

EXECUTIVE SUMMARY

Women in Science in India

Amongst practitioners of science and technology in India, women constitute a distinct minority. Moreover, many highly qualified women (for example, those with doctorates) drop out of the workforce, thus constituting a considerable depletion of national resources in science and technology. This report evaluates the present situation for women scientists in India, attempts to identify the societal and institutional reasons why women scientists appear to be at a disadvantage, and suggests some measures that could be taken to improve the situation.

Task Force for Women in Science

In December 2005, the Government of India set up a Task Force on Women in Science. Department of Science and Technology in the Ministry of Science and Technology was given responsibility to provide the necessary support. The Task Force had members representing different disciplines of science, institutions and different regions of the country. The mandate of the Task Force is to recommend appropriate measures to promote and encourage women to take up scientific and technological professions; to formulate a time bound plan of action for these measures; to suggest measures to motivate girls to take up S&T for higher education and develop a scientific temper and awareness; to interact with other scientific departments/organizations on implementation of gender enabling measures; and to consider and recommend other proactive gender enabling measures to bring about a greater involvement of women in science and technology.

Activities of the Task Force

- The Task Force held ten meetings in different geographical parts of the country. All the meetings included a half-day interaction with local women scientists, so as to gather information, suggestions and feedback from them.
- A website, www.indianwomenscientists.in, has been set up. This website will host a Directory of Indian Women Scientists, which will be a useful database that can be consulted when choosing speakers for conferences, members of selection committees, etc. It will also provide an interactive forum for women scientists to network and share information.
- A project has been commissioned to compile a book highlighting the achievements of prominent women scientists. This will be brought out by Dr. C. S. Lakshmi of the Sound and Picture Archives on Women (SPARROW), Mumbai. This book should serve to inspire girl students to take up science as a career.

- Another project to examine portrayals of gender in school science textbooks was commissioned from Dr. Sugra Chunawalla of the Homi Bhabha Centre for Science Education and Research, Mumbai. An adverse portrayal in such textbooks can reinforce prejudices, while a positive portrayal could encourage more girls to study science.
- A National Conference showcasing women's achievements in science and technology was held on March 8-9, 2008. This conference featured scientific talks by several Indian women scientists. The level of these talks was universally acknowledged to be very high. In addition, panel discussions concerning the issues relevant to women in science were also held. The Hon'ble Minister for Science and Technology and Earth Sciences, Shri Kapil Sibal, marked the occasion by making several important announcements concerning government incentives to promote and further the participation of women in science.

Study and Practice of Science by Indian Women – The Current Status:

- Though the percentage of girls studying science in Indian universities has increased since Independence, the ideal fraction of 50% of female students has not been achieved; in fact there is evidence that the percentage has plateaued off at a lower level.
- The percentage of girls studying engineering is even lower than in basic science. The situation in the IITs is particularly dismal.
- Some parts of the country appear to be lagging behind. Gross regional disparities are evident, greater effort is needed here to increase the percentage of girls studying science.
- There is a drastic drop in the percentage of women, from the doctoral level to the scientist/faculty position suggesting a bottleneck at the employment stage, due to recruitment procedures and family responsibilities. Focused efforts are needed to identify the sources of this precipitous drop, and counteract them.
- Another striking observation is the major paucity of women at the senior most administrative and policy making positions in the scientific institutions.

Recommendations based on discussions with scientists

A feedback was obtained from over a 1000 women on the basis of structured questionnaire and/or personal interactions. A summary of recommendations from this exercise is given below—

Summary of Recommendations

Fostering and Supporting Women Resources in S&T

- *Rules and guidelines for a time bound recruitment target system (RTS) for increasing the proportion of women scientists recruited in institutions per year must be put in place.*
- *The unwritten barriers on employment of husband and wife in the same institution should be addressed proactively and broken.*
- *A directive regarding code of ethics to be followed while asking questions to women candidates in search/selection/hiring committees to be enforced.*
- *In case provision for part time jobs is made or they are available, they should be first offered to women desiring the same.*

Enabling Measures for Career Advancement and Re-entry

- *Enhancing opportunities for women who have highest qualifications in science, but are unable to do research because of circumstances.*
- *Rules that do not allow scientists to work beyond 5 years in project positions should be re-looked and modified.*
- *Refresher Training & mentorship programme for women scientists who would like to re-enter R&D careers after a career break.*
- *Further relaxation in eligibility criteria regarding age of recruitment for highly qualified women should be examined.*
- *Women's presence in all government sponsored conferences/workshops should be positively encouraged and % for participation to be made mandatory.*

Support Related Issues at Work Place

- *Financial support for improvement of overall generic facilities such as crèches, toilets, campus housing & safe transportation.*
- *Compliance of the Supreme Court guidelines to prevent and redress sexual harassment at the workplace to be made mandatory.*
- *Notifying the procedure to handle complaints of harassment by women scientists against the heads of the institutions.*
- *Rules on provision for air travel even for women who are not eligible, particularly in difficult/far-flung/isolated areas should be formulated.*

Measures to Attract Girls into Science career

- *Supporting summer/winter science camps for girls who have opted for science.*
- *Initiating a well planned role model programme with successful women scientists both through the visual media and by personal interactions.*

- *A special fellowship scheme for girls who get top positions in examinations conducted by universities.*
- *Safe hostel accommodation for girls in towns and cities.*
- *Setting up free/subsidised residential science schools for girls in class IX to XII in smaller places.*
- *Outreach programme during scientific conferences for local school or college students.*
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Educational Reforms

- *Effort should be made so that girls in schools are encouraged to take up further studies in science.*
- *The representation of girls and women in science text books in school is uninspiring, underplayed and needs a re-look.*

New Policies, Rules and Initiatives

National level Gender-segregated data collection, annual upgradation and processes monitoring to be initiated involving all the stake holders.

- *Institute transformation award to be instituted for those institutes that move towards a gender enabling environment.*
- *Concept of 'maternity leave' needs to be broadened to special leave.*
- *Salary-linked child-care allowance in the absence of crèche on campus.*
- *A gender Unit to be set up as a part of all the State Council for Science, Technology and Environment.*
- *Establishment/augmentation of infrastructure of women's universities especially in those states where statistics shows less than 30% women students in the science stream.*
- *Development of avenues to promote entrepreneurship and self-employment for women scientists.*

CHAPTER-I

Genesis of the Task Force

Introduction

In all walks of life, gender inequity arising out of a discriminatory mindset is a global phenomenon. In most patriarchal societies, certainly in India, formal education does not try to dispel myths about women being a subordinate and less important part of society. Subtle or not-so-subtle prejudices against women's competence become more obvious in more demanding (and traditionally male-dominated) vocations like scientific and technological research. Discrimination in science and technology on the basis of irrational biases is ironic, since science by its very nature and ideology is supposed to be a rational subject; practitioners of this profession at least should be above such biases. Gender discrimination hinders females from being equal partners in acquiring knowledge, particularly scientific knowledge and worse still being marginalised after acquiring knowledge is a loss of precious human resource. It has to be seen also from the point of view of the denial of human rights in terms of opportunities for full expression of abilities to half of humankind. That gender bias persists in the 21st century which boasts of a knowledge society is a matter of concern. Though, today the scientific world has moved away from the days when women scientists (even those whose research was later acknowledged by a Nobel Prize) were made to do research stealthily in cellars, the recent remarks of Lawrence Summers (then president of Harvard University) are similar in tone and substance to those of Prof. Stanley Hall in 1905 (see box).

A broad review of the issue of women in science was conducted a century ago, in 1905. Albion Small, the founder of the first sociology department in the United States, conducted a survey of three groups: members of the American Association for the Advancement of Science (AAAS), professors at women's college, and female graduate students (Nerad & Czerny, 1999). The AAAS sample reflected the common belief that men would more likely devote themselves to genuine scholarly work than women.

Prof. G. Stanley Hall, a leading psychologist, contributed his analysis that women are by nature different from men, incompetent in fields that require abstract thinking, and proposed that they be directed to scientific fields that do not emphasize such skills. The female graduate students reported that they enjoyed little intellectual contact with their instructors but were aware that their male peers often met informally with professors. Nerad and Czerny observed that "Many of the women's responses to Prof. Small's survey can still be heard echoing through the halls of modern campuses." (Nerad & Czerny, 1999:3).

In January 2005, Lawrence Summers, President of Harvard University, addressed a National Bureau of Economic Research on Diversity in Science.

He suggested that “the primary barrier to women, as in other high powered jobs, is that employers demand single-minded dedication to work. He also offered a so-called, “fat tails hypothesis” of differences between men and women: that more women have average scientific ability while larger numbers of men are at the high and low ends of a scientific ability scale. His third hypothesis, which he characterized as the least significant of the three, was that “women are discriminated against or socialized as children not to go into science.” Summers’ first hypothesis reprises Small’s summary of the attitudes of AAAS members in 1905; his second, which also included the corollary that women may have lesser innate mathematical abilities than men, replicates Hall’s analysis. Finally, his third hypothesis is congruent with the experience of female graduate students in 1905 and more recently as well. The firestorm of responses to Summers’ remarks called forth new initiatives to improve the condition of women in science, including from his own university (Henessey et al. 2005; Etzkowitz & Gupta, 2006).

Source : Ref.1

Problems Unique to India

While there are many common factors responsible for gender bias across the globe, there are some which are unique to India and a few developing countries. Unlike in the developed countries and many developing countries, where the gender gap in education begins to appear only at the level of university education, in India fewer girls than boys enroll in primary school, and many more girls than boys discontinue schooling after primary school. The proverbial leaky pipeline leaks heavily from primary to secondary school. The reasons for this are many, one of them being the lack of high schools in most villages. While many villages do have primary school of some sort, children often have to travel to another village for high school studies. Parents hesitate to send girls out of the village for reasons of safety and the fact that most government schools do not even have basic facilities such as toilets - a matter of great inconvenience for young girls and women. Private schools, even if present in the village, charge fees. Resource-poor families in a patriarchal society would rather invest in the education of sons than that of daughters. Needless to say, if the science base for the country has to be made robust, a beginning will have to be made with school education, so to ensure that all children at least complete high school, and gender disparity at the school level disappears.

There are cultural mindsets and attitudes towards females which are also unique to India and some developing countries. Right from birth, females are perceived as a burden to the family (thanks to the dowry system), and rejected. Technological advances have unfortunately resulted in sex-selective abortions of female foetuses and a skewed gender ratio, starting from infancy (0-6 years)² that is one of the most lop-sided in the world. Being near the bottom worldwide of the Human Development Index (128th out of 177 countries)³ and having the highest incidence of malnutrition in women and children in the world⁴ despite

a high macroeconomic growth, does not make the nation proud. India's ranking in the World Economic Forum's Global Gender Gap Index is 113th out of 130 countries⁵. Out of the three parameters used for calculating the Gender Gap Index (political empowerment, educational attainment and health and survival), India's ranking is 116th on educational attainment, and 128th in health and survival. India does better in political empowerment – 25th - and it is time to see that this success spreads to other indicators of women's well-being.

Women are regarded as child bearers and home makers, and men as bread winners. Yet women do contribute significantly to the economic well-being of the family by doing more drudgery-oriented, less-paying jobs, besides taking the full burden of housework and child care - the familiar double burden, a third burden being the patriarchal mindset.

Yet there can be little doubt that women have the intrinsic capability to succeed in fields related to science and technology. It may be pointed out that out of the three astronauts of Indian origin till today, two were women. A small but notable proportion of women are CEOs of successful S&T ventures. Similarly, the scientific accomplishments of several Indian women have been acknowledged by international and national awards. While these women, apart from having grit and determination, may have been specially privileged by having good family support systems and receiving encouragement, these facts serve as a clear indicator that Indian women can reach the same heights as men, if given the opportunity.

The issue of science and women includes Women in Science and Science for Women. While both are important, the present report deals only with the former.

Earlier INSA Study⁶

The issue of gender disparity in India has been the subject of earlier studies, mostly done by social scientists. In 2002, Professor MS Valiathan, who was then the president of the Indian National Science Academy, identified 'Science Career for Indian Women' as an issue which needed to be examined and addressed. A committee constituted for the purpose, examined 1) the status of the study and practice of science by Indian women, based on secondary data sourced from reports and records, and 2) factors influencing science career for Indian women. The latter was based on a study conducted by the Research Centre for Women's Studies, (RCWS), SNDT Women's University, Mumbai. Based on the findings, the committee made some recommendations in the report.⁶ Some of the salient findings and recommendations in the INSA Report are summarized below:

Study and practice of Science by Indian Women

1. There has been a steady growth in women's enrolment at the university level, from 10.9% in 1950-51 to 39.4% in 2000-01. However, there are marked regional differences. In states like Goa, Kerala, Punjab and Pondicherry women represent

more than 50% university enrolment, whereas the proportion of women in universities in states like Arunachal Pradesh, Bihar, Orissa and Rajasthan, is less than 35%.

2. Amongst women who opt for natural sciences, fewer women tend to opt for subjects like engineering and technology, as well as agriculture and veterinary science, compared to subjects like basic sciences and medicine.
3. Women constitute 37% of PhDs in science. Despite enormous individual efforts the information that could be obtained about women scientists' presence from a nation as big as India was meager. Based on these admittedly incomplete data available, it was observed that the percentage of women scientists occupying faculty positions in research institutions and prestigious universities is less than 15%, except in some ICMR and DBT institutions, where the percentage is higher. Recognition of women by way of awards and fellowships of academies is very low (less than 4%). This suggests that there is a glass ceiling at the level of practice of science, particularly research and recognition.

Factors Influencing Science Career by Indian women - The SNTD study

The study conducted by RCWS, SNTD University involved the administering of a structured questionnaire to women scientists and students from different universities all over India, in addition to focus group discussions. Despite the small sample size, some important information and suggestions were obtained. Some of the salient observations are summarized below:

1. Most respondents had studied in English medium schools in urban areas, suggesting a vast untapped human resource living in rural areas, and studying in vernacular language schools, that can be drawn in to science.
2. Biological sciences followed by chemical sciences were the preferred subjects.
3. 59% of respondents said they decided on a science career at the secondary school level and, and faced no discouragement from their families. Parents were an important source of encouragement.
4. While few (9%) experienced entry level constraints in getting post graduate research positions or their first job (11%), impediments in terms of family problems and biases did appear in career advancement for 37% of the respondents.
5. 92% of respondents quoted interest in science as their main reason for selecting the subject.
6. Lack of time, finance and encouragement, and health problems were mentioned as reasons for inability to fulfill career goals.

7. Among specific suggestions given by scientists were flexi-time, establishment of a women's cell, a good crèche and a day care centre for the elderly, permitting or encouraging mid-career breaks, transfer with spouse, desirable location of work, gender sensitization, opportunity for re-entry after a career break, and the inclusion of women in selection committees and as speakers in conferences.
8. Only 44% of scientists and 29% of students were aware of the institute having a policy on sexual harassment.

It should be noted that the scientists interviewed were a distilled lot who had cracked, if not broken, the glass ceiling, and who had persisted with a career in science. Thus, they in some respect represent success stories, and their experiences need not necessarily reflect those of the many women who chose to, or were forced to, drop out of a scientific career.

The INSA Report was discussed by the Scientific Advisory Committee of the Prime Minister. Based on its recommendations, a National Task Force for Women in Science, under the Ministry of Science Technology, Department of Science and Technology was constituted in December 2005.

CHAPTER II

National Task Force for Women in Science

Mandate of the Task Force, Tasks Identified and Functions

The Mandate

- *To recommend appropriate measures to promote and encourage women to take up scientific and technological professions;*
- *to formulate a time bound plan of action for these measures;*
- *to suggest measures to motivate girls to take up S&T for higher education and develop a scientific temper and awareness;*
- *to interact with other scientific departments/ organizations on implementation of gender enabling measures;*
- *to consider and recommend other proactive gender enabling measures to bring about a greater involvement of women in science and technology.*

Thus, the Task Force is expected to function as a think tank for providing suggestions and guidelines to the Government, so that more girls are motivated and facilitated to study science, and more women can take up careers in scientific research, particularly after studying science.

(We point out that throughout this report, the term “Science” will be used in a broad sense, to include technology, engineering, health and agriculture.)

The Task Force includes scientists from different disciplines in science, engineering and medicine, from different regions in the country. See Box 2.

Composition of Task Force		
1.	Dr. Mahtab S Bamji, Hyderabad	Chairperson
2.	Dr. Anuradha Lohia, Kolkata	Member
3.	Prof. Arun Nigavekar, Pune	Member
4.	Dr. KV Peter, Thrissur	Member
5.	Dr. Malathi Laxmikumaran, New Delhi	Member
6.	Prof. PP Parikh, Mumbai	Member
7.	Dr. Phoola Kaul Dhar, Jammu	Member
8.	Dr. Purnima Sharma, New Delhi	Member
9.	Dr. Renu Swarup, New Delhi	Member
10.	Dr. Rohini Devi, Hyderabad	Member

11.	Prof. Sobhana Narasimhan, Bangalore	Member
12.	Dr. Sudha Nair, Chennai	Member
13.	Dr. Vineeta Bal, New Delhi	Member
14.	Dr. Vinita Sharma, DST, New Delhi	Member-Secretary

Activities of the Task Force

Seeking Inputs from the Women scientists

Creating Awareness Regarding the Task Force

At the first meeting of the Task Force held on March 10, 2006 at New Delhi at the DST, it was decided that the Task Force should try to interact with, and get inputs from, a wide spectrum of women scientists and students from various geographical locations in India, to assess the problems faced by them and their perceptions regarding what needs to be done. In the process, regional problems, if any, could also be assessed. One way of getting this information was by holding Task Force meetings in different parts of the country. The establishment of the Task Force and its mandate was publicised by placing advertisements in national newspapers and science journals such as “Current Science”, with an appeal to women scientists to get in touch with the Task Force with their opinions and suggestions (Annexure-1). The creation of a website described later was also a part of this process.

A total of ten formal meetings of the Task Force were held. In each city, a local organiser was identified who would bring the women scientists and students together for a half-day interaction with the Task Force members. These meetings were extremely useful in getting inputs on the difficulties that women face while entering and pursuing a science career. While there were many issues which were shared by women practitioners across the country, some problems were peculiar to specific locations. A compilation of this feedback is presented in Chapter IV. For details of the locations of the meetings and host organisations, see Annexure-2.

Study and Practice of Science by Indian Women - An update

Since the information provided in the INSA report⁶ is almost five years old, it was felt that it should be updated. To get reliable data on a large sample size is a herculean task that has been carried out in the landmark India Science Report, published after the INSA report in 2005. However, despite providing extensive information and the first large-scale data available on societal preference for science career in India, gender-segregated data was not a part of that effort. Such data would have been extremely useful to the Task Force, providing information from a wider base.) In the absence of readily available data, through individual efforts data were accumulated from various governmental sources. However, there still remains a great need for collection and collation of larger amount of data, and a system to collect this should be put in place.

Website

The scientific accomplishments of women are often overlooked. This is because of a lack of visibility. Moreover, women are frequently excluded from the kinds of informal scientific networks that help male scientists make contacts and gain visibility. To address this issue, a decision was taken to develop an interactive website where women having a PhD in the natural sciences and agriculture, or a Master's degree in engineering or medicine, can register with their résumé. This would help us assemble a directory of women scientists and professionals in science, which could be referred to for invitations as speakers, as members of selection committees, etc. The website would also post newsworthy items related to science such as news items and conference announcements, and would also function as a forum where readers could provide views and suggestions.

An interactive web site (www.indianwomenscientists.in) has been put up. The design and maintenance of this website has been handled by the Vigyan Prasar. The design of the home page is given in Annexure-3. The website was advertised in local papers and Current Science. A directory of women scientists and engineers, with their profiles, is being created by discipline, specialisation and location.

Profiling successful women scientists

Young girls and women need to be inspired through knowledge about the lives of successful women scientists who have broken the proverbial glass ceiling through capability, determination, and perseverance. Thus a decision was taken to prepare an anthology of the lives of eminent women scientists. For the purpose, a Mumbai-based organisation called SPARROW (Sound and Picture Archives for Research on Women), which has a mandate to build a national archive for women with print, oral history and pictorial material, was identified. A three year project has been granted by DST to Dr. C. S. Lakshmi, Director of SPARROW. The criteria for inclusion in this compilation were suggested as: women Bhatnagar awardees and women scientists who are fellows of at least two of the National Science Academies.

Gender sensitisation at School Level and Gender portrayal in the Illustrations in School Science Text Books

Gender sensitisation of teachers and students at school level was considered to be an important area of intervention. A project was commissioned, where Dr. Sugra Chunawalla of the Homi Bhabha Centre for Science Education, Tata Institute of Fundamental Research, Mumbai, was asked to examine gender bias in illustrations in school science text books. Dr. Chunawalla had done a similar study some years ago, and it was felt worthwhile to see if there has been any improvement since then. The study also tried to find out students' and teachers' ideas regarding gender issues. This report is being published separately. However, a summary of the findings is included in this report (See Box 3).

Box 3

Study of the state of the art of gender illustrations and writings in the school science textbooks developed by the NCERT in India

The study funded by DST, and carried out at the Homi Bhabha Centre for Science Education focused on the gender aspects of illustrations and writing in the NCERT science textbooks for Grades III to X in use during the academic year 2007-08 and also on students' and teachers' ideas related to gender.

The study revealed that there are more human figures in the lower Grades than in the higher Grades and 4 of the 10 books analyzed are not gender-fair. These textbooks present gender biases in various ways. Not only are there significantly less female figures, these figures are also not active and are often passive observers. Besides, females are shown in stereotypical images (mother, nurse, teacher, etc.) and in non-remunerative occupations limited to the domestic space. On the other hand, men are portrayed in a variety of activities, which are economic in nature.

The books present gender biases by omission and commission. Nowhere in the texts are women depicted as developers of history and initiators of events in S&T – neither are actual woman scientists depicted nor is the possibility of women scientists explored. What example does this set for a girl who has a dream to become a scientist (or does she even dream thus?) and for a boy who wants to be an elementary school teacher? Also there is a bias in the language use with terms like 'mankind', 'manmade', 'businessmen', etc. used. Surprisingly, the Grade VIII (new) and VII textbooks which talk about "Giving girls their chance", present these examples of gender unfairness.

The study unearthed gender stereotypical perceptions about occupations amongst students and teachers. The image of S&T as male-only domains remains the dominant perception in most students' minds. While these perceptions reflect the existing situation, they do not represent the changing scenario with regard to women's participation in S&T.

Educators and textbook illustrators need to make conscious efforts to overcome the biases that creep into textbook production and besides science content, keep the concepts of gender in mind. Simple recommendations are: have equal representation of male and female figures in illustrations and textual content; portray females in active, positive, and professional roles, and not in traditional stereotypic ones; depict males on par with women as contributing to household chores; and increase the numbers of female role models such as scientists, freedom fighters, social reformers, innovators and contributors to the history of science. Sensitize teachers to imparting education free of gender bias. If we envision a world that values equality, tolerance and the well-being of all those who live in it, then we must begin by instilling these values in young minds.

Showcasing Work by Women Scientists

After listening to the voices of women scientists from the country through our interactions, it was felt that women scientists' achievements go unnoticed more often than those of their male colleagues. In order to highlight such achievements, conferences showcasing cutting-edge science done by women should be held. Accordingly, one major conference was held on 8th and 9th March, 2008, March 8th being International Women's Day. Over 1200 women scientists attended this conference. Smt. Pratibha Devisingh Patil, the Hon'ble President of India inaugurated the conference. A report of this conference was published in Current Science, thereby providing further visibility to the efforts of the Task Force. This report is given in Annexure-4. Scientific sessions covered frontline research done in wide ranging areas such as aerospace and defence technology, climate change, biology of infectious diseases, non-communicable diseases and nutrition, nanotechnology and nanomaterials and plant biotechnology. The scientific sessions were of a uniformly high standard, and proved that Indian women can be extremely productive and successful in science. However, men scientists were present primarily for the inaugural session. The near-absence of male colleagues during the scientific sessions in this conference, and the resulting inability to project science done by women to a wider audience of male scientists was, we feel, regrettable. Future conferences should make special efforts to see that male scientists also get to hear the work done by women.

Discussions with the Minister of Science and technology and Earth Sciences and other Eminent Male Scientists

Apart from the discussions with women scientists, the Task Force members had detailed discussions with Prof. CNR Rao, Linus Pauling Research Professor and Honorary President, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru & Chairman of the Scientific Advisory Committee to the Prime Minister (SAC-PM), Government of India and Dr. T. Ramasami, Secretary, Department of Science & Technology. The issue was also discussed in the Planning Commission's Steering Committee for Science and Technology, for the 11th Five Year Plan, chaired by Dr. R. Chidambaram, Science Advisor to the Planning Commission. Based on these efforts, Shri Kapil Sibal made some important announcements. (See box 4)

Box 4

Announcements made by the Hon'ble Minister for Science & Technology and Earth Sciences during the National Conference on "Showcasing Cutting Edge Science & Technology by Women" held on March 8-9, 2008 at Vigyan Bhawan, New Delhi.

- (i) All DST Aided Institutions would be provided financial support to establish a state-of-art crèche facility in the institutions,*
- (ii) DST's scientific institutions would start flexible working hours for women scientists having children up to the age of 3 years with provision for work*

from home for the rest of the time these Flexi timings will be allowed for a total of 3 years during the career,

(iii) all women who are young associates of INSA will be provided a research grant of up to Rs. 10 lakhs a year for a period of 5 years, and

(iv) support will be provided by the government to build a women residential block in all scientific institutions having more than 20 women scientists. He also stressed that he hoped other Scientific Departments would follow and also find how the same could be implemented in their departments.

The Task Force has compiled a set of recommendations which would pave way for the continuation of the task that the SAC-PM had bestowed on the Task Force. It is hoped that heads of the institutions would provide their input on the feasibility and time frame for the implementation of recommendations. For this, a meeting with the heads of the institutions was thought to be imperative.

CHAPTER III

Study and Practice of Science by Indian Women - The Current Status

Study of Science by Indian Women : University enrolment

UGC reports show that there has been a steady improvement in women's enrolment at the university level. However, it is still almost 20% lower than that of men (Figure 1)^{7,8}. Over the last five years there has been only a marginal improvement in women's enrolment, suggesting plateauing^{7,8}.

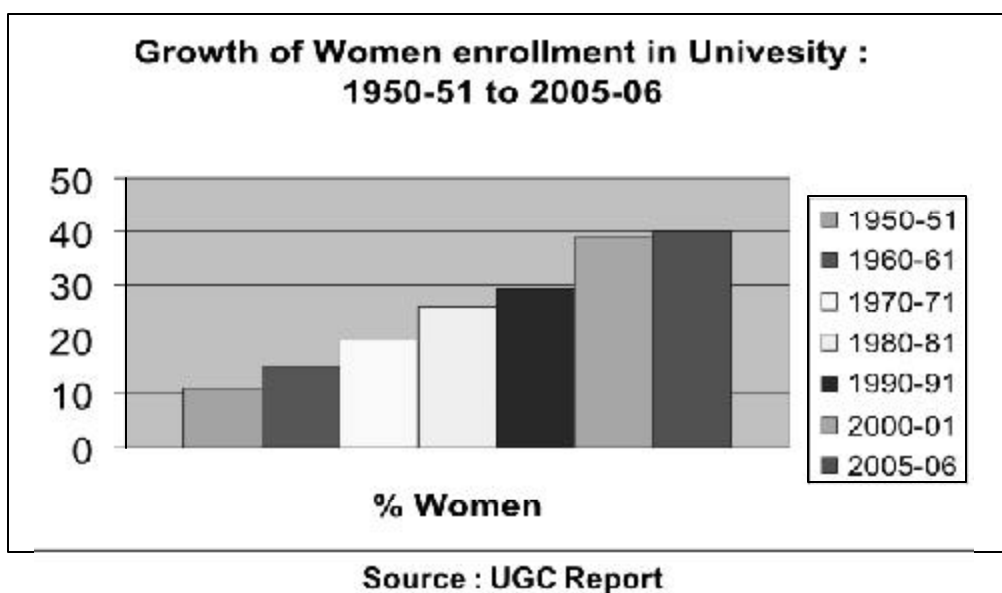


Table-1 gives data on subject-wise university enrolment. It is interesting to note that almost 45% of university enrolment is in the arts, with some decline between 1995-96 to 2000-2001. The total enrolment in science increased marginally from 18.6% in 1995-96 to 20.4% in 2005-06. The percentage of women among the total number of students who enrolled for science also shows a marginal increase over the years. In 2005-06, the percentage was 40%. This indicates a substantial presence of women (though still not 50%) at the level of university enrolment in science. Among science-related disciplines, Medicine appears to be the most attractive to women. Thus, 46.6% of all medical enrolments in 2005-06 were women. On the other hand, the presence of women in faculties like agriculture, veterinary science and engineering/technology was less than 25%, though some increase over the years was seen, particularly in Engineering and Technology (16% in 1995-96 to 23.4% in 2005-06).

Table 1
University enrolment : UGC Report

Faculty	1995-96		2000-01		2005-06	
	% Total	% Women	% Total	% Women	% Total	% Women
Arts	48.1	40.6	45.1	44.2	45.1	45.7
Science	18.6	37.0	19.8	39.4	20.4	40.0
Medicine	2.9	39.8	2.9	44.0	3.2	46.6
Agriculture	0.6	14.3	0.6	17.4	0.6	16.8
Veterinary Science	0.2	18.0	0.2	20.9	0.2	21.6
Engineering/Technology	5.9	16.0	6.9	21.5	7.2	23.4
Commerce/Management	17.1	32.5	17.8	36.5	18.0	37.0

India is a vast and diverse country. There are universities in places like Kerala, Goa, Punjab and Pondicherry where the percentage of women students is more than 50%. On the other hand some of the northern universities have less than 35% women enrolled. (Tables 2 and 3).

Table 2
States with > 50% women enrolled in university
Comparison of total enrolment in 2000-01 and 2005-06

State	Total	Science	Engineering/ Technology	Medicine	Agriculture	Veterinary science	Total
	2000-2001						2005- 2006
Goa	58.6	59.8	26.2	61.4	-	-	59.2
Kerala	60.0	63.9	30.6	56.0	53.8	47.6	61
Punjab	53.2	53.8	19.4	56.0	26.4	22.9	51.8
Pondicherry	54.5	57.3	29.2	47.3	-	41.3	51.2

Source: Ref 6, 8, 9

Table 3
States with < 35% women enrolment in University
Comparison of data in 2000-01 and 2005-06

State	Total	Science	Engineering/ Technology	Medicine	Agriculture	Veterinary science	Total
	2000-2001						2005- 2006
Arunachal	29.7	33.0	13.5	-	-	-	30.2
Bihar	23.9	21.3	11.8	20.2	25.2	-	24.5
Jharkhand	30.5	26.9	6.8	33.8	29.6	-	30.6
Rajasthan	32.6	39.2	11.4	24.3	10.1	-	34.1

Source: Refs: 6,8,9

In 2005-06, there were 18 states which had higher enrolment of women than the national average of 40.5 percent⁸. In the rest, the percentage of women enrolled was less than the national average, with Bihar recording the lowest enrolment of 24.52%. A marginal increase in the percentage of women is seen in most universities, except in Punjab and Pondicherry where there has been a marginal decline. The decline in Pondicherry was almost 3 percent. The fact that the “laggard” universities have not shown much improvement (Table-3), suggests that more proactive measures, including possibly establishing women’s universities, are needed to encourage university education for girls in those states.

Within a state, universities differ in the representation of women. Thus while the UGC report quotes a figure of 40% for the state of Assam in the year 2005-06, the percentage in Guwahati university in that year was 57.2 and improved to 59.5 in the year 2007-08⁹.

Currently exhaustive gender-segregated data are not easily available. The Task Force experienced difficulties in collecting data as mentioned earlier. Even when data are collected as in the form of UGC report, the format changes preclude uniform data analysis. We emphasize that the availability of such data are highly desirable, as it helps one in formulating policies accordingly.

It should be noted that almost 37% of PhDs in science are women (Table 4).

Table 4
Level-wise, student enrolment : Percentage of women

Year	Graduation	PG	PhD
1995-96-All	36.00	36.38	31.78
2000-01 – All	39.31	40.66	33.61
Science	39.00	42.50	37.20
Engineering/Technology	21.80	15.80	16.50
Medicine	45.50	34.40	29.30

Source: Refs: 6,7

More recent data could not be sourced from UGC reports⁸.

In the absence of any published information, an attempt was made to obtain gender-segregated data in select universities and institutions where contacts were available, by writing to the vice-chancellors or a faculty member. Some such data are presented below.

Women’s Enrolment in the Indian Institute of Science (IISc), Bangalore

IISc is a post graduate institution of high repute in India. Women’s enrolment in this prestigious university is pathetically low, being 14-17% between 2001-02 and 2007-08. This may be due to the fact that there is no undergraduate enrolment.

Gender Barrier in IIT

The percentage of girl students is <10% in Indian Institutes of Technology (IITs)¹⁰. It is interesting to note that at the +2 level percentage of girls who pass out is similar to that of boys. Yet at the joint engineering entrance exam (JEE) the percentage of successful boys in the last two years (2007 and 2008) is about 3%, whereas the percentage of girls who qualify is only 1% (see Table below).

Table 5
Gender in IIT qualifying exam (JEE)

		2007	2008
1.	Total candidates who appeared	2,40,000	3,11,258
2.	Girl candidates who appeared	54,000	78,159
3.	Candidates who qualified	7,209	8,652
4.	Girl candidates who qualified	587	840
5.	% Qualified (Total)	3	2.8
6.	% Girls qualified	1	1.1
7.	% Girls in the qualified cohort	8.1	9.7

Source: Ref.11

This difference between the success rates of male and female students is primarily attributed to fewer girls receiving coaching in special coaching classes. Those who reappear after taking such coaching do just as well. The high fees of the special coaching classes that train students for the entrance examination, and the 'unsuitable' timings (early in the morning or late at night) of such classes aid in marginalising girls.

The increase in the total number of girls who qualified, and the improvement in their cohort (Table 5) are encouraging signs. The Joint Entrance Examination (JEE) for the IITs should be so structured that true ability is tested. In response, the challenge is to design an examination that tests intrinsic aptitude and innate ability that cannot be mastered merely by intensive coaching.

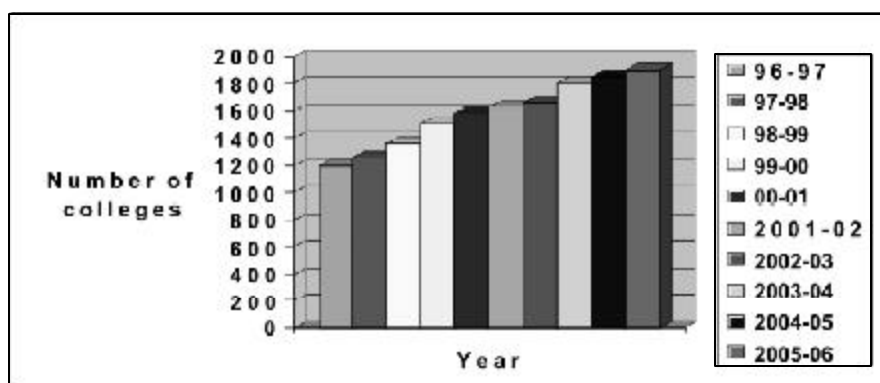
To encourage more girls to take the JEE, the CNR Rao Committee has halved the entrance fee¹¹. While this is a positive step, we point out that the entrance fee constitutes only a small part of the typical financial outlay required for performing well in the JEE.

Anecdotal evidence suggests that the very low percentage of girls at IITs leads to isolation and intense psychological pressure on girl students. There is a need for the administration of IITs to recognize this as a problem. We note that several similar institutions in the US (such as the Massachusetts Institute of Technology) faced problems of this sort, but have largely managed to eliminate them in recent years by sustained efforts geared towards increasing the percentage of girls in the student body.

Gender Friendly Measures to Encourage The Study of Science by Girls

Fig. 2 shows that there has been a steady increase in women's colleges in the last decade. The figure stood at over 1900 in 2005-06⁸. However, for a vast country like India this number may have to be increased many fold, particularly in the more conservative states where women's education is not considered to be important and parents hesitate to send girls to co-educational institutions. It is likely that colleges offering science courses would be in very small proportion, however, the precise information on number of colleges having science departments is not available in the UGC report.⁸

Decadal growth in women's colleges



In the 10th five year plan several gender friendly measures were adopted with some funding for it (Box 5)⁸. However, the budgetary allocation seems to be inadequate to meet the challenge.

Box 5

Facilities for women in higher education in UGC 10th plan

- Special scheme for construction of women's hostels. (Rs.15 lakhs-up to 250, 20 lakhs- 251-500, 25 lakhs-more than 500)
- Establishment of women's studies centres
- Part-time research associateship for women. (Rs.6000/- fresh PhD, Rs.8000/-, 5 years of experience).
- Day care centres. For 1 deemed university. and 16 state universities. Rs.48 lakhs provided
- Infrastructure for women students, teachers, and non-teaching staff. Rs.10 lakhs one time grant.

Practice of Science by Indian Women

Employment opportunities for women scientists in India are available in:

- 1) S&T institutions under different government funded departments like the Department of Science and Technology (DST), Department of Biotechnology (DBT), Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Department of Atomic Energy (DAE), Department of Ocean Development (DOD), Indian Council of Agricultural Research (ICAR) and various defence laboratories under the Defence Research and Development Organisation (DRDO). Research and development are the main mandates of these institutions.
- 2) Central and state universities, and deemed universities. The main mandate of these universities is teaching, but good research is being done in many universities, especially the centrally funded universities.
- 3) IITs and engineering colleges (especially for engineers and technologists). Most engineering colleges (other than the IITs) are mainly teaching institutions with little, if any, scope for research.
- 4) Government and private sector industries, where research, if any, is mostly translational/applied research.

An effort was made to collate information on employment of women scientists in various institutions and some universities. The data are given in Tables 6 and 7.

Comparison was made with earlier information published in the INSA report⁶.

Table 6
Women scientists in various organisations as percentage of total scientists

Organisation	2004 ⁶		2008	
	Total scientists	% Women	Total Scientists	% Women
CSIR	5030	13.0	4556	16.05
DST	-	-	659	20.8
DAE (TIFR)	436	16.5	4173 (BARC)	15
DBT	179	31.8	208	27.4
ICMR	615	27.3	561	29.0
DRDO	-	-	6890	14.0
DOD	127	8.7	-	-
ICAR	2000	8.5	2378	14.3

Table 7
Women faculty in select universities

University	2004 ⁶		2008	
	Total scientists	% Women	Total Scientists	% Women
IISc, Bangalore	Academic 316	6.6	Total 330	7.5
	Scientific 113	9.7	Asst. Prof. 91	9.9
			Assoc. Prof. 92	5.5
			Prof. 147	8.3
Hyderabad University	Total 101	15.8	Total 135	20
			Prof. 62	8
			Reader 32	40.6
			Lecturer 41	31.7
JNU	82	16	120	20
Delhi University	-	-	Science Depts. 185	20
			Prof. 85	10
			Reader 22	6
			Lecturer 185	37
			Maths Depts. 38	34.2
			Prof. 11	18.2
			Reader 9	47.4
			Lecturer 8	25.0

Data given in Tables 6 and 7 show that women form less than 25% of scientific faculty in various institutions and universities, except for those under ICMR and DBT, which are primarily engaged in biological research. While there has been a substantial improvement in the presence of women scientists in ICAR, and marginal improvement in some universities like the JNU-Delhi and the University of Hyderabad, the presence of women in other organisations like CSIR, and Indian Institute of Science, Bangalore continues to be very low. Moreover, the DBT has shown a decline in the fraction of women scientists by almost 5%; this is worrisome and needs to be looked into.

We note the glaring fact that the percentage of women amongst professional scientists is extremely low, compared to the percentage of women among science students.

Recognition of Women through Fellowships and Awards

Data in Tables 8 and 9 shows that far fewer women compared to men get elected as fellows of science academies, and the situation has not changed much since this point was highlighted in the INSA report of 2004⁶. It is interesting to note that the gender ratio is more favourable for young scientists' awards (Table 7) and the best thesis award of ICAR, which is also a junior award. This clearly shows that women do better while still studying science, than in later years when they take up careers in science.

Bhatnagar Prize: Out of 333 awards since 1958, only 9 women. One in last 8 years including 2006. Surprisingly despite a relatively high presence, no woman has received the award in biological sciences, though 2 have received it in medical sciences.

The glass ceiling becomes tougher at the level of practicing science and recognition than at the level of studying science

Table 8
Academy fellowships and Awards for Women Scientists- % women

Name	2004 ⁶			2008		
	Fellowship	Young Scientists awards	Senior awards	Fellowship	Young Scientists awards	Senior awards
INSA	3.2	-	-	4.2	18.1	3.8
IASE Bangalore	4.6	-	-	5.1	-	-
NAAS (agr.)	4.1	-	-	4.0	-	6.2

Table 9
ICAR Awards

Year	ICAR Awards		Best thesis award	
	Total recipients	% Women	Total recipients	% Women
2003	104	10	--	--
2004	55	15	17	31.6
2005	106	12	17	29.4
2006	60	26	18	50
2007	103	13	17	23.5
Total	428	15.4	71	33.8

Missing Women for Nobel Prize

Lack of recognition for women is best indicated in the trend of Nobel Prize winners.

According to a report in Hindu of October 28, page 4, of the 513 Nobel winners in the sciences, only 11 have been women¹².

This year - 2008 - one French woman scientist, Francoise Barre-Sinoussi, a virologist did share the Nobel Prize for medicine.

The ones who got the prize had to struggle to study science and get recognised.

Many others had their work used by their male peers¹² without their knowledge or recognition. Most recent example- James Watson used Rosalyn Franklin's X-ray pictures of DNA and he and Francis Crick got Nobel Prize for the double helix. Franklin was overlooked¹³.

Discussion

The information presented in this chapter shows some encouraging and some not-so-encouraging trends with respect to the study and practice of science by Indian women, and largely discouraging trends when one examines the recognition of women in science through awards and fellowships. While the steady decadal growth in university enrolment since 1950s is a desirable trend, the plateauing seen between 2000-01 and 2005-06 is not so encouraging. Even so, it is obvious that there is a substantial presence of women at the university level. Regional trends suggest that a greater effort is needed to attract women to university education in states where their representation is below the national average of 40%. Increase in number of women's colleges is necessary and desirable. The emphasis should be on states with low enrolment.

Unfortunately the university reports do not provide information on the gender ratio in different disciplines of natural science, but the fact that almost 47% of enrolment in medicine is women suggests that biological sciences, including medical science, are strongly preferred by women. Agriculture and veterinary sciences are still avoided except in Kerala, where over 50% of students in agriculture and 48% in veterinary science are women. A more recent study in Kerala done by Krishnakutty et al.¹⁴ shows that in the College of Horticulture in Kerala Agriculture University (KAU) more than 75% of the students, and almost 47% of the scientists, are women. These figures again show attrition when one moves from the study to the practice of science. Interestingly in an interview using a structured questionnaire in the above study, 51% women professionals in KAU said that they preferred research to teaching (33%), extension work (4%) or administration (2%). In many ways, Kerala is sociologically and demographically different from the rest of India, and the observations made in Kerala cannot be extrapolated to the other states.

The more recent UGC report (2005-06) does not provide information on level-wise student enrolment. However, judging by the earlier report^{6,7}, it is obvious that while almost 37% of science Ph Ds are women, their presence in faculty positions in prestigious universities or research institutions is much lower, suggesting that the real glass ceiling is at the level of practising science, and proactive action would be needed to ensure that the precious human resource constituted by trained women scientists is not frittered away. Anecdotal evidence suggests that many women with advanced science degrees become teachers in colleges, rather than active researchers. Further data are needed to see how qualified women channelise their education. Statistics of women's participation in research, as well as recognition through senior awards and fellowships, have not improved from the time the INSA report⁶ was published in 2004. Obviously reports would have meaning only if some affirmative follow-up action is taken. The fact that women are better represented in

junior level awards suggests that the attrition at a later stage has nothing to do with their abilities or competence. An encouraging trend is seen in the fellowships awarded by INSA for the year 2009. Out of 29 fellows, 6 are women (21%). Of these, 3 women are biological scientists, one a chemist, one a mathematician-biologist and one a physicist.

Why are women so under-represented among successful practitioners of science? We have accumulated some reasons, as well as suggestions to remedy the situation, from the responses to a questionnaire, as well as the comments made by the women who attended brain-storming sessions with the Task Force. These are summarized in the next chapter.

CHAPTER IV

Challenges and Choices : Voices of the Women

We must create a competitive, yet cooperative, gender-inclusive, knowledge-based society

The Task Force has systematically tried to identify the problems which affect women's participation in science through interactions and brainstorming meetings with women in their capacities as students, faculty members, practising scientists, researchers and administrators in different regions of the country. A questionnaire was also circulated to women professionals who gathered at the National conference held at Vigyan Bhawan on March 8, 2008. Based on the responses to the questionnaire, a quick analysis of the feedback given was presented to the large audience. An open discussion in the concluding session of the conference was the highlight of this event. Secretaries of Department of Scientific & Industrial Research, Department of Biotechnology, Ministry of Earth Sciences and DRDO were present in these deliberations. This gave the Task Force members additional impetus to see that a good set of recommendations came out of the process, which would help policy makers take action to correct any imbalances that still persist and hinder women in science.

The Task Force members also met with some leaders who hold key positions in policy matters, opinion makers, and senior members from other networks who also work towards the same goal of bringing in equality for women in science. In all, the Task Force members held at least a dozen interactive meetings, and met over 1000 women professionals who have chosen S&T as their career, and students who have picked S&T for their future career path.

The following paragraphs summarise the voices captured in this process. They have helped the committee to identify the progress made in various areas, as well as the persisting grey areas and challenges. This has helped the Task Force in formulating and finalizing the recommendations presented in Chapter V.

Increasing the presence of girls at secondary and tertiary levels in school – plugging the leaky pipeline

Attracting Girls to Science

While the Task Force had very limited scope for interaction with school children, interactions with college students provided the opportunity to understand the reasons why there was this leaky pipeline at the secondary and tertiary levels, and what could be done at the secondary level which would lead to the greater presence of girls at the tertiary levels. Many suggestions, on the need to inspire girl students at the school level when they are impressionable, kindle a scientific temperament in them, and create awareness on avenues of employment & research in science were given. It was unanimously felt that interest in

natural sciences was dwindling and there was an urgent need to rekindle it. Suggestions received based on interactions and questionnaires:

Exclusive summer & winter camps for girl students from rural areas with outstanding teachers in science and maths.

District level awareness programmes in girl schools on scholarships and opportunities and special free coaching and merit scholarships for girls from resource-poor families, to encourage them to enter into the science stream.

With privatisation science education would becoming increasingly expensive, and the axe may fall on girls. There is need to reserve seats in government institutions for girls/reduce fee structure for girls as has been done in some states of the country.

Travel support to girls from resource-poor families (and, where necessary, for one escort) to enable them to come to cities to write competitive examinations was also suggested.

Funding to be made available to schools for organising science exhibitions, visits to science labs, interactive programmes with senior scientists.

Establishment of mobile science laboratories in areas where there is poor science infrastructure. These could be run by trained science communicators/retired scientists and supported by Governmental and corporate support.

Urgent need to make learning of science enjoyable particularly for underprivileged children, for attaining this science teachers, particularly in vernacular medium schools and rural colleges need to be sponsored periodically for refresher courses.

Gender sensitisation programmes to be initiated in all institutions including schools, teachers' training colleges and for parents.

A review of illustrations in science/environmental science and mathematics books should be made and corrections to make them gender friendly should be undertaken.

Parents hesitate to send girls to far-away institutions (particularly co-educational ones), especially in rural and peri-urban areas. Residential schools (Class X –Class XII) and colleges for girls with infrastructure and facilities like proper toilets, drinking water, and common room for girls are needed in rural areas.

Substantial investment is needed to improve the laboratories in schools and colleges. It was felt that corporate social responsibility should be tapped to the advantage of education for girls.

Enabling higher education and career development in science for girls

Box 7

“It seems to that we have developed in science and technology a stratified system in which men are favoured with career advancements at the expense of women.”

This section deals with the inputs received from respondents on higher education and career development path within educational and research organizations.

Poor laboratory facilities in undergraduate colleges were pointed out to be a great impediment to teaching science in a creative way.

Support for small research projects (provided adequate laboratory facilities are available) can rekindle the joys of science for the faculty and provide students with a research orientation.

The cost of equipping and running science laboratories in institutions is huge and hence science is being taught without colleges having properly equipped laboratory. Cost effective lab solutions should be worked out in terms of micro/virtual experiments to cut running costs for institutions and the environment.

Course modules in counselling girls for a career in science and development should be designed.

Establishing some more women’s universities (or even a central university for women), particularly in rural areas of North and Northeast India. Though there are six state sponsored women’s universities in Southern and Western India, not all of them offer science subjects, except perhaps computer science. All women’s universities should offer courses in natural sciences, besides technical courses. Emphasis in these universities should be on matching education with job opportunities.

A vice-chancellor of a women’s university suggested that the best faculty should be chosen regardless of gender.

A well structured role model programme should be planned on a regular interval with provision for eminent women scientists of nearby institutions to visit, give lectures, and interact with students and teachers in colleges/universities, to inspire them.

Scope should be provided for continuing education for science lecturers/teachers through summer schools, short-term placements and provision for leave for acquiring Ph D.

Career development opportunities should be available for women who take up S&T careers to improve their performance. Schemes for career advancement should include opportunities for pursuing a PhD for those who are employed as research associates in projects. Provision for extension of duration of registration period for PhD should be made for women who are forced to take breaks due to biological and domestic compulsions.

A programme unit to promote women scientists through career refreshment programmes; international exposure; sabbatical options; access to research grants, mentoring on grant raising and paper writing was felt by many respondents to be essential in Universities.

Women scientists felt that reasons for rejection of projects could be communicated, so that the project could be rewritten/revised. This feedback will make the system more interactive, and help women to improve their project writing skills.

Developing modules (inclusive of e-modules) on project writing/communication skills/results documentation/ paper writing etc. can also help.

Women faculty should be able to avail of short-term leave for doing projects in established laboratories.

Inclusion of women in appropriate platforms and forums for presentation, discussion of research done by them can help networking, visibility and recognition.

The issue of simplifying administrative procedures at the university and college level for release of funds was raised by many.

Providing adequate travel facilities, such as allowing air travel for women scientists and researchers would help them to travel in minimum time, especially when they have young children.

To increase women's participation in administrative and decision making positions, special training in leadership and management skills was considered essential.

Most of the respondents felt that they have no information on various schemes, conferences etc. Mechanisms to improve access to information regarding policies and programmes will help women to avail of opportunities. Men manage to do information sharing during informal get-togethers and networking; women are often excluded from these.

Re-entry policies and programmes after a break became one of the largest issues for discussion in all the brainstorming meetings. Existing policies and programmes like the re-entry scheme of the DST were extensively discussed. While appreciating the opportunity it offers, many women felt that the window of opportunity was small, and questions were raised about the future of women who have availed of this scheme, after the 3-5 years period. Age extension for this scheme up to 55 years was also suggested.

Rules of CSIR that did not permit scientists to work in project positions beyond 5 years were discussed. This rule was particularly detrimental to women who were prepared to work in project positions for a long term as they did not want to leave the town due to family compulsions. Since these scientists are well trained not allowing them to work beyond 5 years lead to loss of trained human power. It was suggested that CSIR should be requested to look into these rules and find some legal remedy in the form of an MOU with the scientists for allowing them to continue beyond 5 years. The scope of greater participation of women in other entry fellowships like pool officers/research associations was also brought up.

Recognition and reward

Women scientists felt that their work is seldom recognized. They were not given equal opportunities in terms of writing projects, participating in conferences and attending training programmes, or even being in decision making bodies or selection committees.

Suggestions

- Relaxation of age for consideration for awards was suggested.
- Greater inclusion of women in selection, award, promotion and policy making committees.
- Establishment of a website and a directory of women scientists, giving professional profile to be used to identify speakers for conferences, appointment to committees.
- Large scale media publicity in both visual and print media and also school text books on achievements of women scientists should be undertaken.
- Short films on lives of women scientists as sponsored spots on TV and general articles on the subject in regional languages too.

Institution /Organisation Level – Proactive measures

S&T institutions, Universities should reflect the policies that the organization/institution follows in terms of being pro-women to include – Number of women scientists recruited, promotions; academics committees/awards; head of the institution; implementation process, etc. in the web page and in the annual reports of all institutions.

Institutions to foster team spirit to help in nurturing good research.

Institutions to provide facilities like a crèche, where children of working women (and men!) can be left. Functioning of the crèche to be managed by scientists themselves.

Government support for campus housing, transportation facilities and hostels for working women especially in metro towns.

Safety provisions for girls/women who want to work late hours in labs and libraries.

Unwritten barriers on employment of husband and wife in the same institution should be addressed proactively and broken.

Counselling to be given to remove societal and ingrained mindsets. Workshops to enable women to develop self-confidence and self esteem.

Workshops need to be conducted to eliminate gender bias.

Policy directives

State S&T Councils should be strengthened to proactively have gender enabling units. This will enable them to network with central ministries to obtain information regarding gender specific schemes and in turn disseminate information regarding these schemes to students and scientists of the state, initiate role model & gender sensitisation programmes in schools and colleges and identify location specific issues that hinder girls in pursuing science careers.

Special units within Departments/Institutions/Universities to promote the empowerment of women and addressing gender concerns.

Every department in Science Ministries should have a focal point to handle gender initiatives with an appropriate manpower/ budget.

A policy directive that the annual report of organizations should reflect the number of women in science at recruitment; promotions; academy committees/ awards; grievances.

Conferences and workshops supported by government agencies should stipulate that there should be adequate representation of women in the programme advisory committee as well as speakers.

The Government may think of an Academy for Women in Science and Education.

Amendments of service rule, such as an increased retirement age; leave plans; 5 years relaxation;

Opportunity for part time work (without break in service) at 50% salary.

A National Science Report, which captures gender audit – (Performance indicators, number of women in science at recruitment; promotions; academics committees/awards; Head of the institution) can be brought out once in two years to capture the improvements in this area.

BOX 8

Voices from the North East

- ☺ *A specific focus on career development should be given in the Northeast region; it being a remote area. It was suggested that when major projects are planned with multiple partners, North-eastern institutions should be taken on board so that supervision by eminent scientists is available and scientists working in Northeast are also exposed to state of art in that particular area.*
- ☺ *Scientists should be made aware of various options/opportunities available; these should be widely publicized. It was also suggested that in each institution a nodal coordinator is to be identified who could get all the information and disseminate it locally. For this position of nodal coordinator, some volunteers in institutes/colleges/universities may be identified.*
- ☺ *It was mentioned that young scientist lacked skills in developing project ideas, writing projects, managerial skills, report writing and research methodology for which they require support. For this special regional workshops should be organized specially in the Northeast. The curricula for the workshops should be designed centrally and experts should be identified for conducting such workshops.*
- ☺ *Women who have to travel for project/job-related work in Northeast brought up the issue of safety and asked for special concession for air travel to “non-entitled” women scientists also since road travel is very time consuming and unsafe.*
- ☺ *There was considerable discussion on the scope of entrepreneurship for women in the Northeast and linking education and research with entrepreneurship potential based on local resources. Wasteland development, Sericulture and Pisciculture and Floriculture were mentioned.*

BOX 9

Self Employment *Entrepreneurship and Self Employment for women scientists is one of the alternative actions for the creation of more jobs. Economic improvement of the nation would occur in a knowledge-based society if there is conversion of knowledge to commerce. Most women scientists are unaware of how to harness this quality and need a formalised system to empower them. Special science parks where equity-based help is provided and training is given in marketing are needed, so as to improve women’s participation in self employment. Such training may be targeted for both urban and rural based technologies and for women from urban, peri-*

urban and rural areas. Local economic factors and investment modalities suitable for a stated technology need to be communicated. Successful women entrepreneurs may be inducted to provide advice and encouragement. Special loans with favourable payment options are available; however women scientists need to be educated for optimum use of these facilities. Industry – academia interaction; Single Window Clearance System; venture capital; technology transfer; turn key; incubation centers; EDP programmes; vocational unit – Public – Private Partnership/Universities can also help promoting entrepreneurship. An institute to promote entrepreneurial skills/business incubators in various sectors should be considered. Women from the Northeast were keen that entrepreneurship training and projects are matched with the natural resources of the region.

BOX 10

Professor CNR Rao, FRS Chairman of the Scientific Advisory Committee to the Prime Minister (SAC-PM), Prof Rao stressed that the Task Force must submit to the government priority recommendations which could be operationalized by the government via an action oriented plan. Prof. Rao also suggested that the Task Force must meet the Chairperson of the National Women Commission and discuss with her some of the gender issues like gender insensitive advertising, promotion of gender stereotypes and superstitions in TV programmes. He suggested that a National conference for women scientists be held at least once in two years, which besides discussing gender related issues should also showcase science. The President or the Prime Minister should be invited to inaugurate this conference so that it receives publicity. He suggested that Task Force members should write articles on gender issues to be published in newspapers and Current Science etc.

CHAPTER V

Task Force for Women in Science Recommendations AND STRATEGIC ACTION PLAN

Working on the premise that education and career are not only rights of a woman but also key factors that contribute to the economic and social development of a nation the Task Force for women in science has systematically tried to identify issues which hinder women's participation in science. This was achieved through interactions and brainstorming meetings with women in their capacities as students, faculty members, practising scientists, researchers and administrators in different regions of the country. The recommendations listed in various categories are the result of this interactive process and also of valued suggestions given by TF members based on their vast experiences as administrators, practising scientists and educators.

These are divided under three sections and are intended to provide input for:

1. Fostering and supporting women resources in S&T
2. Attracting girls to science
3. New policies, rules and initiatives

I. FOSTERING AND SUPPORTING WOMEN RESOURCES IN S&T

(1) Affirmative action to improve women's ratios

Specific Recommendation -1 <i>Introduce Time-bound Recruitment Target System (TRS)</i>		
Measure:	Action by:	Time frame:
1. Put in place rules and guidelines for time-bound Recruitment Target System (TRS) for increasing the proportion of women scientists recruited in institutions per year		
2. Set for different institutions with differing proportions of women employees, achievable targets which will improve the gender ratio		
3. Make it mandatory for the institutions to mention the steps taken in pursuant of the target in the annual report and on the website		

4. Make it mandatory for the institutions to prepare and submit recruitment enhancement plan to the Standing Committee for women in science		
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Specific Recommendation-2
Women representation in search/hiring committees

Measure:	Action by:	Time frame:
1.Ensure at least one qualified competent women to be member of these committees 2.Make task force activity proactive to identify competent women scientists to sit in above committees (website of the Task Force can be used in this regard) 3.Ensure that if there is no appropriate woman expert available in the department in question, a woman scientist from an outside department/institution is co-opted onto the search committee.		

Specific Recommendation-3
Addressing proactively the unwritten, irrational barriers on employment of spouses

Measure:	Action by:	Time frame:
1. Make it mandatory that all job advertisements issued by various departments of the Government of India, universities funded by the UGC and government-funded organisations contain the following sentences: <i>“This institution/university is an equal opportunity employer, and women are encouraged to apply. This institution/university does not have any rules that prevent spouses being employed in the same department/institution.”</i>		

Specific Recommendation-4
Women-friendly proceedings of search/selection/hiring committees
 Certain questions that tend to be asked from women candidates (for example, “Do you plan to get married?”, “When do you plan to have children?”, or “Who will look after your children if you come to work?”) are indicative of prejudices harboured by society against working women and are discriminatory in nature. Such issues must not be raised in the deliberations of the selection committee, even if the candidate is not present.

Measure:	Action by:	Time frame:
Enforce a directive regarding code of ethics to be followed while asking questions to women candidates in search/selection/hiring committees to be enforced		

Specific Recommendation-5
Priority to women candidates in part-time jobs, jobs with flexible working hours and those workable from home
 Certain jobs such as those related to intellectual property rights and patent searches, scientific editing, science communications can be worked out by home-based women scientists.

Measure:	Action by:	Time frame:
1. Make it mandatory that all part-time jobs is made or they are available, they should be first offered to women desiring the same.		
2. Ensure that women candidates are given preference and training for jobs which are amenable to flexibility of working hours and/or working from home		

(2) Enabling measures for career advancement and re-entry

Specific Recommendation-1
Targeted research programmes for women scientists
 Women with highest qualifications in science are unable to do research because of circumstances. They can fall in different categories:

- a. Those who have completed PhD, are employed but are not doing research;
- b. Women who are teaching in State universities and would like to start a research programme;
- c. Those who have done a post-doc but have not found a semi-permanent or permanent job.

Some Scientific Departments (e.g. DST) already have schemes in place. A major limitation in the current schemes is that they are available only for a 3-5 year period. Also the rules of some scientific organisations (e.g. CSIR) do not permit scientists to work in project positions beyond 5 years; this rule is detrimental to women who are prepared to work in project positions for a long term as they did not want to leave the town due to family compulsions.

Measure:	Action by:	Time frame:
1. Initiate targeted research programmes for enhancing opportunities for highl qualified women scientists		
2. In view of the present contractual, non-pensionable nature of these fellowships, make fellowships extendable up to 10-15 years following a defined review process		
3. Make it mandatory for other departments to start such schemes		
4. Encourage scientific departments to carry a review of these rules and find some legal remedy in the form of an MOU with the women scientists for allowing them to continue beyond 5 years		

Specific Recommendation-2
Refresher training and mentorship programmes for women scientists for re-entry in R&D careers after a career break
DST already offers courses to train women in IPR issues. The range of such courses can be expanded. With more complex, multi-dimensional issues in medicine, science and technology gaining focus such as clinical trials for drugs, devices and vaccines, stem cell research, assisted reproductive technologies a translational research perspective needs to be developed. Women can be trained to look at the ethical, legal and science perspectives of such complex issues.

Measure:	Action by:	Time frame:
1. Introduce a mentorship scheme for those women (i) who want to refresh their old skills acquired during their PhD and begin a career afresh at whatever stage possible; (ii) who want to continue in science research but need formal [e.g. degree/diploma] or informal training because of a long [3-10 years] gap in career; and (iii) in an area where their primary science training will provide an additional advantage		
2. Provide an age-relaxation for women scientists who need formal training for gaining admission to the course/taking extra time to finish the course		
3. Make specific collaborative with educational institutions for women scientists who want to get trained to bring in expertise from complementary fields and re-training opportunities (For example, colleges offering a course in journalism can be asked to train people for science journalism)		

4. Examine the possibility of further relaxation eligibility criteria regarding age of recruitment for highly qualified women		
5. Encourage women's presence in all government sponsored conferences/workshops		

(3) Breaking the glass ceiling

<p>Specific Recommendation-1 <i>Promote Women scientists as science planners and managers</i></p>

Measure:	Action by:	Time frame:
1. Hold training courses for middle level and senior women scientists in administration, financial management		
2. Involve women scientists in research and development from policy and programme planning stages and decision making committees to include purchase, stores, vigilance & grievance committees		

(4) Support-related issues at work place

<p>Specific Recommendation-1 <i>Financial support for improvement of overall generic facilities such as crèches, toilets, campus housing and safe transportation for post-docs and scientists</i></p>

Measure:	Action by:	Time frame:
1. Introduce preferential allotment in on-campus housing for women employees or alternatively provide safe transportation arranged for them between their residence and workplace		
2. Provide safe transportation from airport/railway stations at odd hours when women employees move for official work		
3. Set up state-of-the-art crèche in all institutions with proper management involving all stake holders including male employees and for viability, explore the crèche arrangement for sharing with other institutions		
4. Feasibility of a day-care centre for elderly should also be examined		

Specific Recommendation-2
Compliance of the Supreme Court guidelines

Measure:	Action by:	Time frame:
1. Make it mandatory for all institutions to ensure compliance of the Supreme Court guidelines to prevent and redress sexual harassment at the workplace.		
2. Make it mandatory for all institutions to display the composition of the sexual harassment committee and contact information of members on their websites		
3. Make it mandatory for all institutions that the Committee regularly meet (even if it does not receive any complaint) and have workshops on gender sensitization		

Specific Recommendation-3
Separate procedure for handling complaints of harassment by women scientists against the heads of the institutions

Measure:	Action by:	Time frame:
1. Formulate and notify justice procedures for handling complaints of sexual harassment by women's scientists against heads of institution		
2. Set up a redressal committee at the headquarter [e.g. ICMR, CSIR], or at the level of Science Departments [e.g. DST, DBT, DSIR, DAE etc.] to investigate complaints (Information about such referral committees should be easily available at the website of the respective institutions and departments)		

Specific Recommendation-4
Provision for air travel even for women who are not eligible, particularly in difficult/far-flung/isolated areas
 Women with young children or other family responsibilities often decline invitations to participate in meetings, conferences due to pressure on time.

Measure:	Action by:	Time frame:
Provide special provision for air travel to women other family responsibilities to reduce travel time and discomfort		

II. MEASURES TO ATTRACT GIRLS INTO SCIENCE CAREER

Specific Recommendation-1
Summer/winter science camps for girls who have opted for science

Measure:	Action by:	Time frame:
1. As a part of science popularisation effort, identify and provide funding to some labs for hands-on experience for conducting practical classes. While such classes would be attractive for all students, adequate representation of girl students should be ensured		

Specific Recommendation-2
Well-planned role model programme with successful women scientists
 Successful women scientists should be encouraged to take up the role model programme reaching out to rural schools and colleges to enthuse and enlighten girl students.

Measure:	Action by:	Time frame:
1. Introduce and publicise a well structured role model programme by Science communication programme networks through the audio-visual and print media and by personal interactions Vigyan Prasar, National Science Museum, Central Institute of Educational Technology [CIET] of NCERT National Book Trust to disseminate of information in different languages		
2. Examine text books with a gender lens and address anomalies National Book Trust		
3. Provide due place to achievements of women scientists/technologists in text books with illustrations featuring women in roles such as scientists, engineers, doctors etc. and not in stereotypical roles National Book Trust		
4. Promote inclusion of women scientists as the chief guests in the celebrations of International women's day [8th March] in schools/colleges National Commission on Women, women's organisations and women's educational institutions		

Specific Recommendation-3***Special fellowship scheme for girl toppers in university examinations***

Many girls who top the university examinations do not pursue careers because of financial constraints. These girls should be considered on par for the placement in the research programme as the NET qualified or Kishore Vaigyanik Protsahan Yojana qualified students are.

Measure:	Action by:	Time frame:
1. Develop a special PhD fellowship scheme for girls who get top positions in examinations conducted by universities		

Specific Recommendation-4***Safe hostel accommodation for girls in towns and cities***

Science courses are available in fewer places even today in most of India. One major limitation for girls to pursue science courses available in places far away from home is the unavailability of hostels.

Measure:	Action by:	Time frame:
1. As part of the infrastructure development for 10+2 level school courses, Build colleges and universities hostel for girls through core grants by Central Ministries/ Departments and mobilizing corporate social responsibility for additional grant		

Specific Recommendation-5***Free/subsidised residential science schools for girls***

Education for girls is given less priority in households with limited income.

Measure:	Action by:	Time frame:
1. Provide in the Plan budget, funding for set-up free/ subsidised residential science schools for girls in class IX to XII, providing excellence in science education and safe accommodation for girls in small towns and at district headquarters in smaller places		

Specific Recommendation-6***Opportunities for closer interaction for school or college students with women scientists during scientific conferences***

Measure:	Action by:	Time frame:
1. Ensure that all conferences held with government funding include an outreach programme (e.g., a public lecture by a women scientist for schoolchildren), as a part of their conference schedule.		

Specific Recommendation-7
Educational reforms
 The scope of this area is vast and the Task Force felt that recommendations which are of general nature need not be included here. However, some suggestions which specifically concern girl students have been made.

Measure:	Action by:	Time frame:
1. Launch school-level campaigns to encourage girls to take up further studies in science/mathematics		
2. Introduce interactive/innovative teaching approach to make the teaching of science / mathematics interesting for girls		
3. Adopt a policy to ensure increased number of women teachers in science and mathematics		
4. Introduce programmes on gender sensitization of teachers to encourage girls to continue in science		
5. Support annual workshops on avenues available in science should with successful women scientists and career councilors invited as resource persons for such workshops		

Specific Recommendation-8
Re-enforcing representation of girls and women in science text books
 The representation of girls and women in science text books in school is uninspiring, underplayed and needs a re-look. The absence of women's figures in any role-models in the school text books can have a negative impact on girls' aspirations. A recent project completed under the auspices of this Task Force has reinforced the impression that there is a bias against depicting women in competitive, professional and leadership roles in school textbooks for science. This needs to be constantly kept in mind and steps taken to remove the gender-bias.

Measure:	Action by:	Time frame:
1. Include inspirational women's figures as role-models in school text books		

III. NEW POLICIES, RULES AND INITIATIVES

Specific Recommendation-1

National level Gender-segregated data collection, annual upgradation and processes monitoring

Gender-segregated data at the institution level and at a national level on student enrolment, employment, promotion is not always available. For process monitoring a system needs to be in place. Thus the process has to be devised, notified and the data generated should be analysed for taking further steps. Institutions which achieve the targets for improving female: male employment ratio should be rewarded in the form of budgetary allocations which will feed into further improvements. This has to be seen as a continuous process of gender auditing.

Measure:	Action by:	Time frame:
1. Make it mandatory for all government-funded institutions to collect, collate and publish national level gender-segregated data about (a) admissions to scientific/technical institutions, (b) selection of subjects, (c) recruitment in scientific institutions, (d) output of work [performance] in a common format		
2. Devise and propagate among institutions a check list as a performance monitor for gender auditing		

Performance monitor for gender auditing:

1. Total number of employees, number of men and women employees, numbers in different categories - in each pay scale.
2. Total number of new recruitments in the year, number of men and women recruited in various pay scales.
3. Total number of toilets at the workplace, number of toilets for women and men.
4. For the crèche located at the workplace and run/subsidised by the organisation: average number of children using the facility during the year, the distribution of ages of children, the number of care takers in the crèche, the details of subsidy provided for the crèche. If a crèche is not available on campus, location of the nearest crèche used by the employees, distance from the workplace etc.
5. Number of gender sensitisation workshops conducted for men and women at the workplace during the year. Number of men and women attending the workshop/s. Name of the NGO which helped in conducting the workshop.
6. How many complaints of sexual harassment were received by the women's cell established to handle such grievances. How many cases are pending, how many are disposed of, and what is the outcome of such cases. Name of the external expert/s who are members of such a grievance committee.
7. A mechanism for third party evaluation for gender friendliness of the institution should be put in place.

**Specific Recommendation-2
Institute Transformation Award**

Measure:	Action by:	Time frame:
Introduce Institute Transformation Award for those institutes which move towards a gender enabling environment		

**Specific Recommendation-3
*From 'maternity leave' to Family leave***
While maternity leave is seen as a rest and recuperation period revolving around the delivery of the baby and is an essential part of the mother's well-being, the responsibility of child-care only begins there. Three to 6 months of maternity leave or 2 weeks of paternity leave is inadequate to look after the needs of the child which are intermittent in nature over a 10-12 year period. Looking after ageing parents and in-laws is also a part of the family responsibility falling on working partners.

Measure:	Action by:	Time frame:
In addition to the existing provision of maternity leave, introduce a new category of leave for part time work for women scientists for a total of nine months with the following provisions: (i) upto six months of this leave can be availed by either parent over a period of ten years; and (ii) upto three months of this leave can be availed by the husband or the wife to take care of the elderly parents in the family		

**Specific Recommendation-4.
*Salary-linked child-care allowance in the absence of crèche on campus***

Measure:	Action by:	Time frame:
1. Provide child-care allowance to women employees (if crèche is not available on campus or within 2 kms from the workplace) which is linked to salary and which tapers off when the child becomes 10 years old		

**Specific Recommendation-5
*Gender Unit in all the State Councils for Science, Technology and Environment***
Implementation and monitoring of gender initiatives in all the states of the country by the centre is not possible. There exists a network of S&T councils supported by the central government. Augmentation of these councils to take up additional responsibility

of having a gender unit with the objective to disseminate information regarding special schemes for women, help scientists in formulating presenting project proposals to access grant, hold summer/winter camps for girls for coaching in Science and Mathematics etc. should be done.

Measure:	Action by:	Time frame:
2. Work out the detailed requirements for setting up the gender units, recurring budgetary requirement and objectives in consultation with the State Councils for S&T. (The budget for the exercise should be taken from within the Women Component Plan of the Ministry)		

Specific Recommendation-6

Establishment/augmentation of infrastructure of women's universities

In many parts of the country, especially more backward regions, girls/women are not allowed to pursue higher education in mixed colleges/universities.

Measure:	Action by:	Time frame:
1. Set up women's universities which will include science education in backward regions and especially in those states where statistics shows less than 30% women students in the science stream		

Specific Recommendation-7

Promoting entrepreneurship and self-employment for women scientists

Economic improvement of the nation would occur in a knowledge-based society if there is conversion of knowledge to commerce. Most women scientists are unable to harness this quality and need a formalised system to empower them. The successfully running Biotechnology Park at Chennai can serve as a model for replication.

Measure:	Action by:	Time frame:
1. Build technology/biotechnology parks/business incubators, where equity-based support, training in management and support in marketing is provided in all states of the country with centre-state partnership, targeting both urban and rural based technologies and for women from urban, semi-urban and rural areas.		

STANDING COMMITTEE ON PROMOTING WOMEN IN SCIENCE

From the extensive deliberations of the Task Force and discussions with women scientists it is evident that in order to achieve equity for women in science in India, further work is required. This is a long-term process and continuous monitoring of the progress is necessary.

It is, therefore, recommended that a ***Standing Committee be constituted under the Ministry of Science and Technology***, This Committee should be vested with administrative and financial powers and also a dedicated secretariat.

The Standing Committee would take proactive measures to correct any imbalances that still persist and hinder women in science. These would be the country in formulating plans to ensure gender justice and support the women in becoming strategic stakeholders in the society.

ACKNOWLEDGEMENT

Women scientists in general and the Task Force in particular is grateful to the Hon'ble President of India Smt. Pratiba Patil for inaugurating the conference on 'Showcasing cutting edge science by Indian women' on March 8, 2009 and her valuable suggestions; to Shri Kapil Sibal, Hon'ble Minister for Science and Technology and Earth Sciences, who took the initiative to constitute the Task Force, interacted with some of the members and made some important affirmative announcements which if implemented will encourage and help women to take-up careers in science and technology. The interest, valuable advises and support of Prof. CNR Rao, Chairman, Scientific Advisory Council to the Prime Minister and his commitment to the cause of gender equity in science are gratefully acknowledged. The Task Force has received full support and encouragement from the Department of Science and Technology (DST) with freedom to chalk out its own agenda and modus operandi keeping the objectives in mind. Our sincere gratitude to the Secretary, DST, Dr. T. Ramasami, for his interest, advice and help and for providing all logistic and financial support to the Task Force. The staff of the Science and Society Division of DST has been very supportive and helpful.

The March 8, 2008 conference was attended by over 1000 women scientists. This was possible thanks to the interest of various heads of grant giving agencies, universities and institutions who deputed the scientists. Many children from the Delhi Public School attended the inauguration and some lectures, thanks to the interest of the Principal of that school.

The data given in Chapter III, on study and practice of Science by Indian women has been provided by the heads of the universities/ institutions/ academies, through their office or by scientists on personal request ^a. The Task Force appreciates and acknowledges with gratitude these valuable inputs. The meetings of the Task Force could be held in different parts of the country, thanks to the facilities provided and help given by the host institutions. This has helped interaction with a wider canvass of women scientists and students and in some instances men. This help is gratefully acknowledged. The Web site was developed and is being maintained by Ms. Kinkini Dasgupta Misra and colleagues at Vignan Prasara. Their professional help and interest is gratefully acknowledged. Last but not the least, the Task Force would like to thank the Indian National Science Academy for providing logistic support for holding its meetings, extending guest house accommodation and for some valuable suggestions. Since this whole exercise is to encourage women scientists to take up careers in science, it would be fortuitous to thank fellow women scientists who spared their time to participate in the conference on March 8, 2008 and will participate in subsequent conferences, as well as scientists who have taken up the projects mentioned in the report. However their valuable contribution is appreciated.

a. CSIR- Rama Swamy Bansal,; DBT-Renu Swarup, DST, Vinita Sharma, DRDO, Nabanita R. Krishnan, JNU-Kasturi Datta, ICAR-SDSharma, JP Mishra, KV Peter, ICMR- Indian Academy of Sciences-G Madhavan, Indian national science academy-A.K.Tagore, National Academy of Agriculture Sciences-M.Vijaya Kumar, University of Delhi- Nayanjot Lahiri, University of Hyderabad,- S.Parabrahmaiaha

References

1. The Hand book of Science and Technology Studies, 3rd edition. E.J. Hackett, O. Amsterdamska, M. Lynch, J. Wajcman editors, The MIT Press, Cambridge, Mass., London, 2007
2. Bardia A. Anand K. The Sex Ratio in India. The Lancet, 367: 1727-28, 2006
3. United Nations Development Programme.2007. Statistics of the Human Development Report May 2008. <http://hdr.undp.org/en/statistics>
4. International Institute of Population Studies, Government of India. Ministry of Health and Family Welfare, 2005-06. National Family Health Survey (NFHS-3),1:.. Deonar, Mumbai. New Delhi, India
5. Bridging gender gaps, The Hindu, November 22, 2008.
6. Indian National Science Academy. Science Career for Indian Women- a report. 2004, www.insa.ac.in, reports.
7. Bal Vineeta and Sharma Vinita, Women Scientists Meet in Delhi on International Women's Day, Current Science, 95, 709-711, 2008.
8. University Grants Commission. University development in India- basic facts and figures, on institutions of higher education, students enrolment, teaching staff,. Report. University Grants Commission (Information and statistics Bureau, new Delhi), 1995-96 to 2000-2001
9. Annual Report 2005-06, University Grants Commission, New Delhi
10. Dr. Archana Goswami, Cotton College, Guwahati, R. I. (personal communication).
11. Prakash, N. Study on gender-related issues regarding admissions in higher professional educational institutions in India. May 2008.
12. Menon S. Where are the women? of the 513 Nobel winners in the sciences, only 11 have been women. Why? Hindu of October 28, page
13. Maddox B. The double helix and the 'wronged heroine'. Nature 421: 407-412, 2003.
14. Krishnakutty J., Menon, M.V., Nazeem, P.A., Peter, KV. Women in science in Kerala- an overview. 2008 (Unpublished report)
15. Report, Women Engineers in India, Indian Institute of Technology, Bombay, 1992
16. Parikh PP and Sukhatme, Women in Engineering Profession in India, The Millennium Scenario, Indian Institute of Technology, Bombay, 1992
17. Shukla R, India Science Report, National Council for App[lied and Economic Research, 2005.



Ministry of Science and Technology Government of India

Re-emphasizing on Women Power... An effort to consolidate women in science

The Department of Science and Technology has constituted a 14 member Task Force for women in science to suggest policies and programmes which would encourage women to study science and pursue career in science. The Task Force invites suggestions from the general public for:-

- **Measures to bring greater involvement of women in Science and Technology.**
- **Gender sensitive initiatives for retaining women scientists in R&D Careers.**
- **Steps to motivate girls to study science & take up career in S&T.**

A website dedicated to women scientists of the country has been set up by the Department (www.indianwomenscientists.in). Women having a PhD in Natural Sciences/ Masters Degree in Engineering/Medicine are invited to register in the directory of women scientists of India being prepared. Website has other features like women pioneers in science, success stories of women scientists, chat and discussion forum.

Suggestions may be emailed to

feedback@indianwomenscientists.in

Announcement:

A Conference showcasing science by Indian women scientists' is scheduled during **March 8-10, 2008** at

Vigyan Bhavan, New Delhi.

See the details in website (www.indianwomenscientists.in) for registration.

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Annexure - 2

List of Task Force Meetings held

Sl. No.	Task Force Meeting held at	Date of Meeting
1.	Department of Science & Technology, New Delhi	March 10 th . 2006
2.	National Institute of Nutrition, Hyderabad	June 22 nd , 2006
3.	Rajasthan college of Engineering for Women, Jaipur	November 2 -3, 2006
4.	Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore	February 28 th 2007
5.	Agharkar Research Institute, Pune	June 27 -28, 2007
6.	Indian National Science Academy (INSA), New Delhi	January 31 st & February 1 st , 2008
7.	Indian National Science Academy (INSA), New Delhi	March 7 th , 2008
8.	Cotton College, Guwahati	June 9 -10, 2008
9.	Kerala Agricultural University, Thrishur, Kerala	August 31 st & September 1 st , 2008
10.	Indian National Science Academy (INSA), New Delhi	January 2 nd , 2009





INDIAN WOMEN SCIENTISTS

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- + Careers in S&T
- + Chat Session
- + Discussion Forum
- + SpotLight
- + National Conference Brochure

Welcome

The Scientific Advisory Council to the Prime Minister has recommended the Task Force on Women in Science under the **Ministry of Science and Technology, Government of India**. The main purpose of the Task Force is to ensure that the interests of women practitioners in science are protected and that appropriate measures required to promote women to take up the scientific profession are indeed taken by the Government and other organisations. The Task Force will help the Government to give constant attention to the problems related to women in science. The Website will give an opportunity to highlight women's achievements like awards and rewards. Please communicate relevant information, publications and reports to us at feedback@indianwomenscientists.in

DIRECTORY REGISTRATION

Signup (New User)

Member Login

User ID

Password

NEW Read Articles And Reports

DIRECTORY OF INDIAN WOMEN SCIENTISTS

The Directory will provide access to a resource pool of Women Scientists, Engineers, and Doctors with Ph.D in Science/Agriculture, or Masters in Engineering/Medicine, who have registered. It will be a resource base Directory, which can be used for ensuring women's participation in promotional, academic, and decision making activities and events including participation in conferences, public speaking, membership of decision making committees, recognition for awards, rewards and fellowships etc.

Registration in the Directory will be a continuous process. Those interested please register.

The Directory will provide full bio-data including publications/awards etc. of women who have registered with the required qualifications.

Updates on National Conference of Women Scientists

8-9 March 2008, New Delhi

- ☆ Prof. Swaminathan's Message
- ☆ Souvenir and Abstract Book
- ☆ Feedback - Questionnaire
- ☆ Recommendations from conference

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Women scientists meet in Delhi on International Women's Day*

Recently New Delhi's Vigyan Bhawan – a hub for high-level seminars addressed by Heads of State – witnessed a conference with a difference. On 8 March, International Women's Day, a majority of women participants came together to discuss science, an area in which almost all visible faces are male! It was also befitting that the first woman President of India, Pratibha Patil inaugurated this landmark conference. The inaugural function at the Panchay Hall with a capacity of over 1200 was packed with women participants, with only a sprinkling of men.

The conference was the brainchild of the Task Force (TF) on Women in Science, formed after the Scientific Advisory Council to the Prime Minister recommended the setting up of a body that would ensure the interests of women practitioners of science. A fourteen-member TF came into existence in December 2005, with Mahtab Banji as the Chair (see <http://www.indianwomen-scientists.in/>). The TF is expected to identify and recommend to the Government measures which are required to encourage women to take up science as a profession, measures which will help in their retention and career development. TF realized the need to give publicity and visibility to the competent work done by women scientists and technologists in this country and hence organized this conference.

Over 700 women participated in the scientific sessions bringing together women scientists, technologists, teachers, students and entrepreneurs from across the country from many diverse fields. The first conference of women scientists of a similar nature was organized under the leadership of Manjit Sharma, then Secretary, Department of Biotechnology, in 2002.

Pratibha Patil, in her inaugural address questioned whether women are given the necessary education, skills, options and a level playing field. 'Can we overcome societal biases against women? Can we fight against sexism against women? Only if the answer to these questions is in the affirmative,' she

said, 'will we achieve gender equality'. She also conferred the National Awards for Women's Development through Application of Science and Technology for the year 2007 and the Women Bioscientists Award. She expressed hope by saying 'Women scientists can bring about significant social change by working at the grassroots level for women's empowerment through the application of science and technology.'

Girja Vyas, Chairperson, National Commission for Women, in her special address referred to the increase in crimes against women and the need to implement legislations to protect women at the workplace. She felt there was need to educate girls in rural areas as education was the only means of empowerment.

Kapi Sibal, Union Minister for Science and Technology, and Earth Sciences, took the lead to announce concrete measures – all DST-aided institutions would be provided financial support to establish state-of-the-art creche facilities. DST's scientific institutions would start flexible working hours for women scientists with children up to the age of 3 years, with provision to work from home. These flexi-arrangements will be allowed for a total of 3 years. All women who are young associates of Indian National Science Academy, will be provided a research grant of up to Rs 10 lakhs a year for a period of 5 years, and support will be provided by the Government to build a residential block for women employees in all scientific institutions having more than 20 women scientists. The Minister also stressed that other scientific departments must ensure that these measures are implemented in their departments.

The first scientific session of the conference had six plenary lectures. Importance of cell survival and cell death in the life of multicellular organisms was the focus of the lecture by Chandrima Shaha (National Institute of Immunology, New Delhi). More specifically, she discussed some of the concepts with the help of data from her own laboratory regarding death of *Leishmania donovani*. She mentioned that response of *L. donovani* to oxidative stress is similar to other metazoans, and death involves the mitochondria. Climate change being one of the relevant topics globally, Sandhya Rao (INRM

Consultants, Delhi) talked on the assessment of climate change in the context of its impact on Indian water resources. With the help of data she showed how water stress is likely to be exacerbated leading to shortage in some regions and flooding in other regions. Drought-affected areas may increase in extent. Heavy precipitation events may increase in frequency, resulting in increased flood-risk. Complexity of brain function was discussed by Shobna Pale (Data Institute of Fundamental Research, Mumbai). She showed how development of the hippocampus, that part of the cerebral cortex which controls memory, is regulated. She discussed various signals and switches which helped her team characterize some of the developmental issues involved. Many scientists in India have been working on nanomaterials for several years and Sulabha Kulkarni (University of Pune) illustrated a variety of applications of nanomaterials based primarily on her work, and also from others. Her team has developed a variety of semiconductor and metal nanoparticles whose optical properties vary with particle size or shape in biosensors. She discussed their use in laser welding of cells, field emission displays, amongst others. Usha Vijayaghasan (Indian Institute of Science (IISc), Bangalore) discussed developmental biology questions in the context of plants. She discussed how the role of master regulators gets refined with research and how they choreograph flower formation. She discussed illustrating her own work on *Arabidopsis* floral organs. Light combat aircraft, a single-seater engine fighter aircraft, is the world's smallest aircraft and a crucial component of the Indian Air Force. Indira Narayanswamy (Aeronautical Development Agency, Bangalore) described her aerodynamic studies for the aircraft optimization. More specifically, she described her work in computational fluid dynamics, which involves testing various aerodynamic loads for checking the capacity of the aircraft.

On the second day there was further discussion on the six themes of the conference. In a session where developments in plant biotechnology were discussed, Puranjit Khurana (University of Delhi) presented her work on genes and gene-

*A report on the conference entitled 'Showcasing Cutting-edge Science and Technology by Women' held on 8 and 9 March 2008 at New Delhi.

mies for crop improvement; Vidya Gupta (National Chemical Laboratory, Pune) discussed molecular approaches for crop improvement taking chickpea as an example. Potential applications of research in plant viruses were discussed by R. Usha (Madurai Kamaraj University), whereas Vibha Dhawan (The Energy and Resources Institute, New Delhi) talked about the contribution of biotechnological approaches in the growth of Indian agriculture. Climate change was the theme for another session, where the discussion was about how climate change is affecting various aspects of our eco-system. Impact on agriculture was presented by V. Geethalakshmi (Tamil Nadu Agricultural University, Coimbatore). Impact on health with special focus on malaria was brought to light by Sumana Bhattacharya (Wintock International India, Gurgaon). The effect on the forests is the theme of the talk by Indu Murthy (ICSE). Joyashree Roy (Jadavpur University, Kolkata) covered the economic and social dimensions of climate change affecting Sunderban's mangroves and air pollution was the focus of Rashmi Patil's talk, where she presented her work from Indian Institute of Technology, Bombay.

Infectious disease research is a strong area in biology in India. Some of the recent developments in this area were the focus of another theme. While interplay between mycobacteria, which cause tuberculosis, and macrophage signalling pathways was presented by Joyoti Basu (Bose Institute, Kolkata). Sudha Bhattacharya (Jawaharlal Nehru University, New Delhi) discussed work from her laboratory concerning differential regulation of palindromic transcription units in the ribosomal DNA circle of *Entamoeba histolytica*, a parasite which causes dysentery and liver abscess. Namita Suroja (Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore) presented her work on developing strategies and identifying targets for the treatment of malaria. Saman Habib (Central Drug Research Institute, Lucknow) also works on malarial parasite and presented data on DNA-protein interactions involved in replication and organization of the parasite genome. Cholera still causes a lot of morbidity in the Indian population and Rukhsana Chowdhury (I

■ sion of certain virulence associated genes of *Vibrio cholerae* is regulated.

Women scientists and engineers from the defence research establishment presented their work on various aspects of aerospace and defence research. Statistical approach for

components for airworthiness was a focus of the talks by Hina Gokhale (DMRL, Hyderabad). I. Manjula (DRDL, Hyderabad) gave an overview of advances in personal

Ranjana (Advanced Systems Laboratory, Hyderabad) explained how software signing, verification and testing is done for embedded systems in missiles. An update on software engineering in CMI scenario was provided by V. Prameela and her team (DRDL, Hyderabad). Jyotsna Lahiri (Advanced Systems Laboratory, Hyderabad) gave an overview of composite materials which are used for missiles and aerospace systems and NDB technologies. Deharati Bhattacharjee (DMSRDE, Kanpur) informed the audience about how to predict thermal properties of textiles.

A session on nanotechnology and nanoparticles covered different aspects of this emerging field, reflecting its multidisciplinary nature. Tanusri Saha-Dasgupta (S.N. Bose National Centre for Basic Sciences, Kolkata) discussed how quantum mechanical calculations can help us determine the basic structural arrangements of atoms in such small nanoparticles. Charisita Chakravarty (Indian Institute of Technology, Delhi) showed how classical simulations can help us understand the way in which nanosized objects 'self-assemble' into a variety of arrangements. Yamuna Krishnan (National Centre for Biological Sciences, Bangalore) described experiments by her group to construct nano-architectures using DNA molecules as building blocks. Sadhana Rayalu (NEERI, Nagpur) discussed the use of biomimetics to tackle environmental challenges, such as clearing-up water sources and the environment. Lakshmi Kantari (Indian Institute of Chemical Technology, Hyderabad) discussed the use of nanocatalysis strategy for environmental protection and industrial efficiency.

The proportion of people from India affected by non-infectious diseases has been going up steadily over the past many years. The sixth theme covered topics related to this area. Incidence of diabetes mellitus is increasing and A. C. Ammini (All India Institute of Medical Sciences, Delhi) discussed the cost-effective management of this disease.

Many researchers are working in the area of stem cell biology. Geeta Venuganti (J.V. Prasad Eye Institute, Hyderabad) discussed some work about cell therapy for ocular degenerative diseases. Similarly, Jyotsna Dhawan (Centre for Cellular and Molecular Bi

on quiescence of the muscle cells and its implications for stem-cell function. B. K. Thelma (University of Delhi) described the current status of human genome research and potential health benefits based on her work of mapping genes for various human diseases. Nutrition plays a significant role in one's life and Shobha Rao (Agharkar Research Institute, Pune) illustrated the connections between maternal micronutrient (un)availability, its impact on the foetus and how such deficiencies manifest during adulthood.

Many young girls these days opt for the science stream. However, compared to jobs in academia or industry, women as leading entrepreneurs in the biotech industry are rare. A special session was organized where a few first-generation CEOs were invited. Mahima Datta (Biological Evans), Sushama Srikanth (AVT McCormick), Anuradha Acharya (Oceanium Biosolutions) and Jayashree Sathyanarana (Dream Finders) talked about how they managed to enter and establish themselves in their respective fields of entrepreneurship.

There were opportunities available to discuss policy issues as well. On the first day itself women participants received a questionnaire from the organizers. A feedback on the difficulties they faced while negotiating work and family responsibilities successfully was sought. C. N. R. Rao (Jawaharlal Nehru Centre for Advanced Scientific Research), in his special lecture also mentioned the difficulties and possible avenues that could be chosen to address the problems. Sujara Manohar (retired judge of the Supreme Court of India), Vijayalakshmi Ravindranath (National Brain Research Centre, Manesar) shared their thoughts about sexual harassment and discrimination at the workplace, concerns about why women drop out of promising careers and what can be done to prevent it. This session saw a large number of women sharing their opinions and concerns.

On the second day of the conference, the feedback received via questionnaires, talks, discussions, etc. was compiled and presented to the Heads of various science

departments. The TF members participated in all these deliberations and the conference provided yet another opportunity to gather inputs from women present under one roof as participants.

Not only women scientists, but women technocrats, college teachers, women CEOs, college students and school students were present during different sessions. The only time a few men were present during the two day conference was at the inauguration. In fact, during an interactive session a pointed comment was made about the absence of men, with women wondering whether they were talking amongst themselves, and whether

talking to the converts has any relevance at all.

While such conferences serve the purpose of providing exposure to competent work done by women scientists and technologists to the world, in general, absence of male colleagues meant that women's work and achievements went unnoticed by their male colleagues, competitors and bosses. Pursuit of science is not done in isolation, but is a globally collaborative activity. Thus, listening to each other's work is a professional necessity. Since in today's world of science and technology women are in minority, their existence is unrecognized. Absence

of male colleagues from this conference, thus defeated part of the purpose of the sinewsing effect. The lesson to learn from this effort is not to organize women-only conferences, but to strive for a near-equal representation of both the sexes as speakers and participants, even if that has to be achieved by affirmative action!

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MEETING REPORT

Combating land degradation for sustainable agriculture – Is conservation agriculture the way forward for India?*

The need to address land degradation becomes critical looking at expectations from agriculture productivity to meet needs of food security in the country. Conservation Agriculture (CA) practices as pursued in many parts of the world are built on agro-ecological principles making land use more sustainable and thus helping farmers use agricultural inputs more efficiently. 17 June 2008, being observed by the United Nations Convention to Combat Desertification (UNCCD) as World Day to Combat Desertification, offered a perfect opportunity for Professional Alliance for Conservation Agriculture (PACA) to bring together concerned professionals involved with the subject of agriculture and environment to promote the cause of CA. The meeting focused on deliberations around the subject 'Is conservation agriculture the way forward for India?'. The meeting attended by

*A report on the meeting 'Combating Land Degradation for Sustainable Agriculture – Is Conservation Agriculture the Way Forward for India?' held at the NASC Complex, Pusa Campus, New Delhi on 17 June 2008. The meeting was organized by PACA, a joint initiative by the Society for Strategy Technology Delivery for Development and the Centre for A

practitioners and believers in the cause of CA and included scientists from Indian Council of Agricultural Research (ICAR), the international agricultural system, State Agricultural Universities (SAUs) and policy makers.

The opening session began with Sanjeev Vasudev (Society for Strategy, Technology & Delivery for Development) welcoming the delegates on behalf of PACA and highlighting the need for CA to reflect on food security situation the world is facing today. The brief introduction paved the way for the inaugural presentation by R. S. Paroda (formerly at ICAR), Trust for Advancement of Agriculture Sciences, who chaired and made a presentation on the 'Major concerns of Indian agriculture'. He related these to global concerns such as climate change, land degradation, de-

pletion, declining buffer stocks of food crops world over, need for linkages to the market, increasing role of private sector and farming systems approaches. ■ UN Millennium Development Goals (MDGs) relevant to agriculture, eradication of extreme poverty and hunger (MDG 1), he stressed for ensuring environmental sustainability (MDG 7) and expressed the need for developing a global partnership for development (MDG 8). He referred to the need to take the knowledge from basic sciences and translate them into practical

products/agricultural innovations. He stressed benefits of participatory research with scientists working on farmer-field locations, illustrated through successful cases in Central Asia and India. He ended by reminding that path ahead was not likely to be smooth and strategies to meet the goals of sustainability would emerge only from customized eco-regional approaches.

R. B. Singh (formerly at FAO) deliberated on 'Reforming agriculture to meet needs of climate change with specific reference to land degradation'. The presentation addressed two important issues: land degradation and desertification and emphasized the need to understand the processes of desertification beyond technology dissemination. Footprints of agriculture on climate change were a matter of both economic and ecological concern. He shared findings from National Farmers Commission with special reference to farmers in rainfed areas and expressed the need for market stabilization fund or AgriRisk fund to meet farmers' livelihood requirements and ease migration pressure. A hint of caution was sounded with respect to crop diversification especially related to rice and wheat, that may harm cereal needs of the nation. He concluded that partnership amongst stakeholders will pave the way for India to assume a leadership role in south Asia with CA as the way forward.