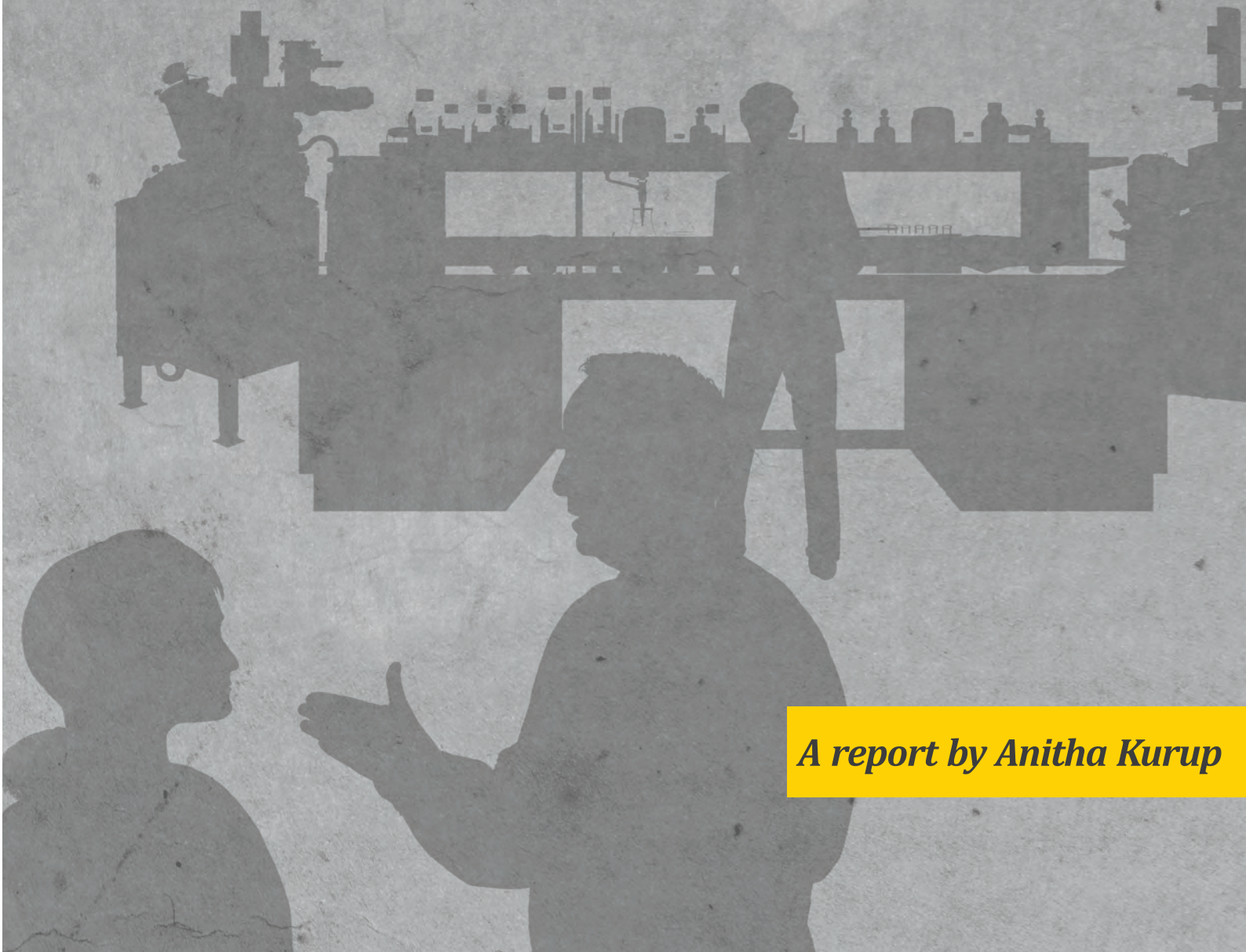
NIAS

# AN ASSESSMENT OF THE SUMMER RESEARCH FELLOWSHIP PROGRAMME OF THE NATIONAL ACADEMIES OF SCIENCE IN INDIA 1995–2016



*A report by Anitha Kurup*

# ACKNOWLEDGEMENTS

This report provides the first assessment of the Summer Research Fellowship Programme of the Science Academies of India. The Indian Academy of Sciences, under the leadership of Prof. Ram Ramaswamy, initiated this study in collaboration with the National Institute of Advanced Studies, Bengaluru, India.

The author would like to place on record her sincere appreciation to the Indian Academy of Sciences, particularly Prof. Ram Ramaswamy who spearheaded this effort with Prof. K. L. Sebastian, the then chair of the Science Education Panel

The Academy administrative staff, Mr C. S. Ravi Kumar and Mr N. Maheshchandra, provided data and the necessary logistic support including space for the Research Assistants to work in the Academy. Prof. N. Mukunda gave an overview of the Summer Research Fellowship Programme, which was developed under his leadership, during the initial years.

Sincere thanks are due to all the Summer Research Fellows who participated in the survey despite their tight schedules. If not for them, the study would not have been completed. Ms Aishwarya and Ms Divya, who initially joined as Research Associates, spent months collecting and compiling the survey data. The study has also benefited from the data analyses provided by Ms Ashwini K, Ms Surbhi Arora and Ms Pritha Chakraborty, Research Associates at NIAS, and Mr Sudarshan, Consultant, Education Programme, NIAS, who worked on extremely tight time schedules. The views expressed in this publication can in no way be taken to represent the official opinion of the funding agencies.

# ABOUT THE AUTHOR

Anitha Kurup is a Professor and Dean, School of Social Sciences, and the Head of the Education Programme at the National Institute of Advanced Studies. She leads the National Gifted and Talented Education Program in India anchored at NIAS. Her research interests span the broad disciplines of education and gender studies. Her recent publications Trained scientific women power: How much are we losing and why? and Trends in higher education: Creation and analysis of a database of PhDs in India (1998-2007) have been widely appreciated. Prof. Kurup was a part of an international panel that discussed the overview of shared challenges and need for identifying and adopting Best Practices for women in science. Kurup was the only social scientist in the Indian delegation of Women in Physics at the International Conference of Women in Physics, organised in Waterloo, Canada, in 2014. She conducted a Gender workshop for the international participants, drawing from the research insights of the study of women scientists in India and the USA. She has been involved in numerous studies concerning the issue of gender equity in science.

Kurup was a member of the Governing Board of Institute for Social and Economic Change, Bengaluru, and a member of the Academic Council at Christ University. She has several publications to her credit. She was awarded the Fulbright–Nehru Senior Research Fellowship for the year 2011–2012 and was hosted at the University of California, Davis.

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# EXECUTIVE SUMMARY

The Summer Research Fellowship Programme (SRFP) organised by the three National Science Academies of India – the Indian Academy of Sciences, Bengaluru, (IASc), the Indian National Science Academy, New Delhi, (INSA), and the National Academy of Sciences, India, Allahabad, (NASI) – has witnessed a steady growth over the last two decades. The broad objectives of the survey were

- to evaluate whether the programme has been able to meet its original objectives and
- to strengthen the current phase of the programme through appropriate policies, strategies and interventions to provide mentoring support to participating Fellows.

## HIGHLIGHTS OF THE ANALYSIS

The study covered the Summer Research Fellows (SRFs), who have availed this Fellowship between the years 1996 and 2016. The Academy received a total of 1,58,114 applications during the years 1997–2016. About 10% of these applications were selected for the SRFP and ~77% of the selected candidates availed the Fellowship.

### *Gender Distribution*

A positive trend is observed with a slow but steady rise of female summer Fellows, from less than 20% in 1997 to ~49% in 2016.

### *Distribution by Disciplines*

Biology has always attracted the highest number of SRFs over the years.

Engineering has seen a steady increase in the proportion of the Fellowships. Maths, Earth and Planetary Sciences and Agriculture attract less than 10% of the Fellowships.

### *Geographical Representation*

The representation of students from the north-eastern region is mostly low, although the numbers have been increasing very slowly. The overall trend shows that the SRFP is predominantly represented by candidates from the southern states.

The distribution of the Fellowships across different states shows that 20.39% of the total SRFs are from Tamil Nadu. West Bengal has a percentage of 8.91% of the total SRFs. Karnataka has 9.3.9% and Andhra Pradesh has a percentage of 9.18% of the total SRFs.

## CHALLENGES EXPRESSED BY THE SUMMER RESEARCH FELLOWS

- One of the most prominent concerns raised by the SRFs was regarding accommodation in their respective institutes; many were forced to seek accommodation for a period of 1–2 months in a new city and this was not easy.
- Issues were also raised about the availability of clean washrooms in the places of accommodation. Cleaniness in academic institutions cannot be overlooked. A healthy mind requires a healthy body. Untidy washrooms can lead to several health conditions like UTIs. As the cost of living was high, some SRFs wanted the Academy to consider an increase in the stipend.
- A recurrent concern/complaint observed was that the Fellows had very little interaction with the research guides as they mostly had to work the scholars of the guides.
- Another concern was regarding the allotment of guides, where the fellows

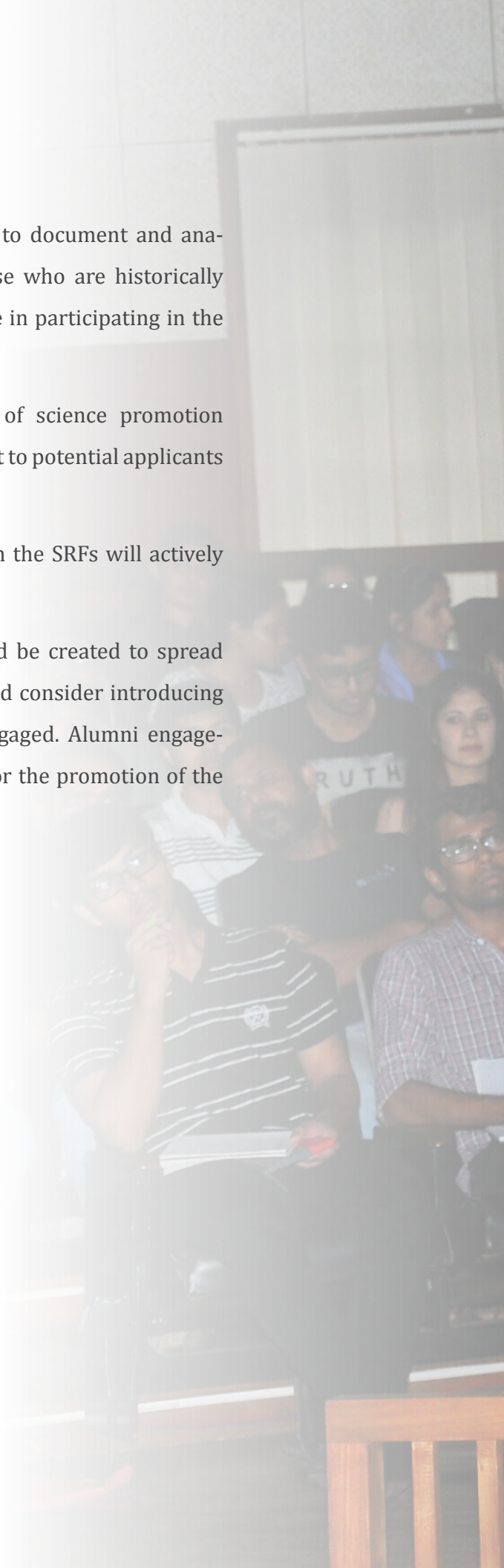
complained that they could not connect their interests with the area of the guide. Better allotment can be achieved by matching the interest/project areas of the fellows to the projects undertaken by the Guides.

- The SRFs felt that the programme could benefit from more number of 'Special Lectures' and interdisciplinary projects during the Fellowship period.
- While the student SRFs wanted a longer period of the Fellowship programme, the faculty SRFs expressed difficulty in participating in the SRFP due to the difficulty in obtaining leave from their institutions for the duration. A two-month exposure is not enough for the fellows as they come from different backgrounds. The sudden change in academic environment will take time to adjust to.
- Most SRFs expressed the need to improve the outreach by including the advertisement in the local newspapers and in regional languages.

## RECOMMENDATIONS

- Providing a better structure for mentoring and counselling could have a potential for drawing a greater number of students to scientific and engineering research and improve the quality of the SRFP. Intermittent exposure to science institutes should be maintained in order to nurture the talents of the fellows which a one time exposure would not be able to achieve.
- It may be important for the Academy to work with Indian women in the scientific network specifically in Physics, Astrophysics and Maths to examine if there are factors with respect to gender that may be responsible for the relatively low participation of women in these disciplines.
- The Academy needs to evolve strategies to increase the representation of the under-represented states, disadvantaged communities, and rural areas, without undermining merit.

- There is also a need for a detailed qualitative study to document and analyse the experiences of students, particularly of those who are historically disadvantaged, to understand the challenges they face in participating in the programme.
- The Academy could access the student databases of science promotion programmes like, NTSE, KVPY and INSPIRE to reach out to potential applicants interested in science.
- It may be worthwhile to conceive a strategy by which the SRFs will actively contribute to the alumni database of the programme.
- A WhatsApp group of SRF faculty and students could be created to spread information about the programme. The Academy could consider introducing various approaches to keep the group active and engaged. Alumni engagement activities, such as seeking SRF success stories for the promotion of the programme, could be undertaken.



# INTRODUCTION

The Indian Academy of Sciences was founded in 1934 by Sir C.V. Raman. Its objectives include promoting the progress and upholding the cause of science, both in pure and applied branches. The Academy recognises the special role of scientific creativity in the process of education and holds that the course of discovery includes the identification and nurturing of scientific talent among the young.

In 1994, the Academy brought out a document on University Science Education containing several recommendations. Following this, the Council of the Academy spearheaded the establishment of a Science Education Panel to organise programmes for teachers and students of science, across India, to attract talent in science and bring them into beneficial contacts with the Fellows of the Academy.

Starting in the mid-1990s, the Academy had initiated several activities for the benefit of students and teachers of science all over the country. These included the following:

- Summer Research Fellowships for students and teachers to work with the Fellows of the Academy and other scientists in the country;
- Refresher Courses of two-week duration for teachers;
- Lecture Workshops, of 2–3 days' duration, for teachers and students;
- Invitations for teachers to attend the mid-year and annual meetings of the Academy.

In January 2007, the Indian National Science Academy, New Delhi, (INSA)

and the National Academy of Sciences, India, Allahabad, (NASI) joined forces with the Indian Academy of Sciences (IASc), constituting what is now known as the Joint Science Education Panel. Prominent among the initiatives of the Panel are the Summer Research Fellowship Programme, Refresher Courses, and Lecture Workshops.

## ABOUT THE INITIATIVE

The Academy was concerned with the state of university education in science in the country. It realised that without a proper base in science education it will not be possible to promote progress and attain excellence in science. Reflecting upon this concern, the Council of IASc decided in its meeting on 30 July 1994 that an Academy Paper should be prepared setting out the Council's views on the challenges of science education in India, as well as outlining the actions that can be taken by the Academy and various other agencies in the country.

A Panel was constituted in July 1994 with Prof. N. Mukunda, FASc, serving as the Chairman, which then proceeded to prepare a draft for the Academy Paper on the subject. Its terms of reference were the following:

- to assess the state of education in science in the country, particularly at the undergraduate level; and
- to propose such measures as may be considered appropriate to improve the quality of education in science through the combined efforts of universities, higher institutes of learning, government authorities, voluntary agencies and the Academy.

The Panel wrote to all Fellows of IASc seeking their views on the question and many who were in Bangalore joined the open meeting held on 16 August 1994.

## COMMON PERCEPTIONS OF THE PROBLEM

A brief review of the state of science education in Indian colleges and universities was made and the members of the academic community involved in higher education and research expressed their perspectives. A uniform opinion expressed in the letters written by Fellows to the Panel was that the standards of education had declined in all respects and immediate measures had to be taken to remedy the situation.

There was an alarming drop in the quality of students who opted for higher studies in the sciences after school level. There had been no assessments of the country's needs for talented scientists. The options available to undergraduate students were limited and inflexible. There was hardly any initiative or involvement by private non-governmental sources for providing support towards higher levels of education and research. These were some of the commonly voiced opinions that identified the problems of university science education.

Under these circumstances, the Academy recognised that there was a need to find ways by which it could help identify and reach out to the talented and motivate them towards pursuing higher studies and careers in science.

## GENERAL VIEWS OF THE PANEL

In its discussions, the Panel paid careful attention to the numerous concerns raised regarding the plight of science education in the country, from high school to postgraduate levels. The deliberations brought out the fact that the importance of high-quality science education cannot be over-emphasised in a country like ours. This became even more significant in the context of the efforts of the country towards globalisation and market economy. However, even as India prepared itself for global competition, little attention was paid

to the standards of science education in the country. There was a strong consensus that the nation needs to support and strengthen capacities to create, absorb and transform technology at various levels, and this can only be achieved against the background of a solid foundation in basic sciences, particularly at the undergraduate and postgraduate levels.

In suggesting possible solutions, the Panel discussed, at length, two crucial issues. The first pertained to meeting societal demands for preserving equity and excellence in academia – both facets of the education sector that are seemingly mutually exclusive. The second matter had to do with the need to provide adequate opportunities, simultaneously, for both the small number of talented students who may be able to enlarge the horizons of scientific knowledge, as well as the large number of students, who could potentially be trained to contribute at diverse levels towards the welfare of Indian society in an intelligent and competent way. The Academy was mindful of both these objectives while formulating its proposals.

The Panel had extensive discussions on the issue of equity and excellence. It was unanimous in recognising that the issue is a complex one with far-reaching ramifications and room for multifarious points of view. Many academicians have asserted that merit should be the sole criterion for admission to educational institutions. On the contrary, laws were being enacted in the country to provide for positive discrimination through the process of reservations for underprivileged sections that have experienced historical disadvantages. However, concerns regarding the impact of positive discrimination beyond a certain level were being expressed among the academics. It was equally clear that such reservations, beyond a certain level, will be counter-productive in the long run and will cripple the nation's scientific aspirations; it will prove to be detrimental even to the very segments that need to be brought into the country's social, educational and economic mainstream.

The Panel was thus looking for a way that would promote social justice and at the same time preserve academic values. It reoriented its strategy so that it could consider the issue on hand as one of equity and excellence rather than one of equity versus excellence.

One must recognise that, for a variety of historical and social reasons, a very large segment of our population aspires for a college degree and this aspiration had to be met. It was, therefore, essential to completely revamp the fundamental structure of our university education system. There was a need to expand educational opportunities by several orders of magnitude and create a rich menu of possibilities and opportunities in such a way that the problem of providing for equity gradually disappears and becomes virtually irrelevant. There was also a need to develop a large number of various flexible undergraduate degree courses that would permit the channelling of students according to their aptitude and motivation, without depriving any segment of the society. One way to achieve this was to have a large variety of undergraduate degrees in 'Applied Science', where the students will get a thorough exposure to the fundamentals of different subjects such as Physics, Chemistry, Mathematics and Biology in the first year and then go on to learn specialised skills in their chosen branches of science or technology. In this process, the advantages offered by distance education methods could also be explored.

In the light of the above-mentioned points, the Council of IASc proposed to set up a Special Committee to examine these issues in greater depth and to advise the Academy on the role it can play in bringing about this transformation in attitudes.

### *The Academy initiatives*

- The Council proposed to commission a group of Fellows to compile two volumes of information on what students should know in each area of science, at the

BSc and MSc levels, and as preparation for embarking on a PhD programme.

- It proposed to commission and support the writing of brief expository monographs (appreciation courses) on scientific topics, in the style of the MIR publications of the former U.S.S.R.
- The Council planned to commission teams of Fellows to devise sets of experiments (~100) in each of the basic sciences, which would bring out the fundamental principles in an appealing way, wherever possible, using inexpensive and commonly available materials.
- Working with existing centres such as the EMRCs at Pune and Hyderabad, in cooperation with experienced teachers and expositors, the Academy would aid in the production of radio and TV programmes in science, along with videotapes to supplement classroom instruction at school and college levels. These would also be in regional languages and would explore 'alternative' methods of teaching.
- The Academy would attempt to periodically assess the state of affairs in education in each major scientific field and publish its findings, announcing current trends, pointing out lacunae, highlighting possible opportunities, and offering suggestions on areas requiring special effort.
- The Council proposed to launch a journal of science especially intended for science students and to educate the common people interested in science. The editorial, intellectual and financial backing of the Academy would be available to sustain such an effort. The journal would contain expository articles, descriptions of new teaching methods and innovative experiments, science news, historical notes, etc. Information on course openings and facilities in various institutions were to be included in the journal, along with advertisements from prospective employers of science graduates.
- Subject to the availability of resources, the Council would establish a programme

wherein Fellows would be invited to identify one or two college students each year (within some overall limit) for placement in a (summer) programme organised or assisted by the Academy. Such students would be supported to spend some time (around two months) working and studying under a Fellow's guidance. Such short-term research experience would help the student to use his or her spare time productively, and it is hoped that many bright youngsters might thereby be motivated into pursuing careers in scientific research.

### *Need for the research study*

The Summer Research Fellowship Programme of the three National Science Academies thus emerged out of a study carried out by the Indian Academy of Sciences, in 1994, about the state of science education in universities. However, the efficacy and relevance of the programme have not been analysed, till date. This survey was therefore designed to understand the outreach and effectiveness of the Summer Research Fellowship Programme. After more than two decades of operation, this will be the first review of the programme. Insights from this study will be used

- to evaluate whether the programme has been able to meet its original objectives and
- to strengthen the current phase of the programme through appropriate policies, strategies and interventions to provide mentoring support to participating Fellows.

# LITERATURE REVIEW

India has made progressive and concerted efforts to promote science education and research, realising its importance for the country's growth. During the post-independence era, the government set up the National Research Laboratories and the Indian Institutes of Technology (IITs) as centres to undertake research in the field of science and technology. To encourage and attract students to science education and research, various Fellowships are offered across the country. The Fellowships are offered at different levels of higher education, including doctoral and post-doctoral Fellowships, which are widely offered to provide support to the candidates who wish to pursue research, like the INSA–JRD TATA Fellowship and the National Post-Doctoral Fellowship. Research studies point to the fact that Fellowships offered at school and college levels are effective in attracting students towards research in science and technology. There are a few Fellowships that provide mentorship and financial support to students in their early grades of schooling, under-graduation and post-graduation levels like NSTS–NCERT, KVPY–DST and SRFP among others. The fellows themselves have requested that a two month time period is actually not enough to hone their research skills. The SRF should actually aim towards developing quality in research rather than focussing on the quantity of fellows undertaking one-time fellowships in science institutes.

There has been an increase in the number of science Fellowships offered in the country over the years. Although there has been no systematic assessment of the different Fellowship programmes in India, it has been noticed that despite several efforts, the Fellowships have not reached students from small towns and villages. This has been a major challenge to address, especially

considering that achieving equality in education in terms of caste, class, rural/urban and gender is a national objective of the Government of India (1998). To reach out to the underprivileged sections of society, relaxation of eligibility criteria is offered to students from such backgrounds. It has been established that there is a need to regularly evaluate the Fellowship/training programmes to improve its quality and allow the recommendations to be implemented to enhance the performance of the students within it (Rotem et al., 2010). In particular, developing an impact map of each candidate will have a positive effect on the institution and the country as a whole (Brinkerhof & Gill, 1992). The literature points to the fact that the participation of women in the Fellowship programmes is lower compared to men, especially in engineering (Kumar & Chatterji, 2009).

There are various institutes and departments like DST, NCERT, JNCASR, etc., which are contributing to the development of scientific temper among the students, who are motivated to pursue research in sciences. The Fellowships offered by some of the institutes, which have proved to be very crucial in the development of research in science education are discussed below.

### *INSA–JRD TATA Fellowship*

The Indian National Science Academy offers INSA–JRD TATA Fellowship administered by Centre for International Co-operation in Science. The Fellowship aims to nurture scientists and researchers from developing countries by supporting their research through the provision of scientific expertise and advanced infrastructure available in India. The Fellowship is open for all the candidates from developing countries (other than India) who are below the age of 45 years and possessing a Doctorate or Master's degree in Science/Engineering/Medical and allied disciplines. About ten Fellowships are awarded annually. The application process is scrutinised twice a year, in May and November, by a selection committee.

### *DST–KVPY*

The Kishore Vaigyanik Protsahan Yojana (KVPY) is a programme started in 1999 by the Department of Science and Technology (DST), Government of India, to nurture exceptionally talented and motivated students to pursue research in basic sciences. DST, the nodal agency of the Government, has entrusted the overall responsibility of organising and running the KVPY Programme to the Indian Institute of Science, Bengaluru, and has set up a Management Committee and a National Advisory Committee (NAC) for overseeing its implementation. A core committee looks after both the day-to-day and the academic aspects of the KVPY Programme.

The objective of the programme is to identify students with talent and aptitude for research, help them realise their academic potential, encourage them to take up research careers in science and ensure the growth of the best scientific minds for research and development in the country. The Fellowship is provided in various streams. The stream SA is meant for students enrolled in the XI standard (science) having secured a minimum of 75% (65% for SC/ST) marks in aggregate in Mathematics and Science subjects in the X Standard Board Examination. This attracts the largest pool of applicants every year but is accompanied by a large attrition rate too, as many opt for professional degree courses afterwards. Stream SX includes the students who are enrolled in class XII (+2) and aspiring to join undergraduate programmes in basic sciences (BSc/Integrated MSc). Stream SB includes students enrolled in 1st year BSc/Integrated MSc; this group of students usually continues with research activity and pursues science. An original and creative science-based research project is compulsory for applying to the programme.

The programme provides its awardees generous Fellowships and contingency

grants up to the pre-PhD level or 5 years, whichever is earlier. In addition, summer camps for the KVPY Fellows are organised in prestigious research and educational institutions in the country. Over the years, KVPY has tried to reach out to all parts of the country and advertisements for applications appear twice in a year (May and November). In the year 2017–18, 1,72,732 applications were received and 3,036 were provisionally awarded the Fellowship.

### *National Post-Doctoral Fellowship*

The SERB-National Post-Doctoral Fellowship (N-PDF) is aimed to identify motivated young researchers and provide them support for doing research in frontier areas of science and engineering. The Fellows work under a mentor, and it is hoped that this training will provide them with a platform to develop as independent researchers. The Fellowship is open to all the citizens of India below the age of 35 years, who possess a PhD/MD/MS Degree in Science and Technology.

### *National Science Talent Search Fellowship*

The NSTS Fellowship was started by NCERT in the year 1963. It identifies exceptionally talented students in science. The Fellowship is offered on the basis of a national competitive examination process for classes 8th and 10th, providing financial support from class 9 until the completion of PhD. The selection process involves a written examination, which tests the scientific aptitude of candidates, followed by the submission of a project report and an interview.

In its initial year, the programme was confined to the Union Territory of Delhi and offered a total of ten Fellowships. In 1964, the Fellowship scheme was extended to all states and Union Territories of India with 350 scholarships. These scholarships were awarded to students who aim to pursue basic

sciences up to PhD level.

The scheme was revised in 1976 and was no longer confined to Basic Sciences but was extended to Social Sciences too. The Scheme was then named as National Talent Search Scheme (NTSS). In 1981, the Scheme was further revised, and the Fellowships were enhanced from 500 to 550, where 50 scholarships were exclusively meant for the candidates belonging to the Scheduled Castes (SC) and Scheduled Tribes (ST). The reservation policy was further revised in 2000, where out of 1000 seats, 15% of the seats was reserved for SCs and 7.5% was reserved for STs. In 2008, a provision of reserving 3% seats for Physically Challenged candidates was also introduced (NCERT).

### *Science Academies' Summer Research Fellowship Programme*

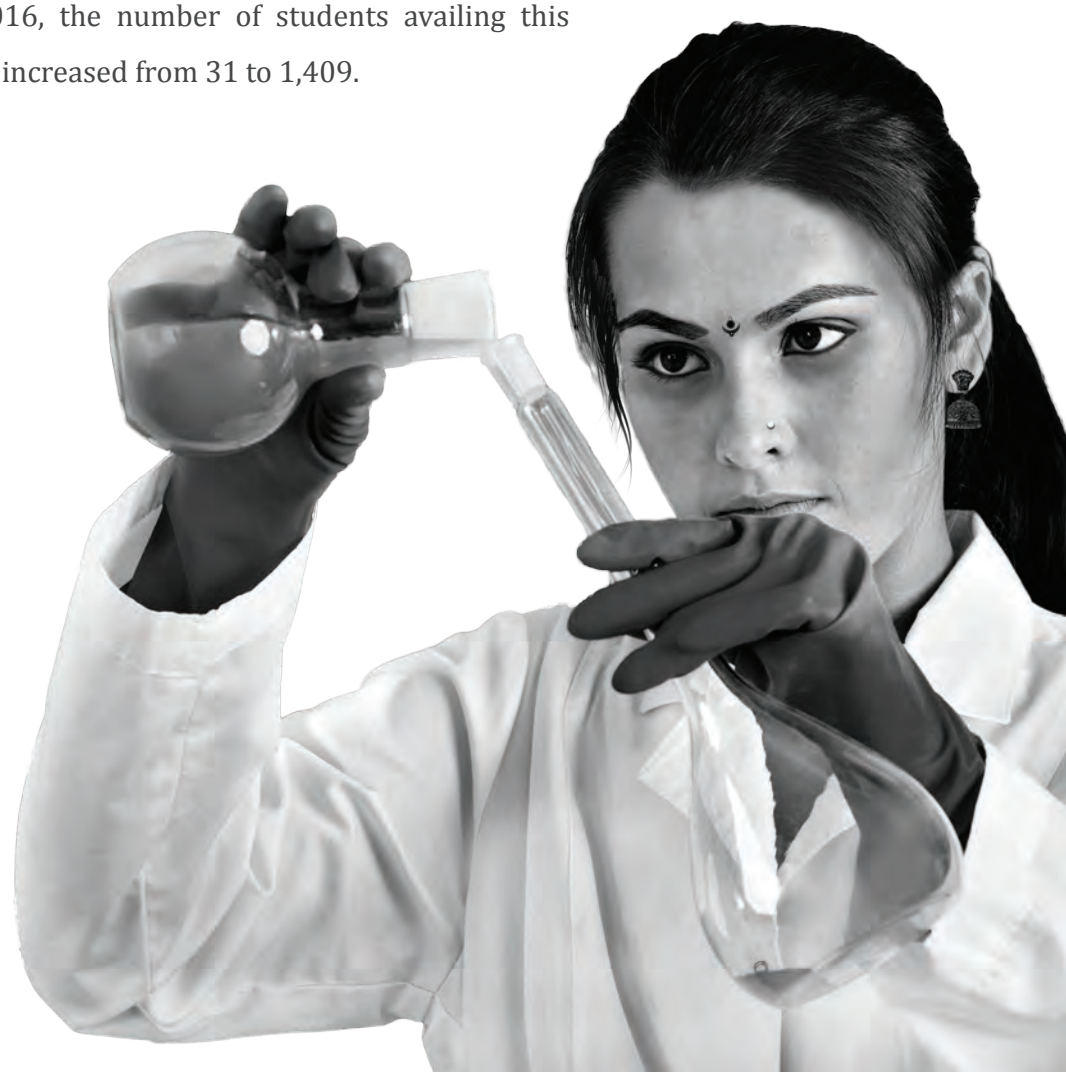
The three National Science Academies of India offer two-month Summer Research Fellowships for students/teachers to work with scientists associated with the academies. This is a unique opportunity for the undergraduate and postgraduate students, and even teachers, to pursue their research ideas under efficient mentorship.

The Fellowship aims to nurture scientific curiosity in the candidates through rigorous engagements in various short-term projects. The SRFs are selected through a rigorous selection procedure laid down by Indian Academy of Sciences (IASc). The selection is based on the merit of the student and availability of guides rather than a fixed number of Fellowships every year. The SRFs are encouraged to take up research projects at prestigious institutes, where they get the opportunity to work under scientists. This is an initiation in mentoring the students towards a career in research.

The Summer Research Fellowship Programme was started in 1995 by IASc. Since 2007, the programme was conducted jointly with the Indian National

Science Academy (INSA) (New Delhi) and the National Academy of Sciences, India (NASI) (Allahabad). It was agreed among the three Academies that IASc will take the responsibility for running this programme. The Fellows of IASc, INSA and NASI would guide the SRFs and the total expenses would be equally shared. The Fellowship holds high prestige in the global academia and is highly valued by the candidates who are motivated for research in sciences. Since 1995, there has been a progressive increase in the applications received and Fellowships offered. Key statistics of the programme include the following:

- In 1995, the first Summer Research Fellowships were offered to three students.
- In 2013, out of the 23,166 applications received, 2156 fellowships were offered and 1576 were availed.
- From years 1997 to 2016, the number of students availing this Fellowship, per year, has increased from 31 to 1,409.



### *JNCASR's Summer Research Fellowship Programme*

Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) offers the Summer Research Fellowship to the undergraduate and postgraduate students studying in India. Selected candidates are placed under reputed scientists at the centre or other leading universities in the country. The candidates are provided with a monthly stipend of ₹6000 with travel expenses. Candidates with the following qualifications can apply for the Fellowship at various levels:

- Students who have successfully scored 80% in mathematics and science in their 10th and 12th grades.
- Students presently studying in I and II year of BSc; I, II & III year of BS; I, II & III year of BE/BTech; I year of MSc; and I–III year of Integrated MSc can apply for Life Sciences.
- Students presently studying in II & III year of BSc; II, III & IV year of BS; II, III & IV year of BE/BTech; I year of MSc and I–III year of Integrated MSc can apply for Physical Sciences, Engineering Sciences and Mathematics.
- Students presently in IV year of BS–MS; I year of MSc and IV year of Integrated MSc can apply for Material Sciences and Chemical Sciences.

Bhagwan (1999) talks about the Fellowship opportunities at the undergraduate, postgraduate, doctoral and post-doctoral levels as necessary and efficient for training scientific temper. He explains that although many science and technology organisations like CSIR, DST, UGC, DOD, DAE, etc., provide funds for research work after post-graduation (JRF, SRF, RA, pool Officers, Young Scientists award, etc.), there is no mechanism to evaluate the impact of the programme on the students. There are no systematic studies of these programmes to measure the candidates' growth or their contribution to the growth of the institute or country.

The need to evaluate the Fellowship and training programmes has been identified in the 1990s. Kirkpatrick (1994) describes the need to evaluate the training and Fellowship programmes for the following reasons:

- to justify the existence and budget of the training department by showing how it contributes to the organisation's objectives and goals
- to evaluate if the programme must be continued in its present form or whether it requires appropriate modifications
- to gain information on how to improve future training programmes.

Rotem et al. (2010) argue that in order to evaluate the effectiveness, efficiency and sustainability of a programme, there is a need to have a pre-test and post-test to measure the level of student's competencies. In addition, there is a need to evaluate the 'performance story' of the candidates, which goes beyond calculating the number of Fellows who have availed the Fellowship and their immediate experience. For an efficient evaluation, the Fellowship and training programme should have a clear statement of goals, fair selection of candidates and scientists (mentors), output, timely completion of the Fellowship programme, evidence of positive contribution at work, and evidence of positive development in performance. SRF should also emphasize on quality research

Mayne (2001) refers to this as the 'Contribution Analysis'. It is critical to record and evaluate what the Fellows have learned, gained and grown through the training in the long run of their careers and, also, if their respective institutions and countries are being benefited by the whole training process. Brinkerhoff & Gill (1992) call this process of evaluation as the 'Impact Map', which measures the impact a training has had on the growth of the candidate along with the institution and country at large.

Kumar & Chatterjee (2009) conducted a review on KPVY–DST, after a decade of its inception. The detailed study of the Fellowship programme reveals that there is a considerable increase in the Fellowship offered from 1999 to 2008. The years between 2005 and 2008 saw the maximum increase in the Fellowships offered, which went from 100 in 2005 to 333 in 2008. The mentorship received by the candidates ensures learning opportunities in prestigious institutes. Besides these, they get access to good libraries and science museums throughout the country and can seek out support from people already working in the field. The study revealed that out of the total Fellowships, only 20% were the female candidates. It was further observed that the female Fellows in engineering were even far less than those in the basic sciences.

The literature review points to the fact that Fellowship programmes for science and technology, worldwide, are proportionately larger for the doctoral and post-doctoral students when compared to undergraduate and graduate students. The pattern is similar for India. While most of these programmes have grown in numbers over the years, there has been little effort to systematically review the Fellowship programmes. However, with the increased realisation that talent among children needs to be spotted early and sustained mentorship is important, the undergraduate and graduate Fellowship at national and institutional levels is growing. However, we do not have much documentation or analyses of these Fellowships. Fellowship programmes with a sturdy mentoring system can help potential students in nurturing their talents and undertaking research.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# METHODOLOGY

The Summer Research Fellowship Programme has been in place for more than two decades. As this is the first time that the Academies are evaluating the SRFP and since they were keen that the study is completed within a six-month period, it was decided to conduct a survey of the Summer Research Fellows who had participated in the programme.

The major objectives of this study are to

- critically evaluate the outreach and effectiveness of the Summer Research Fellowship Programme and
- strengthen the programme through appropriate interventions, strategies and policies.

The study covered the SRFs, who have availed this Fellowship between the years 1996 and 2016. The study drew on the database of the Academy to reach out to every student, based on the address the student provided during the application process of the Fellowship. The total number of student Fellowship offered was 13,872 and the Fellowship availed was 10,916 from the year 1997–2016. The Academy provided the contact details of 10,281 students who were approached to participate in the survey. The contact details of the remaining students were not available.

Questionnaires were sent to all the SRFs, who had availed this programme from the time of inception of the Fellowship. The survey focused on collecting data on gender to analyse whether all students were being given equal opportunities across the country. The data on gender aided in understanding the distribution of SRFs across the diversities.

The questionnaire was sent individually to all the participants who had provided an email contact to the Academy. To increase the rate of responses, the survey questionnaires had to be administered as interviews. Four sets of reminders and individual follow-up, wherever contact numbers were available, were made to increase the participation of the SRFs in the survey. In several instances, the questionnaires were filled up through telephone interviews. In addition to emails, an online Google form was created to enable the SRFs to participate in the survey. Over four months were spent in canvassing the questionnaire and creating a dataset of the responses.

The questionnaire was designed to include information such as

- Fellowship details
- Experiences during the Fellowship
- Education and employment details and
- Personal details (gender).

A cover letter assuring confidentiality of the data, survey questionnaire and a consent letter were sent to all the SRFs through emails as attachments. A link was also sent in the email, which allowed the participants to fill in the questionnaire through a Google form; most of the responses received were through this form.

A sample of the questionnaire, cover letter and consent form is attached as Appendix I, Appendix II, and Appendix III, respectively.

The questionnaire was sent to all the SRFs who had an email id. 2,129 SRFs (out of the 10,281 contacted) responded to the survey. The analysis is based on these responses. It is important to note that the survey was designed to allow respondents to opt not to respond to specific questions, should they

choose to. The flexibility offered was intentional; it was designed to respect the choice of the respondent. The data obtained were analysed using distributive frequencies and percentage analysis.

Although it was intended to conduct a few in-depth interviews as part of the study, it was not possible to do so due to time constraints. Most of the time was spent in reaching out to the SRFs and ensuring their participation in the survey. The contact details of approximately 400 SRFs were also obtained through LinkedIn, of which a very small number responded.

# ANALYSIS

The Summer Research Fellowship Programme was started in 1995 with five applications from students and three of them were offered the Fellowship. Since then, the Academy has received a total of 1,58,114 applications during the years 1997–2016. About 10% of these were selected and ~77% of the selected candidates availed the Fellowship. This fairly high percentage of the number of candidates availing the Fellowship indicates the demand for the Fellowships.

An impressive rise in the number of applications to the programme is observed, over the last two decades. The overall numbers achieved throughout the years typically represent the pattern of any new programme – a phase of slow increase in numbers and then a phase with a steady surge. The first phase, in this case, is between the years 1995 and 2006, followed by the second between 2007 and 2015. The year 2015 attracted the highest number of applications, when 24,513 candidates applied. During the years 2013–2015, the Academy received over 70,000 applications and it may be worthwhile to examine the reasons for these increased numbers. The drop in the number of applications in 2016 is a cause for concern and needs to be examined to understand whether the numbers have attained stability or if there are underlying reasons for the fall in applications. It may be useful also to pay attention whether the number of Summer Research Fellowship Programme is reaching a saturation point. The Academies may need to make a careful evaluation of whether they need to expand this programme, and if so, what will be the nature of this expansion.

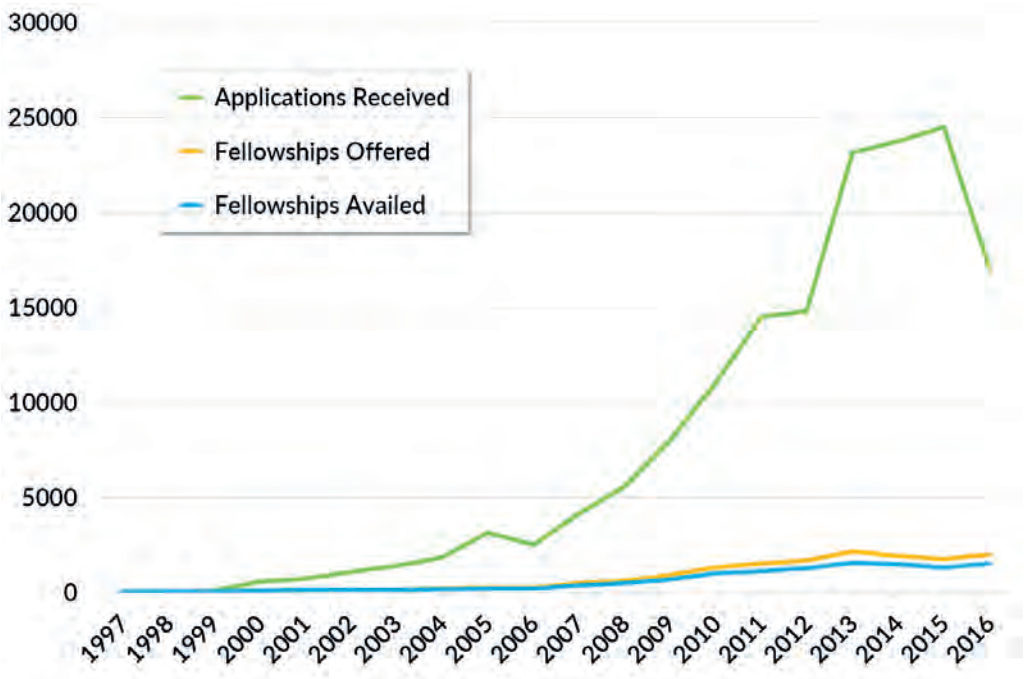



*Figure 1: Plot illustrating the total number of applications received, Fellowships offered, and Fellowships availed (1997–2016)*

The number of SRF application has grown from 84 in the year 1999 to 16,668 in the year 2016 (Figure 1) (Table 1, Appendix IV).

### *An analysis of the SRF numbers – students and teachers*

Students are the largest target group of the programme. Figure 2 (Table 2, Appendix IV) represents the growth in the number of applications over the years (1997–2016). Every year, the number of applications received increased by an average of 1.5 times – the highest being a 5.8x surge in the year 2000, followed by 1.8x increase in 2005, when the number of application received reached close to 3000.

A drop in the number of applications is observed in the year 2016 – the programme received only 0.7x the number of applications compared to the previous year. The Indian Academy of Sciences could highlight no specific reason for this decline. The general trend, however, appears to be of a rise in the number of student applications.

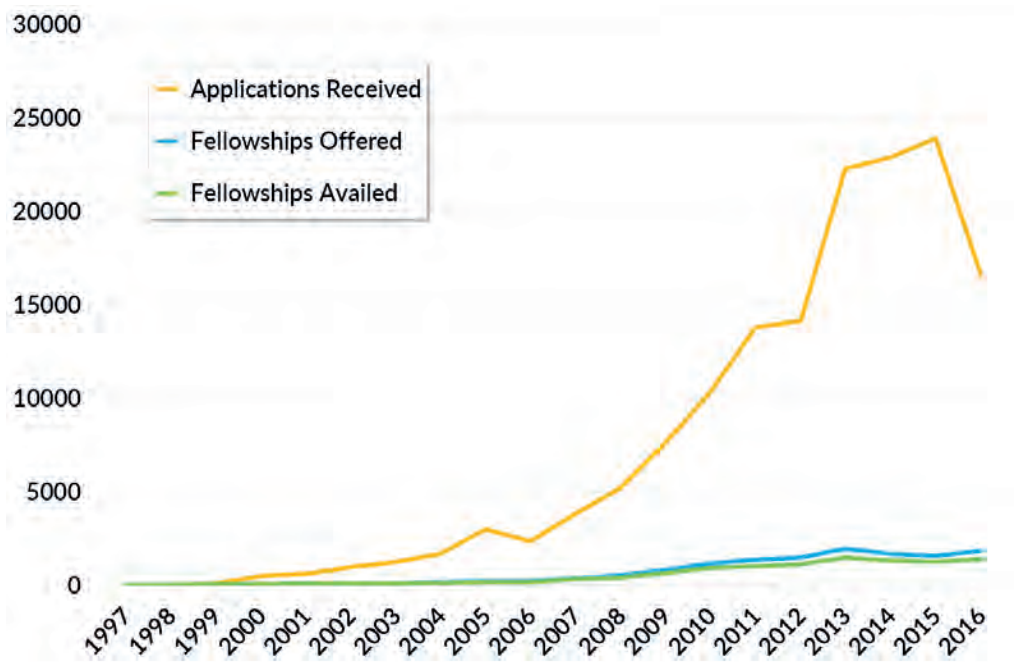



*Figure 2: Plot illustrating the number of student applications received, Fellowships offered, and Fellowships availed (1997–2016)*

Of the total number of student applicants, only an average of ~10% are offered the Fellowship. Of these, an average of 90% of students are observed to be availing the Fellowship in the previous decade (2000–2009). However, this number has dropped to 77% in 2010–2016.

The SRFP was originally planned to reach out to both students and faculty to encourage science education in the country. However, even though the faculty programme started in the same year as that of the students, the first set of applications from faculty was received only in 1999. The increase in the number of faculty applications was marginal until 2006, following which there was a steady rise in the number of applicants until the year 2013, when the programme received the highest number of applications (883). After 2013, the number of applications reduced further; only 454 teachers applied for the programme in 2016. The 2010s shows ~150–200 teacher applicants being selected every year (Figure 3) (Table 1, Appendix IV).

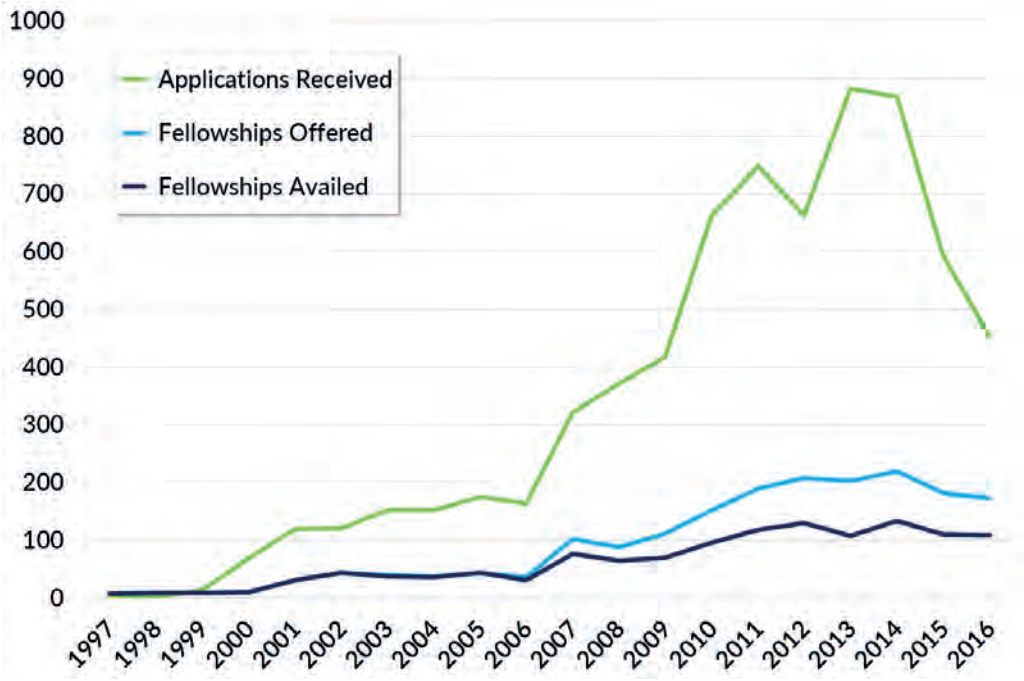



*Figure 3: Plot illustrating the number of teacher applications received, Fellowships offered, and Fellowships availed (1997–2016)*

Although the first few years saw an impressive 100% availment of the Fellowship, this number dropped to 88% in the 2000s. A greater decline can be observed in the years 2010–2016, where only an average of 61% of teachers that were selected, availed the Fellowship. It could be important to explore the possible reasons that are hindering the rise in the number of faculty availing the Fellowship. When compared to teachers, the number of students availing the Fellowship shows a significant increase over the years (Figure 4).

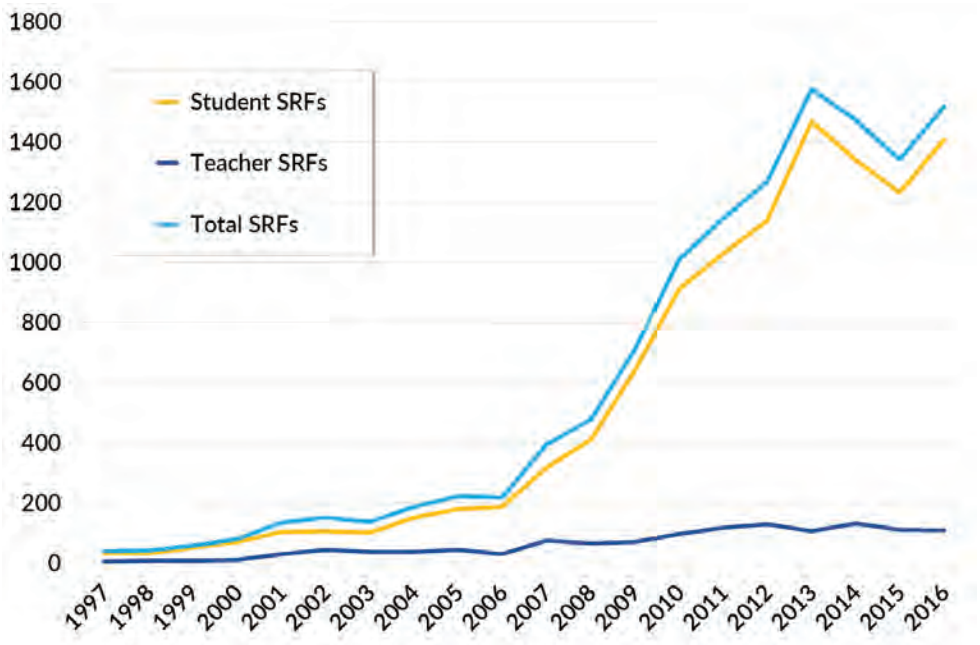
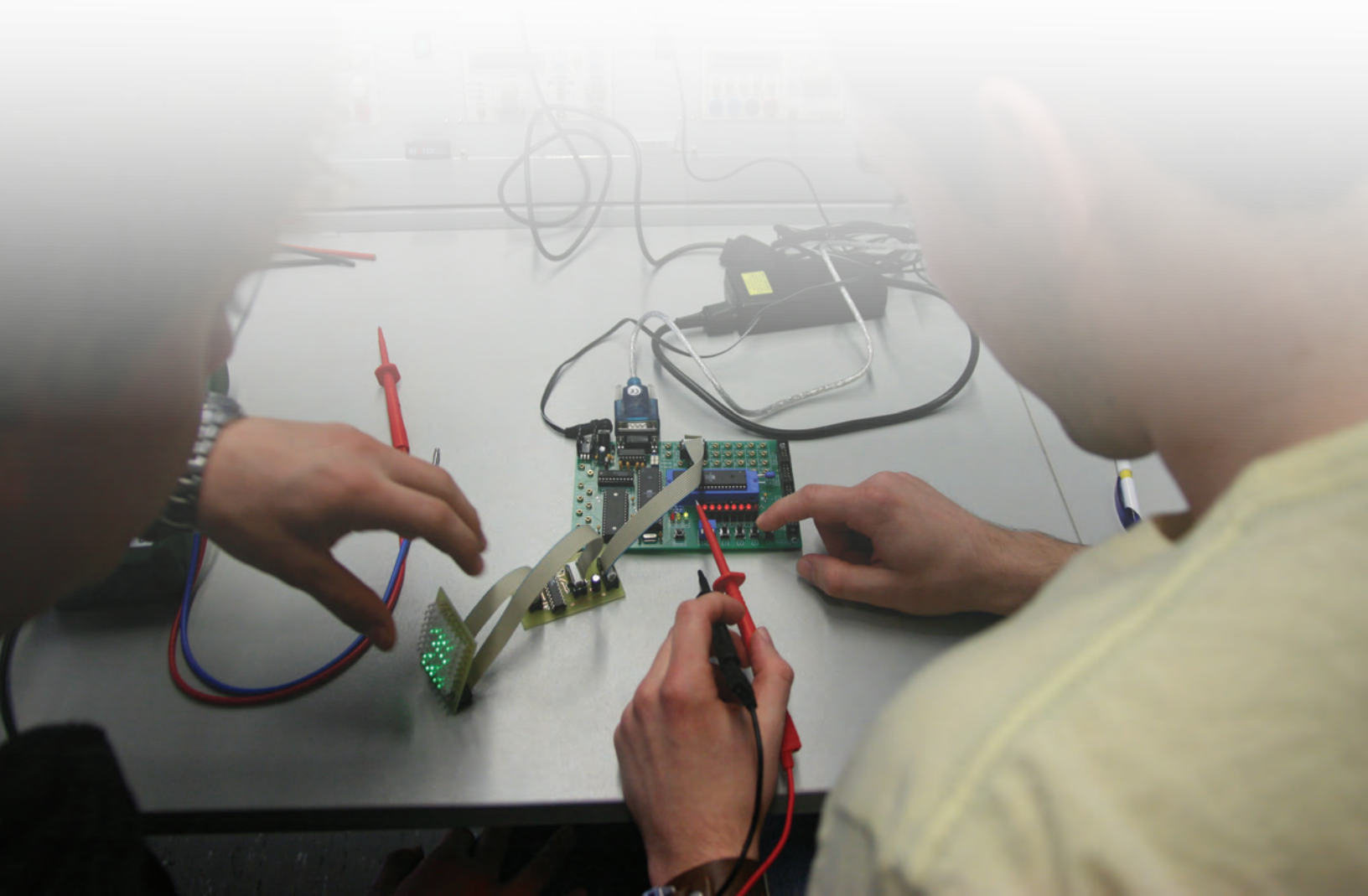



*Figure 4: Distribution of SRFs of students and faculty (1997–2016)*



### *An evaluation of the gender distribution of the SRF*

The gender distribution of the Fellowship, over the years (1997–2016), shows a positive trend, with a slow but steady rise of female summer Fellows, from less than 20% in 1997 to ~49% in 2016 (Figure 5) (Table 2, Appendix IV). Though in absolute numbers, the number of male SRFs is marginally higher than that of female SRFs, the difference is much smaller in recent years. The data also shows that during 2014 and 2015, the number of female who availed the Fellowships was higher than that of male.

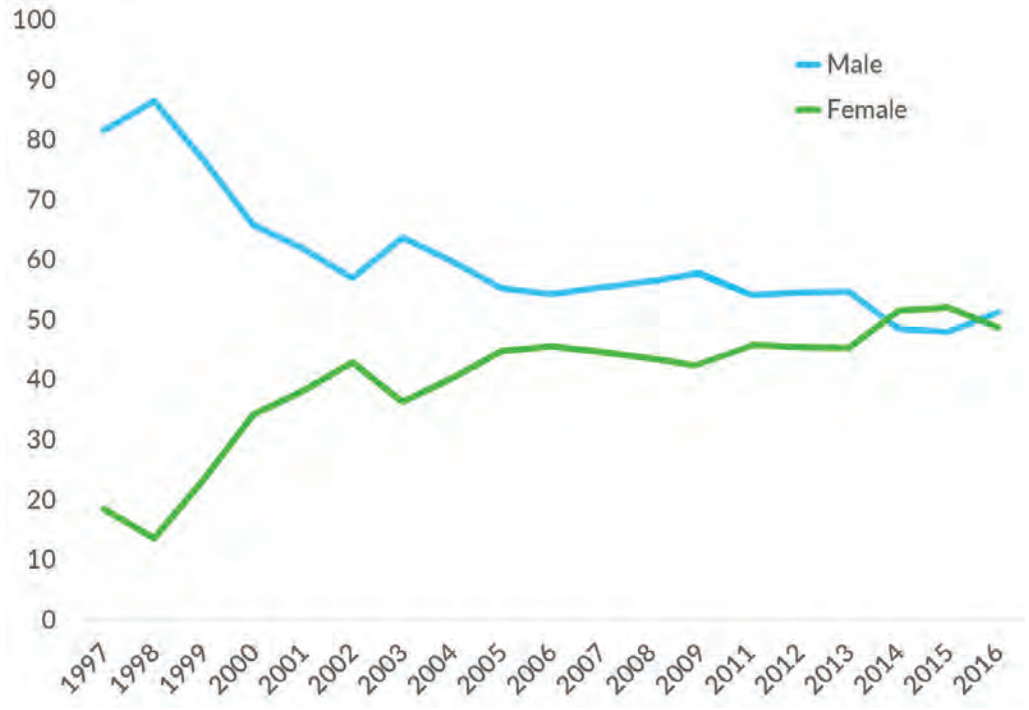



*Figure 5: Gender distribution of Summer Research Fellows (1997–2016)*
*The data for the year 2010 is not available.

### *An insight into the subject preference of the SRF*

The Summer Research Fellowships were introduced to attract talent to the basic sciences. Understanding subject preferences of the Fellows will provide a snapshot of the major target groups of the programme, while also focusing on those disciplines that receive lesser participation. The analysis, however, is not altogether

comprehensive, as the SRFP database has information regarding specialisation only from the year 2004.

Over the years 2004–2016, the distribution of SRFs across the disciplines shows that a large proportion of the Fellowships is distributed among Biology, Engineering, Chemistry and Physics, with very few students choosing Maths, Earth and Planetary Sciences, or even Agriculture (Figure 6) (Table 3, Appendix IV).

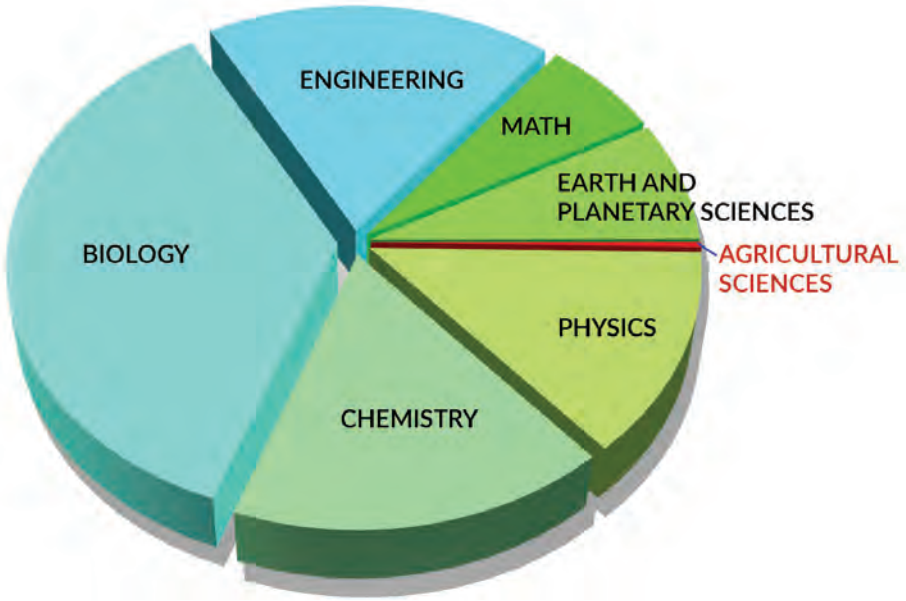



*Figure 6: Distribution of Fellowships across disciplines (2004–2016) ; n=10771*

The percentage of students that chose to work in Biology, Engineering, Chemistry and Physics are 37%, 19%, 17% and 13%, respectively (2004–2016). While Biology has always attracted the highest number of SRFs over the years, Engineering, as a discipline, has seen a steady increase in the proportion of the Fellowships. One of the reasons for this could be that an internship is integral to the undergraduate and postgraduate programmes of engineering. The distribution across the years shows that over one-third of the Fellowships are in Biology (Figure 7) (Table 4, Appendix IV). Maths, Earth and Planetary Sciences and Agriculture attract less than 10% of

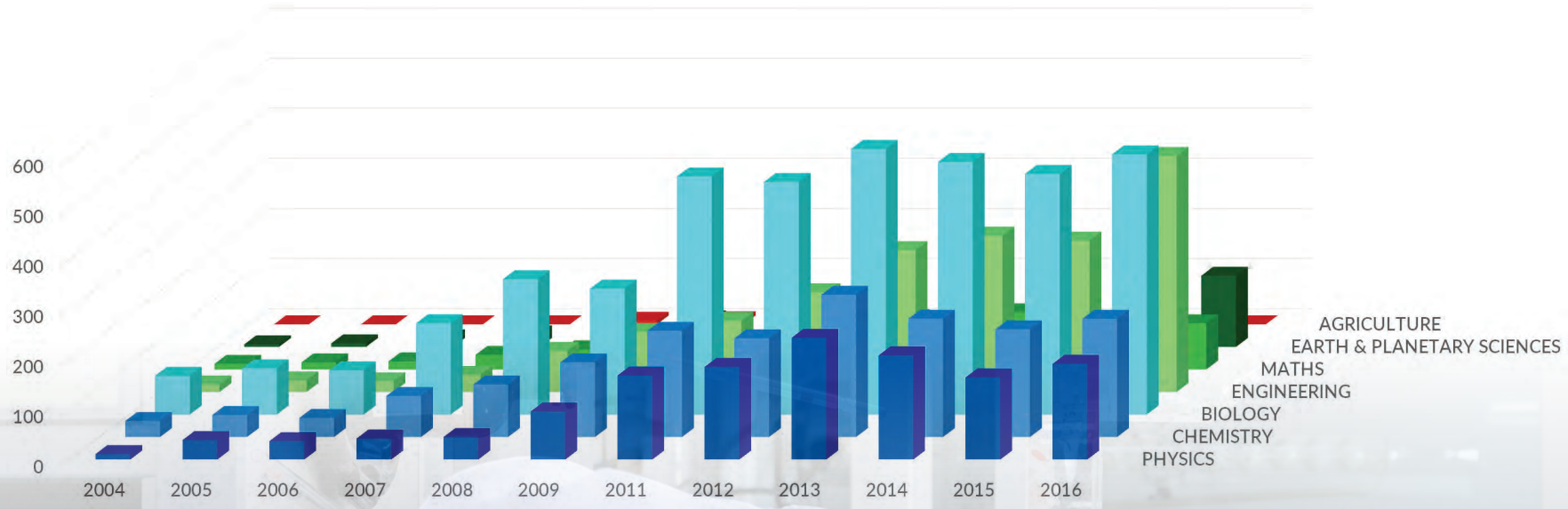



*Figure 7: Subject preferences of the SRFs during 2004-2016*

*The data for the year 2010 is not available.



the Fellowships. One wonders if the distribution of Fellowships is a reflection of, both, the infrastructural and human resources available within the country, which are accessed by the Academies for the Summer Fellowship Programmes.

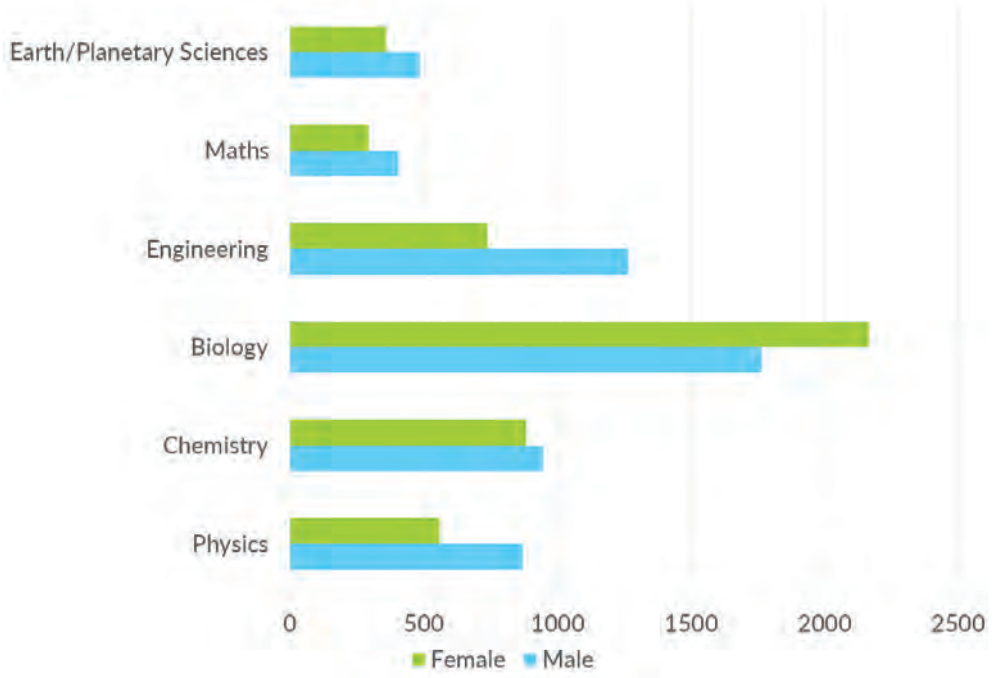



*Figure 8: Gender distribution of the SRFs across major disciplines (2004–2016)*

Figure 8 represents the gender distribution of the total SRFs for each of the disciplines for the years 2004–2016. The representation of male is higher than female in all disciplines, except for Biology, where over 50% of the Fellows are female. Chemistry comes a close second, with female comprising 48%. The lowest proportion of female Fellows is observed in the field of Engineering.

### *An overview of the geographical distribution of the SRF applicants*

The Summer Research Fellowship Programme has attracted applications from all parts of the country. To understand the outreach of the SRFP across the nation, the data available with the Academy (1997–2016) was classified across different regions, viz., North, South, East, West and the North-east. (Table 5, Appendix IV) During the initial years, up to about 2001, the SRFP witnessed

small numbers and they were predominantly drawn from the southern and western regions of the country (Figure 9) (Table 6, Appendix IV). After 2001, the Summer Research Fellowship witnessed increased representation from the Northern and Eastern regions of the country. Representation of students from the North-eastern region is mostly low, although the numbers have been increasing very slowly. In order to address this, the Academy has recently introduced a focused programme for the North-eastern states (Focus Area Science Technology Summer Fellowship) specifically to increase their numbers in the Summer Research Fellowship Programme.

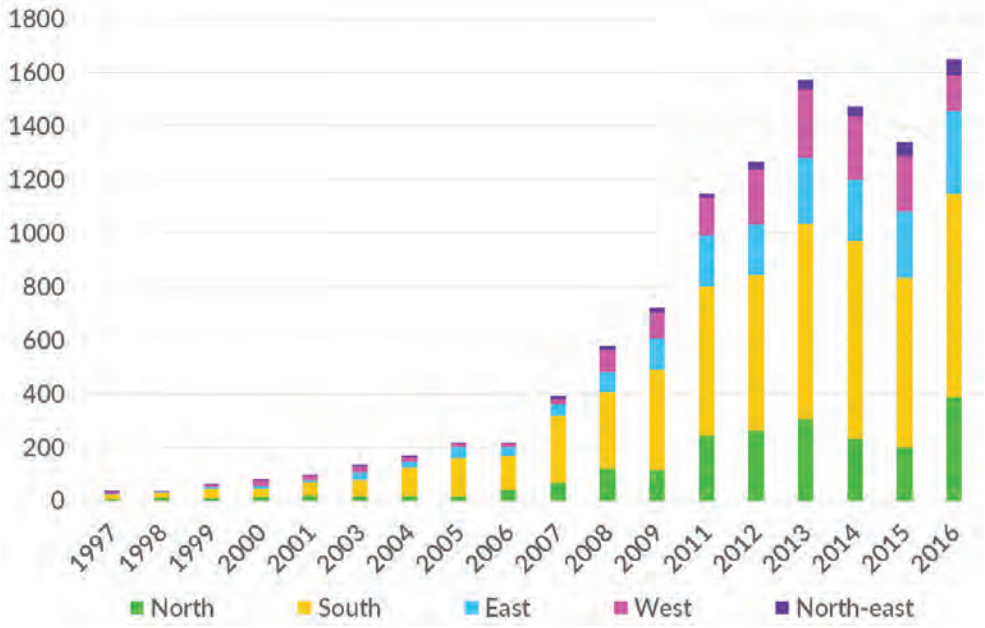



*Figure 9: Geographical distribution of the SRFS (1997–2016)*
*The data for the year 2010 is not available.

The overall trend shows that the SRFP is predominantly represented by candidates from the southern states. The southern states have also, historically, shown advanced indications of development, including education, and this could be one of the possible reasons for their large presence in the programme.

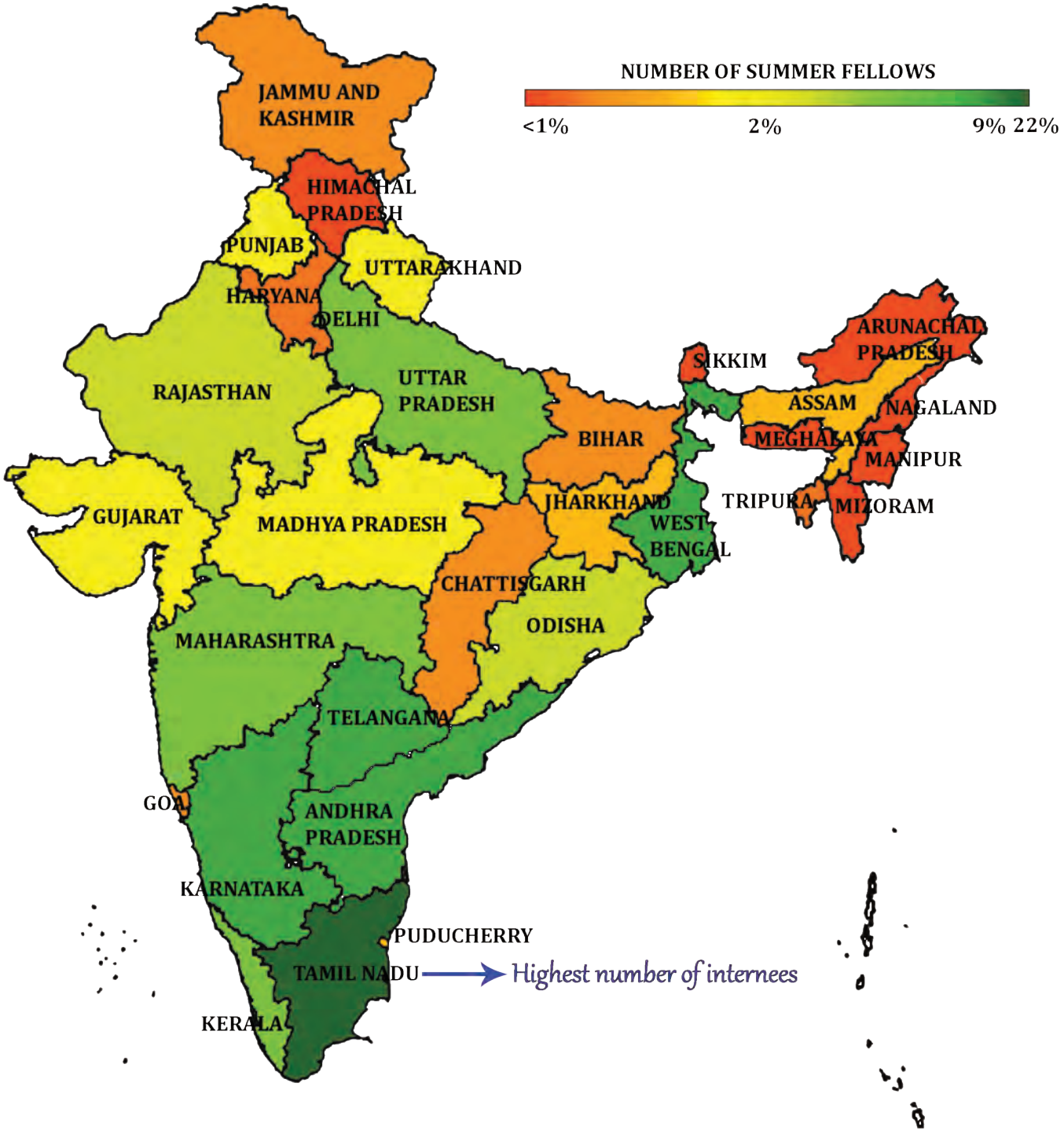



*Figure 10: Map depicting the distribution of SRFs across India*

Close to half (49.3%) of the SRFs, over the years, belong to the Southern states. The percentage from western states is 13.47%, from Northern states is 18.35% and from eastern states 16.04%. The North-eastern states have the least representation of about 3% (Figure 10).

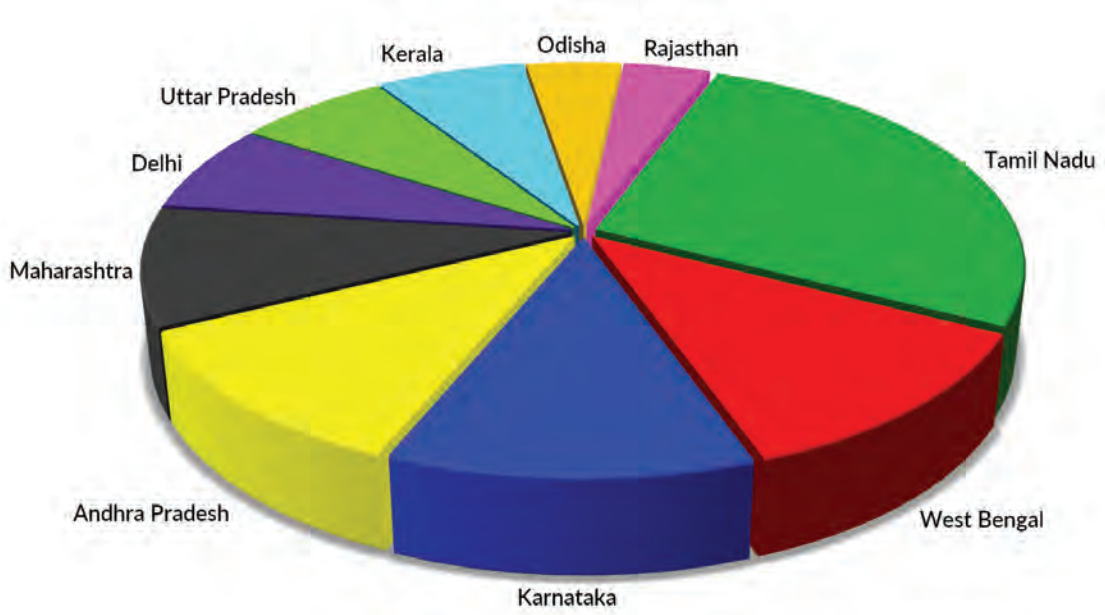



*Figure 11: The ten most-represented states; n=10771*

To further understand the distribution of the SRFs across different states, Figure 11 shows the state-wise classification of the ten most-represented states. Nearly one-third of the total SRFs are from Tamil Nadu. This is followed by West Bengal that records about one-tenth of the number of SRFs. Karnataka comes a close third with ~ 10% applicants. It is interesting to note that even though the Indian Academy of Sciences is in Bengaluru, the representation from Karnataka is less than 10%. It may be interesting to correlate the number of colleges and universities in different states and the number of Academy Fellows from different states to examine if they have a bearing on the number of Summer Research Fellows.

# IMPRESSIONS OF THE PROGRAMME

As part of the survey, the past Summer Research Fellows were requested to respond regarding the quality of the programme considering the strengths, as well as aspects of the programme that could be strengthened.

In response to the question on the positive aspects of the Fellowship, most of them expressed that the SRFP gave them an opportunity to participate in research projects. Being part of research projects provided them with an exposure to scientific research that was beyond the scope of the college curriculum and a hands-on experience in using advanced instruments. During the period of their Fellowship, they had an opportunity to work with leading research groups and scientists that enabled them to develop skills of working in groups. Many admitted that Summer Fellowship attachment, which reflected in their CVs, was instrumental in the advancement of their career. The reference letters from their guides were useful when they sought admissions in institutions of higher education. They learned aspects related to methodology and research ethics, which were critical to their growth as scientists. During this period, the experience of being part of research laboratories in leading institutions created interest and motivation to pursue their doctoral studies.

**Challenges of Summer Research Fellows:** One of the most prominent challenges, raised by the Summer Fellows, was regarding accommodation in the respective institutes. While some of the campuses provided free accommodation, many others were not able to do so, which then required the student to look for accomodation outside the campus. Being in a new city or town and seeking accommodation for a period of 1–2 months was difficult. Many of

the female SRFs complained about the non-availability of clean washrooms/ cloakrooms in their places of accommodation. As the cost of living was high, some of them wanted the Academy to consider an increase in the stipend.

Several of the SRFs were disappointed as their research guides were extremely busy and had very little time available for interaction. Most often, they had to work with research scholars of the guides. However, it must be noted that this was counter to their expectations and hence the reluctance to work with the research scholars, who were part of the research programme. The shift in the culture of working with research scholars rather than the faculty requires the SRFs to treat this as an opportunity and explore the possibility of working with research scholars/ peers as an opportunity for learning.

Some of them expressed few restrictions regarding the choice of the guides. Others expressed the need for more information about the research areas of the guide to assist them while making their choice of guides. It may be useful if the Academy would consider reviewing the current practice of guide allotment to better match the mutual needs of guides and students. A greater focus on improving the mentoring mechanism is essential for improving the quality of the SRFP.

As part of the programme, special lectures from eminent scientists were organised. The SRFs wanted more of such lectures. In addition, some students

expressed that they will benefit a great deal if career counselling was also offered as part of the Fellowship programme. The SRFs wanted to be part of more interdisciplinary projects during the Fellowship period.

While the student SRFs wanted a longer period of the Fellowship programme, the faculty SRFs expressed difficulty in participating in the SRFP due to the difficulty in obtaining leave from their institutions for the duration. Opportunities to present papers and writing of research articles will be useful to hone their oral and writing skills.

The SRFs expressed the need to create an Alumni network, which will allow them to keep in touch with other SRFs as they move ahead in their professional career. To this end, a Facebook group has been created for the SRF Alumni. This platform could be utilised by the Academy to organise alumni meetings. The Alumni network will be extremely useful to trace the professional growth of students who have been part of the SRFP.

Most SRFs expressed the need to improve the outreach by including the advertisement in the local newspapers and in regional languages.

# RECOMMENDATIONS

- The Summer Research Fellowship Programme (SRFP) is a unique programme that provides college teachers and students with an exposure to premier universities and institutions in the country. For most students in India, it is a first-time exposure to a research environment.
- The SRFP provides mentoring for students by Fellows of the Academies. Given the fact that most college and university environment has few opportunities for providing mentor support for research, the programme is important. However, for effective mentoring, there is a need for periodic opportunities of interaction, which could be integrated into the programme. Providing greater structure for this mentoring could have a potential for drawing a greater number of students to scientific and engineering research.
- It is heartening to note that the programme has, over the years, seen an increase in the number of female, amounting to a nearly equal participation as that of male. The gender break-up with respect to disciplines shows that Biology has over 50% of the SRFs who are female, closely followed by Chemistry. Disciplines such as Physics, Maths and Engineering traditionally have a relatively lower representation of female and the same is reflected in the distribution of the SRFs. The participation of female in the SRFP may be a reflection of the large number of female enrolled in undergraduate and post-graduate science programmes across the country.
- It may be important for the Academy to work with the scientific networks of women that are existing in the country in Physics, Astrophysics and Maths disciplines. In this connection, it will be useful to examine if there are factors with respect to gender that may be responsible for the relatively low participation of female in these disciplines in the Summer Fellowship Programme.

- The increasing inequality between urban/rural areas with reference to opportunities of resources, both material and human, needs to be addressed. It should be noted that rural children have equal and perhaps greater talent when compared to urban areas. Hence, the Academy can explore strategies to increase the outreach of the SRFP in rural areas.
- Designing specific strategies to reach out to students from under-represented states and communities will be useful to increase the diversity of the Summer Fellows. The special programme for the North-eastern states (FAST-SF) started by the Academy is a case in point. The Academy could develop more such programmes to reach out to the other under-represented groups.
- It may be useful if all Science Promotion programmes like, NTSE, KVPY and INSPIRE have independent database which can be accessed for the Summer Research Fellowship Programme. The opportunity for research provided by SRFP can be used by a sub set of the above database if they qualify for the SRFP. Such opportunities may enhance the impact of these bright minds pursuing research in Science and Maths.
- There is a need for a detailed qualitative study to document and analyse the experiences of students, particularly of those who are historically disadvantaged to understand the challenges they face in participating in the programme.
- The Academy maintains a database that allows SRFs to update information about their growth in their professional lives. However, SRFs seldom visit the database and update their information. It may be worthwhile to conceive a strategy by which the SRFs will actively contribute to the database.
- The Academy has initiated a Facebook alumni group, which has seen moderate activity during the first few months of creation. A WhatsApp group of SRF faculty and students could be created to spread information about the SRFP programme. The Academy could consider introducing various approaches



to keep the group active and engaged. Alternatively, the Academy can explore the creation of a technology-based platform to connect and strengthen the programme through the Alumni network. Updating SRF success stories on the Academy website, for instance, could prove to be inspirational to the succeeding batches of SRFs.

# CONCLUSION

The Summer Research Fellowship Programme was introduced by the Indian Academy of Sciences in 1995. It was extremely important to review this programme to understand its impact on the Summer Research Fellows. The study will provide useful feedback to strengthen the programme. The findings of the study would have been more insightful if we had conducted in-depth interviews of the Summer Research Fellows and the guides who are the critical blocks of this programme. Due to the paucity of time, this was not possible. Creating a network of the Summer Research Fellows across the years will be useful for exchange of ideas and building professional networks.

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# APPENDIX 1

## QUESTIONNAIRE FOR THE SUMMER RESEARCH FELLOWS

**THE SURVEY**

The questionnaire is to be filled by Fellows who have been part of the Summer Research Fellowship Programme of the National Science Academies of India.

**Purpose of the Survey:**

This survey aims to assess the outreach and impact of the Summer Research Fellowship Programme of the national Science academies. Insights from this study will be used 1) to evaluate whether it has been able to meet its original objectives and 2) to strengthen the programme. The findings will be used to strengthen the current programme through appropriate policies, strategies and interventions to provide mentoring support to participating Fellows.

1. **We assure you of complete confidentiality, with regard to all the information you provide us.**

2. This is a questionnaire designed to trace the career path of students who have been part of the Summer Research Fellowship Programme from 1995 to 2016.

3. To ensure the fullest confidentiality, the survey has been commissioned outside the Science Academies, to the National Institute of Advanced Studies (NIAS). All survey responses will be collected, compiled and aggregated by NIAS and kept strictly confidential. **Only aggregated data will be handed over to the Science Academies. We will take all care to make sure that no individual response can be traced back to the respondent.**

4. We propose to supplement this information with a select number of in-depth interviews of respondents. If you let us know of your interest to be a part of this sub sample, we will contact you at the next stage. We assure you

that the information at this stage will also be completely confidential.

5. You can also not fill applicable if needed.

6. We will be more than pleased to clarify any queries during any stage of the study.

(d) TO BE FILLED IN FROM IASc DATA:

(e) Name:

(f) Year of Fellowship:

(g) Any other details:

(h) INTERVIEW QUESTIONS:

I. Academy Summer Fellowship Details

1. How did you hear about the Academy Summer Fellowship?

2. Name of the Guide

3. Gender of the Guide

4. Name of the Institution

5. Period of the Fellowship: Year/Month

6. Title of the Project

7. Was the project proposed by your Fellowship guide, College guide, or yourself?

8. How often did you meet your Fellowship guide?

9. What did you typically discuss during these meetings?

10. What kind of support was provided by your guide?

11. Did you take up any other internships before or after this?

    a. Details of other Fellowships, if any

II. Relationship with Guide After the Fellowship

12. Did you keep in touch with your guide after the Fellowship?

    a. How often?

    b. Regarding what?

13. Did your guide put you in touch with others working in your field?

    a. Who? Name:

    b. Name of institution

    c. Position (Prof, Associate Prof, Assistant Prof, Graduate Student)

14. Did you receive any other support from your guide?

15. Are you in touch with your guide now?

a. Regarding?

III. Fellowship Experiences

16. What were some of the positive experiences of the Fellowship?

17. What are the areas that you think can be improved? Give details

18. If you had the choice, how would you design the Fellowship programme?

19. Is there anything else you would like to tell the Academy about the way the Fellowship is designed?

(i)

IV. Educational Details

V. Employment Details

| | Name of the institution | Address | | Passed Year |
|---|---|---|---|---|
| Std X | | | | |
| Std XII | | | | |
| | Name of college and university | Address | Name of degree, Subject | Year degree was awarded |
| Bachelor's Degree | | | | |
| Master's Degree | | | | |
| Ph.D | | | | |

VI. Personal Details

| Year of Joining | Name of the institution | Position | Period of work | Reason for leaving |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

20. Date of Birth

22. Gender

23. Marital Status

26. Mother's Occupation:

27. Father's Occupation:

# APPENDIX 2

## Cover Letter

Dear former Summer Research Fellows,

The Summer Research Fellowship Programme of the national Science academies emerged out of a study carried out by the Indian Academy of Sciences in 1994 about the state of science education in the universities. Based on the recommendations of the study, in 1995, the first Summer Fellowships were offered to five students. The programme proved to be popular with the number of Fellowships rising to 1673 in 2013, from an applicant pool of 23,173. From 2007, the three Science Academies set up a joint Science Education Panel to administer the Summer Fellowship programme.

This survey has been designed to understand the outreach and effectiveness of the Summer Fellowship programme. Though the programme has been operational for over two decades, this is the first review of the programme. Therefore, your participation in the survey is vital to help the Science Academies take stock of their flagship Science Education programme.

**To ensure the fullest confidentiality, the survey has been commissioned outside the national Science Academies, to the National Institute of Advanced Studies (NIAS). All survey responses will be collected, compiled and aggregated by NIAS and kept strictly confidential. Only aggregated data will be handed over to the Science Academies.**

The survey questionnaire and a consent form are attached with this email. You are welcome to fill the form and send it back to us by email. Follow-up will be conducted telephonically, after setting up appointments for a time that is convenient for you.

Lastly, after the surveys are completed, a subset of the respondents will be invited to participate in more in-depth interviews. Please do indicate during the survey if you are willing to participate in these.

Please feel free to write to us for any clarifications.

Thanking you in advance for being a part of this survey.

# APPENDIX 3

## Consent form

**CONSENT TO PARTICIPATE IN SURVEY**

Survey of Summer Research Fellowship Programme (1997–2016)

You have been asked to participate in a research study conducted by the National Institute of Advanced Studies. The purpose of the study is to understand the outreach and effectiveness of the Summer Fellowship programme offered by the three national Science Academies. Please read the information below before deciding whether or not to participate.

• This survey is voluntary. You have the right not to answer any question, and to stop the survey at any time or for any reason. We expect that the survey will take about 20 minutes. We hope to receive your response as soon as possible.

• The information collected will be confidential. All survey responses will be stored at NIAS and only aggregated data will be handed over to the national Science Academies.

I understand the procedures described above and I agree to participate in this study.

My name _____

My signature _____Date _____

# APPENDIX 4

## SRF DATA

**TABLE 1:** ***Summer Research Fellowship Programme: A look at the overall numbers***

| | STUDENTS | | | TEACHERS | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| YEAR | AR | FO | FA | AR | FO | FA | AR | FO | FA |
| 1997 | 0 | 31 | 31 | 0 | 7 | 7 | 0 | 38 | 38 |
| 1998 | 0 | 33 | 33 | 0 | 8 | 8 | 0 | 41 | 41 |
| 1999 | 84 | 51 | 51 | 13 | 8 | 8 | 97 | 59 | 59 |
| 2000 | 486 | 69 | 69 | 68 | 10 | 10 | 554 | 79 | 79 |
| 2001 | 609 | 104 | 104 | 119 | 30 | 30 | 728 | 134 | 134 |
| 2002 | 969 | 107 | 107 | 120 | 43 | 43 | 1089 | 150 | 150 |
| 2003 | 1260 | 116 | 101 | 152 | 39 | 37 | 1412 | 155 | 138 |
| 2004 | 1689 | 167 | 152 | 152 | 37 | 36 | 1841 | 204 | 188 |
| 2005 | 2988 | 202 | 180 | 175 | 44 | 43 | 3163 | 246 | 223 |
| 2006 | 2371 | 202 | 187 | 163 | 36 | 30 | 2534 | 238 | 217 |
| 2007 | 3827 | 386 | 318 | 321 | 102 | 76 | 4148 | 488 | 394 |
| 2008 | 5210 | 529 | 412 | 372 | 88 | 65 | 5582 | 617 | 477 |
| 2009 | 7608 | 822 | 639 | 417 | 111 | 70 | 8025 | 933 | 709 |
| 2010 | 10355 | 1162 | 912 | 662 | 152 | 96 | 11017 | 1314 | 1008 |
| 2011 | 13776 | 1353 | 1030 | 748 | 189 | 118 | 14524 | 1542 | 1148 |
| 2012 | 14167 | 1483 | 1139 | 662 | 208 | 130 | 14829 | 1691 | 1269 |
| 2013 | 22283 | 1954 | 1469 | 883 | 202 | 107 | 23166 | 2156 | 1576 |
| 2014 | 22902 | 1705 | 1341 | 868 | 219 | 133 | 23770 | 1924 | 1474 |
| 2015 | 23920 | 1565 | 1232 | 593 | 181 | 110 | 24513 | 1746 | 1342 |
| 2016 | 16668 | 1831 | 1409 | 454 | 173 | 109 | 17122 | 2004 | 1518 |
| TOTAL | 151172 | 13872 | 10916 | 6942 | 1887 | 1266 | 158114 | 15759 | 12182 |

***AR: Applications Received | FO: Fellowships Offered | FA: Fellowships Availed***
***Academy data pool: 12182 | Data period: 1997 – 2016***

**TABLE 2: *Gender-based distribution***

| | NUMBERS | | | PERCENTAGE | |
|---|---|---|---|---|---|
| YEAR | Male | Female | Total | Male | Female |
| 1997 | 31 | 7 | 38 | 81.58 | 18.42 |
| 1998 | 32 | 5 | 37 | 86.49 | 13.51 |
| 1999 | 49 | 15 | 64 | 76.56 | 23.44 |
| 2000 | 52 | 27 | 79 | 65.82 | 34.18 |
| 2001 | 60 | 37 | 97 | 61.86 | 38.14 |
| 2002 | 69 | 52 | 121 | 57.02 | 42.98 |
| 2003 | 86 | 49 | 135 | 63.7 | 36.3 |
| 2004 | 101 | 68 | 169 | 59.76 | 40.24 |
| 2005 | 121 | 98 | 219 | 55.25 | 44.75 |
| 2006 | 118 | 99 | 217 | 54.38 | 45.62 |
| 2007 | 218 | 176 | 394 | 55.33 | 44.67 |
| 2008 | 326 | 252 | 578 | 56.4 | 43.6 |
| 2009 | 434 | 318 | 752 | 57.71 | 42.29 |
| 2011 | 621 | 527 | 1148 | 54.09 | 45.91 |
| 2012 | 693 | 576 | 1269 | 54.61 | 45.39 |
| 2013 | 862 | 714 | 1576 | 54.7 | 45.3 |
| 2014 | 714 | 760 | 1474 | 48.44 | 51.56 |
| 2015 | 644 | 698 | 1342 | 47.99 | 52.01 |
| 2016 | 847 | 804 | 1651 | 51.3 | 48.7 |
| TOTAL | 6078 | 5282 | 11360 | 53.5 | 46.5 |

***Academy data pool: 12182 | Data period: 1997–2016***
***(Data of 2010 is unavailable)***

**TABLE 3:** ***Subject versus gender distribution***

| | TOTAL NUMBERS | | GENDER BREAKUP | |
|---|---|---|---|---|
| | | | Male | Female |
| **Physics** | 1429 | (13%) | 870 | 559 |
| **Chemistry** | 1830 | (17%) | 947 | 883 |
| **Biology** | 3932 | (36.5%) | 1765 | 2167 |
| **Engineering** | 2004 | (18.6%) | 1265 | 739 |
| **Maths** | 698 | (6.5%) | 404 | 294 |
| **Earth and Planetary Sciences** | 843 | (7.8%) | 484 | 359 |
| **Agricultural Sciences** | 35 | (0.3%) | NA | NA |
| **Total** | **10771** | | **5735** | **5001** |

***Data period: 2004 – 2016***
***Note: Data of 2010 is unavailable***

**TABLE 4:** ***Subject preferences of the Fellowships***

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Physics** | 11 | 39 | 37 | 42 | 45 | 96 | 168 | 185 | 243 | 208 | 164 | 191 | **1429** |
| **Chemistry** | 32 | 44 | 38 | 82 | 105 | 149 | 212 | 197 | 284 | 236 | 215 | 236 | **1830** |
| **Biology** | 77 | 92 | 88 | 182 | 270 | 251 | 475 | 464 | 530 | 504 | 480 | 519 | **3932** |
| **Engineering** | 15 | 23 | 21 | 34 | 82 | 120 | 142 | 199 | 283 | 312 | 302 | 471 | **2004** |
| **Maths** | 11 | 14 | 16 | 29 | 40 | 73 | 56 | 88 | 92 | 114 | 73 | 92 | **698** |
| **Earth and Planetary Sciences** | 5 | 7 | 17 | 25 | 29 | 55 | 87 | 124 | 144 | 100 | 108 | 142 | **843** |
| **Agricultural Sciences** | 0 | 0 | 0 | 0 | 7 | 8 | 8 | 12 | 0 | 0 | 0 | 0 | **35** |
| **Total** | **151** | **219** | **217** | **394** | **578** | **752** | **1148** | **1269** | **1576** | **1474** | **1342** | **1651** | **10771** |

***Data period: 2004–2016***
***Note: Data of 2010 is unavailable***

**TABLE 5: *Number of SRFs from each state categorised into geographical regions***

| NORTH | |
|---|---|
| Jammu & Kashmir | 79 |
| Himachal | 29 |
| Punjab | 224 |
| Haryana | 58 |
| Uttarakhand | 208 |
| Delhi | 566 |
| Uttar Pradesh | 545 |
| Rajasthan | 315 |
| TOTAL | 2024 |

| NORTH-EAST | |
|---|---|
| Assam | 198 |
| Tripura | 36 |
| Nagaland | 19 |
| Meghalaya | 16 |
| Arunachal Pradesh | 15 |
| Manipur | 15 |
| Mizoram | 12 |
| TOTAL | 311 |

| WEST | |
|---|---|
| Gujarat | 324 |
| Madhya Pradesh | 313 |
| Maharashtra | 848 |
| TOTAL | 1485 |

| SOUTH | |
|---|---|
| Andhra Pradesh | 1014 |
| Karnataka | 1035 |
| Kerala | 635 |
| Tamil Nadu | 2248 |
| Goa | 193 |
| Puducherry | 310 |
| TOTAL | 5435 |

| EAST | |
|---|---|
| West Bengal | 983 |
| Odisha | 378 |
| Jharkhand | 163 |
| Bihar | 109 |
| Chattisgarh | 112 |
| Sikkim | 24 |
| TOTAL | 1769 |

*Academy data pool: 11024 | Data period: 1997 – 2016*
*(Data for 2002 and 2010 is unavailable)*

TABLE 6: *Region-wise distribution*

| | NORTH | SOUTH | EAST | WEST | NORTH-EAST | TOTAL |
|---|---|---|---|---|---|---|
| 1997 | 7 | 19 | 1 | 10 | 1 | 38 |
| 1998 | 13 | 22 | 2 | 4 | 0 | 41 |
| 1999 | 9 | 36 | 5 | 8 | 1 | 59 |
| 2000 | 15 | 31 | 11 | 21 | 1 | 79 |
| 2001 | 30 | 55 | 17 | 22 | 10 | 134 |
| 2003 | 17 | 63 | 29 | 22 | 7 | 138 |
| 2004 | 23 | 108 | 28 | 22 | 7 | 188 |
| 2005 | 20 | 144 | 39 | 15 | 5 | 223 |
| 2006 | 41 | 125 | 35 | 14 | 2 | 217 |
| 2007 | 67 | 250 | 45 | 18 | 14 | 394 |
| 2008 | 79 | 258 | 53 | 74 | 13 | 477 |
| 2009 | 112 | 371 | 111 | 98 | 17 | 709 |
| 2011 | 243 | 560 | 190 | 142 | 13 | 1148 |
| 2012 | 265 | 579 | 189 | 207 | 29 | 1269 |
| 2013 | 308 | 730 | 246 | 255 | 37 | 1576 |
| 2014 | 232 | 738 | 230 | 236 | 38 | 1474 |
| 2015 | 201 | 633 | 248 | 205 | 55 | 1342 |
| 2016 | 342 | 713 | 290 | 112 | 61 | 1518 |
| TOTAL | 2024 | 5435 | 1769 | 1485 | 311 | 11204 |
| PERCENTAGE | 18.35 | 49.3 | 16.04 | 13.47 | 2.82 | |

*Academy data pool: 11024 | Data period: 1997 – 2016 (Data for 2002 and 2010 is unavailable)*