Fisheries Biochemical  
Research Unit  
University of Aberdeen

CAS in Marine Biology  
Annamalai University

Prof. M.M. Woofson  
Department of Physics  
University of York Shire

CAS in Biophysics  
University of Madras

Prof. Heredith  
Department of Fihre Science  
Royal College  
University of Strathelyde  
Glasgow

CAS in Applied Chemistry  
University of Bombay

Dr. Charles Feinstein  
Fellow  
Clare College  
Cambridge

CAS in Economics  
University of Delhi

Mr. L.J. Handy  
 Research Officer  
 Department of Applied Economics  
 University of Cambridge

John Parham Esq.  
 Division of Advanced Studies  
 School of Education  
 University of Bristol

Prof. E.K. Malton  
 Head of Geology Department  
 University of St. Andrew

Dr. J.R. G. Savage  
 Department of Geology  
 Queens Building  
 British University

Mr. M. Barrett Brown  
 Department of Extramural Studies  
 University of Sheffield

Mr. J. Carnochan  
 Reader in Phonetics  
 London University

Mr. M.A. French  
 Lecturer in General Linguistics  
 Department of General Linguistics  
 University of Manchester

Dr. K.D. Elworthy  
 Mathematics Institute  
 University of Warwick

Prof. D. Rees  
 Department of Mathematics  
 University of Exeter

Dr. J. Jacob  
 Lecturer  
 Institute of Animal Genetics  
 University of Edinburgh

Dr. P.J. Pighton  
 Lecturer  
 Department of Molecular Biology  
 University of Edinburgh

CAS in in Public Finance and  
 Industrial Economics  
 University of Bombay

CAS in Education  
 M.S. University of Baroda

GAS in Geology  
 Saugar University

CAS in Geology  
 Punjab University

CAS in History  
 Aligarh Muslim University

CAS in Linguistics  
 University of Poona and Annamalai

CAS in Linguistics  
 Annamalai University

CAS in Mathematics  
 University of Madras

CAS in Mathematics  
 University of Madras

CAS in Zoology  
 University of Delhi

CAS in Zoology  
 University of Delhi



## INDIAN CAS VISITORS TO THE UK

*1964-65*

Dr. A.S. Patel,  
Coordinator,  
CAS in Education,  
M.S. University of Baroda

Department of Education,  
University of Bristol

*1965-66*

Professor J.N. Bhar,  
Ghose Professor of Physics,  
Director, Institute of  
Radiophysics and Electronics,  
Dean of Faculty of Technology, and  
University of Calcutta

Department of Electronics &  
Electrical Engineering,  
Birmingham University, and  
Radio Research Station,  
Slouth

Mr. TVVCRK Murty,  
Assistant Professor,  
Department of Geology,  
University of Saugar

Department of Geology,  
University of Cambridge

Dr. D.N.S. Bhat,  
Reader in Tibeto-Burman Linguistics,  
Deccan College of Postgraduate & Research  
Institute, Poona

Department of Linguistics  
Universities of Edinburgh, Leeds etc.

Dr. R.B. Kulkarni,  
Reader in General Linguistics,  
CAS in Linguistics,  
University of Poona

SOAS London,  
Universities of  
Oxford, Cambridge etc.

Dr. M.S. Basu,  
Lecturer,  
Institute of Radiophysics & Electronics,  
University of Calcutta

Department of Radiophysics,  
University of Birmingham

*1966-67*

Mr. N. Jamshedji,  
Astronomical Computer  
Nizamiah Observatory,  
Hyderabad

Department of Astronomy  
University of Manchester

Mr. R. Swaminathan,  
Research Fellow,  
Nizamiah Observatory,  
Hyderabad

Department of Astronomy,  
University of Manchester

Dr. G.B. Shah,  
Senior Research Fellow,  
CAS in Education,  
M.S. University of Baroda

Mr. A.M. Francis  
Technician-cum-Lab. Assistant  
Marine Biological Station,  
Porto Novo

Mr. D. Kumar,  
Lecturer in Philosophy,  
Visva-Bharati,  
Santiniketan

Dr. B.R. Nag,  
Reader,  
Institute of Radiophysics & Electronics,  
University of Calcutta

Department of Education,  
Universities of Bristol,  
Birmingham, Slough & London.

Marine Biological Laboratory,  
Plymouth

Department of Philosophy,  
University of Bristol

Department of Radiophysics of  
University College,  
London

1967-68

Dr. C.R. Rao,  
Junior Research Fellow,  
Osmania University

Dr. K.S. Sastry,  
Junior Lecturer,  
CAS in Astronomy  
Osmania University

Professor A.S. Patel,  
Professor,  
CAS in Education,  
University of Baroda

Professor M.S. Patel,  
Director,  
CAS in Education,  
Baroda University

Dr. B.P. Lulla,  
Reader in Curriculum  
CAS in Education,  
Baroda University

Dr. V.J. Gupta,  
Research Associate,  
CAS in Geology,  
Panjab University,  
Chandigarh

Mr. S.P. Jain,  
Department of Geology,  
Panjab University,  
Chandigarh

Dr. I.C. Pande,  
Director, CAS in Geology,  
Panjab University,  
Chandigarh

Young Astronomers School,  
University of Manchester

Young Astronomers School,  
University of Manchester

Department of Education, Bristol University  
and to see audiovisual equipment  
used in education in various places

Department of Education, Bristol University  
and visits to centres of teacher education and  
educational research

Department of Education,  
University of Bristol

Departments of Geology of  
University College of Wales,  
Imperial College,  
British Museum and  
Aberystwyth

Departments of Geology of  
Aberystwyth University and  
Imperial College

Geology Departments of Imperial College,  
and Universities of London, Aberystwyth,  
Reading and Edinburgh

Dr. N. Sen,  
Reader in Sanskrit,  
Linguistics,  
University of Poona

Mr. V.K. Venugopalan,  
Reader of  
CAS in Marine Biology,  
Porto Novo

SOAS and visits to  
Lexicographical Centres

Department of Marine Biology,  
University of Southampton

1968-1969

Professor T.S. Sadasivan,  
Professor of Botany & Director,  
CAS in Botany,  
University of Madras

Mr. B.M. Srinivasan,  
Technician,  
CAS in Botany,  
University of Madras

Professor C.V. Subramanian,  
Professor of Botany,  
CAS in Botany,  
University of Madras

Mr. D.R. Darji,  
Senior Research Fellow  
in Curriculum Development Unit,  
CAS in Education,  
M.S. University of Baroda

Professor I.M. Desai,  
Director, Rural Centre of Education  
Research & training and Head, Department of  
Educational Administration,  
M.S. University of Baroda

Dr. B. Das,  
Reader,  
CAS in Geology,  
University of Saugar

Dr. B.V. Mehta,  
Reader in CAS in Industrial Economics,  
University of Bombay

Mr. S.N. Salgarkar,  
Reader,  
Electronics & Phonetics,  
CAS in Linguistics,  
Deccan College,

Mr. K. Murugaiyan,  
Research Associate,  
CAS in Linguistics,  
Annamalai University

Dr. R.P. Pandey,  
Research Associate (Lecturer)  
CAS in Philosophy, Visva-Bharati

Department of Botany, Bristol, Bothamsted  
experimental station, British Council, ODM, and  
Nuffield Science Projects—attended 1st Inter-  
national Phytopathological  
Congress in London

Department of Botany,  
University of Bristol

Department of Botany,  
University of Bristol  
Commonwealth Mycological Institute,  
Kew and several other universities

Institute of Education,  
University of Bristol

School of Education,  
University of Bristol

Department of Geology,  
Imperial College of Science &  
Technology, London

Institute of Advanced Legal  
Studies, Department of Economics,  
University of Oxford.

Linguistics Departments at  
University of Edinburgh and SOAS,  
London

Department of Linguistics,  
University of Edinburgh

Department of Philosophy,  
University of Edinburgh

Dr. S.K. Sen,  
Lecturer,  
CAS in Philosophy, Visva-Bharati

Mr. N. Purinit,  
Research Associate,  
CAS Institute of Radiophysics & Electronics,  
Calcutta

Professor G.N. Ramachandran,  
Director,  
CAS in Biophysics,  
University of Madras

Department of Philosophy,  
University of Bristol

Physics Course at  
University College of Wales,  
Aberystwyth

Visits to research centres in Physics at London,  
Oxford and Cambridge—renewed professional  
contacts—attended a symposium in Cambridge

1969-70

Dr. B.R. Seshachar,  
Director,  
CAS in Cell Biology,  
University of Delhi

Dr. R. Narayanaswamy,  
Lecturer in Botany,  
CAS in Botany,  
University of Madras

Dr. D. Kumar,  
Reader in Economic History,  
Delhi School of Economics

Dr. A.L. Nagar,  
Professor of Econometrics,  
Delhi School of Economics

Professor A.K. Choudhury,  
CAS in Radiophysics & Electronics,  
Calcutta University

Dr. K.V. Rao,  
Lecturer,  
Department of Zoology,  
University of Delhi

Dr. M.N. Sexena,  
Reader  
Department of Geology,  
Punjab University

Professor B.S. Tewari,  
Department of Geology,  
Punjab University

Dr. M.A. Ali,  
Reader,  
Department of History,  
Aligarh Muslim University

Professor T.V. Desikachary  
CAS in Botany,  
University of Madras

Universities of  
Edinburgh, Leicester and Cambridge

University of Bristol

London School of Economics

London School of Economics

Department of Electronics Engineering  
University of Technology,  
Loughborough

Institute of Animal Genetics,  
Edinburgh

Department of Geodesy and  
Geophysics, University of Cambridge

Imperial College,  
London

School of Oriental and African  
Studies, British Museum and  
India Office Library

Bristol University,  
Marine Biological Station, Plymouth and  
Freshwater Research Station,  
Ambleside

Mr. K.K. Bagchi,  
Lecturer,  
CAS in Philosophy, Visva-Bharati

Universities of  
Oxford, Sterling and Edinburgh

Mr. N. Jainullabdeen,  
Laboratory Technician,  
CAS in Physics,  
University of Madras

Pye Unicam, Cambridge,  
Evans Electrosalem Braintree  
Bellingham Stenley London, Etc.

Dr. S. Parthasarath,  
Lecturer,  
CAS in Physics,  
University of Madras

University of Cambridge

Mr. K.K. Gowda,  
Reader, CAS in Linguistics,  
Annamalai University

University of Manchester

*1970-71*

Dr. L.K. Deshpande,  
Reader in Industrial Economics,  
CAS in Economics, University of Bombay

Queen Elizabeth House, Oxford

Dr. S.R.V. Rao,  
Reader  
CAS in Zoology,  
University of Delhi

Institute of Animal Genetics,  
University of Edinburgh

Dr. A.D. Khariwal,  
Professor of Geology,  
CAS in Geology,  
Punjab University

Universities of St. Andrews and  
Reading and Imperial College, London

Dr. S.K. Mishra,  
Research Associate,  
CAS in Geology,  
University of Saugar

Department of Geology,  
University of St. Andrews

Mr. I.A. Khan,  
Reader,  
CAS in History,  
Aligarh Muslim University

School of Oriental and African  
Studies

Mr. A.M. Kureishy,  
Reader,  
CAS in History,  
Aligarh Muslim University

St. John's College, Oxford,  
British Museum and  
India Office Library

Dr. G.S. Varma,  
Research Associate,  
CAS in Linguistics,  
Annamalai University

Department of Linguistics,  
University of North Wales

Dr. K.S. Padmanabhan,  
Reader,  
CAS in Mathematics,  
University of Madras

School of Mathematics,  
Imperial College,  
London

Dr. G. Rangan,  
Lecturer,  
CAS in Mathematics,  
University of Madras

Mathematical Institute  
University of Oxford

Dr. Paul Pandian,  
Research Associate,  
CAS in Marine Biology,  
Porto Novo

Department of Oceanography,  
University of Southampton

Professor M.K. Das Gupta,  
CAS in Radiophysics,  
University of Calcutta

University of Canterbury

Dr. P.K. Sen Gupta,  
Reader,  
CAS in Philosophy,  
Visva-Bharati

University of Oxford

Dr. S. Ganguly,  
Reader, CAS in Philosophy,  
Visva-Bharati

Departments of Philosophy,  
Universities of Bristol and Oxford

Mr. A.K. Mukhopadhyay,  
Lecturer,  
CAS in Radiophysics,  
University of Calcutta

University of Technology,  
Loughborough

*1971-72*

Professor T. Ramasarma,  
CAS in Biochemistry,  
Indian Institute of Science

University of Liverpool

Dr. D.R. Ramamurthy,  
Technical Assistant,  
Department of Biochemistry,  
Indian Institute of Science

University of Liverpool

Dr. S.S. Bhojwani,  
Research Associate,  
CAS in Botany, University of Delhi.

John Innes Institute, Norwich

Dr. Manohar Lal,  
Reader,  
CAS in Botany,  
University of Delhi.

University College, London

Dr. C.V. Subramanian,  
Professor of Botany,  
CAS in Botany,  
University of Madras

University of Exeter and short visits to  
other Universities

Prof. T.S. Sadasivan,  
Director, CAS in Botany,  
University of Madras

Attended Commonwealth Mycological  
Congress, Exeter and visited  
University Departments

Dr. D. Subramanian,  
Reader  
CAS in Botany  
Madras University

Universities of Bristol and Dundee

Dr. S.L. Tandon,  
CAS in Botany,  
University of Delhi

Plant Breeding Institute

Dr. (Mrs.) Dharma Kumar,  
Reader in Economics,  
Delhi School of Economics,

Universities of Oxford,  
Cambridge and London, and  
India Office Library

- Dr. A.K. Sengupta,  
Reader in Economics,  
Delhi School of Economics,
- Queen Elizabeth House and  
Institute of Economics and Statistics,  
Oxford
- Professor S.N. Hasan,  
Director (Now Minister of Education)  
CAS in History,  
Aligarh Muslim University
- University of Oxford
- Dr. Z.U. Malik,  
Reader,  
Department of History,  
Aligarh Muslim University
- SOAS
- Dr. S.B. Bhatia,  
Reader in Geology,  
Panjab University.
- British Museum (Natural History)  
London
- Dr. P.S. Subrahmanyam,  
Reader in Linguistics,  
Annamalai University
- Department of Phonetics and  
Linguistics, SOAS
- Dr. V.C. Dumir,  
Reader in Mathematics,  
CAS in Mathematics,  
University of Panjab,  
Chandigarh
- Universities of Cambridge and Glasgow
- Professor T.S. Bhanu Murthy,  
Director,  
CAS in Mathematics,  
University of Madras
- Universities of Oxford, Cambridge and Warwick
- Dr. V.C. Nanda,  
Reader  
CAS in Mathematics,  
University of Panjab
- Universities of Cambridge and Glasgow
- Dr. T.V. Panchapagesan,  
Lecturer,  
Ramanujan Institute of Advanced  
Study in Mathematics,  
Madras
- Universities of Newcastle and Cambridge
- Dr. K. Ramamoorthi,  
Reader,  
CAS in Marine Biology,  
Annamalai University.
- Plymouth Laboratory,  
University of Southampton
- Dr. P.K. Roy,  
Lecturer in Philosophy,  
Visva-Bharati
- University of Reading
- Professor M.R. Padhye  
Professor of Applied Physics  
CAS in Applied Chemistry,  
University of Bombay
- University of Leeds
- Mr. A. Subramanian,  
Jr. Research Officer in Marine Biology,  
Annamalai University
- University of Lancaster