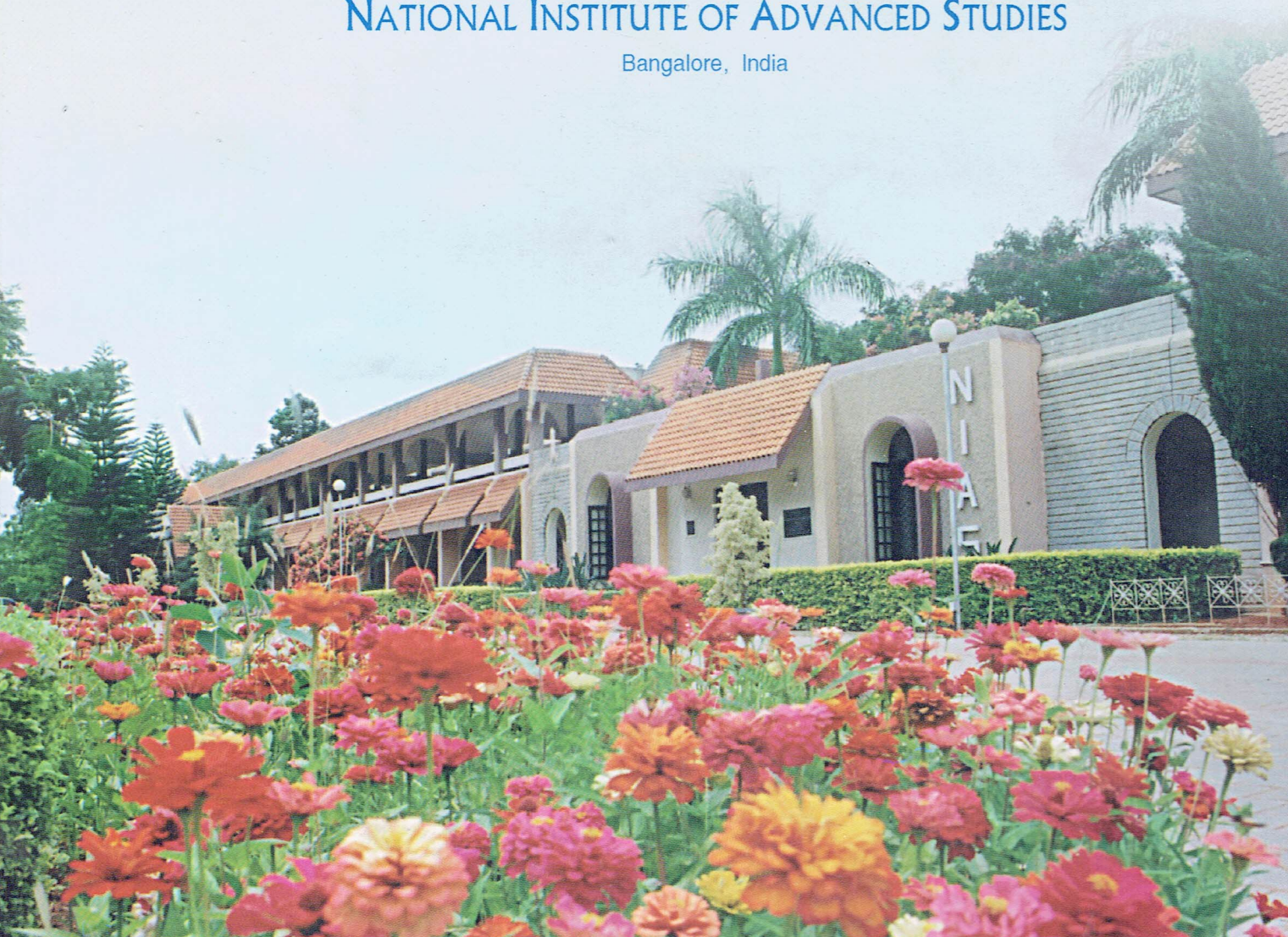
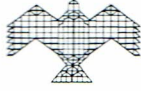


(Annual Report)
2004-2005

NATIONAL INSTITUTE OF ADVANCED STUDIES

Bangalore, India





The NIAS emblem can be traced back to a remarkable Sanskrit work called the Śulva-sūtras, which, while being one of the four Kalpa-sūtra texts concerned chiefly with vedic ritual, displays a deep knowledge of geometry from pre-Euclidean times. Śulva (or śulba) stands for rope, string or cord, and is derived from the root śulv, meaning “to measure”; the Śulva-sūtras are therefore literally “The Rules of the Cord”. (To this day a cord is part of the basic equipment carried by an Indian mason, to be used in surveying or in laying out a structure in any construction activity.) The text is in fact a handbook of ritual geometry, and describes a series of geometric ‘constructions’ or procedures (using only strings and pegs) for the lay-out of sacrificial altars and fires of various shapes and dimensions, usually specified with extraordinary precision.

There are four extant versions of the Śulva-sūtras, but the one attributed to Baudhāyana is considered to be the oldest as well as the most systematic and detailed. Scholars are not agreed on the precise date of the Sūtras, but the text clearly pre-dates Pāṇini and must have been composed before the 6th century B.C. The procedures described in the text, however, must have been known very much before its composition, as the text itself acknowledges.

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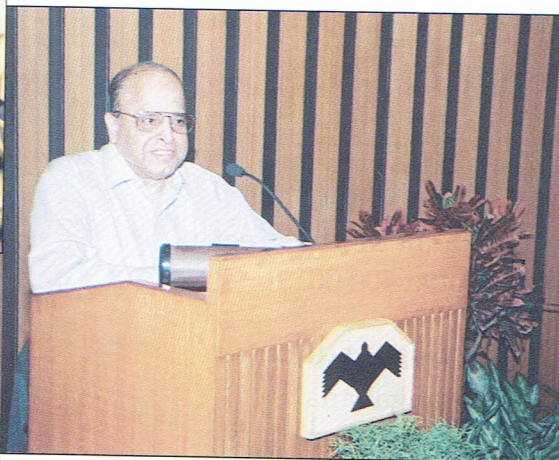
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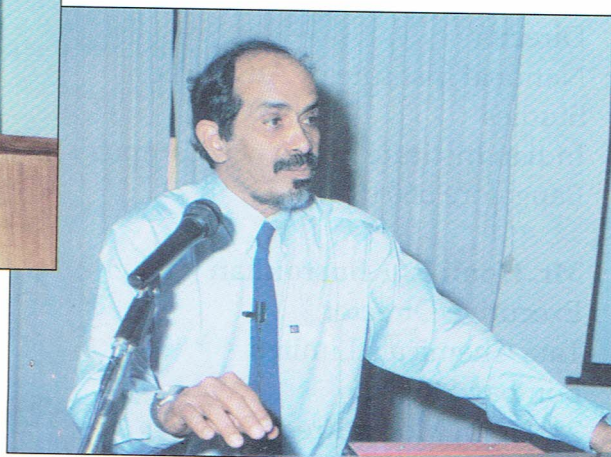
Prof. M. S. Swaminathan (*Chairman*)



Dr. K. Kasturirangan (*Director*)



Late Dr. Raja Ramanna (*Founder Director*)



Prof. R. Narasimha (*Former Director*)

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Director's Report

(April 2004 March 2005)

I. Introduction

I am pleased to present this brief report of NIAS's activities for the year 2004-2005. The last one-year of my association with NIAS has been both eventful and satisfying. The new demands that the Institute placed on all of us in this period of one year were not only challenging, but also called for bringing to bear the best in each one of us. These encompassed, among other things, getting support for new projects and programmes, initiating a programme of doctoral studies, restructuring the academic system of the Institute, taking the first step for building the much needed faculty block and improving the finances as well. These developments, owe much to the extraordinary role that the faculty and other members of staff of NIAS played, bringing in the best of their creative thinking and professionalism. I am sure these steps will set the direction and pace of the Institute in the coming years.

II. Follow-up to the NIAS Review

Among the recommendations made by the Committee to Review the functioning of NIAS were the following:

- i) It is necessary to define useful but not burdensome structures for the intellectual organization of the faculty;
- ii) The existing doctoral programme should be expanded;
- iii) The Institute suffers from acute space shortage, and the proposed new Faculty Block is essential; and
- iv) A second major campaign to attract additional funds from outside sources is now necessary.

During the past year, the Institute has taken significant strides on all these fronts. We take up each in turn.

2.1 Restructuring of NIAS

In order to have more coherent structure, NIAS faculty, after four faculty meetings and several drafts of the proposal, decided on 22 September 2004 to replace the existing units by three Schools. There would be a School each for Humanities, Social Sciences and for Natural and Engineering Sciences. Each School would be headed by a Dean, appointed by the Director for a specified fixed duration. There would also be a Dean for Administration

in place of the Controller. The plan that the faculty adopted also envisages that much of the research of the Institute would be organized in Institute-wide Research Programmes (IRP). In order to be accepted as an IRP, the faculty, after a presentation by the proposing faculty member, would vote by consensus for adoption. The Schools have also begun discussions on the criteria for faculty retention and promotion and on the modalities to be followed.

2.2 The Doctoral Programme

The induction of new students for carrying out research leading to a Ph.D. degree through a formal mechanism has had an encouraging beginning. The first batch of eight students, coming from varied backgrounds such as science, mathematics, engineering, sociology and humanities, and selected after a rigorous process, have been made to go through a preparatory programme involving a comprehensive foundation course, encompassing topics that range from metaphysics, mathematical modelling, gender studies, Indian philosophy to various aspects of research methodologies. In the coming weeks, the follow-up to this foundation course would include courses specially focused on research methodologies, statistical analysis and field-based studies. I am keenly interested to see this initiative to be a harbinger of a new generation of interdisciplinary scholars capable of bringing laurels to themselves and to the Institute.

I am also grateful to Dr. P. S. Goel, Director of the ISRO Satellite Centre, Bangalore for donating six personal computers and two workstations for use by NIAS doctoral students.

2.3 The Faculty Block

I am happy to announce that the Sir Dorabji Tata Trust, through a generous grant of Rs. 3 crores has enabled the Institute to under take the construction of the faculty block. This is a part of the Trust's plans to support worthwhile initiatives all across the country to commemorate the birth centenary of Bharat Ratna, the late J. R. D. Tata and the death centenary of the late J. N. Tata. The work on the building has already begun and is expected to be ready for occupation by the middle of next year. The entire NIAS community expresses its deepest sense of gratitude to the Sir Dorabji Tata Trust, especially to its distinguished Chairman, Mr. Ratan N. Tata for this gesture. We also would like to record our sincere thanks to Dr. J. J. Irani and Prof. M. S. Swaminthan for their personal interest to support the cause of NIAS. NIAS will raise the rest of the required resources for completing the Faculty Block from other sources.

2.4. Finances

We started the year by aligning the dearness allowance being given to NIAS faculty and staff with rates prevailing in other central government institutions. We have been also exploring with different agencies, the possibility of raising suitable grants to strengthen the finances of the Institute. I am glad to inform everyone that we have succeeded in getting Rs. 10 crores, as a one-time grant from the Department of Science and Technology to support the various activities of the Institute. Here, I should particularly express our grateful thanks to the Secretary of the Department of Science and Technology, Prof. V. S. Ramamurthy for his unstinted support in ensuring the availability of this grant. Further, his two colleagues, Dr. V. Rao Aiyagari and Dr. B. Hari Gopal were exceptional in their efforts to follow up the

processing of this grant over several months and we express our deep appreciation for their commitment. Officials and the leadership of both the Finance Ministry and the Planning Commission were equally supportive; I would like to particularly acknowledge the interest and support of the Union Finance Minister. The availability of this grant should go a long way in strengthening the ambience at NIAS for research, getting eminent academicians for short periods, organising specialised seminars and workshops, and many similar endeavours.

III. Highlights of Research

3.1 School of Natural and Engineering Sciences

On the research front, the Institute Faculty made notable contributions. One prominent such example is the work of Dr. Anindya Sinha and his team. They have successfully identified a primate, hitherto unknown to science, the Arunachal Macaque *Macaca munzala* in northeastern India. A long-term field study of this newly discovered macaque in the western districts of Tawang and West Kameng in the state of Arunachal Pradesh is now underway. Prof. Vaidya used topological methods to achieve a large reduction in noise in speech samples. Two students of this School were awarded doctoral degrees during the year.

3.2 School of Humanities

Dr. Sundar Sarukkai has finished writing a book titled *Philosophy of Science: Some Perspectives from Indian Philosophical Traditions*. This book, which has been reviewed and accepted for publication, explores the possibility of drawing upon Indian philosophical traditions, particularly its rationalistic ones, to understand the nature and foundations of science. Dr. Sarukkai has also completed writing a book titled *The Human Touch: A Philosophical Walk with JRD Tata*. Dr. Sharada Srinivasan of this School has received a grant under the DST Young Scientist Nurture Scheme on Ancient Harappan Metallurgy to work on the recently excavated site in Dholavira, Gujarat. Dr. Sangeetha Menon has received a grant from the University of Paris and Elon University to conduct research on Consciousness and Agency.

Prof. Settar is finalising an annotated Dictionary of Early Kannada Language, the first of its kind attempted in any Indian vernacular language. It covers the developments that took place in this second most ancient of the Dravidian languages during the 4th to the 9th century AD., the period of *Hale Kannada* or ancient Kannada. To prepare this work, Prof. Settar has relied on numerous inscriptions and the first literary work called the *Kavirajamarga*, composed during the 9th century in the *Rashtrakuta* court.

3.3 School of Social Sciences

At the request of the Indian Space Research Organization, the School of Social Sciences is assessing the pilot programme of interactive television broadcasts via Edusat to 100 engineering colleges in Karnataka of the Vishveshwara Technical University, Belgaum. Three aspects were evaluated-technical, academic and institutional. This is the first time NIAS has been involved with the evaluation of tertiary education programmes in the

country. Prof. Dilip Ahuja is the Principal Investigator for this project. The project on improving the quality of elementary education in Chamrajnagar district, led by Dr. A. R. Vasavi, entered its third year. Programmes on Language Development and on training mid-level education administrators are fully in place.

3.4 International Strategic and Security Studies Programme

The preceding year (2004-2005) was a period of transition and change for the International Strategic and Security Studies Programme at NIAS. Based on the outcomes of an on-going review exercise, the programme will now lay greater emphasis on strategic and security issues facing the Indian region. As a first step towards the realization of this larger vision, NIAS is trying to build up expertise on two of its most important neighbours – Pakistan and China. The group has just completed a detailed study of Pakistan's missile programme. To strengthen NIAS expertise on China, an expert on China will soon be joining the NIAS faculty.

The realization of the larger vision of building up “Indian region expertise” requires further augmentation of the human resources available to the programme to look at SAARC, ASEAN and our other neighbours. NIAS has already initiated steps for raising the required resources and hopefully during the forthcoming year we will be able to move forward. While the programme will continue to address traditional dimensions of security – nuclear weapons, WMDs, missiles, conventional weapons, the weaponisation of space, maritime security, terrorism, etc., – there will also be an attempt to extend the scope of NIAS studies and projects to look at economic, social and ethnic dimensions of security.

NIAS played a major role in the improvement of Indo-US relations in the aftermath of the Pokhran tests as a track 2-dialogue partner with the Committee on International Security and Arms Control (CISAC) of the National Academy of Science (NAS) of the USA. NIAS would continue to play its part in this initiative in consultation with the various parties involved.

IV. Courses Conducted

NIAS conducted 8 courses during the year, seven of them were held at NIAS. These are briefly described below and listed in reverse chronological order.

The **8th NIAS Course for University and College Teachers** was held between February 10 and March 2, 2005 and was jointly sponsored by the University Grants Commission, New Delhi, the Indian Space Research Organisation, Bangalore and the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore. The theme of the course was “*Research and Development in India: Current Frontiers*”. The course had 26 participants from different parts of the country covering different disciplines. Like all NIAS Courses, it provided a unique opportunity for the teachers to interact with distinguished speakers from different fields. Such a course could considerably help to enhance the ability of the participants to adopt inter-disciplinary approaches to conceptualise and solve complex problems facing the country. The course, which was very well received by the participants, was coordinated by Dr. B. K. Anitha and Dr. Anindya Sinha.

The **19th NIAS Course for Senior Executives**, entitled "Excellence in Leadership" was held during 23-29 January 2005. Twenty-four participants drawn from both private and public sector organisations attended the course, inaugurated by Dr Anji Reddy, Chairman of the Dr. Reddy's Labs. We had several eminent speakers addressing the participants, including Capt. G. R. Gopinath of Air Deccan, Dr. V. Sumantran of Tata Motors Ltd., Dr. Claude Nicollier, Dr. Bob Hoekstra of Philips Innovation Centre, Dr. Narendra Pani of Economic Times, Dr. Meenakshisundaram of NIAS, and many others. Coordinated by Dr. Sangeetha Menon, the response to the course, which also included formal discussions, interactive sessions and semi-formal sessions, was beyond expectations.

The **First DST Course on Multi-disciplinary Perspectives on Science and Technology** was held at NIAS and at Orange County between the 15th and 27th of November 2004. The course was designed for a select group of 18 senior scientist-administrators from various scientific organizations in the country. Its purpose, like that of the ISRO Course below, was to offer views of the broader scientific, economic, social and cultural milieu in which the scientific enterprise operates in the country. Prof. Dilip Ahuja coordinated the course. The Department of Science and Technology has requested NIAS to conduct two such courses this year.

The **Fifth Annual ISRO Course** was held at the Institute between 5-11 September 2004. It was attended by 38 senior scientists and engineers from ISRO, who were identified by ISRO as potentially constituting its future leadership. The theme for this year's course was *Indian Space Enterprise: Technology for National Development*. As in preceding three years, Prof. Dilip Ahuja coordinated this course.

The **Fifth NIAS Course for Senior IAS Officers** was held during 5-9 July 2004 with the theme of *Disaster Management*. The course, coordinated by Prof. S. Rajagopal, was designed to inform the participants about preparedness, mitigation and handling of disasters through specific case studies. Topics included psychosocial aspects, the use of the Indian Space Programme, drought management, and the management of the aftermath of earthquakes.

The **Third NIAS Course on Understanding Science: Introduction to the History and Philosophy of Science** was held during 14-25 June 2004. It was co-sponsored by the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore. This course is aimed at introducing undergraduate students of Bangalore to the broader perspectives needed to understand nature and the growth of scientific knowledge. Dr. Sundar Sarukkai coordinated this course.

The **Second Course on System Operational Effectiveness: Systems Engineering and Profitability** was held between 19-24 April 2004. The course was coordinated by Prof. S. Rajagopal in association with the Defence Research and Development Organization (DRDO). The faculty was drawn from IIM, Kolkata and a company from the U.S. Two further courses on systems engineering for entry-level scientists of DRDO were organized at the Institute of Armament Technology, Pune.

V. Seminars and Lecture Series

Among the various meetings held during the year was a meeting held on 24-25 June 2004 to discuss the feasibility of a postgraduate programme in (elementary) education and the development of its curriculum. On 27 July 2004, a meeting was held to discuss Hydrogen-based fuel cell power generation systems in association with the New Energy Technology Centre of NTPC. Finally, a meeting was held on 3 December 2004 to discuss the need to evolve comprehensive employment policy for the Information Technology and the Information Technology Enabled Sector in India.

The Senior Associates met eight times during the year. Prof. J. P. S. Uberoi from the University of Delhi delivered the Fifth M N Srinivas Memorial Lecture on the *Technology of Obsolescence* on 16 November 2004. There were six sessions of the Seminar on the *History of Ideas*, six public lectures and four special lectures. The Literary Forum met four times and the Consciousness Discussion Forum met twice. The Wednesday morning Discussion meetings had 26 talks by NIAS Faculty and 7 by guest lecturers. We also had a Vocal recital by Kaivalya Gurav and a Sitar recital by Shafique Khan and Rafique Khan.

5.1 The JRD Tata Memorial Lecture Series

The Institute began a series of lectures to commemorate the birth centenary of our founder, Mr. J. R. D. Tata. These events are expected to run to the end of 2005. Prof. M. G. K. Menon initiated the series by giving a very widely attended talk on *JRD Tata's Legacy to Science and Higher Education* on August 24, 2004. On September 30, 2004 Profs. Anuradha Mathur and Dilip da Cunha spoke on *Deccan Traverses*, on the transition of Bangalore from naked Country to a garden city. On November 26, 2004, a book titled "*India's Legendary Wootz Steel*" by Dr. Sharada Srinivasan and Prof. S. Ranganathan was released by Mr. B. Muthuraman, the Managing Director of Tata Steel. The book is aimed at inciting interest among young students for scientific studies of materials. This programme was organised jointly between the Indian Institute of Science (IISc) and NIAS. Prof. H. P. Khincha of IISc paid tributes to J. N. Tata, the founder of IISc, and whose death centenary is also being observed this year. NIAS paid its tribute to Mr. J. R. D. Tata.

VI. Visiting Professors and Visitors to NIAS

Dr. Timothy Poston joined the Institute as the Sir Ashutosh Mukherjee Visiting Professor starting on August 15, 2004. Prof. Poston's area of expertise is Mathematical Modelling. Prof. S. Chandrashekar from IIM Bangalore will be a Visiting Professor organizing the new International and Security Studies Programme at NIAS. Prof. S. Ranganathan, until recently a Professor in the Department of Metallurgy at the Indian Institute of Science, will work on the health effects of nano-particles, and Dr. S. S. Meenakshisundaram, IAS, and until recently with the Department of Space, Government of India, will focus on issues of Rural Development.

During the last six months, we had several distinguished visitors visiting NIAS for discussions and lectures. Among them, we had astronaut, Dr. Claude Nicollier, talking on

the future of human space flights on January 27, 2005. On February 7, 2005, Sir David King, the Chief Scientific Adviser to the UK Government, spoke on climate change. He characterized it as one of the greatest problems facing the government today (a greater threat than terrorism) and linked the drought in India in 2003 to the combined impacts of climate change and El Niño. He called for increased capacity building in science and international collaboration in tackling this problem. We also had teams led by US Senator Jeff Bingaman and Chancellor Carol Tomlinson-Keasey of the University of California at Merced visiting us during this period. Both teams had very useful exchanges with NIAS faculty.

The International Strategic and Security Studies Programme also organized a number of workshops and seminars with fellow researchers across the globe. These included visits from Dr. Bhupendra Jasani of Kings College London, a team from the China Institute of International Studies, Beijing, a delegation from the Asian Development Society and a team from the Sandia National Laboratories, USA.

VII. Concluding Remarks

Although this past year, as I mentioned in my introductory remarks, has been satisfying, I am sure that the coming years are expected to be even more eventful for NIAS. We have already inducted doctoral students into the Institute to keep research current and to increase the research productivity. Creating more visiting positions at all levels, and achieving critical mass in the three Schools must await finishing of the Faculty Block. Early discussions have begun within the Institute on creating a few flourishing Institute-wide Research Programmes of world quality. I look forward to working with the NIAS Community in translating our shared vision of the NIAS of tomorrow to reality.

A Plan for Organization of

NIAS Activities

As Adopted on 22 September 2004

1. Preamble

The Report of the Committee to Review the Last Decade of NIAS Activities (2003; henceforth referred to as the Review Committee Report) states that 'the absence of a plan for development entails that today NIAS consists of a number of semi-autonomous "units", sometimes of only one person. It has no real internal structure apart from the individuality of its faculty and research groups. It is important that NIAS remain a place where creative individuals can work, sometimes alone. But the growing faculty also requires increasing thought about internal structure, mechanisms of coordination, and plans for future development.' The Report recommended:

An important task is therefore to define useful, yet not burdensome, structures for the intellectual organization of the faculty. A conscious effort should be made to coordinate and focus the currently diverse intellectual activities of the faculty. The impact of NIAS and the possibilities of creative scholarly interaction amongst its faculty would be increased by some combination of existing units and by the joint development of a set of intellectual priorities, which would guide the future development of the Institute.

Finally, the Review Committee Report reminds NIAS faculty of the need for selectivity, and to recognize the impossibility of doing everything well.

2. Proposed Organizational Structure

As a response, a structure for the internal organization of NIAS activities is proposed. NIAS Faculty currently enjoy considerable autonomy in the pursuit of their interests. The functioning of the Institute has thus far admirably avoided bureaucratic and hierarchical procedures. The proposed organizational structure aims to retain these strengths while addressing the concerns identified in the Review Committee Report.

Briefly, three Schools are proposed: Natural and Engineering Sciences, Social Sciences and Humanities. These Schools will have the flexibility to have finer *disciplinary* disaggregation, if the faculty belonging to that School so choose. The Heads of Schools will be called Deans. Operationally, some of the research of the Institute will be organized in Research Programmes. The Institute Research Programmes will be co-ordinated by rotating Convenors. Programmes will have the flexibility to have sub-programmes within them.

The working level of the Institute Research Programmes will be that of Research Projects¹, each headed by one/or more Principal Investigator/s. As is currently the case, individual faculty members can continue to undertake exploratory and open-ended research outside of Institute Research Programmes and Research Projects.

The Institute will first aim at having a critical mass of faculty in each of the Schools and then in each of the Programmes. Even then, the Institute will remain relatively small. Thus, networking both within and outside the Institute will continue to remain important. Our Schools, Programmes, Projects and Courses should all endeavour to impart a unique NIAS multi-disciplinary imprint to their activities. NIAS will be judged largely by the *results* from the research it undertakes, and the *impacts* from Courses it conducts. As a learning institution, NIAS therefore must constantly assess its performance and review its achievements.

2.1 Main Functions of NIAS

The two main functions of NIAS, as originally enunciated in its Memorandum of Association and reiterated in its Mission Statement, are to conduct multi-disciplinary research and to impart higher knowledge. Besides exploratory and open-ended research, the research of the Institute will be conducted through Research Programmes and Research Projects, and the knowledge imparted through publications, Courses and teaching.

2.2 Proposed Basic Structure of NIAS

1. NIAS shall be administratively divided into three Schools called the School of Humanities, the School of Social Sciences and the School of Natural and Engineering Sciences.
2. While all NIAS Faculty members are encouraged to participate in the activities of more than one School, each faculty member would affiliate to a School, based on his or her current core interests and track record.
3. A Dean, appointed for a fixed duration by the Director, from amongst the full-time faculty with affiliation to that School, will be the head of each School. The Dean will also be responsible for the doctoral and post-doctoral programmes of his or her Schools.
4. A Committee of Senior Faculty (CSF) members, including the Deans, will assist the Director on all major issues of policy, promotions and appointments². The composition of this Committee will be reviewed at least once every two years.

¹ The term Research Project is used here to describe *any* research undertaking requiring concentrated effort. A research project can be circumscribed by further references to its size, to the source of funding, to its anticipated duration, or to the type of its output.

² One of the first tasks for this Committee will be related to the definition of what constitutes a member of the Faculty, distinguishing between core, associated, project, adjunct, visiting, honorary and emeritus faculty; and the designation of Programme Conveners, and Course Coordinators, etc.

3. Conducting Research

3.1 Institute Research Programmes

1. The Institute will provide incentives for joint faculty research efforts and encourage multi-disciplinary Research Programmes. In order to be designated as an Institute Research Programme, the following criteria should be satisfied:
 - a) It involves a substantive collaboration of at least 2 faculty members;
 - b) The proposed Programme straddles at least two disciplines; and,
 - c) A proposed Programme must be presented to the Faculty, accepted by faculty consensus and recommended to the Director for designation as an Institute programme.
2. Programmes will have rotating Conveners, appointed by the Director for specified durations.
3. When Programmes encompass several areas of inquiry or get too large, a sub-programme may be created under that programme umbrella. Sub-programmes will also be co-ordinated by the Programme Conveners. In exceptional cases, the Director may appoint a separate Co-ordinator for a sub-programme.

3.2 Research Projects

1. A Principal Investigator, or co-principal investigators, shall head each research project. Whenever a project proposal exists, it will identify the principal investigator or co-principal investigators.
2. Principal Investigators will continue to have the same degree of autonomy as currently in place.
3. While many future research projects will fit under the umbrella of an Institute Research Programme, some research projects will be outside the ambit of Programmes.

3.3 Exploratory and Open-ended Research

1. Individual Faculty members can continue to undertake exploratory and open-ended research outside of Institute Research Programmes or Projects as this may lead to the development of future Programmes and Projects. As this research is also likely to be high-risk and high pay-off, its undertaking calls for some judiciousness.

4. Disseminating Knowledge

4.1 Courses

1. Besides research, the other activity of NIAS is to impart knowledge through its Courses. Courses can be proposed by any faculty member or a sponsoring organization and conducted by the Institute. Institute Courses will draw upon all three Schools.
2. Consistent with its mission, NIAS Courses will emphasize the development of leadership qualities through the integration of multi-disciplinary knowledge.
3. Each Course shall have a Course Coordinator, who will be appointed by the Director preferably at least 3 months prior to the Course.

4. The Institute will set up an administrative mechanism (such as a Cell) to ensure the smooth operational running of all its Courses.
5. It is desirable for all Faculty members to share responsibilities for Co-ordination and the smooth functioning of Courses.

4.2 Teaching Programs

1. NIAS Faculty are also engaged in teaching activities through its doctoral programme, and other tertiary-level courses and programmes for the general public. In all instances, the rationale for such activities is that they improve research quality and productivity.
2. Any faculty member may propose a teaching programme in an area that is likely to promote his or her research output. The proposing faculty would be responsible for coordinating all activities related to the Programme.

5. NIAS as a Learning Institution

5.1 Improving Quality and Productivity

1. To improve its performance, NIAS is committed to continuously and objectively review all its activities taking into account both feedback from outside and recent developments elsewhere. It proposes to put in place mechanisms for review both at the start of an activity and at its end.
2. For all new major activities, whether internally or externally funded research, courses or teaching programmes, the Faculty will recommend approval by consensus to the Director after hearing a presentation from a colleague, similar to the mechanism for the approval of Institute Research Programmes (mentioned in Section 3.1.1 (c)). If such a presentation is not possible prior to the submission to an external agency, this should be made any time prior to start of the undertaking. The faculty would provide suggestions regarding, as appropriate, hypothesis formulation, research design and methodologies. In cases where faculty colleagues lack expertise to provide useful advice, the Director will seek competent external advice.
3. NIAS will continuously assess all major activities through peer-review by NIAS faculty and competent experts from outside. The funding or sponsoring organizations will conduct their evaluations and some assessment is inherent in peer-reviewed publications that result. For Courses and teaching programmes, an additional necessary evaluation will be the assessment provided by Course participants and students. The ultimate worth of NIAS Courses and teaching programmes will be indicated by improved on-the-job performance by NIAS alumni.
4. The times for assessment will vary: Projects and Courses can be assessed on a rolling basis or at least more frequently than once in every 5 years; Programmes (and sub-programmes) will have to be reviewed at greater intervals, perhaps once in ~5-10 years; Schools perhaps once in 10-15 years, and the Institute direction should be assessed perhaps every 20 years.

5.2 Assessment of Faculty Performance and Feedback

1. Each School will establish criteria and modalities within the School for periodic assessment of faculty performance at different levels.
2. A representative Committee headed by the Director shall ensure that the above criteria and modalities are by and large similar across Schools.
3. The Schools will also establish a formal system of feedback on performance and informal systems of mentorship to guide faculty members on career development.

Schools and Programmes

School of Humanities

Members of the School

Prof. B. V. Sreekantan, *Visiting Professor and Dean*
Dr. Sundar Sarukkai, *Fellow*
Dr. Sangeetha Menon, *Fellow*
Dr. M. G. Narasimhan, *Fellow*
Prof. S. Ranganathan, *Visiting Professor*
Dr. Sharada Srinivasan, *Visiting Associate Fellow*

Introduction

School of Humanities grew out of the "Culture, Cognition and Consciousness Unit". The areas of research and interest of the members of the School of Humanities are the following:

- (i) Philosophy of Science
- (ii) Scientific and philosophical studies on consciousness
- (iii) Indian philosophical traditions
- (iv) History and philosophy of biology
- (v) Biolinguistics
- (vi) Scientific studies in culture, heritage, archeomaterial and archeometallurgy

Research Carried Out

Relevance and Meaning of Parallelism in Modern Science

Prof. B. V. Sreekantan has been pursuing his efforts to understand the relevance and meaning of the parallelism in the conclusions of modern science, in particular of modern physics, on the existence of an all pervading universal substratum, the quantum mechanical vacuum (four-dimensional or multi-dimensional substratum with well defined specific physical properties) which is behind all creation and activity in the universe and the very similar insights from ancient philosophies (both Eastern and Western). It is becoming increasingly clear that this "oneness" interconnectedness of everything, which is a modern insight in science and a very ancient one in philosophy, may hold the key to the solution of the most fundamental and unresolved problems like origin of the universe, origin of matter and radiation, origin of life and origin of consciousness. Between 1999 and 2005, three

conferences, one national and two international, were held at NIAS to discuss related issues and the proceedings have been published by NIAS.

History of Indian Science, Philosophy and Culture

Dr. Sundar Sarukkai has completed his Project of History of Indian Science, Philosophy and Culture (PHISPC) Fellowship, which ended in November 2004. As part of this, he has finished writing a book titled *Philosophy of Science: Some Perspectives from Indian Philosophical Traditions*. This book has subsequently been reviewed and has been accepted for publication. It is in the final stages of copy editing before publication, which is expected within the next two months.

He has also completed writing a book on J. R. D. Tata and his philosophy, titled *The Human Touch: A Philosophical Walk with J. R. D. Tata*. Decision on its publication will be taken soon.

Philosophical Studies in Consciousness

Dr. Sangeetha Menon's work has been primarily in the area of Consciousness Studies and Philosophical Debates in Recent Interdisciplinary Dialogues on 'Consciousness'. She tries to juxtapose (i) the recent semantic trends in interdisciplinary dialogues on 'consciousness', and, (ii) perspectives on 'experience' and 'self-exploration' in Indian psychology, Indian philosophy and Indian dramaturgy.

She has been particularly looking at the importance of the 'experiencer', which she terms as the 'harder problem of consciousness' in the context of different ways of Indian thinking, in order to understand the intractable relationship between physical mechanisms and subjective experiences. The hard problem of consciousness has caused a major change in the 'method' for understanding consciousness by questioning the source for the qualitative nature of consciousness.

The second part of the study continues to look at central issues in consciousness studies in the context of two different traditions of thinking and experiencing: Indian epistemology (*pramana-prameya-prama-prayojana vyaparaha*) and Indian dramaturgy (*natya sastra*).

A study on cognition, consciousness and experience develops an epistemology with emphasis on experience so as to understand consciousness. A major argument is that cognition could be viewed not purely as a perceptual function but also has having transpersonal components. This study, which is nearing completion, will be published in the PHISPC volume edited by Prof. P. K. Sengupta.

Archaeomaterials and Archaeometallurgy

Dr. Sharada Srinivasan has been working in the field of scientific studies in cultural heritage, especially archaeomaterials and archaeometallurgy.

During December 2003 and December 2004, she was involved in a project supported by TATA STEEL (TISCO) to undertake research and writing with Prof. S. Ranganathan, resulting in a popular book monograph on wootz steel from India, entitled 'India's

legendary wootz steel: An advanced material of the ancient world', and released at NIAS as part of Tata's Twin Centenary celebrations. The book has attracted favourable reviews and press attention.

She has also been commissioned by India Foundation for the Arts, India, to write a book on Metals in Indian Crafts Traditions and undertook preliminary research towards this. She was also commissioned by Infinity Foundation, to write book on 'Textures of wootz: Techno-cultural perspectives on steel ferrous metals in Indian antiquity' as part of TKS series of 'History of Indian Science and Technology' project and undertook preliminary research towards this.

Currently she is working on the project granted in March 2005 under DST-Young Scientist Nurture Scheme entitled 'Ancient Harappan Metallurgy: Investigations on recently excavated sites such as Dholavira'.

Other Activities

Prof. B. V. Sreekantan

Editorial Fellowship of the PHISPC project of ICPR in September 2003 to edit the Volume on "Foundations of Sciences". Organized a workshop-cum-seminar on this subject during 23-25 February 2004. Also organized a workshop on "Nature and Culture" during 28-29 May 2004 at NIAS. Both were funded by PHISPC.

Chairmanship of the Gandhi Centre of Science and Human Values of the Bharatiya Vidya Bhavan at Bangalore from 17 June 2004.

Continues his association with the Cosmic Ray group of Tata Institute of Fundamental Research (TIFR) at Ooty on "Extensive Air Showers". The focus is on the composition of primary cosmic rays in the Knee region 10^{14} - 10^{16} eV.

Authored an article on Dr. Raja Ramanna for the Biographical Memoirs of the Indian National Science Academy.

Dr. Sundar Sarukkai

Guest editor for a special section in *Current Science*, edition of 10 February 2005.

Editorial Advisor for the international publication series *Advanced Studies in Mathematics and Logic*, Italy, 2005.

Coordinated, along with Dr. M. G. Narasimhan, the Summer Course for College Students on *Understanding Science*, 14-25 June 2004.

Dr. Sangeetha Menon

Coordinator for the 19th NIAS Course for Senior Executives on "An integrated approach to knowledge and information" entitled "Excellence in Leadership".

Organized the in-house seminars for the "NIAS-Discussion Forum on Consciousness".

Organized weekly NIAS faculty and guest lectures for "Wednesday Discussion Meetings".

Awarded the international GPSS award (Global Perspectives on Science and Spirituality) for 2005-2006, managed by Interdisciplinaire Universite de Paris, Elon University and supported by Templeton Foundation. Will write a book on "Consciousness, Agency and Spiritual Experience" as part of the research study.

Advisor to the Editorial Board on developing books for University students on Indian Psychology.

Advisor to the international committee for organizing the Arts/Spirituality/Science Reconnections Symposium in Spanish city of Melilla, jointly organized by Leonardo/OLATS, Paris, UNESCO and Al Andalus Foundation, Spanish Morocco.

Reviewer for journal publications, *Journal of Transpersonal Psychology*, Leonardo.

Dr. M. G. Narasimhan

Coordinator, History of Ideas and NIAS Doctoral Programmes.

Dr. Sharada Srinivasan

Invited to visit megalithic excavation at Kadebakale, Karnataka, excavated by Prof. Carla Sinopoli, University of Michigan, USA and recommended strategies for excavating and studying iron artifacts. Visited megalithic site of Hirebenkal and rock art sites.

Field investigations were undertaken at Hampi to explore technical and sculptural aspects of Vijayanagara art and architecture. In particular aspects of stone architecture relating to the "musical pillars" of the Vittala Temple were explored that forms the basis of lecture at Nehru Centre, London, which will debate whether these are accidental or intentional lithophones, followed by a Bharata Natyam dance event.

Undertook visual documentation on use of weapons and metal implements in Kalaripayattu, the martial art form of Kerala at Calicut. This fieldtrip forms the basis of a paper for presentation at the international conference at British Museum, London.

Undertook visual documentation of a few stages of lost wax casting by metal craftsmen from Bastar at national workshop at Shilpa Ramam Crafts Village, Hyderabad, organized by Indira Gandhi Rashtriya Manav Sangralaya. Invited by Prof. S. Settar, committee member and Dr. Kishor Basa, Director, IGRMS, Bhopal to undertake documentation.

School of Natural and Engineering Sciences

Members of The School

Prof. Prabhakar G. Vaidya, *Dean*

Mr. Nithin Nagaraj, *Research Scholar*

Ms. P. S. Sajini Anand, *Junior Research Fellow*

Prof. Timothy Poston, *Sir Ashutosh Mukherjee Professor*

Prof. K. Ramachandra, *Honorary Visiting Professor*

Dr. H. K. Anasuya Devi, *Fellow*

Ms. Dimple Kolhapure, *Senior Research Fellow*

Dr. P. K. Shetty, *Fellow*

Dr. M. B. Hiremath, *Research Assistant*

Ms. Mariam Sabitha, *Research Assistant*

Dr. Anindya Sinha, *Fellow*

Dr. Sindhu Radhakrishna, *Visiting Associate Fellow*

Mr. Rishi Kumar, *Research Scholar*

Mr. Mayukh Chatterjee, *Research Scholar*

Mr. Narayan Sharma, *Research Scholar*

Dr. Avanti Mallapur, *Research Associate*

Mr. Robin Vijayan, *Research Associate*

Introduction

Details of research and other activities carried out by the faculty, students, staff and visitors of the School are given below. Two highlights need to be mentioned. One is that Prof. Timothy Poston joined the Faculty of the School. Another is that Dr. M. D. Madhusudan and Dr. Savita Angadi completed their Ph. D.'s under the NIAS-MAHE Programme.

Research Carried Out

Cardio-Physics

Continuing analysis and modelling of ECG data, Prof. Prabhakar G. Vaidya has obtained an interesting result about the mechanism of the synchronization of cardiac cells. This is crucial to avoid arrhythmia. A hypothesis about the beneficial effect of the variability of the intervals between the heartbeats will be presented at a conference in Germany in May 2005. Some of the earlier work in this area was presented at a conference in Italy in June 2004.

Theoretical Issues of Nonlinear Data Analysis

Prof. Vaidya and Prof. Poston are working on two specific problems: (i) "The inverse problem": Finding equations from experimental data. A specific application will be presented at the same conference in May. (ii) "Nonlinear spectral Analysis": Specific application of ECG data will also be presented at the conference. (iii) Application of chaos theory to signal and image processing. This work is being supported by an ISRO Grant. Of particular interest is a result about a very large reduction in Noise in a speech sample, using topological methods. This was also presented at the conference in Italy.

Mathematics of Buckling

Prof. Poston is working on the mathematics of the appropriate force feedback response of an object as it goes through buckling. Current methods in computing force feedback lead to unwanted vibrations at such points, and one must apply bifurcation theory to create stable algorithms. Prof. Poston is also continuing work on human/machine interaction with an emphasis on intuitive and cost-effective systems for work with virtual objects in 2D and 3D.

Knowledge Based Processing of Epigraphy Texts

In the second phase, Dr. H. K. Anasuya Devi has carried out research with the following objectives:

- to develop automated software to be used as a development tool by archaeologists, epigraphists, linguists, historians and social anthropologists;
- to extend the software used to cover a variety of diverse applications such as handwriting recognition, especially for Indian languages;
- to use the OCR software to help the research community in their primary task of *understanding* the Brahmi script through modern languages.

Keeping in view with the above objectives, the following highlights work done:

- Several preprocessing algorithms have been applied and a cascaded technique has been designed and implemented.
- Towards segmentation and word level recognition the following algorithms have been implemented.
 - › Otsu Thresholding.
 - › Feature Extraction.
 - › Ternary Trees.
- Cascaded Neural Network is being designed and implemented.

Socio-Economic and Ecological Implication of Pesticide Use

Dr. P. K. Shetty has been carrying out a field-based research project on socio-economic and ecological implication of pesticide use, sponsored by National Science and Technology Management Information System, Department of Science and Technology, Government of India. The study is focusing on mapping crop pests, pest resurgence, and pesticide use (and misuse) in different agro-climatic regions in the country. Further, the study is also looking into the longitudinal trends of pesticide usage in various States and will identify and develop strategies to reduce the misuse of pesticides by the farming communities.

Social Relationships, Communication and Cognition in Wild Bonnet Macaques

This research project involving Dr Anindya Sinha, Mr. Rishi Kumar and Mr. Mayukh Chatterjee has been investigating social organization and individual relationships in wild groups of bonnet macaques (*Macaca radiata*), a primate species endemic to southern India. These studies have thrown light on two inter-related problems of primate ethology: (1) individual- and sex-specific strategies employed in the development and maintenance of social relationships and troop organization, and (2) cognitive processes that facilitate the integration of individuals into a social organization.

During the last year, research was carried out on three particular aspects of this project: (1) the existence of phenotypic flexibility, behavioural traditions and cultural evolution among wild bonnet macaque populations; (2) the temporal persistence of social relationships within troops; and (3) the developmental patterns of infant-mother relationships. In the course of such work, we have also been exploring the cognitive mechanisms underlying several facets of complex social behaviour and the problem of self-awareness and consciousness in nonhuman primates.

Demography and Ecology of Wild Bonnet Macaques

This long-term project, the first of its kind in India for any animal population, is investigating the demographic structure and dynamics, as well as the ranging and feeding ecology of a population of bonnet macaques, consisting of about 25 troops with over 400 individually-identified animals, in the Bandipur National Park – Mudumalai Wildlife Sanctuary complex in the states of Karnataka and Tamil Nadu. During this project, Dr. Anindya Sinha and Dr. Kakoli Mukhopadhyay have been able to recently document the influence of the tourist traffic through these sanctuaries on the evolution of a new form of social organization in this species, characterized by certain unique demographic and behavioural features.

Discovery and Natural History of New Macaque Species in Northeastern India

Recent biological expeditions, conducted in collaboration with the Nature Conservation Foundation of Mysore, in the biodiversity hotspot of Arunachal Pradesh, Eastern Himalaya, have resulted in the discovery of the Arunachal macaque *Macaca munzala*, a primate new to science. Preliminary information suggests that this species may be restricted to the high altitudes, and its continued existence may be threatened due to hunting and conflicts with people over crop depredation. Dr. Anindya Sinha and his colleagues have now begun the first study on the demography and behavioural ecology of this hitherto-unknown species that also aims to understand its interactions with humans and initiate awareness programs directed at safeguarding the future of this fascinating primate.

During the course of these expeditions, fairly direct evidence has also been uncovered for the presence of the Tibetan macaque *Macaca thibetana*, a species known so far only from central and eastern China, in central Arunachal Pradesh. This discovery, which has served to extend the distribution range of this species southward by about 1000 km and has important implications for India's mammalian biodiversity, will be followed by an intensive search for troops of this species in the Upper Subansiri district of the state later this year.



"Macaca Munzala" in Arunachal Pradesh
A New Primate Species Discovered by NIAS Faculty

Behavioural Ecology and Conservation of Macaque Communities in Northeastern India

Dr. Anindya Sinha and his team have recently initiated a research programme that will investigate the behavioural ecology of primate communities, particularly consisting of macaques, in two areas of northeastern India: (1) A community of four macaque species the Assamese macaque *Macaca assamensis*, the pigtailed macaque *M. leonina*, the rhesus macaque *M. mulatta* and the stumptailed macaque *M. arctoides*, together with the hoolock gibbon, the capped langur and the slow loris in several fragments of low-lying tropical rainforests of the Brahmaputra Valley in Assam and (2) the community of the Arunachal macaque *M. munzala*, the Assamese macaque *M. assamensis* and their hybrids in the high-altitude subtropical forests of western Arunachal Pradesh. In addition to intensively mapping the habitat parameters of these communities, this programme also aims to evaluate their survival status and devise conservation strategies for endangered populations of these species. It is also envisaged that local people students, teachers, researchers and conservationists in the habitat states of these primates will be trained in some basic methodologies to enable them to monitor specific macaque communities, identified as threatened, and implement appropriate management strategies for their conservation.

Sociality and Communication in Wild Slender Lorises

Dr. Sindhu Radhakrishna has been studying the incipient sociality and analyzing vocalizations, for the first time, of an endangered nocturnal prosimian primate: the slender loris *Loris tardigradus* in the Western Ghats mountains of western India. In addition to studying the behavioural ecology of several geographically distinct populations of the species, calls are being recorded from identified individuals. This species, being nocturnal, is likely to be heavily dependent on vocalizations for individual recognition, establishment of territoriality, mating opportunities and for the development of its typically rudimentary social relationships. Acoustic analysis of slender loris calls should also not only reveal

gender and population specificity in calls, but also environmental and social disturbances faced by the study populations and their adaptations to these stresses.

Population Surveys and Conservation Strategies for the Slow Loris

In the course of this newly initiated research programme, Dr. Sindhu Radhakrishna and Dr. Anindya Sinha are conducting a population survey of the slow loris *Nycticebus bengalensis*, another unknown but highly endangered prosimian in northeastern India, with the aim of identifying populations for behavioural studies. Such a study should not only permit, for the first time, a comparative study of the field biology of the two Indian lorises, but also allow for the development of conservation plans and management strategies to protect this unusual primate.

Abnormal Behaviour, Management and Welfare of Captive Lion Tailed Macaques

If reintroductions and supplementation of wild primate populations are to be successful or even considered, it is important that captive primate populations are founded and managed according to scientific principles and that these animals retain as many of their natural individual and social behavioural patterns as possible.

In collaboration with Dr. Avanti Mallapur, who had been working for a doctoral degree, and Natalie Waran of Edinburgh University, Dr. Sinha has been investigating the occurrence of abnormal behaviour in the endangered lion-tailed macaques, maintained in selected Indian zoos, particularly with reference to the influence of enclosure size and the complexity of these exhibits on such behaviour. This study will help to prepare schematic models of primate enclosures for consideration and adoption by Indian zoos as new enclosure designs and recommend possible exhibit restructuring and environmental enrichment prospects for some old and non-compatible exhibits in zoos.

Ecology, Behaviour and Conservation of The White-Bellied Short Wing Bird

This study, which forms part of the research being conducted by Robin Vijayan for a doctoral degree in collaboration with Dr. Sinha, has been investigating various aspects of the biology of the short wing, including its population, foraging and breeding biology in natural forests and along a disturbance gradient. They hope to understand and demonstrate how the species is adapted to its particular habitat and understand its biology in order to develop a sound conservation plan. Focus will also be laid on developing the species as a flagship indicator species for the conservation of the entire montane evergreen forest habitat of the Western Ghats.

Behavioural Ecology and Conservation of Flying Squirrels in the Western Ghats

The study, which forms part of the research being conducted by Nandini Rajamani for a doctoral degree, in collaboration with Drs. F. S. Dobson and A. Sinha, will determine if the two species of flying squirrels are sympatric across different forest types and altitudes, and will record their natural abundance levels in such habitats. Attempts are being made to study the basic behavioural ecology of these virtually unstudied mammals with the hope that the results that will be obtained from this study can be used to frame conservation strategies for these highly endangered nocturnal squirrels.

Other Activities

Prof. Prabhakar G. Vaidya

The following papers are being prepared to be presented at the "346 WE-Heraeus-Seminar: Cardiovascular Physics – Model Based Data Analysis of Heart Rhythm", 9-11 May 2005 at Physikzentrum Bad Honnef, Germany.

Separating the influence of brain signals from the dynamics of heart, using T.S.C. and Complexification.

Synchronizability of cardiac cells.

Stochastic variety in ECG data (With Timothy Poston).

Dr. H. K. Anasuya Devi

Taught a course on "Intelligence Systems and Computing Methods" at the Proficiency Continuing Education Programme, I. I. Sc., Bangalore, August-December 2004.

Teaching a course on "AI systems and its Developments" at the Proficiency Continuing Education Programme, I. I. Sc., Bangalore, January-May 2005.

Guided Mr. Suresh Kashyap, Mr. Uphar Agarwal, Mr. Sanjeet Kumar Sahoo and Mr. Mohammad Qumar Farooqui, on their project entitled "*GUI for Script Analysis*" for the fulfillment of BE Degree, from Siddaganga Institute of Technology, Tumkur during 1 January to 31 May 2004.

Guided Mr. Prabuddha Samaddar, on his project entitled "*Online Epigraphy*", for the fulfillment of MCA Degree, from Dr. Ambedkar Institute of Technology, Bangalore during 1 March to 8 July 2004.

Guided Mr. L. Umashankar on his project entitled "*Word level interaction of Brahmi Scripts*" for the fulfillment of BE Degree, from APS College of Engineering, Bangalore during 1 January to 31 May 2004.

Guided Mr. Raghuram, Mr. Tarun, Mr. Sriram, Mr. Siddharth, Mr. Abhishek, on their summer project entitled "*Image Processing and Segmentation of Ancient Indian Scripts*" for the degree of B. Tech from N.I.T. during May - June 2004.

Prof. Timothy Poston

Weekly 3-hour lecture (Saturday morning lecture) at NIAS on "2x2 matrices" as an introduction to multidimensional geometric linear algebra, differential equations, mechanics, mathematical modelling, etc.

Dr. P. K. Shetty

Was Dean (Administration) of NIAS between August and December 2004. Apart from day-to-day administrative responsibilities, he ensured successful completion of NIAS courses held during that period. He paid special attention to enhance the natural landscape of the campus with the introduction of additional lawns and planting of new species and also naming of trees in the campus.

Visited the Beijing Glorious Land Agricultural Co. Ltd. Beijing, China and Singapore National University, Singapore, 9-20 May 2004.

Visited St. Petersburg Agrarian University, St. Petersburg and University of Moscow, Moscow, Russia, 5-9 July 2004.

Dr. Anindya Sinha

Guided a dissertation entitled "The welfare of captive lion tailed macaques (*Macaca silenus*) housed in Indian zoos" by Dr. Avanti Mallapur, submitted in partial fulfillment for a doctoral degree at the University of Edinburgh, Edinburgh, Scotland in October 2004. The degree was awarded in January 2005.

Organized and conducted the Eighth NIAS Course for University and College Teachers on An Integrated Approach to Knowledge and Information, sponsored by the University Grants Commission, New Delhi, the Indian Space Research Organization, Bangalore, and the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, February 10 March 2, 2005.

Initiated, in collaboration with Dr. Ullas Karanth of the Wildlife Conservation Society (WCS) India Program, a two-year Postgraduate Programme in Wildlife Biology and Conservation, which commenced in July 2004. This programme is being organized in association with the WCS India Program, Bangalore, and the National Centre for Biological Sciences (NCBS), Bangalore and the Manipal Academy of Higher Education (MAHE), Manipal.

Taught two-week course in Philosophy of Biology and Conservation Science for the Postgraduate Programme in Wildlife Biology and Conservation, organized by the WCS-India Program, NIAS, NCBS and MAHE, during July 2004.

Taught a six-week theoretical and field course in Behavioural Ecology for the Postgraduate Programme in Wildlife Biology and Conservation, organized by the WCS-India Program, NIAS, NCBS and MAHE, during January February 2005.

Edited NIAS News, the quarterly newsletter of NIAS, and published four issues April 2004, July 2004, October 2004 and January-April 2005 during the year.

Coordinated the NIAS-MAHE Doctoral Programme from April to October 2004.

Continued to serve as Member, Editorial Board, *Current Science*, Bangalore.

Served as Member, Council of Editors, *Resonance*, Bangalore, till March 2005.

Continued to serve as Local Coordinator of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Environments and Forests (Animal Welfare Division), Government of India, for the Indian Institute of Science and Rallis India Pvt. Ltd.

Nominated as Member, Institutional Animal Ethics Committee of the Indian Institute of Science, Bangalore, from July 2004.

Dr. Sindhu Radhakrishna

Taught a five-lecture course in Primatology at the Postgraduate Program in Wildlife Biology and Conservation, organized by the WCS-India Program, NIAS, NCBS and MAHE, during September 2004.