

# IWSA NEWSLETTER

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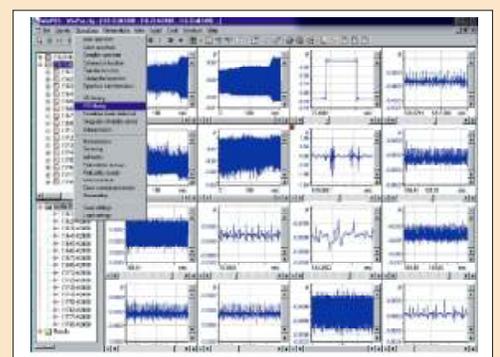
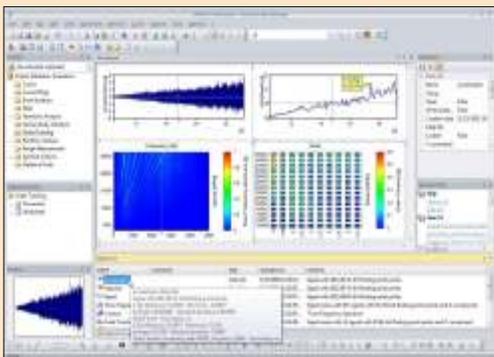
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## From the Editor's Desk

Scientific research plays a pivotal role in knowledge creation and development of innovative technologies. When institutions and countries are collaborating at international level, research integrity becomes all the more important. Currently India has no national code of conduct in having ethics in Science and Technology and no government body is responsible for ensuring scientific integrity. As in other fields, frauds in scientific research are also on the rise and the scientific bureaucracy has turned a blind eye to these major frauds and misconduct in scientific research.

Good research practices include honesty in performing and reporting research, accuracy in reports and fairness in peer-review. With the value systems eroding, ethical issues in science and technology are also facing a serious threat. With an atmosphere of "publish or perish", scientists succumb to temptations of a quick publication with insufficient data or copied matter. Higher competitions in the scientific field, improper data management, irregularities with authorship, research misconduct and conflict of interest are problems which affect today's scientific research. Plagiarism has become a common phenomenon. The tight competition in scientific field is putting a lot of pressure on researchers and the competitive environment forces many to falsify and fabricate data. Pressure from supervisors and advisors to clean up the results and to publish it very fast to beat the competition makes research students misbehave. In this context, Indian Women Scientists' Association will be organizing a conference on "Science and Technology: Ethical Issues" in January 2011 at Navi Mumbai, where all these issues will be addressed and find a platform for discussion.

The annual water consumption is set to increase by 2 trillion cubic meters by 2030. For agriculture, 70% - 90% of the available water is being used. To increase food production and to feed the ever increasing population, there is a dire need to manage the available water. The water tables in India are declining since farmers are using ground water for irrigation. Climate change also plays a role in the depletion of water. Therefore desalination of sea water, and waste water recycling have important roles in future. Access to clean drinking water is a basic human right and water needs to be purified of biological and chemical contaminants to fit human consumption. These issues have been highlighted in an article "Need of Drinking Water Purification and Role of BARC in this Field" by Saly T. Panicker.

Utilizing the abundant resource of thorium available in the country is a major goal in India's atomic energy programme. Advanced Heavy Water Reactor (AHWR) is very complex in design. Dr. Neelima Prasad's article on "Physics Design of AHWR Critical Facility" deals with the details in design of AHWR critical facility.

An article by Dr. Gaurangi Maitra, "A classroom without Walls...." on Charles Darwin's travelogue to a strange new

world collecting data, which led to the path-breaking theory of Evolution, is included in this issue of newsletter.

This year's Nobel prizes have been announced. Robert Edwards who is responsible for "Baby boom" wins this year's Nobel Prize in Physiology and Medicine. Details of this year's Nobel winners in Medicine, Physics and Chemistry are included in this issue of the newsletter. At the Commonwealth games, our sportsmen and women have won laurels for the country. An article "A Salute to the Women Power in Commonwealth Games-2010" by Umasankari Kannan highlights the exploits of Indian women contingent at the recently concluded Commonwealth Games.

Three distinguished women scientists, Dr. Shubha Tole, Dr. Sangamitra Bhandopadhyaya and Dr. Mitali Mukherji bagged the prestigious Shanthi Swaroop Bhatnagar Award this year and Indian Women Scientists' Association places on record its appreciation and congratulates them on their great achievement. This issue also has an article by Dr. Pradnya P. Kanekar on "Contributions of Women in Science". Dr. Kanekar's profile also finds a place in this issue in the Women Achiever's column.

Over the past couple of years, our branches have been taking active interest in reporting news in time and readers get to know more about branch activities. The editorial team applauds the various branch conveners for their initiative and sustained interest. We also place on record our sincere thanks to all the contributors, advertisers, executive committee members and headquarters staff for their valuable assistance in bringing out this issue on time.

**Dr. Susan Eapen**  
*Editor*

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## COMPETITION FOR TEACHERS, STUDENTS & MEDICOS

### A special session with attractive prizes

Submit essays/posters/papers for possible oral presentation during the January 2011 IWSA Conference on any one of the main three sub-themes: I, II and III.

OR

### IV: -Importance of ethics in S&T;

- A code of conduct for S&T personnel;
- Case studies of ethical infringements in S&T: Lessons learnt?
- Is ethical clinical practice possible today?

The authors of the best papers (~ five) to make oral presentations.

**Other papers will be published in the Abstract Book.**

## XI All India Meeting of Women in Science IWSA, Vashi, Navi Mumbai.

**CONFERENCE THEME:  
SCIENCE AND TECHNOLOGY: ETHICAL ISSUES  
28-30 January, 2011**

### Key Themes

#### I: Ethics of Doing Science, 28th January, 2011

This session aims to focus on ethical issues confronting scientific institutions (at organizational and decision-making levels) and individual scientists (social responsibility, objectivity, careless research, conflict of interest, data management, publications, mentoring, et al) in the pursuit of 'doing science' and developing technologies.

A special workshop by **Dr. Shubha Tole, TIFR, Mumbai**

#### II: Ethics in Scientific Applications (Technologies), 29th January, 2011

The growth of new technologies genetics and biotechnology, nano-, nuclear-, information-, robotic-technologies, among others have raised ethical dilemmas about their uses and their effects on environment and human health; these issues will be discussed.

#### III: Ethics in Medical Sciences, 30th January, 2011

The last two decades has seen a variety of investigative and treatment modalities-reproductive technologies, organ transplantation, etc, being used in medical practice. In addition to raising ethical issues, these technologies have altered prescription practices and the right to die with dignity. These topics will be discussed.

**Last date for Registration : 30th December, 2010**

*Please refer to the website (www.iwsa.net) for updates.*

**Conference is open for both men and women**

## FELLOWSHIP

A fellowship is being awarded to women from developing countries, who are preparing for PhD or post-doctoral study in the physical sciences, engineering, or related disciplines to pursue advanced graduate study at top universities in their disciplines abroad. This fellowship, known as the 'Faculty for the Future Fellowships', is awarded by Schlumberger Foundation, France. Presently applications for the 2011 fellowship are open from September 1, 2010 till November 30, 2010. More details can be obtained at the following link:

<http://www.slb.com/about/community/foundation/facultyfuture.aspx>

## President's Message



**Dr. Uma N. Rao**  
*President,*  
**Indian Women Scientists' Association**  
Email: umarao49@gmail.com

I consider myself very fortunate to have attended the '2010 Asian Science Camp', from August 17 -21, 2010, hosted by the Homi Bhabha Centre for Science Education and TIFR. It was the fourth such camp and a feast of science for me. It was conceptualized by two Nobel laureates Prof Lee (China) and Prof Koshiba, (Japan), in the 55<sup>th</sup> meeting of Nobel laureates and students in Lindau, Germany. This was thought of because Asian students were under-represented. The first three camps in this series were held at Taipei (2007), Bali (2008) and Japan (2009) and the next will be hosted in Korea in 2011. Dr. Chidambaram, Principal Scientific Advisor to Government of India, was instrumental in hosting the camp in India.

The faculty included two Nobel laureates and eleven distinguished scientists largely from Asia and host India. About 200 students (girls and boys) from seventeen countries across Asia and Asia-Pacific attended this camp: Japan, China, Taipei, Taiwan, Hanoi, Vietnam, Nepal, Hong Kong, Kazakhstan, Korea, Bangladesh, Sri Lanka, Bhutan, Indonesia, Malaysia, New Zealand, Syria, Turkey and others. The thirty students from India were selected from a repository of students with the HBCSE who have participated in Olympiads, Kendriya Vaigyanik Protsahan Yojana, Kishor Bharati Vaigyanik from varied branches of science, engineering and medicine in the country.

It included varied topics in science ranging from: 'Green chemistry and supercritical fluids', 'Nano world', 'Cells and stem cells', 'The future of genetics', 'Nuclear energy' to 'Role of symmetry in physics', 'Raman Spectroscopy' etc. Some of the scientists narrated their personal experiences which were very interesting and inspiring for the students.

Prof. Ernst's lecture (Nobel prize, 1991 in Chemistry) was one of the most impressive. He spoke about Hindu philosophy and of the four stages in life. He is into the final stage of 'Vanaprastha' according to him. He and his family have moved back from U.S.A to settle in Zurich. He is still pursuing science actively and has a Raman spectrograph in his bedroom for analyzing plant pigments in ancient Buddhist paintings, to determine their source.

He advised students to pursue some hobby like music, photography etc. as it helps in pursuing science better. How true! I wish our scientists would come out of their shells and

interact more with students by approaching schools and colleges in the vicinity of their houses. One can talk about experiences in their research life, about the fascination and benefits of science and last but not the least, to be true to oneself in whatever they wish to pursue i.e. the ethical issues in science and everyday life.

This camp makes me dream of holding a similar camp exclusively for girl students from SAARC countries, with a majority from all states from India. It is a tall order given the very small infrastructure and man power IWSA has, but nothing is impossible if we all put our heads and hands together. The younger generation of IWSA scientists is presently a quiet lot. If they want to take it up, with seniors to help and guide, the dream can become a reality!

Uma N. Rao

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### News from Head Quarters

Teacher's Training Course is being conducted at IWSA for the last 15 years. This one-year diploma course is affiliated to the S.N.D.T Women's University at Mumbai. This year's batch was inaugurated by Mr. Madhav Shirvalkar, C.E.O. Pujasoft Technology Pvt. Ltd. Airoli, Navi Mumbai, on 14th June, 2010. He highlighted the importance of computers in our day to day life. He also spoke on the various sites good for teachers and children. The use of computer as a teacher also helps them in promoting IT skills, which acts as a better method for teaching today's generation. Mr. Madhav Shirvalkar is the author of several books and a regular writer in Loksatta.



The Guest of Honour Ms. Gaurita Manjerekar, a free-lancer spoke on the importance of e-learning. The overall presentation clearly gave an idea to help oneself recognize their potential. I.W.S.A. President Dr. Uma Rao, the Vice President and the course coordinator Dr. V. Sudha Rao and convenor of Nursery Education Committee Dr. Usha Thakare were also present.

### Teacher's Training (2009-2010 Batch)

On 2nd August, 2010 IWSA trainees of 2009-2010 batch were given their mark sheets and a Prize distribution ceremony was also conducted. Thirty six trainees had appeared for the exam, 9 passed out with distinction, 16 with first class and 8 in second class. Ms. Monika Arora topped in the English Medium with 86.67% and Ms. Kavita Thorat from Marathi Medium with 81.47%. Trophies were given to both toppers.

During the yearly training, a lot of competitions were held, like the Nutrition Competition, Projects and the Teaching Aids Exhibition. The trainees were judged by outside judges. Dr. Vrinda Dutta, professor from the Tata Institute of Social Sciences, was the chief guest of this function. She spoke on the role of a teacher, and how important it is, as a teacher to be a reflective practitioner. All the trainees presently are well placed in schools such as Gold Crest, North Point, Avalon Heights, St. Mary's, Sacred Heart to name a few.

### Ganesh Chaturthi celebrated

The teacher trainees of IWSA celebrated Ganesh Chaturthi on 16th September, 2010 with their Nursery and Day Care children. They introduced this festival by giving a brief description of the decoration and on-going preparations to welcome Ganesh. The children participated in bringing Lord Ganesh in the classroom and in singing the aarti. After performing the puja, the trainees conducted an activity with them in making an eco-friendly Ganapati. Dough was prepared using maida, salt, fevicol and food colour. The children were taught how to make a Ganapati and each child made one which could be taken home.

### Initiative in solid waste monitoring and up gradation of science laboratory skills

This year's "Clean and Green Cities"- second phase (2009-2010) 'Initiative in Solid Waste Monitoring and Up-gradation of Science Laboratory Skills', prize distribution program was held on August 14th 2010 at the IWSA's ICICI Multipurpose Hall, Vashi. An overview of the programme and how it was executed over the past 10 months was narrated by Prof. Bhaktavar Mahajan, who also remained the coordinator for the second phase of the project. The chief guest for the ceremony was Dr Sharad Kale of NABTD, BARC, an eminent scientist and environmentalist. In his very own interactive style of communication he stole the attention of his audience instantaneously. Objecting to using the word WASTE, he simply changed the thought process to believe that it is instead a RESOURCE. One only needed to derive creative ways of utilizing this resource for the benefit of mankind. He gave several examples from our ancient history and heroes who practised recycling of solid waste in their times. His own contributions towards converting canteen biomass or abattoir blood into useful energy are best examples for 'walk the talk'. He urged that we think differently in order to make this world a better living place and this can be achieved by recycling and reusing the so called waste materials.

He quoted Leo Tolstoy who had said, "everyone thinks of changing the world, but no one thinks of changing himself" to instil self motivation as the first step towards betterment. His message for the students was "don't sleep until you have learnt something new everyday".

Evaluation of this years' project was done by 3 judges and their introductions were given by Dr. Rita Mukhopadhyaya, who was conducting that day's program. Ms. Gargi Lagu, a freelance writer, who was present for the occasion shared the judges' view on the difficulty of deciding the best project from among the 16 final entries from different schools of Navi Mumbai. The two other judges were Ms. Namrata Randive TERI, and Mr. Dhanajay Nanekar, MPBC. This year, 2 prizes were given for each category and one general consolation prize. English medium best project prize was taken by Father Agnel school, Vashi, runners up were students from St Augustine school, Vashi. In the non-English category, first prize was fetched by a Marathi project from Vidya Prasarak Mandal's High School, Belapur and the second prize went to a project in Hindi by Gyan Vikas High School,

Koparkhairane. Consolation prize was bagged by students from Sainath English High school, Vashi. Dr. (Mrs.) Kale, who was present for the occasion, joined her husband in distributing prizes to the group of students.

### **Celebration of Homi Bhabha's 101st Birthday at IWSA Headquarters, Vashi, Navi Mumbai.**

The 101st birth anniversary of Dr. Homi Jehangir Bhabha, the founder of atomic research in India was celebrated on 30th October 2010. Dr. Bhabha was a multi-faceted personality, whose vision for the future of independent India led to the present day Atomic Energy Commission and institutes like Bhabha Atomic Research Centre and Tata Institute of Fundamental Research. A full day program was organised at the IWSA Head quarters in association with the Indian Association of Nuclear Chemists and Allied Scientists (IANCAS). The morning session opened with an introductory lecture on Dr. Bhabha's vision by the chief guest Dr. A. P. Jayaraman. An ex BARC employee, Dr. Jayaraman currently is Dean of Management Institute, Palakkad. He was lucky to have met Dr. Bhabha once during the graduation ceremony of their batch of Training School in 1964. The guest of honour for the program was Dr. A. V. R. Reddy, Head, Analytical Chemistry Division, BARC. He gave a very lucid, student-friendly lecture on 'Atom for Peace'. Beginning with the discoveries of radioactive substances and radioactivity, he covered life of scientists involved with these discoveries, the situation during the World War II and the birth of atomic energy programs in India. He enthralled the students with stories that helped to understand the difficult subject of nuclear sciences. Interestingly his lecture brought out the fact that Smt. Vijayalaxmi Pandit, a member of cabinet then was sent as Ambassador of India to the very first session of IAEA. Following this was a presentation by Dr. Tarveen Karin of Board of Radiation & Isotope Technologies (BRIT), Turbhe, Navi Mumbai. She gave a very informative presentation on uses of radiation in health, medicine and agriculture sectors and also pointed out how it is linked with development of our country.

A tasty and healthy working lunch was provided to all participants at the IWSA cafeteria between the two sessions, which gave opportunity for interactions between the speakers and the participants. The afternoon session was conducted by the IANCAS members, who set up the demonstration of equipments required for measuring and monitoring radioactivity. Dr. Reddy spoke once more on behalf of his IANCAS team members. The students took keen interest to interpret their book knowledge into real life observations during the demonstration of presence of radioactivity in inorganic salts of potassium, a pouch of milk powder etc. They learnt about the safe levels of exposure to radioactive substances from natural surroundings, exposure during medical examinations through X-ray and also safety of our nuclear reactors. A total of 63 students and 10 teachers from 6 schools in Navi Mumbai attended the program and were grateful to IWSA for conducting such informative programs.

## **KALPAKKAM BRANCH NEWS**

### **1. General Body (GB) on 5th May at 14.00 hrs at Raja Ramanna auditorium:**

Annual GB of Kalpakkam IWSA branch started with a presentation by Dr. Vineetha, Paediatrician, DAE Hospital, and our EC member, on the need of a workshop for school teachers on handling adolescents. She told that in the backdrop of globalization and the hidden threat of value deterioration or rather compromising on values, the children especially our adolescents are very much stressed up and need help. She felt that empowering the teachers to handle the stress of adolescents would go a long way to solve this problem. In the present day of increased violence, substance abuse and sexual experiments, our children should be equipped with life skill managements and teachers are the best persons to impart this. She concluded her presentation by showing a brief sketch of the programs planned including compendium and group activities and expert talks for teachers. This was followed by GB where Convener Dr. Rani P. George welcomed all IWSA members and Mrs. Premila, Secretary read out the report where activities of branch was highlighted followed by Mrs. Parimala reading the Treasurer's report and both reports were passed. In the any other matter session, Dr. Vaidehi, IWSA member, informed the members that she will be leaving for International Women Scientists' Congress (June 26 - 30) in Beijing organized by Third World Organization of Women in Science, where she will present a technical lecture and a lecture on general topic and IGCAR is supporting her travel. Forty members attended the GB and everybody enthusiastically gave ideas and expressed their support for the program "Workshop on Handling Adolescents" to be held on August 14th 2010.

### **2. "Worskshop On Handling Adolescents for School Teachers", August 14th, 2010, Anupuram Convention Centre:**

IWSA Kalpakkam Branch organized a workshop on "Handling adolescents for school teachers" of DAE townships, Kalpakkam and Anupuram in collaboration with the Department of Pediatrics, DAE Hospital, Kalpakkam on 14th August 2010 in Anupuram Convention Centre. This was a one-day program (09.00 hrs to 17.00 hrs), starting with inauguration session (09.30 hrs to 10.30 hrs). Dr. Prabhat Kumar, the Project Director, BHAVINI, Kalpakkam inaugurated the workshop. In his inaugural address, Dr. Prabhat Kumar clearly brought out the need of parents and teachers acting as facilitators to help the children to mold themselves and avoid undue restrictions. He also asked IWSA to extend this program to parents too. Sharing the best wishes, Shri S. A. V. Satyamurthy, AD, EIG congratulated IWSA and Dept of Pediatrics for arranging the much needed program and told that mother nature has provided this adolescent period to mold the children to enter youth stage and the role of parents and teachers as guides yield responsible youth for the world. Dr. A. Vijaya, Medical Superintendent, DAE hospital explained that adolescence is a period of emotional upheaval due to hormonal changes

and assistance for each child to develop into a balanced personality should be available. To develop emotional quotient which is as important as IQ, life skill management should be taught in schools. Following the inauguration session, the expert lecture by Dr. Jeyanthini, Prof. of Pediatrics and Head, Department of Child Psychiatry, ICH & HC, Chennai started. She told the audience that most of the children pass through this phase in a normal manner and a small percentage only is getting into the extreme bad cases. And majority of these students may be suffering from attention deficit diseases like dyslexia. Teachers and doctors can act in a synchronized manner to save them. Close rapport between teachers and students in the class help in early diagnosis of these cases. The most important problem is loss of self-esteem in the students due to physical appearance and physiological changes in this adolescent period. A teacher like a surrogate parent can instill the self-esteem by friendly interactions. The importance of moral education during this period is important. In the older days, every school had moral education period. In the present time, undue importance is in getting more marks and quality education has lost the glamour. She concluded her talk by comparing every child to a plant where the soil is the parent, sunlight is the teacher and doctor is there to provide pesticide and society imparts water and fertilizer for the good growth. Dr. Vineetha spoke on education issues in scholastic performance and Dr. Lakshmi Priya talked about Reproductive health training. In the post lunch session, Dr. Vineetha made a brief presentation on Life Skill Education and then group activities were initiated. All the five schools in two townships nominated 40 teachers and 12 students were invited from IXth Std. to participate in group activities. Group I activity was on bullying, Group II activity was on gender issues and Group III activity was on coping with stress. Teachers responded saying that this program has immensely helped them. It has thrown light on child behaviour and need for more interactions to help them. Module given was well appreciated. Dr. Vineetha, Convener of the program summarized the day's events and asked the teachers to keep aside some time per week in the school to help children develop life skills. She assured that this program would be extended to other Tamil medium schools outside the township also.

### **3. TWOWS International Meet: Dr. Vaidehi Ganesan IWSA member participates and reports;**

TWOWS (Third World Organization for Women in Science) Fourth General Assembly (4GA) and International Conference "Women Scientists in a changing World", 27-30th June, 2010, was held at Beijing, China, organized by TWOWS, TWAS, Trieste, Italy and Chinese Academy of Sciences (CAS). TWOWS general Assembly and International Conferences are being held every four years. Participation in this conference and General assembly is by "Invitation" only. The conference, 'Women scientists in a changing world is expected to cover a range of socially relevant and critical scientific topics related to overall objectives of TWOWS. Themes of the conference include: Women Scientists and Frontiers of Sciences; Women scientists and Global Change; Women, Innovation and

Entrepreneurship, Leadership Capacity; Gender Mainstreaming in the Global Scientific Community; and the Young Women Scientists Forum. There were about 600 registered delegates attended the above meet, representing different countries and regions. There are four regions: 1. Asia & Pacific, 2. Arab, 3. Africa and 4. Caribbean & South America. We are representing Asia & Pacific. There were about 88 participants from India. Dr. Videhi Ganesan was the only representative from IGCAR, Kalpakkam and DAE. The participants with different expertise and back ground attended the International meet (scientists, engineers, technologists, medical professionals etc). The International meet was arranged in a very high level of organization. Higher officials in the Chinese Academy of Sciences (President and Advisors) inaugurated the meet at "Great Hall of the people at Tiananmen square, Beijing (the site where the Chinese National People's Congress meetings are held)", Beijing, China. All the papers were presented in parallel sessions in the Beijing International Centre. New TWOWS executive committee was formed based on the election results. The name of TWOWS is changed (similar to TWAS) to Organization for Women in Science for the Developing World (OWSDW) in the general assembly. Many suggestions were recommended by the women scientists and engineers from all over the world to improve the present situation of women scientists and engineers. The suggestions are planned to be forwarded to higher level decision making bodies, so that these can be implemented suitably in the Institutions, Universities etc all over the world. Dr. Vaidehi Ganesan, Metallurgy & Materials Group. IGCAR, Kalpakkam received invitation to participate and presented the following two papers during the International meet: "Frontiers in Characterization of materials" and "The problems and prospects of women in science and the need for women leadership in science and technology".

4. IWSA Kalpakkam branch member participates in "The Science of Living", a program for women scientists, 20-24 Sept, 2010 (Residential). Vadodara (Baroda), Gujarat, organized by Academy of Human Excellence and Department of Science and Technology, Government of India.

The objective of this program is to help participating women scientists to learn ways to live rich, fulfilling successful and balanced professional and personal lives. Participants will learn to define their a. Locus of control, b. Personal mission statements, c. Life roles and d. Goals in each role. Women scientists at all levels can participate. This is a 5 days residential program. They conduct similar programmes for Air India, Aditya Birla Group, GE, Reddy's Lab, Oberoi group, Texas Instruments, Tata, Biocon (including many other corporate offices) etc. Dr. Vaidehi Ganesan was nominated by IGCAR and Indian Women Scientists Association (IWSA), Kalpakkam branch also to participate in this program, on behalf of all the other women scientists. She has planned to present a lecture about the program in an IWSA meeting, for the benefit of other women scientists, who could not attend the program. This program is being sponsored by Department of Science and Technology (DST). Her feed back is that this is an excellent program and all men

scientists and engineers also should attend the program. There were lot of useful exercises during the program. The psychometric instruments (forms) were filled and submitted by participants, consisting of the following: 1. Personal Profile System This will generate a profile of you on four dimensions and help you to understand yourself better. 2. Conflict Mode Instrument - This will help you to understand how you handle conflict situations. During the course/program, the above were analysed and explained.

## ROORKEE BRANCH NEWS

IWSA, Roorkee branch has been doing activities which deeply concern the masses. Like previous years, this year also IWSA Roorkee undertook important tasks on hand. A new team of Executive Members was formed in a combined meeting of G.B and outgoing executive members. Mrs. Kiran Handa and Ilona Prakash were elected as convener and co-convener respectively. Mrs. Neeta Mittal and Dr. Rama Mehta were elected as secretary and treasurer and Dr. Vijaya Agarwal as project co-coordinator.

Members of IWSA, Roorkee volunteered their services during the 5 days workshop on 'Capacity Building Women Managers in Higher Education' sensitivity, Awareness/Motivation, organized at Centre of continuing Education IITR during 18-22 May, 2009. Ms. A. Asha, a very energetic person, did her summer training of 6 weeks on 'Women Development' with IWSA, Roorkee, supervised by Dr. K.P. Suleebka at Bangalore. A number of lectures were arranged from time to time. Talk on time management on December 20, 2009 by Dr. Handa S.C. and on "Yoga & Health" by Mrs. Suman Tyagi on 17th May, 2010 were very informative.

Two projects are in the pipeline regarding measures to be taken to manage land, air, water and energy for the next generation. Also it is planned to take strong initiatives to make the city clean and green, thus helping the environment safe to live in. In one of the various meetings held earlier, it was decided to request Mrs. Kiran Handa, convener IWSA, Roorkee to attend the National Conference to be held in Kolhapur (Maharashtra) on "Sustaining Global Pressures, Women in Science & Engineering, Bio-diversity conservation in India : status and approaches from January 8-10, 2010. Consequently Mrs. Handa attended the conference, which was a big success and very well organized. Brain storming discussions were held in which simple, yet untouched measures were suggested to manage land, air, water and energy, which has now become the hot issue in recent times, to sustain and enjoy good life.

IWSA, Roorkee is also trying hard to convince women who are science oriented, who have scientific attitude and who are technically and academically sound, to become life members of IWSA. One new member Mrs. (Dr.) R.K. Lahiri, Assistant Professor at Humanities Department, IIT Roorkee, has joined recently. Fund Raising Campaign is also on its way to help IWSA to become a 'Self sustained Body' for carrying out activities of various nature.

## NAGPUR BRANCH NEWS

**1. Membership Status:** Life Members: 135; Annual Members: 09

**2. Managing Committee:** Dr. Rita Israni (Convener); Dr. Lalita Sangolkar (Secretary); Dr. Vibhavari Khanzode (Treasurer); Members: Dr. Dipti Andhare, Mrs Preeti Katakwar, Dr. Vatsala Sapkal, Dr. Pradnya Bhalerao and Dr. Seema Somalwar.

### Events during the Year:

**24th April 2009:** Annual Get-together and Farewell to Mrs. Swaroop (Life-member) on retirement and shifting to Agra.

**10th June 2009:** World Environment Day was celebrated for the inmates of "Bal Sadan", a Home for the Orphan children. Competitions such as Elocution and Poetry reading were conducted. Three prizes (1st, 2nd, 3rd) were awarded to the children.

**1st August 2009:** Annual General Body Meeting was held at Abhyankar Smarak Trust, Dhantoli Nagpur. Programs to be conducted by IWSA during the year were discussed.

There was a discussion on "Health Care for Senior Women". Dr. Madhuri Wagh, Professor, Govt Ayurvedic College, Nagpur was the main speaker. Dr. Jayshree Pendharkar and others participated. The new team for the year 2009-2011 was installed (as above). The Senior Members, Dr. Anuradha Gadkari and Dr. Chandra Chakrabarti were requested to be the Advisors.

**12th September 2009:** Teachers' Day Celebration. A panel discussion on "Encouraging Students to enroll in Basic Science Stream: SWOT analysis of career in Science" was arranged. Speakers: Dr. Seema Somalwar, Dr. Deepa Panekar. The talks were followed by the Discussions and the response from the audience, especially the college Teachers was very inspiring. The teacher members of different colleges were felicitated.

**3rd October 2009:** Demonstration on Effective Methods of Garbage Disposal. A program was organized at NEERI'S Ladies club in collaboration with a US based agency, Corporate Housing Foundation (CHF) working at Nagpur, Bangalore and Pune. A demonstration was given on the use of specially manufactured and commercially available earthenware pots to be used for composting Kitchen waste (Biodegradable) in a period of 40-45 days. Overhead slides on CHF work to create Environmental awareness, Garbage disposal, Solid waste management in rural areas and community hostels etc by Bio-Gas were screened. The program was inspiring and order was placed with CHF for earthenware pots by the members.

**7th November 2009:** World Food Day was celebrated at Abhyankar Smarak Trust. A Recipe contest was organized followed by talk by Jayashree Pendharkar, Dietician, CIIMS, Nagpur on "How Safe is the Food we eat?" The Theme for

the competition: Recipes for Breakfast and Lunch (Snacks) using Green Leafy Vegetables. The judges for the contest were Jayashree Pendharkar and Savita Kurve. Three Prizes (1st,2nd,3rd) and one consolation Prize were given.

**14th November 2009:** Children's Day Celebration The Day was celebrated at "Matimand Mulinchi Shala" at Takli, Nagpur. Drawing sheets, pencils, papers and crayons were distributed to the children of the school. Donations to an amount of Rs 2500/- were given to the school by IWSA, and senior members of IWSA who visited the school.

**5th and 6th December:** National Children Science Congress 2009, Maharashtra. The 17th National Children Science Congress, Maharashtra State Level Meet was held at Somalwar High School, Khamala Premises. The theme of the Science Congress was "Planet Earth our Home, Explore care & share". The State Level convention was conducted with the support of Somalwar Academy Education Society and IWSA, Nagpur Branch. The members of IWSA actively participated in the program. The prizes for the program were sponsored by IWSA Nagpur Branch.

**22nd - 24th December:** Science Fest for Budding Scientists (SFBS) 2009. The event was arranged in collaboration with Rajasthani Mahila Mandal for VII-IX Standard students. Thirty students from different schools participated. The event started with the lighting of the lamp by the ladies of the Mandal followed by Saraswati Vandana by the participants themselves.

#### **Various activities during the event were as follows:**

**22nd December 2009.** Introductory remarks by Dr. Anuradha Gadkari highlighting the importance of the program Science quiz by Dr. Chandra Chakrabarti and Dr. Rita Israni.

**23rd December 2009:** Identification of common plants (Spotting) by Dr. Dipti Andhare. Simple methods of Detection of Adulteration in Foods by Mr N. V. Sarma from Central Agmark Laboratory, Nagpur. Demonstration on Nutritious Food samples by Mrs. Kalpana Patankar.

**24th December 2009:** Fun with Mathematics by Mr Vivek Wagh. Blood grouping---Demonstration and testing of blood groups by children themselves- By Mrs Aruna Banerjee The project Incharge for the program was Mrs. Shalini Arora, while it was conducted by Dr. Dipti Andhare. Three best performers were awarded 1st, 2nd and 3rd Prizes.

**26th Feb 2010:** Annual Inter-collegiate Event. The event was organized in collaboration with Shankarrao Dhawad Polytechnic, Somalwada, Wardha Road, Nagpur. The subjects for the competition were: Know our Trees, Best out of Waste, Trees and their Usefulness. The Best Speakers were awarded in each category. An exhibition of artistic items prepared from the leaves and other plant materials by children of a rural school was exhibited by the In-charge (a very senior person) who gave a talk as well as the information regarding the exhibits to the students of the college.

**14th March 2010:** International Women's Day was celebrated in collaboration with Institution of Engineers of India, Nagpur Centre-Women's Wing. Er. Vidya Sirsikar was the Project In-charge.

A debate was conducted for the women on the topic "In the opinion of this House modern Women equipped with Science & Technological innovations do not contribute towards upholding the happy joint Family". Eight Speakers participated in the debate competition - Three Prizes viz First, Second and Third and a consolation prize were given.

The following women achievers were felicitated during the occasion:

**1. Dr. Sandhya Kranthi** - Scientist, Central Cotton Research Institute, Nagpur for receiving "Woman of the year" award

**2. Ms. Reena Saha** - Life member, IWSA, Nagpur Branch for receiving the Savitribai Fule National Fellowship.

**3. Dr. Pradnya Bhalerao** - Vice Principal, LAD College for being appointed as Principal, Nikalas Mahila Mahavidyalaya.

**4. Er. Sandhya Bhole**- for receiving 'JAL Sewa Puraskar" of IWWA.

**5. Mrs. Anjali Junghare and Mrs Monali Kshirsagar** for being awarded PhD in Engineering.

#### **Other Activities:**

Dr Anuradha Gadkari and Dr. Chandra Chakrabarti attended SGPW-2010 conference at Kolhapur during 8th Jan-10th Jan 2010. Dr. Anuradha Gadkari was invited to deliver a talk on "Environmental Pollution- Control and Monitoring".

Dr. Rita K Israni, Convener, IWSA, Nagpur Branch addressed the gathering of packers from Vidarbha Region on Microbiological aspects of Packaged Drinking water at Bureau of Indian Standards, Nagpur.

*Compiled by Dr. Rita K Israni,  
Convener, IWSA, Nagpur Branch*

#### **AMRAVATI BRANCH NEWS**

Dr. Anuradha Gadkari introduced Indian Women Scientists Association in Amravati and formed the Amravati Chapter. It was inaugurated by Dr. Shastri. At present, there are 48 Members, 38 Life members and 10 Annual members. All are from the local colleges affiliated to Sant Gadge Baba Amravati University. Till now we have organized the following activities in various targets groups.

1. 22nd July 2009:- Plantation activity was undertaken in slum area of Wadali, Amravati on the eve of Environment Day Celebration. Saplings of economically important plants like Sitaphal, Jambhul, Awla, Nilgiri and Behada were purchased by the IWSA members from the Wadali nursery

which were distributed to women in this area for plantation. Awareness about the importance of Nature and Environment was told to them. The significance of plants in human life and conserve the nature and environment was explained to them. Personal counselling was done regarding hygiene by means of group discussion.

**2. 6th September 2009:-** A collaborative programme was organized with Diabetics Association of India, Amravati Unit. In this activity, the counselling to the diabetic patients from Amravati region was conducted regarding their nutrition, care, exercises etc. Also, there was an interaction session of the patients with eminent doctors of medical sciences, where their queries were answered.

**3. 23rd September 2009:-** Swine flu awareness activity was conducted in schools from slum areas of Amravati by displaying posters in form of Exhibits instead of panel discussion to avoid crowding.

**4. 10th October 2009:-** This programme was organized in Badnera region for housewives and girls, in which Dr. Sudha Deshmukh, a renowned Gynecologist from Amravati delivered a talk on "Health and Nutrition Awareness in Women". She interacted with all of them in very congenial environment and gave solution to their personal problems.

**5. 14th November, 2009:-** Childrens' Day was celebrated in the memory of Pandit Jawaharlal Nehru by distributing fruits to children in the slum area of "Bajrang Tekdi".

**6. 27th November 2009:-** Blood group and Hb% detection camp held at Sharda Kanya Vidyalaya, Sharda Nagar, Amravati. On this occasion Mrs. Rachana Shirsat, Department Of Home Electronics, Bhartiya Mahavidyalaya, Amravati delivered a lecture on 'Importance of Nutritious food". Blood group and Hb% was detected of 100 girl students. Suggestions were also given in their reports.

We have planned the activities in the months to come. We conducted a General Body meeting of all IWSA members of Amravati Chapter on 12th September 2009, under the chairmanship of Dr. Varsha Nathar, Convener, IWSA, Amravati Chapter to discuss smooth and efficient functioning and various other issues.

*Secretary, IWSA, Amravati Chapter*

## DELHI BRANCH NEWS

### Meetings

Executive committee meetings of the IWSA Delhi Branch were held on 30th July and 17th September 2010: Mrs. Kanika Mallik was officially appointed Joint Treasurer by the executive committee in place of M. Deepa who has shifted to Hyderabad.

### Lectures

The Branch started its lecture series for this year with "Veena Memorial Lecture"- a lecture series in the memory of

our ex- colleague Dr. Veena Roonwal of the Dimensional Metrology section of the Standards Division of National Physical Laboratory (NPL) and former IWSA Executive Committee member. Veena passed away on 10th April 2009 after a prolonged illness. Dr. A. Sengupta, Sc "H" of Time & Frequency Standards section of NPL delivered a lecture on From sun dials to atomic clocks we have come a long way on Tuesday, 3rd August 2010.

Dr. Rama Mukherjee MD, ARA Healthcare Pvt Ltd, Gurgaon an R&D Company gave an interactive lecture on Women empowerment, a necessity for the inclusive growth and development of Rural India on 29th September, 2010.

### Industry visit

IWSA under its Industry visit programme, planned a visit to the Agucha. zinc-lead opencast mines of Hindustan Zinc Ltd at Rampura on 9th & 10th October 2010. The mine is located about 100km south of Ajmer. A 12 member group from IWSA Delhi Branch was given a guided tour of the mines, including excavation of the ore, loading and transfer of the material to the site of grinding, extraction, separation, and various stages of beneficiation and purification of the primary metals, zinc and lead and the other by products silver and chromium, etc. The tour was very educative.

### Member participation in other activities

Some members participated in a US Embassy hosted workshop on Women In Science held on 26th August 2010 at Constitution Club, N Delhi. The topics addressed to by the eminent speakers were Nurturing a Science Career, Women in Science Professions, Empowering Women towards Science in three sessions. Each session was followed by lengthy debates and discussions and recommendations emanating from them were listed for communication to the relevant authorities

The Third World Organization for Women in Science (TWOWS) held its Fourth General Assembly & International Conference on Women Scientists in a changing world in Beijing during 27th to 30th June 2010. This was hosted by Chinese Academy of Sciences (CAS) at Beijing International Convention Center (BICC). It was attended by more than 80 delegates from India including five members from Delhi branch of Indian Women Scientists' Association. They participated by presenting their papers in the oral sessions. Dr. Suhasini Agnihotry "Electrochromic Smart Windows"; Dr. Archana Gupta "The participation of women scientists in Research"; Dr. Minati Raychaudhari; Mrs. Kanta Rani "Genderwise analysis of CSIR extramural research (EMR) schemes in Natural Science"; Dr. Bhanu Verma "Career Graphs of women pursuing science in India : Opportunities & Challenges".

*We regret the omission of a small part of the article "Ultrasensitive Magnetometry: Exploring Ultra-low Magnetic Fields in the Physical World" By N. Singh et. al., which appeared in the previous issue of our newsletter (Issue No. 1, Vol. 36). -Editors*

## The menopause effect

**G. Padma Vijay** - *Publisher (Aahaar Publications) and Nutrition Counsellor (Dietmantra)*

Natural changes in the body with age are inevitable. The time when women stop ovulating is termed as menopause, which usually occurs between 40 and 50 years of age. Menstrual irregularities may occur actually 5 years before the actual onset of the menopause, which is called 'pre-menopause'. Now-a-days women in their mid thirties are also at an increased risk to premature menopause due to increased stress levels. Hot flushes, mood swings, depression, anxiety, night sweats, etc, are the symptoms that occur due to hormonal imbalances during menopause. The female hormones, estrogens, protect women during their reproductive stage from the risks of heart attacks and osteoporosis. With menopause, the estrogen levels decrease, thus increasing the risks to cardiovascular disease and osteoporosis.

**HEART DISEASES:** According to Dr. Surekha Mude, Consulting Gynaecologist and Obstetrician at Vashi, menopause increases the risk of increased blood cholesterol and increased blood pressure levels, thus increasing the risk to heart diseases, especially ischemic heart disease. However, there is no relationship between menopause and increased blood sugar levels which, she says, is either genetic or due to increased stress levels.

Depression, mood swings and physical inactivity during menopause can lead to cravings and binge eating in some women leading to rapid weight gain. Weight gain along with hormonal imbalance can also lead to increase in total cholesterol levels, increase in LDL (bad cholesterol) levels, decrease in HDL (good cholesterol) levels and also increase in blood pressure levels.

**OSTEOPOROSIS:** According to Dr. Ikshita Asgekar, Consulting Gynaecologist and Obstetrician at Vashi, 50% of the menopausal women suffer from 'ostopaenia', which is the early stage of osteoporosis. According to her, the decreased hormone levels in menopausal women can result in porous and brittle bones that can be fractured easily. The underweight menopausal women are at an increased risk to osteoporosis than the overweight or obese menopausal women. With osteoporosis, bone composition remains unchanged, but the mass and density are decreased. She further adds, that osteomalacia in women has nothing to do with menopause, as it occurs in women of any age due to vitamin D deficiency. According to Dr. Surekha Mude, hip fractures are common in the post menopausal osteoporotic women. In some menopausal women, the bone loss occurs at a slower rate and in some at a much faster rate. Menopausal women, especially women who do not exercise at all or those who are physically inactive at home, who eat an inadequate diet which lacks bone building nutrients such as calcium, vitamin D etc., small bone frame women, women who had taken steroids over a long time and who have a family history of osteoporosis are at increased risk to osteoporosis.

**CANCER:** Contrary to popular belief, Dr. Ikshita Asgekar, says that risk to endometrial and ovarian cancer also increases in women after 45 years of age, but not due to the decreased hormone levels after menopause.

Proper diet and nutrition in menopausal women not only reduces the unpleasant symptoms of the menopause, but also reduces the risk to various degenerative diseases and disorders.

### Role of important minerals during menopause

Though there are many minerals required by the body, calcium, phosphorus and magnesium are the most important minerals required in the diet of the menopausal women to reduce the loss of bone mass to prevent osteoporosis. The calcium requirement in the menopausal women is 1g (1000mg) to 1.5g (1500mg) per day as a supplement, if the dietary intake is very less. Calcium supplements taken, as advised by the doctor, can help in preventing the risk of osteoporosis and hypertension. They should be always taken with protein foods (legumes, pulses, nuts, fish, etc,) or for best results at bed time. However, excess intake of calcium supplements can cause constipation, hypercalcemia, urinary tract stones etc. Calcium cannot function unless phosphorus is also present as it occurs as calcium phosphate crystals in bones and teeth. However, avoid excess intake of phosphorus because it affects calcium and magnesium absorption. Magnesium maintains the bone structure as it is involved in the conversion of vitamin D to its active form. Magnesium is also necessary to aid calcium in its absorption and utilization.

In addition, food which contain minerals other than calcium, phosphorus and magnesium, that contribute to building bone or which increases its strength should also be consumed by the menopausal women. Zinc encourages the production of bone protein and gastric acid, which is needed for the absorption of calcium. Copper is also required for bone production. However since menopausal women are at a heightened risk to increased cholesterol levels, they should take only vegetarian sources of copper. Manganese is required for strengthening the connective tissue in bones. Boron is required for calcium absorption and retention. Flouride prevents bone brittleness. Silica initiates calcification of bones. It not only is an important component of bones but also of nails, skin, hair and ligaments, structures which suffer during menopause.

### Role of important vitamins during menopause

Though there are many vitamins required by the body, vitamin C, D and E are the most important vitamins required in the diet of the menopausal women to prevent osteoporosis and risks to other diseases and disorders. Vitamin C is a water soluble vitamin and is an important anti-oxidant. It makes the bones flexible, strong and less prone to fractures. It aids in calcium absorption and also helps to reduce unpleasant menopausal symptoms. Vitamin D is a fat soluble vitamin. It helps calcium to be deposited in the bones. Therefore, deficiency of vitamin D during menopause not only increases the risk of osteoporosis but also causes

thinning of hair, brittle nails and ageing skin which is thought otherwise due to menopause. Calcium, phosphorus, vitamins C and E aid in its utilization. Exposure to sunlight at least for 20 minutes every day is also very important to convert vitamin D to its active form. However, avoid sunlight between 12 to 3p.m. Vitamin E is also an antioxidant and is a fat soluble vitamin. Vitamin E also helps in lowering the LDL (bad) cholesterol levels during the menopause and is very beneficial for those women who have a familial increased risk for heart attacks.

In addition, food which contain vitamins other than vitamin C, D and E, that contribute to building bone or which reduces menopausal symptoms or reduces the risks to various degenerative diseases and disorders should also be consumed by the menopausal women. Vitamin A is required for bone protein production. Beta-carotene is pro-vitamin A and it gets converted to vitamin A in the body. Both vitamin A and beta-carotene are important anti-oxidants. Vitamin K is required for the mineralisation of the bones and hence keeps the bones strong. B-complex vitamins, especially thiamine, riboflavin and pyridoxine, help in reducing the menopausal symptoms such as depression and stress. All antioxidants neutralize the harmful effects of the free radicals in the body, thus reducing the risks to various degenerative diseases and disorders.

In short, menopausal women should eat a balanced diet containing all the essential nutrients. So eat whole grain cereals like brown rice, whole wheat, jowar, bajra, ragi; legumes, pulses, nuts, seeds, fruits and vegetables and low fat dairy products. Non-vegetarians should eat only lean meat. In addition to balanced diet, they should also eat food rich in bioflavonoids and also those rich in phytoestrogens. 'Bioflavonoids', are the phytochemicals found in most of the plant food which have antioxidant properties. They also help to reduce the menopause symptoms. So eat lots of fresh fruits and vegetables. Bioflavonoids also enhance the absorption and utilization of vitamin C.

Estrogenic substances found in plant food are called 'phytoestrogens'. Phytoestrogens mimic female hormones, estrogens, in the body which therefore reduces the health risks and the unpleasant symptoms of the menopause. The food rich in phytoestrogens are soybeans, alfalfa sprouts and linseeds. However, take supplements rich in phytoestrogens, strictly on Doctor's advice. There are some herbs, available as supplements, which also reduce the unpleasant symptoms of the menopause by stabilising the hormone levels. These include 'Siberian ginseng' (popular in China), dong quai and licorice. However, consult your doctor before taking the above herbal supplements. Furthermore, menopause women with hypertension should avoid licorice.

### **Excess intake of food and beverages to avoid during menopause**

Non-nutrients such as phytates and oxalates present in food hinder the absorption of some nutrients like calcium, iron and zinc. So avoid excess intake of food rich in them. Whole grain cereals, nuts and soybeans are food rich in phytates.

Spinach, sweet potatoes and legumes are foods rich in oxalates. A little amount of bran (fibre) is important for free bowel movement. But excess intake of bran inhibits calcium and other nutrients absorption. Avoid excess intake of high protein food which are of animal origin. A high protein intake without an increase in phosphorus can increase urinary calcium excretion. Consuming one or two cups of tea or coffee is stimulating and refreshing, but excess intake can cause calcium excretion and absorption of other minerals like iron and zinc. Avoid other caffeine containing products such as cola beverages and chocolate in excess quantities.

### **Foods to avoid during menopause**

Avoid high intake of fats especially rich in saturated fats (animal fats like butter, ghee and plant fats like palm oil and coconut oil) and hydrogenated fats (dalda and margarine). Avoid food rich in fat such as fried food, cakes, pastries, sweets etc. They increase the blood cholesterol levels and thus increase the risk to heart diseases. High fat food also increase the risk to cancer. One also needs to avoid food rich in salt as a high salt diet causes excretion of calcium in urine and can also increase the risk to blood pressure levels. Furthermore, refrain from food rich in sugar as it can increase the blood sugar levels and increase the risk to diabetes. Food rich in sugar increase the risk to various infections and thus reduce the immunity levels in the body.

### **Lifestyle factors to avoid**

Avoid alcohol as it can accelerate the rate of loss of minerals from bones. Avoid smoking as it prevents calcium absorption and increases bone loss.

### **Do regular exercise**

In addition to a proper diet, regular exercise like weight bearing exercise (aerobic exercises like dancing, jogging and brisk walking) is also important, not only to reduce the risk to various diseases and disorders, but also to reduce the unpleasant effects of menopausal symptoms. Regular exercise also keeps the body fit, reduces weight, reduces the blood pressure levels, reduces the total cholesterol and the bad (LDL) cholesterol levels, increases the good (HDL) cholesterol levels, increases the bone mass and thus reduces the risks of heart diseases, osteoporosis and thereby slows down ageing. However, the exercise should not be prolonged or strenuous. It should be of moderate intensity, for 30-40 minutes and at least five times a week. Light weight training is also helpful to protect oneself from osteoporosis.

### **Avoid stress**

A little amount of stress is stimulating, but increased stress can deplete the body of magnesium and other minerals necessary for strong bones. Stress also depletes a number of vitamins like vitamin A and C, which are important antioxidants. It also increases the blood sugar, blood cholesterol and blood pressure levels, thus increasing the risk to heart diseases, diabetes, cancer, arthritis, etc. So avoid stress. If it is inevitable, cope with it using stress

management techniques like yoga, massage, meditation, developing hobbies like gardening, reading, writing, painting or watching movies, etc.

### **Hormone Therapy**

According to Dr. Surekha Mude, Estrogen Replacement Therapy is recommended only to those menopausal women who suffer from severe menopausal symptoms such as depression, mood swings, hot flushes, etc. and to those women who underwent hysterectomy and oophorectomy before menopause. She cautions that, though the therapy reduces the risk to menopausal related diseases like heart diseases and bone diseases, it increases the risk to uterine and breast cancer. Dr. Ikshita Asgekar says "Hormone Replacement Therapy (HRT) is recommended only for young women with premature ovarian failure or surgical removal of ovaries". The treatment usually continues until the age of natural menopause. According to Dr. Surekha Mude, HRT is not recommended to menopausal women as it includes not only estrogen, but also progesterone which causes bleeding. Dr. Ikshita Asgekar feels that all menopausal women should take phytoestrogen supplements like 'ISOFLAVONES', but only as per their doctor's advice.

Moderation is a key word to good health. So eat only moderate quantities of food. Avoid overeating anything, even if the food is good for health. So understand the consequences of your health during menopause and include those foods and other alternate remedies to reduce health risks and unpleasant symptoms. So take charge of your health today.

## **Need of Drinking Water Purification and Role of BARC in this Field**

**Saly T Panicker, Desalination Division, B. A. R. C.**

Our body is estimated to be about 60 to 70 % water. The body needs water to regulate body temperature and to provide the means for nutrients to travel to all the organs. According to the WHO and UNICEF, dirty drinking water kills 2.2 million people per year. This is a tragedy because many of the world's water problems can be solved with education and technology. Access to clean water is a basic human right, and is an essential step towards improving the living standards. On an average, a person requires 20 to 50 liters of water per day for drinking, food preparation and personal hygiene.

About 71% of the earth's surface is covered with water. But, most of it is in the oceans, which is too salty for human consumption. About 2.5 % only is fresh water, of which two-third is frozen in ice caps and glaciers. Water quality problems are caused by industrial and agricultural pollution, over-exploitation, floods and droughts. Though India has 16 % of the world's population, it has only 4 % of fresh water resources. Though, around 4,000 Billion Cubic Meter of fresh water is available by way of rain and glacier melting, most of it returns to the seas via rivers and gets lost.

Water sources can be broadly divided into two - surface and ground water. Surface water bodies such as rivers, lakes and reservoirs have dust particles, microorganisms, minerals and organic matter in them. Ground water contains many dissolved minerals, of which some are toxic. Some of the contaminants can be easily identified from the taste, odor, and turbidity of the water. For others, chemical testing is required to know the type of contaminants. These contaminants can be either man-made or naturally occurring as in the case of fluoride and arsenic. West Bengal is facing arsenic problem, where, >0.01 mg/l can cause cancer of the skin, lungs, urinary bladder and kidney. Over-exploitation of groundwater has resulted in harmful levels of fluoride in the states of Andhra Pradesh, Assam, Gujarat, Karnataka, Madhya Pradesh and Rajasthan. Long term intake of > 1.5 mg/ l of fluoride causes skin diseases, and dental and skeletal fluorosis.

Other contaminants include excess iron, nitrates and brackishness. As per the WHO standards, drinking water should not have more than 500 mg/l of total dissolved salts in it. Increase in brackishness in coastal areas is the result of less recharge of aquifers (water table) due to drought and floods. When the aquifers are dry, salt water from the nearby sea migrates in to them. The ground and surface water get polluted by heavy metals like lead and mercury from fertiliser and pesticide used in agriculture and from industrial sources also. Bacterial contamination is the major cause of waterborne diseases. The pathogenic organisms in India are bacteria (E Coli, Shigella, V cholera), viruses (Hepatitis A, Polio Virus, Rota Virus) and parasites (E histolytica, Giardia, Hook worm).

The undesirable biological and chemical contaminants from drinking water are to be removed using appropriate purification methods, so as to make it fit for human consumption. As the water demand is rapidly increasing and the fresh water sources are getting depleted in quantity, we are also forced to generate extra water sources. Rain water harvesting at places where plenty of rain is available and desalination of seawater in coastal areas can be practiced for this purpose.

### **Removal of biological contaminants:**

There are different methods for removal of biological contaminants. In filtration, the contaminants are physically removed / sieved, based on their sizes by a filter. The conventional water filters are efficient to remove parasitic cysts (5- 30 µm) and bacteria (0.3 µm), but not viruses (5 to 300 nanometers). Membrane based ultra-filtration (UF), which functions as a molecular sieve can remove even viruses.

In chemical treatment, purification is achieved by using halogens such as, chlorine and iodine. They kill almost all the disease-causing microorganisms. Chlorine in the form of bleach is used for disinfecting drinking water. Iodine is available in the form of crystals, tablets and in solution form. Ultraviolet (UV) radiation inactivates the microbes by destroying their DNA (Deoxyribonucleic Acid), thus preventing them from reproducing. It is effective against all

sorts of microorganisms except cysts. As UV does not remove any particulate matter, turbidity and organic compounds, suitable pre filters are to be added in the system.

### Separation of dissolved salts (Desalination)

Desalination techniques are classified as, (i) Thermal (distillation) processes involving phase-change and (ii) Membrane processes. Thermal energy based processes are employed for seawater desalination. They are multi-stage flash (MSF) distillation, multiple-effect distillation (MED) and vapour compression (VC). The membrane based desalination processes are reverse osmosis (RO) and electrodialysis (ED). Reverse Osmosis can work for the full range of salinity, from brackish water (low saline) to seawater. Electrodialysis is normally employed for brackish water. All these require a chemical pre-treatment of the feed water to avoid scaling, foaming, corrosion, biological growth, and fouling within the system.

Multi-stage flash process is based on the generation of vapour from sea water due to a sudden pressure reduction. The process is repeated stage by stage at successively decreasing pressures. It requires an external steam supply, normally at a temperature of 100 -120 °C. The maximum temperature is limited by the salt concentration of the sea water, to avoid scaling. In MED, the steam generated in one stage / effect is utilized to heat the sea water in the next stage which is at a lower temperature and pressure. It needs an external steam supply at a temperature of about 65 - 70°C. In VC, the initial vapour generated from the sea water is thermally or mechanically compressed to generate additional energy for sustaining the evaporation. Thus, VC can be operated without external heat source also.

In RO, when saline water is passed under pressure through a micro-porous semi-permeable membrane, mineral ions are retained and water molecules are allowed to pass through. It is the cumulative effect of the chemical nature of the membrane polymer having affinity for pure water and the pore size of the membrane, which helps in separation of salt and water. The end result is desalinated water on one side of the membrane and highly concentrated saline water on the other side. Reverse Osmosis requires electricity or shaft power to operate a pump for pressurizing the saline water. The required pressure for desalination depends on the salt concentration of the feed water and the normal operating range is 60 - 70 bar for seawater and 10 -20 bar for brackish water.

In ED, the salts are ionized with the passage of electricity. Alternately arranged cation-selective and anion-selective membranes in between a cathode and an anode make the ED unit. The cation-exchange membrane permits only positive ions and the anion-exchange membrane permits only negatively charged ions to migrate through them. Thus, pure water and concentrated brine get collected in the alternate compartments.

### Contribution of Bhabha Atomic Research Centre (BARC) in the field of water treatment

Desalination Division, BARC has been engaged in the research, development and deployment of desalination and water purification technologies for a wide range of applications. The developed technologies include (i) membrane based sea water RO & brackish water RO, (ii) thermal based multistage flash (MSF) using low grade steam, low temperature evaporation (LTE) using waste heat, and multiple-effect distillation (MED) and (iii) UF of domestic and industrial level. In order to deploy in rural areas, solar energy based desalination and water purification systems have also been developed. Most of these technologies have been demonstrated and deployed in different parts of the country and transferred to several parties on non-exclusive basis.

Based on the MSF technology, a 15 kilo litre/day (KLD) desalination experimental facility and a 425 KLD pilot plant at Trombay and a 4.5 million litre/day (MLD) plant as a part of the Nuclear Desalination Demonstration Project (NDDP) at Kalpakkam were built by BARC. As the energy cost component is a major fraction of the desalinated water cost, utilization of waste heat as energy input for seawater desalination is an attractive option. In order to demonstrate the utilisation of nuclear waste heat for desalination, a 30 KLD LTE desalination plant is coupled to the nuclear research reactor (CIRUS). A 10 KLD LTE desalination plant using the waste heat of a diesel generator is installed in one of the islands of Lakshadweep.

In the case of membrane based technologies, work is done starting from the development of tailor-made membranes in different configurations depending on the application. Cellulose acetate asymmetric membrane in tubular and flat sheet configurations and polyamide thin film composite (TFC) membrane in spiral configuration have been developed.

Several brackish water RO plants have been setup in the rural areas of Rajasthan, Andhra Pradesh and Gujarat to produce safe drinking water. Along with salinity, other contaminants such as fluoride, arsenic, nitrate etc. are also removed from the water. A few seawater RO plants for producing drinking water were designed and built at Trombay (100 KLD) and NDDP (1.8 MLD). A barge mounted desalination plant (50 KLD) for the water starved coastal areas has been developed. Being mobile it can also be used for disaster management to provide drinking water in the coastal areas during emergency. Two desalination plants (5 KLD each) have been designed and installed in the Tsunami affected areas of Tamil Nadu.

A novel idea of coating poly-sulfone on a porous candle resulted in the development of a 'point of use' water purifier. This unit operates without electricity and physically eliminates suspended load, color and odor in addition to six (6) log reduction of bacteria and four (4) log reduction of virus. The problem of toxicity caused by high levels of fluoride, arsenic, iron or multiple contaminants also can be

removed more efficiently when UF is used. For commercial applications, spirally wound UF units are available.

It is reported that, there are thousands of Indian villages which cannot be connected to the grid power network due to their remoteness and thus do not have electricity at all. Most of the water problems are also reported in rural areas. Solar or wind based desalination becomes an attractive alternative for such areas. Also, power production utilizing environment friendly renewable energy sources is a solution to global warming. Stand - alone RO and UF units of domestic as well as community level, working on electric power generated through solar photovoltaic (PV) route are developed and demonstrated for sustainable production of pure water.

Co-location of desalination and power plants has the benefit of sharing the resources such as common intake of feed water, concentrate disposal and other infrastructural facilities. The production of potable water in a facility in which nuclear reactor is used as the source of energy for the desalination process is termed as nuclear desalination. Electrical and /or thermal energy from the nuclear reactor is used at the same site for desalination. NDDP at Kalpakkam, consisting of a hybrid MSF-RO desalination plant of 6.3 MLD capacity is coupled to the Madras Atomic Power Station (MAPS). It is the largest nuclear desalination plant based on hybrid technology in the world.

Creating public awareness about the quality of drinking water and its effect on their health is the first step to be taken. There is not a single solution for solving the different water problems. Thus, proper assessment of the problem is essential before searching for a solution. A holistic approach comprising different methods such as, rainwater harvesting, water purification in terms of micro-organisms in open water sources, brackish water desalination for inland areas, seawater desalination in coastal areas and recovery of water from effluents for reuse other than for drinking is required to realize proper water management. Towards this societal cause, BARC's contribution is significant.

## Contributions of Women in Science

*Dr. Pradnya P. Kanekar*

### Women in Science

Women are universally under-represented in science and technology. India, viewed as a potential powerhouse of innovations, is no exception.

***"The question is not why there haven't been more women in science; the question is rather why we have not heard more about them."***

***- Naomi Oreskes, Historian of science***

It is likely that what we have read, what we know about women scientists is just a small portion of the facts. Nevertheless, this is a modest attempt to present contributions of Women in Science. When we start talking about women in science, the first lady that we remember is Madam Curie.



**Marie Skłodowska Curie (7th November 1867 4th July 1934)**

Marie Skłodowska Curie was a physicist as well as a chemist of Polish upbringing and a subsequent French citizenship. She was a pioneer in the field of radioactivity. Madam Curie was the first person honored with two Nobel prizes, one in physics (1903) and another in chemistry (1911). She founded the Curie institutes in Paris and Warsaw. Her achievements include the creation of a theory of radioactivity (a term she coined), techniques for isolating radioactive isotopes, the discovery of two new elements, polonium and radium and world's first studies conducted into the treatment of neoplasms (cancers), using radioactive isotopes.



**Rosalind Franklin (July 25, 1920 April 16, 1958)**

Rosalind Franklin was a Pioneer Molecular Biologist and responsible for much of the research and discovery work that led to the understanding of the structure of deoxyribonucleic acid, DNA. She and Maurice Wilkins led separate research groups and had separate projects in King's college, London, although both were concerned with DNA.

J. D. Bernal called her X-ray photographs of DNA, "the most beautiful X-ray photographs of any substance ever taken". Between 1951 and 1953 Rosalind Franklin came very close to solving the DNA structure. At one point, Wilkins showed Watson one of Franklin's crystallographic portraits of DNA. When he saw the picture, the solution became apparent to him and the results went into an article in Nature almost immediately. Franklin's work did appear as a supporting article in the same issue of the journal. Franklin moved to J. D. Bernal's lab at Birkbeck College, where she did very fruitful work on the tobacco mosaic virus. She also began work on the polio virus. In the summer of 1956, Rosalind Franklin became ill with ovarian cancer. She died less than two years later at the age of 37. James Watson, Francis Crick, and Maurice Wilkins received a Nobel Prize for the double-helix model of DNA in 1962, four years after Franklin's death from cancer. Although debate about the amount of credit due to Franklin on discovery of DNA structure continues, it is clear that she did have a meaningful role in learning the structure of DNA and that she was a scientist of the first rank.

### Microbiology

#### **Lady Mary Wortley Montague (1689-1762) (English):**

Lady Mary introduced the custom of inoculating healthy children with the attenuated strain of smallpox (variolation) in the British nobility with eventual filtering down of the practice to the working classes. Edward Jenner would eventually be given credit for the smallpox vaccine, it was really Lady Mary who pioneered the approach. As smallpox vaccination gained widespread acceptance eventually leading to

eradication of the disease, millions of people owe their lives to Lady Mary Montague and her struggle to popularize smallpox inoculation.

**Dr. Rebecca Craighill Lancefield (1895-1981):** American microbiologist. Using the serum precipitation method, Dr. Lancefield classified streptococci into groups according to the carbohydrate antigens in their cell wall. She further went on to type group A streptococci, demonstrating that different serotypes were the result of antigenic variation of a cell surface M protein.

**Dr. Anna Wessel Williams (1863-1954):** Dr. Williams was a leading physician who worked closely with scientist William Park to develop an antitoxin for diphtheria. She isolated a strain of *Corynebacterium diphtheriae* from a case of tonsillar diphtheria which proved to be a crucial discovery in the development of an antitoxin for the disease. Williams and Park shared the credit for the discovery and named it the Park-Williams strain. This discovery was virtually responsible for eliminating diphtheria in the western world.

**Dr. Margaret Pittman (1902-1995):** Dr. Pittman hailed as a "woman scientist ahead of her time," was considered an authority on the subject of *Haemophilus influenzae* and *Bordetella pertussis*. Pittman discovered that *Haemophilus influenzae* existed in two forms - encapsulated and non-encapsulated. She further discovered six different varieties of the encapsulated *H. influenzae* (Pittman's classification types a - f) and observed that only type b caused serious forms of the disease. The licensing of a polysaccharide vaccine for *H. influenzae* type b for use in pre-school children was a long term outcome of Pittman's early research on this pathogen.

**Barbara McClintock (1902-1992)** was a pioneering American scientist and one of the world's most distinguished cytogeneticists. Her work led her to theorize that genes are transposable on and between chromosomes. McClintock drew this inference by observing changing patterns of coloration in maize kernels over generations of controlled crosses. These came to be known as "mobile genetic elements" or "jumping genes" or "transposons". McClintock was awarded the Nobel prize in Physiology or Medicine in 1983. Today, transposons are recognized as mechanisms for transfer of genes conferring antimicrobial drug resistance from one bacterium to another.

**Yvonne Barr (1932)**, a British virologist is jointly credited with the discovery of the Epstein-Barr virus (EBV). EBV is named after Michael Epstein and Barr who first isolated the virus from a patient with lymphoma. Commonly known to cause infectious mononucleosis, EBV has also been linked with Burkitt's lymphoma and nasopharyngeal carcinoma.

## Drug Discovery

**Gertrude Elion (1918-1999):** A biochemist and pioneer in drug development. She developed several new drugs including Azathioprine - the immunosuppressive agent used widely in organ transplantation, 6-Mercaptopurine - the first treatment for leukaemia, Acyclovir - the first effective antiviral

medication, Pyrimethamine for malaria, Trimethoprim for urinary and respiratory tract infections, Allopurinol for gout (acute inflammatory arthritis), Elion used innovative research methods that would later lead to the development of the drug azidothymidine - the first antiretroviral agent. She was awarded Nobel Prize in Medicine in 1988.

On the lines of drug discovery, scientists **Rachel Brown (1890 -1980)** and **Elizabeth Hazen (1885 -1975)** are credited with the discovery of the polyene antifungal agent - Nystatin. They purified and isolated the active ingredient from the soil bacterium *Streptomyces noursei*. Hazen and Brown named the ingredient nystatin, after the New York State Department of Health where the discovery was made.

**Mycologist Alma Whiffen Barksdale (1916-1981):** Whiffen is recognized for her discovery of the antibiotic cycloheximide or actidione. Derived from the actinomycete *Streptomyces griseus*, the compound is used in laboratories worldwide for isolating pathogenic fungi. The discovery of penicillin changed the world of modern medicine.

**Dorothy Hodgkin (1910 -1994)** identified the beta lactum structure central to the antibiotic using protein crystallography. This marked the beginning of synthesis of chemically modified penicillins which expanded the spectrum and applications of the drug. Hodgkin later went on to discover the structure of vitamin B12 for which she was awarded the Nobel Prize in Chemistry in 1964.

## Diagnostic techniques

**Rosalyn Sussman Yalow** is a medical physicist. In 1977 she was awarded the Nobel Prize in Physiology or Medicine for the development of radioimmunoassay (RIA). RIA was a novel technique of quantifying minute amounts of biological substances in body fluids using radioactive - labelled material. Yalow invented this technique to measure insulin levels in patients with diabetes mellitus. It has since then been applied to several substances such as toxins, hormones, vitamins and enzymes - all previously too small to detect.

## Molecular Biology

**Dr. Anita Roberts (1942-2006):** A molecular biologist who made pioneering observations of the protein TGF- (Transforming Growth Factor beta). Dr. Roberts isolated the protein from bovine kidney tissue and discovered that it plays a central role in wound and fracture healing. She subsequently delineated its role in carcinogenesis and this research is the basis of new therapeutic approaches in breast cancer.

**Esther Zimmer Lederberg (1922-2006)** was an American microbiologist and pioneer of bacterial genetics. She was the first to isolate the lambda bacteriophage, a DNA virus from *Escherichia coli* K-12. Her other notable contributions include delineating the relationship between transduction and lambda phage lysogeny, development of the replica plating technique and discovery of bacterial fertility factor F.

In recent times, **Dr. Claire M Fraser Liggett**, Director of The Institute of Genomic Research at Washington DC and her team have been at the forefront of the genomic revolution. In 1995, Dr Fraser and her team reported the first complete genomic sequence of a free-living organism *Haemophilus influenzae*.

Dr. Claire has also been a pioneer in the field of microbial forensics and played a significant role during the investigation of the rogue mails in 2001 which were laden with spores of *Bacillus anthracis*.

### Contributions of Indian Women Scientists



**Dr. Kamal Ranadive (1917-2001)**

She was born in Pune in 1917. After a post doctoral stint in the laboratory of George Gey who developed the HeLa cell line at Johns Hopkins University Hospital, Kamal Ranadive returned to India and established the first tissue

culture laboratory at the Indian Cancer Research Centre, Mumbai.

Her work on animal models for understanding pathophysiology of cancer was extremely important. She was among the first to recognize the connection between cancer susceptibility and interaction between hormones and tumor virus. The so called Indian Cancer Research Institute (ICRC) mouse studied by her group turned out to be an excellent model for work on leukemia, breast cancer and cancer of oesophagus. In addition to this she continued her work on leprosy bacteria, which eventually led to the preparation of a Leprosy vaccine. She was the recipient of many awards including Padma Vibhushan and the Watumal Foundation award for her work in the field of leprosy.

She founded the Indian Women Scientist Association (IWSA) with the goal of spreading science to masses particularly women and children. After her retirement, Dr. Ranadive worked on the nutrition and health of tribal women and children in Rajur in Maharashtra. This project was a huge success.



**Dr. Kamala Sohoni (1911-1996)**

She was the first Indian woman "on whom the title of PhD degree was conferred. She worked with her students on nutritional aspects of Neera, pulse and legume proteins as well as Dhan (paddy) atta. Her work conducted

by her students showed that introduction of Neera in the diet of tribal malnourished adolescent children and pregnant women, caused significant improvement in their overall health. Kamala Sohoni received the Rashtrapati Award for this work. She made history by being the first lady Director of Institute of Science, Bombay.



**Dr. Darshan Ranganathan (1941-2001)**

She was elected Fellow of the Indian Academy of Sciences, Indian National Science Academy and the recipient of many honors, the last of which was The Third World Academy of Sciences Award in chemistry for her outstanding

contributions to bio-organic chemistry, particularly supramolecular assemblies, molecular design, chemical simulation of key biological processes, synthesis of functional hybrid peptides and synthesis of nanotubes, in 1999. She was deputy Director, IICT, Hyderabad.



**Dr. Edavaleth Kakkat Janaki Ammal (1897-1994)**

Janaki Ammal was born in Tellichery, Kerala. Ammal made several intergeneric hybrids: *Saccharum x Zea*, *Saccharum x Erianthus*, *Saccharum x Imperata* and *Saccharum x Sorghum*. Ammal's pioneering work at the

Sugarcane Breeding Institute, Coimbatore, Institute on the cytogenetics of *Saccharum officinarum* (sugarcane) and interspecific and intergeneric hybrids involving sugarcane and related grass species and genera such as *Bambusa* (bamboo) is epochal.

Ammal worked on some of the most important genera : *Solanum*, *Datura*, *Mentha* *Cymbopogon* and *Dioscorea*, besides a range of medicinal and other plants too numerous to be listed here.



**Dr. Asima Chatterjee (1917-2006) (D. Sc. From Calcutta University in 1944)**

Chatterjee successfully developed the anti-epileptic drug, Ayush-56 from *Marsilia minuta* and the anti malarial drug from *Alstonia scholaris*, *Swertia chirata*, *Picrorhiza kurroa* and *Cesalpinna crista*. The patented drugs have been marketed by several

companies. She made significant contributions in the field of medicinal chemistry with special reference to alkaloids, coumarins and terpenoids, analytical chemistry and mechanistic organic chemistry. She published around 400 papers in national and international journals and more than a score of review articles in reputed serial volumes. Her publications have been extensively cited and much of her work has been included in several textbooks. Chatterjee edited and revised the six-volume *Bharatiya Banoushodhi* published by the Calcutta University and was also the Chief-Editor of the six-volume series, *The Treatise of Indian Medicinal Plants* published by CSIR.

She was conferred Padma Bhushan (1975) amongst other awards. She was elected as the General President of the Indian Science Congress Association (1975) the first woman scientist to be so elected, and was nominated by the President of India as a Member of the Rajya Sabha.

**Dr. Indira Hinduja** produced first scientifically documented test tube baby. In 1986, India's first test tube baby "Harsha" was born. Producing test tube babies is not an easy task even in advanced countries. Dr. Hinduja rejected opportunities to settle abroad so that she can serve our country, India.

**Dr. Kunti Prakash (1934 2001)** was a remarkable woman microbiologist from India. Her work on antibodies to C-carbohydrate antigen of group A streptococci in India and efforts to control rheumatic fever put India on the world map and led to the recognition of Lady Harding Medical College as a WHO Collaborative Centre for Streptococcus. She was President of Indian Association of Medical Microbiologists (IAMM) in 1988.

**Dr. Prema Bhat** was an eminent Indian microbiologist who did pioneering work on enteric bacterial infections and intestinal anthrax. She collaborated with international laboratories for a landmark study on juvenile diarrhoea caused by *Edwardsiella tarda*. During the span of her illustrious career, she was also instrumental in serogrouping of Enteropathogenic *Escherichia coli* (EPEC) 5 - 14 and establishing in vitro culture of *P. falciparum* in her laboratory.

**Dr. Ruth Myers** did profiling the standard methods and procedures used in the laboratory to characterize and identify family Enterobacteriaceae. Dr. Myers is also recognized for her work on ornithosis (infectious disease caused by a bacterium called *Chlamydia psittaci*) in India and identification of the agent *Bedsonia* in the blood of grey herons.

**Dr. Grace Koshi** is known for her work in mycology - in documenting the first case of eumycotic mycetoma outside Latin America caused by *Acremonium recifei*. Her other accomplishments include use of enzymes for typing of group A beta haemolytic streptococci and study of the protean manifestations of actinomycosis.

## Summary

If women can now aspire to leadership positions in the medical world, it is due to the achievements of thousands of outstanding women who preceded them. While certainly not exhaustive, we hope that revisiting the accomplishments and contributions of these chosen women in science will inspire a new generation of medical pioneers.

## A CLASSROOM WITHOUT WALLS.....

*Gaurangi Maitra, A Trobairitz*

My first memories of Santiniketan as I first came there in mid 1981, was of a leafy green avenue leading to Ratan Kutir Guest House. After settling in, my father, who had memories going back to his 1925 visit, took me around the campus. An image that has always stayed with me, down these nearly 30 years, was of children studying in the open, under the trees. Unfettered study always drew me more than any classroom, and it gave me that elusive treasure we all seek in

learning... 'my mind to me a kingdom is....!' Well, I gained and lost that in almost equal measure in the six years that I spent in Siksha Bhavana doing my masters and doctorate in Life Sciences. Many seeds sown then have germinated after thirty year dormancy! And I discovered along the way that life can never be only a "all or none" reaction; never just black or white but many a time, the in between grey mist covered the jagged edges, as it often did in the pine covered hills of Shillong which became my second home. As the mist lifted, I found myself sailing on the golden seas, travelling, telling stories of my first love, of Biology.

In a library, where every glass covered side mirrored a new view, I discovered Charles Robert Darwin anew. A gentle giant, who let me travel along with him as I wrote a biographical travelogue of his life and truly came to understand what a classroom without walls could achieve for persons made of different clay. Darwin, Einstein, Tagore and John Forbes Nash Jr are beautiful minds that walls had no power to bind. As they walked out of a classroom and beyond its walls, they inspired generations and left legacies viable across a century and beyond! The Darwin of my classrooms was evolution, controversy, great and unattainable to the ordinary student! Outside, unbounded by syllabus, he was so humane that I had to travel with him and take you along!

Tossing on the unruly Atlantic, many a time desperately seasick, lying on a hammock, reading Charles Lyell's Principles of Geology, collecting marine specimen, Darwin was a most unlikely traveller on HMS Beagle. Chosen because he was a gentleman, a Christian and had recommendation from Professor J. S. Henslow (who was never his course teacher; but became a lifelong mentor) '....that I consider you to be the best qualified person I know of who is likely to undertake such a situation I state this not on the supposition of your, being a finished naturalist, but as amply qualified for collecting, observing, and noting anything worthy to be noted in Natural History...' What marks would be the equivalent of this fine recommendation? The voyage would take him to the beautiful coast of Brazil, the magnificent delta between Uruguay and Argentina, the Pampas of Argentina, the surreal blizzard driven landscape of Terra del Fuego, the rope like high Cordilleras of Chile, the Galapagos where the giant tortoise roamed, the fabled Tahiti Islands, the Atlantic, Pacific and Indian Oceans, crossing the tropic of Capricorn six times and finally back home via Cape Town and Napoleon's St. Helena! This five year voyage of circumnavigation gave him a unique classroom that he put to unparalleled use.

Lectures in geology at Edinburgh had made Darwin vow that he would never take up geology ever again! He had found it so very so boring! 320 miles off the west coast of Africa, the cliffs of Cape Verde Island would inspire him to write on geology. A white band on the volcanic cliffs made him curious. On closer examination he found it was made up of shells. What were a line of unbroken shells doing so far above the high tide mark? It showed land forms changed but not by cataclysmic upheavals; otherwise the shells would have been an unrecognizable powder! His conclusions were beginning to go against the prevailing notions that held

catastrophic upheavals responsible for changes in the earth's surface. This small beginning would culminate in three books on Geology by the mid 1840s.

When he first landed in tropical Brazil, it would be like a dream come true for this avid naturalist! He would write that it was like Arabian Nights with the advantage of reality! The South American continent would be his main area of study for two thirds of a five year voyage. Unlike other South American voyages of that time, it would not be Amazon centric. Darwin would make the most of the schedule of a coastal survey ship! He travelled overland, camping in the open with gauchos and braving civil war conditions.

Camping with the guachos, the freedom of being able to stop for the night under the stars with bare essentials thrilled Darwin. On one such night they shot and roasted an armadillo for dinner. In the morning only its carcass remained uneaten. Darwin went out fossil collecting, having heard from local people that the red clay of Punta Alta in Argentina was a catacomb of animal skeletons. Among the fossils was the armor plate that could, Darwin concluded only belong to an armadillo. This, with no training in anatomy! Back at camp he realized that last night's armadillo skeleton was similar, but distinctly smaller and different. The animal represented by the fossil no longer roamed these Argentinean grasslands, neither did animals represented by the other fossil! Why had they died out? Was the landscape different when they roamed? Questions came in thick and fast as it should from any good class.

Even better, there were no teachers or guide books with readymade answers; he had only his own resources and his mind to turn to. This classroom began to give him that elusive treasure we all seek in learning... 'my mind to me a kingdom is....! After he returned from the voyage he would tirelessly document, classify, experiment, read, and correspond till he found answers. This again would be the perfect follow up to graduation from this school. If one word could sum up his observations it would be change. This one word would form the key to his path breaking theory of evolution. It would also signal his personal metamorphosis from an amateur naturalist into a scientist ready to hold his own among the peers of the day! It came from making full use of classroom without walls! And lead him to formulate a theory that not only became the cornerstone of modern biology but changed the very intellectual climate of the 19th century. The Origin of Species sold out on its day of publication, 24th November, 1859 and went into six editions in his lifetime! This was just one of at least ten books Darwin wrote after the voyage! For he had the courage to

"Climb every mountain  
Ford every stream  
Follow every rainbow....."  
And walk to the less trodden like Tagore and Einstein!

This trobairitz has other stories to spin in other places. So till we meet again, good bye for now!

**Dr.Gaurangi Maitra,**  
Scientist 1, DBT-Nodal Centre Tezpur University, Napaam  
784028, Assam,  
[gaurangimaitra@yahoo.com](mailto:gaurangimaitra@yahoo.com)

## Nobel Prizes in Science - 2010

Nobel Foundation has announced the Nobel Prizes for the year 2010 in early October. This year, Robert G. Edwards received the prize in Medicine. The prize in Physics was shared by two scientists, Andre Geim and Konstantin Novoselov, and in chemistry by three scientists, Richard F. Heck, Ei-ichi Negishi, and Akira Suzuki. The details are as follows.

### Nobel Prize 2010 in Physiology or Medicine



**Prof. R. G. Edwards**

Robert Edwards, currently professor emeritus at the University of Cambridge, is awarded the 2010 Nobel Prize for the development of human in vitro fertilization (IVF) therapy. His achievements have made it possible to treat infertility, a medical condition afflicting a large proportion of humanity including more than 10% of all couples worldwide. As early as the 1950s, Edwards had the vision that IVF could be useful as a treatment for infertility. He worked systematically to realize his goal, discovered important principles for human fertilization, and succeeded in accomplishing fertilization of human egg cells in test tubes (or more precisely, cell culture dishes). His efforts were finally crowned by success on 25 July, 1978, when the world's first "test tube baby" was born. During the following years, Edwards and his co-workers refined IVF technology and shared it with colleagues around the world.

Approximately four million individuals have so far been born following IVF. Many of them are now adults and some have already become parents. A new field of medicine has emerged, with Robert Edwards leading the process all the way from the fundamental discoveries to the current, successful IVF therapy. His contributions represent a milestone in the development of modern medicine.



**Nobel Prize 2010  
in Physics**

**Prof. A. Geim,**



**Prof. K. Novoselov**

Andre Geim and Konstantin Novoselov, both born in Russia and currently working in University of Manchester, UK were awarded this year's Nobel Prize in Physics "for groundbreaking experiments regarding the two-dimensional material graphene." Graphene is a completely new material, which is a thin flake of carbon, just one atom thick, not only the thinnest ever but also the strongest. As a conductor of electricity it performs as well as copper. As a conductor of heat it outperforms all other known materials. It is almost

completely transparent, yet so dense that not even helium, the smallest gas atom, can pass through it. Andre Geim and Konstantin Novoselov extracted graphene from ordinary graphite. With graphene, physicists can now study a new class of two-dimensional materials with unique properties. Graphene makes experiments possible that give new twists to the phenomena in quantum physics. It also opens up a vast variety of practical applications including the creation of new materials and the manufacture of innovative electronics. Graphene transistors are predicted to be substantially faster than today's silicon transistors and result in more efficient computers. Since it is practically transparent and a good conductor, graphene is suitable for producing transparent touch screens, light panels, and maybe even solar cells. When mixed into plastics, graphene can turn them into conductors of electricity while making them more heat resistant and mechanically robust. This resilience can be utilised in new super strong materials, which are also thin, elastic and lightweight. In the future, satellites, airplanes, and cars could be manufactured out of the new composite materials.

### Nobel Prize 2010 in Chemistry



**Prof. R. F. Heck, Prof. Ei-ichi Negishi, Prof. A. Suzuki**

Richard F. Heck (University of Delaware, USA), Ei-ichi Negishi (Purdue University, USA) and Akira Suzuki, (Hokkaido University, Japan) are jointly awarded this year's Nobel Prize "for palladium-catalyzed cross couplings in organic synthesis." Carbon-based (organic) chemistry is the basis of life and is responsible for numerous fascinating natural phenomena. This has given mankind new medicines and revolutionary materials such as plastics. However, synthesizing complex molecules is not easy and chemists end up with too many unwanted by-products in their test tubes. Palladium-catalyzed cross coupling solved that problem and provided chemists with a more precise and efficient tool to work with. In the Heck reaction, Negishi reaction and Suzuki reaction, carbon atoms meet on a palladium atom, whereupon their proximity to one another kick-starts the chemical reaction. This method is used in research worldwide, as well as in the commercial production of for example pharmaceuticals and molecules used in the electronics industry.

### Shanti Swarup Bhatnagar awardees

**Dr Sanghamitra Bandyopadhyay** is a Professor in the Machine Intelligence Unit, Indian Statistical Institute, Kolkata, India. Her education has been at Presidency College, Calcutta, Rajabazar Science College of the University of Calcutta, Indian Institute of Technology (IIT),



Kharagpur and Indian Statistical Institute, Kolkata .

Her research interests are in Bioinformatics, Soft Computing and Pattern Recognition where she has published over 180 technical articles. She is the recipient of several prestigious awards that include Humboldt Fellowship for Experienced Researcher, Swarnajayanti Fellowship in Engineering Sciences from DST, Young Scientist Medal from both Indian National Science Academy, and Indian Science Congress, Young Engineers Award from Indian National Academy of Engineering, Dr. Shanker Dayal Sharma Gold Medal, IIT Kharagpur and Institute Silver Medal, IIT Kharagpur, and Prof. A.K. Chowdhury Memorial Award, Calcutta University.

She has worked in Los Alamos National Laboratory (Los Alamos, USA), University of New South Wales (Sydney, Australia), University of Texas (Arlington, USA), University of Maryland Baltimore County (Baltimore, USA), Fraunhofer Institute (Sankt Augustin, Germany), Tsinghua University (Beijing, China), La Sapeinza University of Rome (Rome, Italy), University of Heidelberg and (Germany) Max Planck Institute for Informatik (Saarbrucken, Germany). She has also visited many other Universities and Institutes around the world for delivering invited lectures. She has served as the Program Chair and Tutorial Chair at several International Conferences. She has edited a conference proceeding, three edited volumes and two authored book. She has served as the guest editor of special issues of the IEEE Transactions on Systems, Man and Cybernetics - B (Special issue on Distributed and Mobile Data Mining), and IETE Journal of Research (Special issue on Evolutionary Computation in Engineering Sciences).

She was recently awarded the prestigious Shanti Swarup Bhatnagar award in Engineering Science, 2010.



**Prof. Shubha Tole** obtained her B.Sc. in Life Sciences and Biochemistry from St. Xavier's College, Mumbai (1987). Her MSc and PhD are from Caltech, USA. She worked at the University of Chicago as a post-doctoral fellow, and then joined the Tata Institute in Mumbai, India as a faculty member in 1999.

Tole has been awarded India's highest scientific honour, the Shanti Swarup Bhatnagar Award in 2010; the Research Award for Innovation in Neurosciences (RAIN) by the Society for Neuroscience in 2008, the National Woman Bioscientist award by the Department of Biotechnology, Govt. of India (2008), the Swarnajayanti Fellowship (a prestigious young scientist award) by the Department of Science in Technology, Govt. of India (2005), and the Wellcome Trust Senior International Fellowship (1999). She has several publications in leading International Journals. Tole actively engages in public outreach via workshops in schools and colleges, and has chaired as well as presented Café Scientifiques organized by the British Council.

## State award for Dr. Nandini Pai



Dr. Nandini Pai is working as Head, Department of Chemistry of D. G. Ruparel College with a service of 37 years and is a recognized guide for M.Sc and Ph.D students of the University of Mumbai. Out of the 24 students she had been guiding, 14 have successfully completed their Ph.D and M.Sc. respectively. She has more than 40

research papers in National and International journals and conferences.

Dr. Pai has completed a UGC project on the study and synthesis of anti-diabetic compounds and has research collaboration with BASF India Ltd., for Ph.D program. At the University level, she has worked as member of Board of studies in Chemistry, Faculty of Science and Examination Committee since 2005. She also has contributed as a member of syllabus committee for B.Sc Chemistry. She has also worked as a member of Local Inquiry Committee for granting recognition to research laboratories to Colleges and for M.Sc courses in Chemistry (by papers). She has further contributed as Vice Chancellor's nominee for Centralized admission process of M.Sc in Chemistry of University of Mumbai.

She had been in various college committees and has worked as coordinator during NAAC visit in August 2010 when the College was awarded Grade 'A'. She has undertaken Remedial Coaching for weak students and extra coaching for advanced students. She inspires and motivates her students for pursuing higher studies in India and abroad and has organized several workshops and seminars for the benefit of the teachers and students of University of Mumbai.

In recognition of her meritorious service, Dr. Nandini Pai has been awarded the State Government University Teachers' Award by the Chief Minister of Maharashtra on 4th September at Nagpur.

## An Eminent Woman Scientist



**Dr. Pradnya P. Kanekar** did her M.Sc. and Ph.D. from Pune University and has about 5 years teaching experience in various colleges in Pune and Ahmednagar before she joined M.A.C.S. Research Institute, Pune as a Scientist. Title of her Ph. D. thesis was 'Studies on biodegradation of high explosive waste'.

She has successfully guided about 50 students to pass in M. Sc. Microbiology by papers. She was a Member of Syllabus framing Committee in Microbiology of Marathwada University and has participated in Training Program organized at MACS-ARI during 1982 to 1989 for delegates. She was also an invited faculty/ resource person for Refresher courses in Microbiology and Environmental Sciences for college teachers of the University of Pune from 1988 to 2007.

At present, she is Scientist 'G' and Head, Microbial Sciences Division, MACS-Agharkar Research Institute, Pune and has more than 30 years of post doctoral research experience. For a brief period she was also acting Director of Agharkar Research Institute. Her programme of research includes (a) Environmental microbiology and biotechnology, (b) Microbial diversity of extreme environments and culture collection activity and (c) Biotechnological potential of extremophilic bacteria in production of bioactive molecules, biomaterials and secondary metabolites.

Biodegradation of toxic organic pollutants, triphenylmethane (TPM) dyes, organophosphorus pesticides from industrial wastes, nitroexplosives and bioremediation of polluted waters/soil, bioremediation of dye industry waste water, soil contaminated with herbicide atrazine, utilization of microbially treated dyestuff effluent for raising economic plant species, biodegradation of nylon-6 effluent containing caprolactam, microbial remediation of mancozeb pesticide waste effluent, biotechnology for leather towards cleaner processing, biotechnological potential of extremophilic bacteria in production of bioactive molecules, biomaterials and secondary metabolites, microbial diversity of extreme environments and culture collection activity and environmentally secure microbiological route for synthesis of rare earth based colorants are some of the fields where she has successfully done research work.

Dr. Kanekar has more than 140 research papers published/presented in National and International conferences, peer reviewed journals and books. She has obtained 4 patents and 4 more have been applied for. She was convenor of Pune branch of IWSA and was involved in conducting several programmes.

**Dr. (Mrs.) Pradnya Pralhad Kanekar**  
[kanekarp@rediffmail.com](mailto:kanekarp@rediffmail.com) / [kanekarpp@gmail.com](mailto:kanekarpp@gmail.com)

## A salute to the women power in Commonwealth Games - 2010

**Umasankari Kannan**

When Krishna Poonia, Harwant Kaur and Seema Antil stood on the podium in the Jawahar Lal Nehru Stadium sweeping all the medals in the discus throw event of CWG-2010, it was great moment of pride for every Indian woman. The whole nation rose to a standing ovation. A day later came another joy, with the quartet winning a gold medal in the 4 x 400m relay. Mandeep Kaur, Ashwini, Sini Jose and Manjit Kaur have been nicknamed the golden girls after winning gold in an athletics track event after a long 52 years. These women are examples of sheer hard work and perseverance. One cannot forget the path breakers like P.T. Usha, Shiney Wilson, Karnam Malleshwari and the like. Indian women have always excelled in sports in the international arena in the past, but the just concluded Commonwealth Games were indeed a crowning glory for Indian women.

Be it Deepika Kumari, Alka Tomar, Geeta, Renuala Chanu, Soniya, Sandhya, Heena Sidhu, Annuraj Singh, Annesa

Syed or Prajusha or any of our athletes, they are determined women from non-descript villages and towns, who have fought all odds to excel and etched their names in this competition. Their girl-next-door image and talent have won many Indian hearts. Saina, M.C. Mary Kom, Dola, Tejaswini and Sania are our showpiece talents and have won many laurels for India. But the rise of lesser known Jwala, Paulomi, Mouma, Shamini, Rushmi, Kavita, Suman and others are commendable. These medal winners and other women have been silently contributing to nation building. The CWG-2010 have shown Indian women athletes excelling in weightlifting, Shooting, Archery, Athletics, Badminton, Tennis, Table Tennis, in every one of these sports. These women have pushed themselves to become stronger physically and mentally and braved their home, their family, their society to win accolades for themselves and their country. We scientists can draw inspiration from our sports counter-parts to have a never say die attitude and keep excelling in whatever we do.

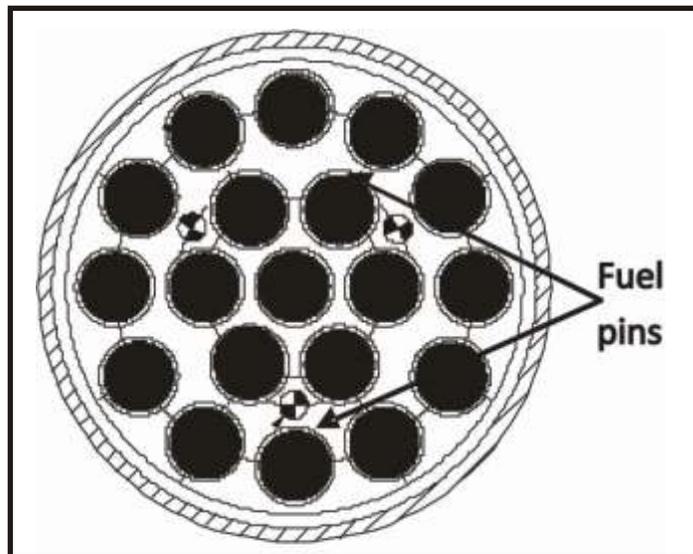
## Physics Design of AHWR Critical Facility

*Neelima Prasad  
Reactor Physics Design Division  
Bhabha Atomic Research Centre*

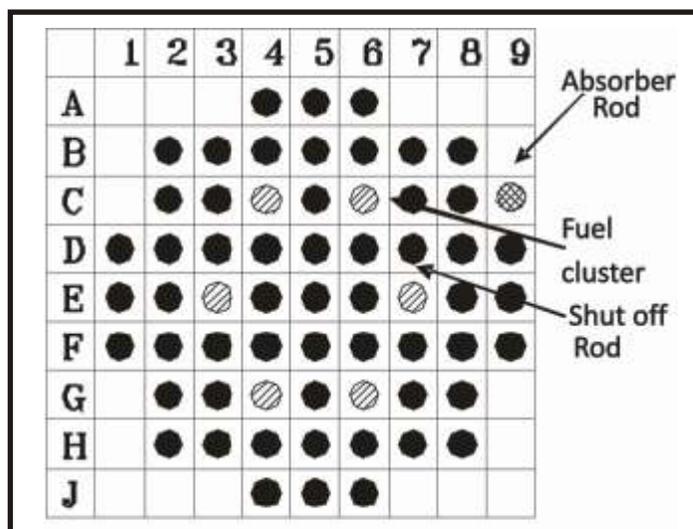
Development of Advanced Heavy Water Reactor (AHWR), which can utilize the abundant source of thorium in our country, is a major goal in India's atomic energy programme. However, the reactors are very complex in design and theoretical models are developed to simulate the physical processes and the geometrical details of a reactor. The approximations involved in modeling result in uncertainties and attempts are made to minimise these to acceptable levels. The spread in nuclear data further increase these uncertainties. A low power Critical Facility in which cold clean fuel can be arranged in a simple and precise geometry has been designed in BARC, India as part of over all technology development program to utilize abundant reserves of thorium. The Critical Facility has been designed to facilitate study of three types of cores using heavy water as moderator and reflector. The three cores are based on different fuel types, namely natural uranium metal fuel, thorium oxide clusters using Pu / <sup>233</sup>U enrichment in different pins and natural uranium oxide fuel. The lattice pitch can be varied in order to constitute the different core configurations. The nominal power of Critical facility is 100 watts for the average flux of 108 n/cm<sup>2</sup>/sec. Fast shut down of the reactor on a trip signal is achieved by gravity fall of a set of six-cadmium shut off rods (SRs). The reactivity control / power adjustment of the reactor is effected by varying the moderator level manually. An absorber rod has been provided for performing the experiments.

### Design of Critical Facility

The reference core is designed with 245 mm lattice pitch. The fuel cluster for the reference core is shown in Fig 1. Schematic layout of the reference core is given in Fig.2. The effective core radius is 108 cm with an additional 57.0 cm thick heavy water radial reflector. Also there is 30 cm axial



**Figure 1 Fuel cluster for Reference core**



**Figure 2 Reference core of CF**

Reflector at the bottom. Out of the total 62 positions, 55 positions will be loaded with 19-pin fuel clusters of metallic natural uranium while remaining 6 positions will accommodate the shut-off rods and one lattice position in the reflector region will be used for absorber rod. The expected critical height of the reference core is 226.5 cm.

AHWR representative core is basically a variant of the reference core, wherein 9 of the central 19-pin natural uranium fuel clusters are replaced by the AHWR fuel clusters. Each AHWR fuel cluster will contain 54 fuel pins arranged in three concentric rings having 12, 18 and 24 pins in the inner, middle and the outer rings and a displacer unit at the centre. The inner and the middle rings contain (Th - <sup>233</sup>U) oxide pins whereas the outer ring contains the (Th-Pu) oxide pins. The fuel cluster is housed in an aluminum pressure tube which in turn is housed in an annular

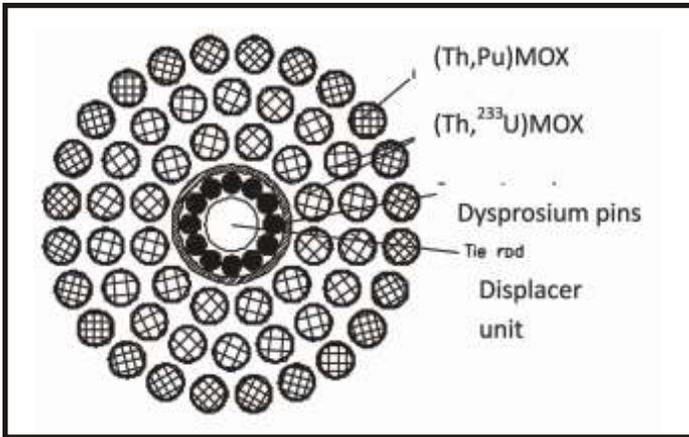


Figure 3 AHWR fuel cluster

aluminum calandria tube. The AHWR cluster is shown in Fig 3. The critical height of the AHWR representative core with 9 composite fuel clusters is estimated to be 186.5 cm.

The PHWR core will have a total of 70 lattice positions of which 63 will be loaded with fuel clusters, 6 positions will be used for locating the shut-off rods and one lattice position will be loaded with absorber rod. The 37-pin clusters of the 540 MW (e) PHWR will constitute the PHWR core of Critical Facility. The critical height of the core for this configuration is estimated to be 223.5 cm.

#### Criticality

The Reference core Critical Facility fuelled by metallic natural uranium went critical on 7th April, 2008. The observed critical height for the reference core configuration was 226.7 cm which agreed very well with the estimated value of 226.5 cm. Since then this facility is being used for performing various experiments for validating the computer codes and the theoretical modellings by comparing the results with the values obtained by the experiments performed in the Critical Facility.

## Science News

### Space tourism to accelerate climate change

Virgin Galactic is one of the many companies pushing forward with commercial spaceflight but at what cost to the environment? Climate change caused by black carbon, also known as soot, emitted during a decade of commercial space flight would be comparable to that from current global aviation, researchers estimate. Scientists predict that soot from commercial space flight will change global temperatures.

"There are fundamental limits to how much material human beings can put into orbit without having a significant impact," says Martin Ross, an atmospheric scientist at the Aerospace Corporation in Los Angeles, California and an author of the study.

Private space flight is a rapidly maturing industry. Spaceport America, a launch site in Las Cruces, New Mexico, opened its first runway on 22 October. During the next three years,

companies such as Virgin Galactic, headquartered at Spaceport America, expect to make up to two launches per day for space tourists.

Commercial rockets burn a mixture of kerosene and liquid oxygen. But several private space-flight companies, such as Virgin Galactic, may soon use a more economical 'hybrid' rocket engine that ignites synthetic hydrocarbon with nitrous oxide, says Ross. These hybrid engines emit more black carbon than a kerosene and oxygen engine, he adds.

### Fat fathers affect daughters' health

Daughters of obese males may be more likely to develop diabetes later in life. Fathers eating a fatty diet can pass on health problems to their female offspring, according to a study in rats published in *Nature*. The father's condition seems to be inherited without changes to the DNA code itself. Instead, there are 'epigenetic' chemical tweaks to the genes, altering how they are expressed in the offspring. "We think this is one of the first findings in mammals where a nutritional effect in a father has been passed on to his offspring," says lead author Margaret Morris, a researcher in obesity and diabetes at the University of New South Wales in Sydney, Australia.

Morris and her team put one group of rats on a high-fat diet. A control group was fed a normal diet. Unsurprisingly, those on the high-fat diet became overweight and showed two hallmarks of type 2 diabetes. They had problems with glucose metabolism and were insulin resistant effectively meaning that the hormone becomes less efficient at lowering blood sugar levels.

The real surprise came when Morris's team went on to examine the obese rats' female offspring. These too had problems regulating insulin and glucose levels. The healthy fathers, however, had correspondingly healthy daughters. Glucose levels in the body are controlled by insulin, produced by groups of  $\beta$ -cells in the pancreas. These cells group to form 'islets'. The team noticed that in the daughters of fat fathers, these islets had shrunk, compared with those of the control daughters.

The next step was to investigate what was causing these changes. The daughters of the obese male rats showed an altered expression of more than 600 pancreatic islet genes. But because the DNA code itself remained unchanged, Morris's team suggest that the changes in gene expression are epigenetic.

Whether this study translates directly to humans remains to be seen. But many mothers are entering pregnancy either overweight or obese, and it is probably the case that many fathers are also having children while obese, says Morris. "Maybe that is affecting gametes in ways that are going to have consequences for the next generation," she says.

Courtesy: *Nature News*



**7 Professional Experience (Technical / Science/Administrative/Managerial):**

Name of Organization	From	To	Title/ Description

**8. Details of payment :**

Amount Rs..... Cash/DD/Che que No. .... Dated .../.../.....  
 Drawn on [Bank/ branch] .....  
 (Payment should be drawn in favour of “Indian Women Scientists’ Association” and payable at  
 Mumbai . Please add Rs. 50/ - for outstation cheques .)

**9. Declaration by Applicant:**

I hereby declare that I shall abide by the rules and regulations of the IWSA and endeavour to maintain the professional integrity that is expected of me as an IWSA member, if admitted.

Date: ..... /..... /..... Signature.....

**10. Introduced by IWSA Member**

I, .....  
 know Dr./ Ms .....  
 for ..... Years and recommend her for membership of IWSA.

Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

\_\_\_\_\_  
 Signature of the IWSA Member  
 Date: ..... /..... /.....

FOR OFFICE USE ONLY		
Date of receipt at H Q: .....	Amount received: Rs. ....	Recpt. No. ....
Branch: _____	President’s recommendation:	Enrolled/ Rejected
Membership Class: _____	Date: ..... /..... /.....	_____ President/ Hon. Secretary

**SUBSCRIPTION RATE:**

- Life member /Associate life member: Rs. 2,000/ - Foreign : US\$ 200 (all inclusive)
- Annual member /Associate annual member: Rs. 200/year  
 Admission fees Rs. 50/ - for all categories of members

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# PHOTO GALLERY



*A seminar in progress - Kalpakkam Branch.*



*'Veena Memorial Lecture' Delhi Branch  
Dr. A. Sen Gupta (NPL) speaking.*



*Dr. Homi Jahangir Bhabha's 101st birthday  
celebrated at IWSA Headquarters.*



*Dr. Vrinda Dutta (TISS) distributes prizes  
Teacher's Training program at IWSA, Vashi.*



*Puppet workshop held at IWSA Headquarters,  
Vashi, Navi Mumbai.*



*Father Agnel School, Vashi, receiving 1st prize -  
English Medium (Clean and Green Cities).*



*Vidya Prasarak Mandal School receiving 1st prize -  
Marathi Medium (Clean and Green Cities).*



*Ganesh Chaturthi being celebrated at IWSA,  
Vashi, Navi Mumbai.*



*Shanti Swarup Bhatnagar Awardee Dr. Shubha Tole at TIFR, Mumbai*



*Independence Day celebrations at IWSA, Vashi, Navi Mumbai.*



*Inauguration of Teacher's Training program, IWSA, Navi Mumbai.*

From:  
**IWSA HEAD OFFICE**  
Plot No. 20, Sector 10-A,  
Vashi, Navi Mumbai 400703.  
Tel: 27661806, Fax: 27653391  
Email: [iwsahq@gmail.com](mailto:iwsahq@gmail.com)  
Website: [www.iwsa.net](http://www.iwsa.net)