

# IWSA NEWSLETTER

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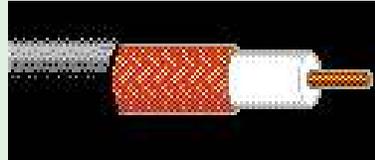
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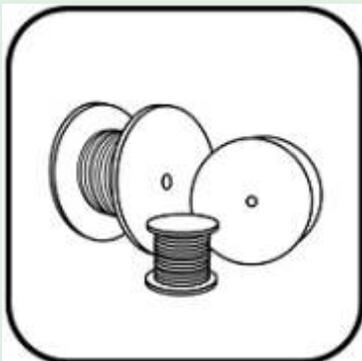
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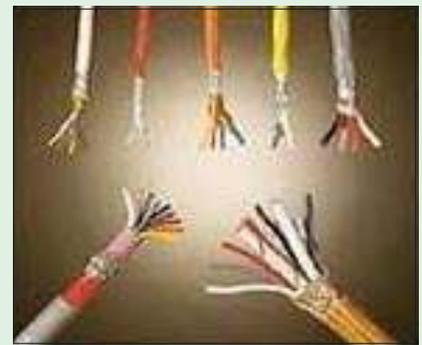
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## From the Editor's Desk

On 26<sup>th</sup> January 1950, the largest democracy in the world, the sovereign democratic Republic of India was born and this year we celebrated the 61<sup>st</sup> Republic Day of the country. The progress of our country depends on the progress of women as well, who constitute half of the population. The first quarter of this year was marked by the efforts of the government for moving 'Women's Bill' in the parliament, which will go a long way in promoting women in larger and effective roles. In 2007, the rate of women representation at national level politics stood at a mere 18%. Although the figure has slightly increased in 2008 and 2009, minimal progress has been made, meaning that the parity between men and women in national legislatures still remain distant. Unless women's voices are heard and they are given an opportunity to take responsibility of their lives, we can not claim to be a true democratic nation. It will take some more time for women to stand up, speak up and take up important roles.

IWSA has always emphasized the pitfalls of our present education system, which creates a workforce more adept in imitation rather than innovation. Development of home-grown scientific talent calls for a new curriculum with problem solving and enquiry-based training, which will in turn encourage critical thinking as well as promote a national feeling among the youngsters. IWSA is making its own efforts in this direction, although it is akin to a drop in the vast ocean. In addition to the above drawbacks, the present exam-centric education system, along with peer and parental pressures probably leads to distress among young minds, which is reflected in the higher suicide rates in children. IWSA recently addressed this important issue in a panel discussion and a report is included in this issue. On March 8<sup>th</sup>, Women's Day was celebrated and IWSA also had its own share of programs and panel discussions.

The year 2010 has been declared 'International Year of Biodiversity'. The rich diversity of life is essential for our existence on Earth. However, due to increased anthropogenic activities, all life forms are at risk of declining at a rapid pace. Highlighting biodiversity will throw light on understanding vital functions of the diversity and help reduce its losses. Our branch at Kolhapur conducted a successful National Symposium on "Biodiversity", the details of which are included elsewhere in this issue.

For the Chandrayan Mission, a very challenging and prestigious project of ISRO, many experimental payloads will be taken from the Indian scientific community. One of these experiments concerns the measurement of magnetic fields. The article by Niharika Singh et. al., describes the measurement of very low magnetic field. It describes the challenges involved as well as applications of these measurements in space explorations and other fields. It is heartening to know such efforts of Indian laboratories in keeping up pace with the development of advanced technology. The world has witnessed creation of a synthetic genome bringing a new life to bacterium and an update on this is included in the present issue. We congratulate Dr. Charusita Chakraborty, last year's Bhatnagar awardee (the

11<sup>th</sup> woman scientist honoured so far in the history of this prestigious award), and her profile is given in the column on "Women Achievers". Various activities of Head Quarters and branches are also covered in this issue.

Let us resolve and rededicate ourselves to continue IWSA's motto of taking science to the masses. Your suggestions and feedback on improving the newsletter are welcome and will help us in strengthening the newsletter to take us forward to the next decade. We place on record our sincere thanks to the philanthropic companies, which contributed towards advertisements. On the behalf of editorial board, we wish to thank the IWSA office staff for all the help rendered and the readers for their continued patronage, encouragement and creative suggestions which will go a long way in our humble efforts to bring forth better issues in future.

**Dr. Susan Eapen**  
*Editor*

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### Symposium Announcement and Call for Abstracts.

#### INDIAN WOMEN SCIENTISTS' ASSOCIATION (IWSA)

##### XI All-India Meeting of Women in Science

##### SCIENCE & TECHNOLOGY: ETHICAL ISSUES

28-30 January, 2011  
Navi Mumbai, India

Indian Women Scientists' Association, an NGO established in 1973 with nine branches in the country, carries out a variety of activities in the domain of science popularization and in understanding the socio-economic issues of working women/scientists. The building complex at its head quarters in Vashi, Navi Mumbai, houses a working women's hostel, day-care centre, nursery school and other community facilities like computer centre, science laboratory and library, health care centre, and a multi-purpose hall. IWSA also conducts a nursery teachers' training programme in affiliation with the SNDT Women's University.

National conferences on different themes are a regular feature of IWSA. Students and young scientists are especially encouraged to participate. Conference registration is open to all women and men.

#### Themes

##### *Ethics of Doing Science*

A host of issues confront scientists and others in the pursuit of their careers. Some relevant issues are: maintaining honesty, social responsibility and objectivity, conflict of

interest, data management, preparation of reports/papers, authorship and credit sharing, mentoring, treatment of whistle blowers, careless research, etc.

##### ***Ethics in Scientific Applications (technologies)***

As different disciplines develop, scientists and technologists face ethical dilemmas as in: biotechnology, genetics and brain research, clinical trials on human subjects, nanotechnology, nuclear technology, information technology, robotics, etc. Their uses, potential dangers and injustices perpetuated by several of these technologies need to be addressed.

##### ***Ethics in Medical Sciences***

Medical ethics has been a topic of discussion in the country for several years. With advancements in various investigative and treatment modalities, certain issues which need immediate attention in the country, are: organ transplantation specially cadaveric, surrogacy and termination of pregnancy under special situations, euthanasia, doctor-patient relationship, prescribing ethics, etc.

##### ***Other themes under ' S&T and ethics 'could also be considered.***

*(The term scientist is used in a wider sense and includes technologists and all those with a basic degree in sciences.)*

##### **Important dates:**

Submission of abstract: 30 Oct. 2010  
Intimation of acceptance: 30 Nov. 2010

##### **Registration details:**

Registration by: 30 December, 2010  
Registration fees: Rs.1,500/-  
Students: Rs. 500/-  
Foreigners: US\$ 200/-

##### **Office bearers:**

Convenor: Prof. Bakhtaver S. Mahajan  
Co-Convenor: Dr. Susan Eapen  
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Dr. Devaki Ramanathan  
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##### **Venue: Indian Women Scientists' Association**

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## President's Message



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

The rains are here at last, ushering in some much-needed cool weather and greenery. We need to "stop and stare" to appreciate the beauty of nature rejuvenating itself. With the onset of the rains, malaria has once again become rampant, which now appears in various atypical forms, one being a strain resistant to all the commonly prescribed drugs. One form of the malarial parasite, *Plasmodium vivax* is reported to cause heart disease in Mumbai, baffling city cardiologists. There is also the "mutant" mosquito which is resistant to the commonly used insecticides like DDT, which is banned abroad, but still in use in India. Once again this goes to show that science should never rest on its laurels, but must strive hard to keep up with the march of evolution.

The monsoon restricts children indoors. To keep them busy at home can be a difficult task for elders. One can form groups of children and have some activities, with homemakers utilizing their hidden talents. They can be given projects to do on science and health at home. Tell them about the interesting life cycle of the malarial mosquito, where the disease is spread from an infected man, whose blood the Anopheles female mosquitoes feed on and spread it to another in subsequent bites. Prevent mosquito bites by using nets which are harmless. Use repellent sprays and other new contraptions although using chemical repellents can be harmful in the long run, especially for sensitive individuals in the house.

The importance of a balanced diet can be emphasized with health values of different foods like fruits, salads, sprouts, curd, fats- ghee, butter and oils, in proper proportion to carbohydrates, proteins and vitamins. This could be scientifically taught and made interesting by trying out new simple recipes like 'vitaminised bhel' with grated carrots and sprouts or fruit chat. This will drive home the underlying scientific principles and make learning interesting even for us.

Ask them to count the nutritive values of the food they are consuming and the approximate calories. Please do not stuff them with rich food, high in sugar and fats. The incidence of obesity in school-going children is on the rise in our country, due to over-eating and lack of exercise. This is leading to blood pressure, diabetes and heart disease in our younger populations (18-30 yrs). We need to act fast in reversing this trend.

Simple every day chores can be probed to understand the science behind them. Why does milk form a cream layer and boil over if overheated? Different methods of cooking: pressure cooking, steaming, baking, using the microwave oven, frying etc. can be taught with the under-lying principles. How does a 'chapatti' fluff up on a flame and a 'puri' puffs up in oil when fried?

The use of Mono Sodium Glutamate (MSG) in Chinese food leads to the "Chinese food syndrome" in sensitive people and youngsters need to be cautioned when they face a reaction from eating Chinese food, which has become so common in our country. Encyclopedias and the internet can be used if and when necessary for more information.

Teach them repeatedly on saving water and electricity by switching off all the mains of equipment which are not in use. They are the future citizens of our country and should know the consequences of wasting our resources.

Indoor games like chess, caroms, scrabble, sudoku etc. could be encouraged as there is not much emphasis on these games in the present scenario, leading to children becoming couch potatoes. When there is a dry spell between rains, it is also good to encourage outdoor games and exposure to sunlight for vitamin D replenishment in our body. Today, we are hardly in the sun and many of our health problems could be due to this. Osteoporosis is becoming common among middle aged women and the elderly. Absorption of Calcium is related to Vitamin D absorption and depending on levels in the body both need to be supplemented.

I wish you all a safe, healthy and enjoyable monsoon and joy in the festivals coming up soon!

Uma N. Rao

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## IWSA News

### News From Head Quarters

IWSA & Navi Mumbai Action committee organized a panel discussion on “**Distress among youngsters : recent suicidal trends**” on Saturday, 27<sup>th</sup> March, 2010 from 15.00 to 18.00 hours at IWSA Multipurpose Hall, Sector 10A, Vashi. Ms. Sandra Padubidri, Councillor at IWSA, compered the seminar and introduced the speaker. Dr. Uma Rao, President IWSA, welcomed all panelists who were present. Dr. V. Sudha Rao, Vice President, IWSA gave a short brief on the importance of the topic in today's scenario and gave some statistical data on the rate of suicide in our country, in Mumbai and Navi Mumbai etc., providing enough reasons for concern. The first panelist Dr.Siva Ramakrishnan, a doctor from Hinduja Hospital, talked about the different stress factors leading to depression in children. In the absence of joint family system where grandparents play a crucial role in destressing the young, he said, parents are mostly responsible for creating tension in children. Parents should befriend and not bully their children. It is the very abnormal children who tend to commit suicide and early detection of depression would help to save the situation. Mrs. A. Sequeira, a retired senior teacher from the Atomic Energy Central School, described how the students can get stressed at higher classes due to the expectation from the school to get 100% results. As a teacher handling maths for higher class, she felt the school was deficient in teaching mathematical concepts at lower classes where maths is taught on set values & formulae alone. Hence building concepts at higher classes becomes an abysmal exercise and hence students get stressed up. She also stressed on parental responsibilities and advised parents to be more relaxed and prepare their children to toughen up to face the ups and downs of life.

Ms. Lata Rajan, an English teacher from a CBSE school and Ms. Lalitha Radhakrishnan, a home tutor in science and maths, alternately discussed, in a dramatical way, all the problems that students faced at home and at school, leading them to a fatal climax. Uncompromising parents with high expectations, insufficient emotional support from nuclear family set-ups, high competition and confusing educational patterns and also misleading media exposures are all contributory factors leading to stress and tension in children. The speakers stressed that 'children must be taught that success is not a key to happiness, but happiness is the key to success.

Mrs. Vrushali Magdum and Dr. Jyoti Marwah, both lecturers from Junior Colleges of Navi Mumbai, specifically talked about the adolescent youth and how they have to be carefully handled. Mrs. V. Magdum said all her boys felt their career options are mostly decided by parental expectations which is totally unfair to students. Mrs. Magdum also talked about a stress management class conducted in the D.Y. Patil College and its good results. Unfortunately the college found it difficult to give time for such classes.

Dr. J. Marwah stressed on the importance of physical fitness in creating social and emotional fitness and she stressed on the E-factor: Emotional anchor (from home) and Examination stresses and empathy at school.

Mrs. Snigdha Roy, Vice Principal, Fr. Agnel School talked about the very low threshold levels present in students before they are driven to the cliff. They should be taught at an early stage to have self-acceptance, self-image, self-confidence and self-esteem. Attitudes of gratitude and fortitude have to be nurtured from unconditional love and support from parents and teachers from an early stage.

Ms. Hemangi Naik, a social free-lance counselor, talked about early symptoms in difficult children and how they should be detected and put on psycho-counseling. Some of these problems could arise from genuine medical disorders or neurological deficiencies and have to be addressed and distinguished.

Dr. Bhaktavar Mahajan in the concluding remarks, asked about the real-time statistics to assess the gravity of the situation. Also the influence of the media TV entertainment shows (like Reality shows), films (like 3 idiots and others) and advertisements also paint extremely wrong pictures to the children who are at a vulnerable age.

Dr. Jyoti Marwah said the society's value system has degraded due to various reasons. The society is growing at random and hence all people should work towards stabilizing the society with high values. Dr. R.N. Sharma, professor from TISS and a member of Navi Mumbai Action Committee, also endorsed the views of Dr. Jyoti Marwah.

Dr. Devaki Ramanathan, Jt. Secretary, IWSA, thanked all speakers and panelists for their excellent presentations. IWSA presented a tulsi plant to every panel speaker. She also thanked Navi Mumbai Action Committee members: Mr. Bhattacharya and Dr. R.N. Sharma who were motivators for the day's seminar and who also hosted the high tea for all.

### International Womens Day

This year, 2010, is the centenary year of International Women's Day celebration. IWSA celebrated this special event on Saturday, 6th March, 2010 from 3-5 pm. at IWSA's ICICI Multipurpose hall, Sector 10A, Vashi, Navi Mumbai.



An interactive panel discussion on 'The art of balancing a career and home as women' was conducted and well-compered by Dr. Rita Mukhopadhyay, member of the Executive committee of IWSA. Dr Uma Rao, President IWSA, initiated the session by remembering the remarkable strength, support and influence of women, mother and sisters, in her life. Dr. Sindhu Joshi, a retired Scientist, CRI and a founder member, IWSA, spoke on how she had to balance her career path, almost 40 years back, with her home and her husband's postings in and out of Mumbai. Compared to today, facilities and infrastructure were non-existent in those days, but she gave full tribute to the encouragement she received from her husband and family to facilitate her through her research career and her accomplishments

Ms. Padma Ranji, HD, medical services section, BARC hospital, narrated how much she learnt from her previous work at the Umar Khade retention centre for juvenile delinquents. She also stressed on the need for support system and enumerated all the features that the VI pay commission has offered to working mothers and discussed the positive/negative aspects of these features for women in research with career ambitions. This was followed by elaborate discussion from the audience with Dr. Sumati Kulkarni and Prof. Sita Venkateshwarlu contributing their views on today's scenario: the value of joint family systems and other facilities that always help a working scientist to balance her home and her career options without a break. Few were vocal about occasional undue advantages taken by women on the privileges offered. Dr. Rita Mukhopadhyaya said women should stand by the dignity they hold and not give in to such misuse.

The panel discussion was well attended by IWSA members and others. Dr. Devaki Ramanathan, Jt. Secretary, IWSA, proposed a vote of thanks. The interactive audience made the program very lively and discussions continued over high tea.

### **RAINBOW 2010: IWSA'S Teaching Aid Exhibition**

Once again the Teacher Trainees of IWSA, spread their rainbow colours on each and everyone who attended their teaching aids exhibition, which was held on the 17<sup>th</sup> & 18<sup>th</sup> February, 2010 from 9.30 a.m. to 6.00 p.m. at IWSA's ICICI Multipurpose Hall.



The Teacher Training Course is a one year course affiliated to the S.N.D.T. Women's University which is conducted in English and Marathi. The Teaching Aid Exhibition was inaugurated by Prof. Jayshree Ramdas, Dean, Homi Bhabha Centre for Science Education, TIFR on 17<sup>th</sup> February, 2010. She explained about how children learn by using their sensory organs at Pre-school level and the role that drawings play, which help us to understand children better.

The teacher trainees exhibited their teaching aids like picture talks, charts, rollographs, flash cards, journals of creativity like crayoning, origami, paper craft, wet and dry painting. Innovative games were also organized based on Science, Maths, EVS, Concepts and language.

Three Puppet Shows were performed by the trainees that were enjoyed by over 800 children coming from various schools and private nurseries. The shows were in English (The Rainbow Fish), Hindi (Sunhere Shabd- teaching good mannaers) and Marathi (Chintuchya Swapnatali Gammat on why you must eat vegetables)

The exhibition was visited by teachers from Goldcrest, Fr. Agnel, Modern, Nensee Nursery, Mobile Creche and many more, as well as many parents with their children. They all found it satisfying, innovative, creative and excellent.

The teaching aids were judged by Ms. Rupa Sudhakar, Coordinator, Pre-primary Section, Fr. Agnel School, Ms. Jyothi Iyanger, Manager, BARC's Day Care Centre "Kilbil" and Dr Sudha Rao course coordinator.

### **Field Visit to Solid Waste Management Sites**

A field visit was arranged by IWSA for school teachers and resource persons of the 'Clean and Green, Navi Mumbai' project on 20th March, 2010. They visited NMMC's solid waste management sites at Turbhe and Koparkhairne and the Nisargruna plant at BARC designed by Dr. Kale. IWSA had arranged a bus to take the group to all these sites and back. 30 school teachers participating in IWSA project and 8 resource persons from IWSA attended the field visits.

At Turbhe, Mr. Mule, the Dy. Engineer NMMC, received the group, took them around after first showing a video of the details of the scientific preparation of a dumping ground adopted for Turbhe. A treatment plant has been developed at the site with planting of trees to sustain environmental balance and also a technique to capture and contain and fill gas - methane which causes harm to the greenhouse effect. Methane given out by the garbage could be used to generate electricity. This part has been contracted to a UK firm.

The area of land fill site is 65.08 acres. The net weight of waste is 603580 tonnes and the number of debris vehicles is 119. Mr. Mule also took the group to Koparkhairane dumping site, which was used earlier for 18 years. But this was not so scientifically designed, so it started leaking out and the site was abandoned for the Turbhe site.

However, the closed dump-ground at Koparkhairane has been developed by NMMC into an attractive Nisarg Udyan (Nature park) with a grass meadow and a walking trail. The methane gas emitted in this area is also continuously monitored and burnt off (the levels have come down with time).

The group proceeded to Anushaktinagar, had lunch at Training school hostel, graciously hosted by Dr. Sharad Kale, Sr. Scientist, BARC. The food was prepared with fuel generated from his Nisargruna plant that converts the bio-degradable, waste into bio-gas. The kitchen waste generated from the hostel and the neighbourhood household is collected for this purpose.

After lunch Dr. Kale gave an illustrative 1 hour talk on waste, its polluting effects and its management. He then took the group to see the Nisargruna plant installed behind the hostel. He explained how the plant works: Total volume of waste handled by the plant is five tons per day. There are four steps involved in this. (1) the waste material is sorted, this is done by unskilled ladies from Stree Mukti Sanghatane, (2) It is processed in a mixer, (3) It is predigested using microbes, (4) biogas is collected and diverted to Training school hostel's kitchen by pipe, about 3 cylinders per day. Remaining material is dried in manure pits and used as manure for beautifying the garden in surrounding areas.

Dr. Kale said that about 100 similar plants were being developed for supply to different people. The visit was very impressive and educative and the teachers were all very excited and motivated after seeing this plant. It was felt that IWSA should initiate Nisargruna project in Vashi to demonstrate such an environment friendly disposal role model. The group had tea, again thanks to Dr. Kale's benevolence and returned to IWSA by 4.00 p.m.

IWSA would like to place on record its sincere thanks to the immense co-operation and support given by NMMC officials (Specially Mr. Mule and his group) and Dr. Kale and his colleagues for educating the group about the solid waste management.

*Report by : Devaki Ramanathan & Sudha Rao*

### **The International Geographic Project**

The Genographic Project is studying the migratory patterns of our species from Africa. to inhabit the whole globe, by using DNA markers (specific mutations) which never disappear and are passed on to each generation.. Samples are obtained from the cheek swab or by mouth wash samples. Dr. Uma Rao, President IWSA, had written an article about this project in the Jan April '09 IWSA Newsletter. She had her DNA (mitochondrial) sampled by the project in USA and found interestingly that her haplotype is now distributed all over central Asia, Europe and America.

The world wide project was started in 2005 by National Geographic and IBM with Professor Spencer Wells a population geneticist from USA, as its principal investigator.

It aims at carrying the message of universal brotherhood. Ten key research centres affiliated to a university have been identified for collection of this colossal data, focusing on indigenous peoples around the world. The principal investigator for the Indian region of the Genographic Project is Dr. Ramasamy Pitchappan, Emeritus Professor of the Madurai Kamaraj University, Tamil Nadu.. The team plans to sample 15-20,000 people from 250 groups all over India.

Dr. Uma Rao met Professor Pitchappan on one of his visits and discussed with him about sample collection in India. Earlier, she had received 20 DVDs from the Genographic Project, USA, to exhibit in schools and colleges in Mumbai for exposing students, teachers and others to these latest studies of human anthropology involving DNA. The present DNA studies indicate that all humanity has emerged from Africa and 50,000 years ago migrated to Australia touching the South Indian coast. Evidence for this is seen in the genetic marker common to the African migrants, Australian Aborigines and a small family of a tribe of South Indians located in Madurai.

Dr. Uma Rao and Dr. Kamal Marolia, life member IWSA and Coordinator of Biotechnology Dept. Somaiyya college arranged for a lecture of 400 students by Professor Pitchappan. They both helped him to collect nearly 100 samples from a Parsi population residing in Mumbai. The Katakari tribes are supposed to be one of the earliest ones to inhabit Western India. 100 samples were collected from these tribals in the villages close to the Vanavasi Ashram School at Mandgaon. Only males were sampled for the Y chromosome. IWSA will be screening the National Genographic film for educational institutions in the coming year too. A Certificate of appreciation is being issued for IWSA by 'The Genographic Project' USA, to IWSA for its participation in this international project.

*Report by: Dr. Uma Rao*

### **DELHI BRANCH NEWS**

IWSA Delhi Branch organized a lecture for the benefit of its members on 3<sup>rd</sup> March, 2010 at national Institute of Science Communication and Information Resources (NISCAIR), New Delhi. Dr (Mrs) Deepika Gunawant, Consultant with Ayush under International Co-operation and a Technical expert with QCI spoke on the occasion on the topic 'Ayurveda and its relevance to health and well-being'.

Dr Gunawant, an MD in Ayurveda from Kolkata University has been associated with Ayurvedic Company of Great Britain and the Ayurvedic charitable hospital in UK in several capacities including as Marketing Director and Chief Physician. She was Head, Global Regulatory affairs at Dabur in the UK and relocated to India with the same responsibility. She has a number of articles to her credit and is the co-author of the book entitled '**Complete Illustrated guide to Ayurveda**', published by Element books, UK. She is the Founder President of British Association of Accredited Ayurvedic Practitioners (BAAAP).

*Report by Mrs. Santhosh Mahtani*

*Co-convenor, IWSA Delhi Branch*

## BARODA BRANCH NEWS

Following activities were organized by the Baroda branch.

1. ENVIRONMENT DAY CELEBRATION-Elucution competition "SAVE WATER FOR FUTURE GENERATION" was organized amongst the students.
2. Participated in "Thalassemia & Sickle Cell" Awareness program organized by Red Cross Society , Vadodara Branch
3. Seminar on "Retinopathy of Prematurity" at Dr. Thakorebhai Patel Eye Institute. Vadodara was conducted
4. Organised Skill Training program of School Teachers for checking the BASIC HEALTH OF EYES. Thus 5 trained teachers checked the Eye fitness of 1200 school students. All needy children were further checked by Expert Doctors of Vaduwala EYE HOSPITAL, Vadodara
5. Rice based Nutritious Recipes competition at Agarwal Samaj Ladies Wing was conducted. The following other programs were also supported;
  - a. Save Girl Child- Awareness
  - b. Global Warming- Awareness
  - c. Tobacco Free Society
6. Another ENVIRONMENT AWARENESS program was organized with the support of Rotary Club, named "Green your School Campus". School children participated in planting more than 500 saplings.
7. Celebrated Teacher's day. Involved Teachers, Students and citizens in tree plantation at the University campus.
8. Organized AIDS AWARENESS program for school children. Invited Medical professionals, Social Workers, Educationists, Psychologist to deal with the different perspectives of the issue. Student Participation was encouraged. A slogan Competition was organized and winners were suitably rewarded.
9. Attended "Pediatric Nutrition" Symposium
10. Participated in Rally Organized to Create awareness for "Healthy Heart".
11. Associated to organize a very special program for & by Deaf and Dumb Children rom the states of Gujarat, Maharashtra, Madhya Pradesh & Rajasthan
12. Participated in National Seminar on Pollution Management in Changing Global Environment
13. Dr. Shashi Kanta Tuteja attended National Conference Organized by Protein Foods & Nutrition Development Association of India entitled " Are We Ready for Global Markets".
14. Workshop on "Yoga & Aging"

15. Dr. Shashi Kanta Tuteja was invited to deliver key note address at Workshop and Awareness Program "GMP/GHP& HACCP Certification including Food Safety in Food Industry organized by Food Processors Association of India, Vadodara Chapter

Report by: **Dr. Shashi Kanta Tuteja**  
Convenor, IWSA Baroda Branch.  
DISHATARA, 33- Pratap Gunj, Vadodara - 2  
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## PUNE BRANCH NEWS

International Women's day was celebrated on 8<sup>th</sup> March 2010 by arranging a seminar on "Role of Women in Science". The participants from various departments on Pune University campus and different Institutes attended the seminar. The details of the programme are as follows.

**Chairperson: Prof. (Mrs.) Sudha Bhoraskar**

**Speakers:**

**Prof. (Mrs.) Nilima Rajurkar**

Convener, IWSA, Pune and Head, Department of Environmental Science, University of Pune ('Role of Women in Science')

**Dr. Pradnya Kanekar**

Director, Agharkar Research Institute  
( 'Contribution of women in science' )

**Prof. Sulabha Kulkarni**

IISER, Pune ('Empowering Women Scientist for Balanced Society')

### Panel Discussion on: 'Women in Science'

**Chairperson:**

**Prof. (Mrs.) Nilima Rajurkar,**

Convener, IWSA, Pune Branch

**Members:**

**Dr. Mangala Naraliker,**

Senior IWSA member

**Prof. Sudha Bhoraskar,**

Treasurer, IWSA, Pune Branch

**Prof. Madhurima Dikshit,**

Secretary, IWSA, Pune Branch

**Dr. Shobha Rao,**

Senior IWSA member

## KALPAKKAM BRANCH NEWS

### **1. A Talk by Dr. Vijayalakshmi Pantheyan on ALPHA Mind Power, Convention Centre, Anupuram.**

Almost 120 women including all the IWSA members and residents of Anupuram and Kalpakkam Townships attended the talk. The gathering was welcomed by Dr. Rani P. George, Convenor, IWSA Kalpakkam Branch, who introduced the speaker. Dr. Vijayalakshmi gave an excellent talk on power of subconscious mind. In detail she described that left brain governs all of us with logical thinking and often gives us limited beliefs that conditions our mind. We are often bound

with invisible chains and fear of uncertainties. Whereas, the magical right brain is the seat of intuition, creativity and emotions. But it is in our hand to develop our right brain to achieve total positiveness by meditation. We have to take our mind to ALPHA level to realize the power of subconscious mind. This is a great stress buster leading to good health, self-confidence, peace and joy irrespective of the surroundings. Her talk so much motivated the audience and the talk was followed by 30 minutes of question-answer session.

## **2. Report on TWAS-TWOWS-PSN-SCOPUS Regional Young Women Scientists Symposium 2009 “Bridging the Science Gender Gap in Developing Countries”, 8 10 November, 2009 attended by Dr. Rani P. George, Convenor, IWSA**

During 08.11.2009 to 10.11.2009, Dr. Rani P. George participated in the RWYS Symposium held in National Science Centre, Kuala Lumpur, Malaysia. This “TWAS-TWOWS Regional Young Women Scientists Symposium” was a first step in global efforts to engage young women scientists and researchers in developing countries towards excellence in science. This significant initiative undertaken by Academy of Sciences for the Developing World (TWAS) and Third World Organization for Women in Science (TWOWS), in fulfilling its strategic intent to nurture young women towards excellence in science. This symposium tried to bridge two gaps, one between the industrialized world and developing world and more specifically the gender gap for successful use and utilization of science and technology for sustainable development. This symposium was beautifully arranged in two parts. One was Young Women Researcher Award Symposium on 9<sup>th</sup> November, and Regional Young Women Scientists Workshop on 10<sup>th</sup> November 2009. The Workshop on 10<sup>th</sup> Nov. comprised of eight plenary talks by successful women scientists who are toppers in their fields and also totally committed to upliftment of women in science. The importance of women in leadership positions, from where they can promote and serve as role models for future generations; prioritizing and organizing our thoughts and deeds; importance of collaboration; maintaining research excellence were all discussed. Following this in the interactive session convenor described the works done by IWSA Kalpakkam Chapter by way of motivating children to science by conducting quiz programmes on science days, Adolescent health programmes, Career Guidance programmes etc and also programmes for women in township. The travel and stay was supported by IGCAR and CCSTDS.

## **3. Participation in SGPW 2010**

**Sustaining Global Pressures: Women In Science And Engineering (SGPW -2010) with the sub-theme - Biodiversity conservation in India: Status and Approaches was held at Panhala, a hill resort near Kolhapur, Maharashtra during January, 8-10, 2010.** The conference was organized by Ms. Dhanashri S. Patil, Convenor, IWSA, Kolhapur branch and her team. Dr.P.Kadam, minister of forest, Maharashtra. inaugurated the conference and Dr.Manisha Rajebhosale, scientist from University college,

London was the chief guest. Dr.Deepti Deobagkar from University of Poona gave the keynote address. Other notable speakers were Dr.Aisha Sultala from Delhi University, Dr. Leela Bhosale and Dr. Manjusha Deshpande, Shivaji university from others. The Kalpakkam branch of IWSA was represented by Dr. Mary Mohankumar who presented a paper on “The Erythrocyte Cytome assay- a Sensitive Biomarker of Pollution in Apparently Healthy Fishes”. The conference encompassed various topics on women's role in biodiversity conservation, regulatory aspects and research methods. The organizing committee succeeded in persuading the minister of forest to establish a bio-diversity park at Panhala.

## **4. Radiation Awareness Programme for non-technical women staff, on 17<sup>th</sup> Feb 2010, Sarabhai Auditorium**

This programme involved two talks, one on Nuclear Reactor Safety by Shri. R. Mathiarasu and other on Radiation Safety by Mr. S. Balasundar of Radiological Safety Division. The talk covered all the actions taken to prevent nuclear and radiation accidents in nuclear power plants. The speakers clearly demonstrated the different depths of defenses in nuclear power plants. The speakers reassured the participants that Reactor safety is the foremost consideration for nuclear power plant operators, as without a strong and deep foundation of safety to prevent accidents before they can occur, no nuclear power generation would be permissible. Talks were followed by an interactive session chaired by a panel of experts from reactor operation side, Waste management side and reactor safety division. About 170 women employees including non-technical staff, IWSA members and other scientists participated in this event. Participants raised various doubts like emergency preparedness of the management, disposal of wastes, and also details on different defense systems. Talks and discussion were covered in a mixture of Tamil and English for the benefit of all.

## **5. Women's day celebrations on March 8<sup>th</sup>, 2010**

IWSA Kalpakkam celebrated women's day on March 8, 2010 by a Talk on “Women and Mental Health” by Ms. P.L. Porkodi, Director, Community Mental Health Project, of The Banyan, Chennai at CDO Seminar Hall, IGCAR. Ms. Porkodi an English Literature person described her first contact with Banyan, how she got interested in their activities. Presently she is running two large projects at Kovalam. She described her satisfaction she derives from working for 15 years with homeless persons with mental illness, predominantly women. She described the bio-medical component in mental illness. According to her 45% are genetic reasons. The most important thing she conveyed to the audience is that anybody at any point of time in their life can succumb to this illness due to sudden shock, intense stress etc. and immediate medical help can increase the recovery rate drastically. The empathy and understanding of the people around goes a long way in this recovery process. She has traveled wide for advocating this issues and also learning how some other groups are working in this area. Around 150 women employees participated in this programme and raised many doubts to Ms. Porkodi. Ms.

Porkodi ended her interactive session with this superb message, that "what you think you are, hence always think positively and all good things will happen to you".

## KOLHAPUR BRANCH NEWS

### **Sustaining Pressures: Women In Science And Engineering (SGPW -2010): January 8-10, 2010**

SGPW-2010 organized by IWSA Kolhapur branch on "Biodiversity conservation of India: status and approaches" with support from Gopal Krishna Gokhale College became a successful event. Objective of the national conference was to take scientific approaches about biodiversity conservation of India, its status and discussion on implementations strategies which were presented with multidisciplinary scientific papers and poster presentations.

Along with 125 registered delegates, 250 other visitors, students, NGOs attended the conference. The programme was inaugurated on 8<sup>th</sup> January 2010. The Convener Dr. Dhanashri Patil, welcomed the chief guests and delegates and briefed about the conference. Dr. Uma Rao, President, IWSA gave a brief introduction of IWSA. Dr. Manisha Rajebhosale, a young versatile woman scientist from Dept. of Medicine, University College London, U.K. was the chief guest. President of the inaugural function was Dr. Leela Bhosale who is a pioneer convener of IWSA Kolhapur branch. Dr. Manisha gave the inaugural address. Year 2010 has been deemed as Year of Biodiversity by United Nations, so the conference has put Kolhapur on the world map by linking the participants to the global initiative and awareness. She talked about eminent great women scientists like Dr. Anandi Gopal Joshi, Marrie Curie, Barbara Mc Clintock etc. The inaugural function was a salute to inspiring women who have created history.

Dr. L. Bhosale covered the status of biodiversity in India in her presidential address. Her area of research is coastal mangroves and she mentioned the necessity for constructive programme regarding biodiversity conservation in India. Convener, Ms. Dhanashri Patil gave an outline of the conference programme. Dr. Anjali Salvi organizing secretary of the conference, proposed the vote of thanks. Dr. Anuradha Samant compered the conference proceedings.

Dr. Deepti Devbagkar gave the key note address with an illustrious talk: " Conservation of biodiversity and genetic resources role of women empowerment". She emphasized on extinction rate, speed of inherited biological traits that are carried within the DNA of each species or individual's genes. Scientific tools using GRASS organisms for waste disposal should be introduced with more efficiencies from lab to lab. The session was chaired by Dr. S.V. Joshi and Dr. N.S. Chavan was the rapporteur. This talk was followed by a presentation by Ms. Manjiri DesaiMore, on "Pawangar Project", which was her role model project regarding biodiversity conservation.

Dr. L.J. Bhosale gave details of Biological Diversity Act 2002 and Biological Diversity Rules, 2004. The informative talk

enlisted all the important legislative data to guide the participants. She had herself constructively participated in the formation of documentation of laws. IWSA should be proud of her participation in the Biodiversity Act and Rules Development. The session was chaired by Dr. Sayad Wafar, NIO, Goa and rapporteur was Dr. Meena Dongare.

Dr. S.R. Yadav delivered his lecture on "Plant Diversity of Western Ghats and its utilization in sustainable development". He focused on the rule of Western Ghats in hydrological cycle and climatology of peninsular India. It is a mega diversity area of the country supporting 12000 species of plants with 1700 flowering endemic species. With beautiful slides of flowers of Western Ghats, he explored the potential within it for medicinal, ornamental, food value and commercial importance. Dr. Aisha Sultana from Aravali Biodiversity Park, Delhi, presented her lead lecture on Role of Government in Biodiversity Conservation in India. She gave a dream of a biodiversity park with an interpretation centre for academic purpose to record development of Western Ghats biodiversity. She mentioned Govt. agencies, whose activities support biodiversity conservation. The day ended with a field visit to locate flora and fauna under guidance of Dr. Shimpale and Mr. F.A. Deshmukh.

Second day started with the presentation by Dr. Shubhada Nayak from KV Patil college, Mumbai, on "Molecular identification of microbial diversity of Nisargruna biogas plant". To divert the pressure on biodiversity, urbanization has to follow sustainable technology. Through her presentation she showed a success story for pollution control. "Nisargruna" is a modern scientific technology using biodegradable waste which generates bio-gas (Methane) and manure. Dr. Anuradha Gadkari NERI, Nagpur, talked on "Environmental Pollution Control and Monitoring". She concluded that control and monitoring efforts have various dimensions at different levels such as technological, scientific, legal, official, bureaucratic community partnership.

Young emerging scientists presented their work on Kalamba lake diversity, shifting cultivation practice on Ecology of Western Ghats, Rab practice and its environmental impact, vermicomposting of Tendu leaf litter, purification of water, seaweed biodiversity of Malvan and Kunkeshwar, sustainable development of rural areas through sustainable tourism, the Erthrocyte Cytochrome, a sensitive biomarker of pollution in healthy fishes, air borne Algal pollutants, botanicals for eco friendly sustainable pest management, plants for use in reclamation of mine wasteland, garbage waste in organic asset etc.

The highlight was a lecture by 85 years old Dr. Sumati Mudambi on "Study of climate change in the habitat of liverworts of Panhala and butterflies of Western Ghats". Dr. Saida Wafar, NIO, Goa, presented her paper on management and conservation of mangrove biodiversity.

Impressive posters were presented, including topics like conservation of some importance spices in the garden of Kolhapur city, diversity in cynometro spices, flora and fauna of Rankala etc. The poster presentation was inaugurated by the State Minister of Forest Dr. Patankgrao Kadam. He also

announced formation of a biodiversity park at Panhala and declared 11 hectares of area for implementation of this project. Hon. Chandrakant Dada Patil (M.L.C.) promised to followup this proposal.

Third day, lead- lecture by Dr. Manjusha Deshpande on "Role of Women in Conservation of Natural Resources and Development" focused on experiences and cultural rituals of women in conservation of biodiversity all over the world. She recommended to policy makers & research activists to advocate participation of women in management of biodiversity. In the valedictory function following resolutions were passed and delegates were awarded prizes for the best papers and posters.

Resolutions:

? The present convener of IWSA Kolhapur branch and the organizing committee should make efforts to explore the possibilities of acquiring land in Kolhapur from possible agencies to set up IWSA office, working women's hostel and educational centre.

? IWSA SGPW-2010 of Kolhapur has decided to follow up the declaration of the Hon. Minister Shri Patangrao Kadam to make available land for the Biodiversity Education Park on the request made by the SGPW-2010.

? It was resolved that all tourism centres be protected from deterioration due to tourist activities in order to conserve the biodiversity in that area. Therefore, the concern department to be approached for necessary action.

? IWSA Kolhapur branch should initiate need based project which could be replicated by other branches.

The resolution was proposed by Dr. Devaki Ramanathan and seconded by Dr. Sudha Padhye.

### **Establishing the role of History in Biodiversity and Environmental concerns at Panhala**

*Dr. Jyoti Marwah,  
HOD, History, ICLES M J College, Vashi, Navi Mumbai*

The conference site was an ideal setting for a National Conference on Biodiversity SGPW-2010 to commemorate the International Year of Biodiversity. The conference organised by Kolhapur Branch of IWSA and Gokhale College, Kolhapur was a rare experience in terms of the spirit of the people of Kolhapur there was unrestrained enthusiasm, scrupulous efforts in organisation and wholehearted participation. Above all was the never waning smile of the convener Dr. Dhanashree Patil, a warm and friendly host. The women (young and old) turned up in large numbers either to express their interest in preventing the degradation of environment or to guide others on how to develop eco-friendly techniques in agriculture while the experts pondered over the government policies, which probably lead nowhere. There were others like Dr. Ayesha Sultana from University of Delhi who were jubilant about government efforts in the making of Aravali Biodiversity Park

in Delhi. What surprises me, is that we waste, destroy and continue to destroy what we have inherited free of cost and then spend crores and crores to show 'Nature that we can make the same that Nature makes "Naturally" '. That's our intelligence? Man truly is a laughing stock for Nature and God!

My students of SYBA and TYBA made a poster presentation on "Eco-feminism: Vandana Shiva and Medha Patkar" viewing them as a contemporary force to reckon with. They represent the face of "Diverse women for Diverse Issues" and have questioned the Government and MNCs so as to secure traditional and indigenous agriculture of India. Without offending anyone, I would like to make a suggestion that a seminar on Biodiversity and Environment Conservation must make it mandatory for participants to use biodegradable and eco-friendly materials for poster exhibits. It makes sense. In fact judges should not have overlooked this sense in those participants who had used such materials. It is a paradox that on one platform we discuss and drill pessimism while talking of phthalates and pollution and on the other hand we use the very same materials, plastics and acrylic sheets to put our point across.

As a rappateur for the session on "Environmental Pollution" for the lead lecture by Meena Gadkari from NEERI, (it was my privilege to do so on the request of Dr. Bakhtawar Mahajan) I was able to put to rest many questioning faces History and Biodiversity? Working with Parvatiya Jadi Booti Kalyan Samiti, Garhwal, Uttarakhand I have contributed my mite in the conservation and domestication of two indigenous plants of high altitude Jatamashi and Kapurkatcheri. So you see, it is the spirit, which is the driving force.

As a student of history, I must remind all that studies of history and culture depend heavily on archeological sources, paleobotanical sources, ethno-botanical sources, quaternary and prehistoric studies and also history is the mother of all social sciences, in fact, all sciences. Friends, consider the importance of taking biodiversity issues to all, water tight 'compartmentalisation' will get us nowhere. At the undergraduate level, UGC has made a 50 marks paper on Environment Studies compulsory for all streams. LET'S HANDLE ENVIRONMENT AND BIODIVERSITY WITH INTELLIGENCE AND HEART RATHER THAN A SUBJECT.

### **The TWOWS Fourth General Assembly and International Conference**

*-Sophia Huyer*

TWOWS fourth General Assembly and the four day 'Women Scientists in a Changing World' conference was held on 27 - 30 June 2010 at the Beijing International Convention Centre (BICC), Beijing, China, hosted by the Chinese Academy of Sciences. Over 600 participants attended from 55 countries to present papers and hold discussions on the scientific contributions of women in four areas: Women Scientists and Frontiers of Sciences; Women Scientists and Global Change; Women, Innovation and Entrepreneurship, Leadership Capacity; and Gender Mainstreaming in the Global Scientific Community. A Young Women Scientists' Forum was also featured as part of the Conference.

The Conference was opened by Xi Jinping, Vice President of the People's Republic of China, and leading scientists and dignitaries from around the world including Naledi Pandor, Minister of Science and Technology, South Africa; Sharon Hrynkow, Senior Advisor to the Assistant Secretary, Bureau of Oceans, Environment and Science, US State Department, Yongxiang Lu, President of the Chinese Academy of Sciences, and Mohamed Hassan, Executive Director of TWAS, the Academy of Sciences for the Developing World.

The Fourth General Assembly held at the same time produced several key results for the Organization, introducing changes which will better position it to address current global challenges and opportunities to support its emergence as the leading organization of its kind:

1) The name of the organization has been changed to **Organization for Women in Science for the Developing World (OWSDW)**, to better reflect its focus on promoting both the greater participation of women in science, technology and innovation as well as the use of science, technology and innovation to better the lives of both women and men in the developing world.

2) A new President has been elected: Prof. Xin Fang is a research professor and member of the Presidium of the Chinese Academy of Sciences (CAS). Supporting her on the Board are:

- Africa: Dolly Ahbor Ighoroje (Nigeria), Vice President; Esi Awuah (Ghana), Member
- Arab States: Samira Omar (Kuwait), Vice President; Rokhsana Abdul Raman (Yemen), Member
- Asia and the Pacific: Farida Habib Shah (Malaysia), Vice President; Sudha Nair (India), Member
- Latin America and the Caribbean: Mayra de la Torre (Mexico), Vice President; Miriam Diaz (Venezuela), Member.

3) A revised set of statutes was presented and approved by the General Assembly.

4) The Beijing Statement (<http://www.twows.org/about-twows/beijing-statement>) was approved by the Conference and released on June 29, 2010. In view of the commitments in the Platform for Action of 1995 Fourth United Nations World Conference on Women, and the recommendations in Para 90 of the Framework for Action of the World Conference on Science held in Budapest in 1999, the participants called on governments and the international community to recognize, document and highlight the contributions made by women to science, technology, engineering and innovation and to take steps in policy and programming to ensure the full participation of women and girls in all aspects of science and technology. More information is available from the OWSDW website at [www.twows.org](http://www.twows.org).

## Ultrasensitive Magnetometry: Exploring Ultra-low Magnetic Fields in the Physical World

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### 1. Introduction

The progress of science and technology heavily relies on the capability to make reliable measurements. This has been beautifully described by Lord Kelvin in his lectures on electric measurements in 1883. ---?In physical science the first essential step in the direction of learning any subject is to find principles of numerical reckoning and practicable methods for measuring some quality connected with it. I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the state of Science, whatever the matter be". This spirit underlies the quest of scientists to make better and better measurements on a physical system to know it better and better. Today the measurement science and technology has entered into a domain, which was unexplored before. The measurements in this domain are described by the adjective "ultra" and they exemplify the ability of modern science to stretch the limits of measurement and thereby our understanding of the physical world. One such area is ultra sensitive magnetometry, where one looks for new methodologies and devices for measuring feeble magnetic fields.

### 2. Living with Magnetic Fields

Magnetic field is one of the most fundamental and omnipresent physical observable that carries information about all the electromagnetic phenomena. Most of the matter in the universe has magnetic fields associated with it, either of inherent, induced or permanent. For us, the most commonly encountered magnetic field is that of the Earth. Its strength at the surface ranges from  $\sim 30 \mu\text{T}$  (microTesla) around the equator to about  $60 \mu\text{T}$  around the magnetic poles. Biological systems also produce magnetic fields, however their strengths are very much smaller, in the range of  $\sim 10^{-10}$  T for heart and  $\sim 10^{-13}$  T for brain. Sensing of these fields is the area of biomagnetic imaging, e.g, NMR, MRI, which provides valuable information on physiological processes. We thus see that the range of magnetic fields in our day-to-day life covers over 8 orders of magnitude.

A magnetometer is a scientific instrument to measure the intensity and/or direction of the magnetic field in the vicinity of the instrument. Such measurements provide very useful information in various walks of life. It is important to note here that in all these applications, magnetometers offer non-invasive and non-destructive means of measurement.

For centuries magnetic compass was used as a navigation device. Today, fluxgate compasses are popular devices

used in ships and aircrafts. Magnetometers are used to detect shipwrecks, mineral deposits, and other buried or submerged magnetic objects. Under the sea, marine geophysicists and ocean engineers use magnetometers to detect variations in the total magnetic field of the underlying seafloor. Magnetic anomaly detectors detect submarines for military purposes. In environmental sciences magnetometers are used for detection of magnetic fields on the earth's surface and in the atmosphere to give indications of solar storms, earthquakes and other natural calamities. In archeological exploration, magnetometers find use in locating disturbances associated with baked materials, buried sites and walls, tombs, and objects of archeological interest. Magnetic transducers are used to detect and locate vehicles and to track the autonomous missiles or intelligent ammunition during the flight. Also these sensors serve as invisible antitheft labels for shops, books in libraries etc. as well can be used for identification and authorization purpose.

Today's medical science heavily relies on bio-magnetic imaging with ultra-sensitive magnetometers. Researchers have accomplished the most challenging aspect of brain imaging and localization of the underlying electrical activity, namely, magneto-encephalography. Among other medical applications, mention may be made to the measurement of bio-magnetic susceptibility of liver iron stores, which can lead to the diagnosis of haemochromatosis and thalassemia.

At the fundamental level, insightful experiments have been performed using highly sensitive magnetometers for the determination of electric dipole moment (EDM) of elementary particles, atoms and molecules, revealing the violation of fundamental symmetries of invariance under spatial inversion (parity, P), temporal inversion (time reversal, T) and the replacement of all particles by their antiparticles (charge conjugation, C) better known as CPT violation.

### 3. Space Magnetometry

Magnetometers are indispensable in any space mission these days. Consider for example a planetary mission in our solar system. In such a mission, measurement of magnetic field provides very valuable information on several aspects. Firstly, magnetic field observations provide clues to the early history and evolution of the planet, and also the early evolution of the solar system. Secondly the magnetic field measurement represents one of the few remote sensing tools that provide information about the deep interior of the planet rather than just its surface and/or atmosphere, which are usually studied with multi-spectral imaging instruments. Finally, they are essential to organize and understand energetic charged particles and plasma measurements, and to derive fundamental information about the environment that surrounds the planet.

The origin of magnetic fields of different objects of the Solar system is also different. Magnetic fields of Earth, Jupiter and Saturn are generated by dynamo, which is powered by the convection currents in their liquid metallic cores along with a

Coriolis effect caused by the planetary rotation. Mercury is magnetized by the remnants of an ancient dynamo that is decaying over time. Venus does not possess an intrinsic magnetic field. Mars does not possess an internal field, it died out ~ 3.5 billion years ago, but there exist strong "crustal" field (~ 1500 nT at spacecraft altitude of 110 km) and in several areas the field is arranged in linear structures. It is assumed that the outermost planets, Uranus and Neptune, have not formed metallic cores and their magnetic fields are generated closer to the surface.

Moon also does not possess internal magnetic field and is expected to have feeble magnetic field of crustal origin. Interestingly there exist several magnetic anomalies on the Moon where the field intensity is stronger than the ordinary regions. For example, strong anomalies have been observed over the Reiner Gamma formation on the western Oceanus Procellarum and over the Rima Sirsalis rille on the southwestern border of Oceanus Procellarum. Magnetic strength of Reiner Gamma is ~ 15 nT as measured from an altitude of 28 km. Similar features are also discovered in Mare Ingenii and Mare Marginis. There are several leading theories on the origin of Reiner Gamma and the other swirl features, which include for example, cometary impact, antipode effect of major basin formation, solar magnetic storm phenomena, and the gaseous alteration from lunar volcanism etc. Another important issue that is intimately connected with localized magnetic fields, albeit of low intensities, on Moon in particular. The surface field strength of this feature may be sufficient to form mini-magnetosphere, which could deflect the solar winds.

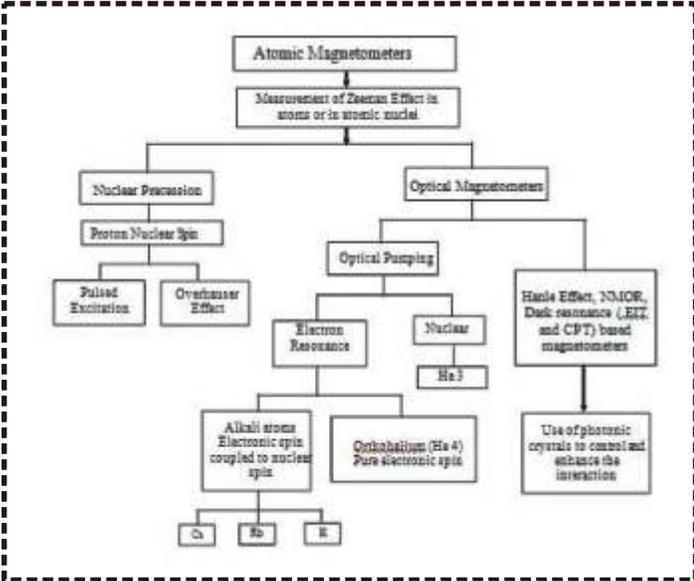
Planetary magnetometry is, thus, an exciting subject and that is behind the immense interests in precision measurement of magnetic fields on planetary objects, particularly on Moon. A magnetometer required for these space applications, however, is required to be space qualified.

### 4. Odyssey of Magnetometers

Beginning from the era of simple needle compass, the development of magnetic sensors has traveled a long way. Magnetic sensing techniques exploit a broad range of physics concepts, most of which based on the intimate connection between magnetic and electric phenomena, such as Lorentz force, Faraday rotation, Joule Effect, Thompson Effect, Hall Effect, Josephson Effect, Zeeman Effect and other galvanomagnetic effects.

The first absolute magnetometer was devised by Gauss and Weber in 1832 and it consisted of a permanent bar magnet suspended horizontally by a gold fiber. Even today, this simplest measurement technique in some form or the other is used for measuring magnetic fields. Other instruments include magnetic balances and fluxgate magnetometers. SQUIDs (Superconducting Quantum Interference Devices) are by far one of the most talked about sensitive magnetic sensors. They are based on the fundamental quantum effect of tunneling between two superconducting materials with an extremely thin separating layer. In spite of being

cumbersome with requirement of cryogenic cooling, for many years SQUIDS were undisputedly best in the field of ultra sensitive magnetometry with sensitivities of the order of 0.5-1.4 fT/Hz<sup>1/2</sup>. However for field experiments, e.g., Earth and space observations, they are certainly not suitable.



**Fig.1. Types of atomic magnetometers.**

Magnetometers based on nuclear precision exploit the property of polarization of atomic nuclei in the presence of strong magnetic field and then they detect the precession frequency while the nuclei decay to the non-polarized state after the polarizing field is turned off. This frequency is proportional to the magnitude of any ambient magnetic field that is present after the polarizing field is removed. While these magnetometers are easy to develop, their sensitivity is limited.

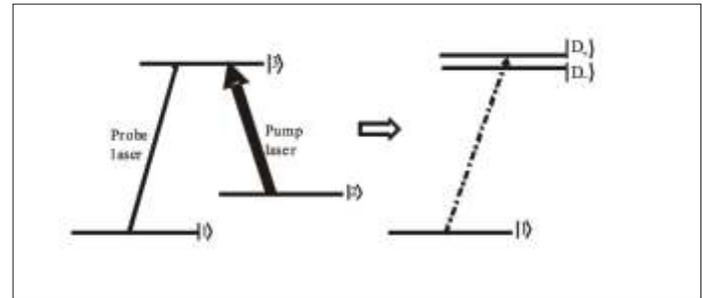
In recent years, much progress has taken place in the development of atomic (or optical) magnetometer, which can provide sensitivity comparable to SQUIDS. These devices are compact, portable, self-calibrating and require power in the range of a few watts. These advantages make them ideally suited for several applications including space missions. The underlying physics behind atomic magnetometers is the Zeeman effect, which corresponds to the splitting of the energy levels of atoms into multiple magnetic states in the presence of magnetic field.

This splitting, i.e., frequency difference between nearby magnetic states, when measured using precision spectroscopic experiments provides a direct measure of the magnetic field. The problem is thus reduced to ultra-precise measurement of transition frequencies in atom that is Zeeman split by external magnetic field. Depending on the technique employed for frequency measurement with a good signal to noise ratio, magnetometers can be classified into different categories as shown in fig1. The atoms used in these devices are, helium and alkali atoms, i.e., cesium, rubidium, potassium, which have sufficient vapor pressure at moderate temperatures. The maximum sensitivities

reported for different magnetometers are presented in Table 1.

### 5. Ultra Sensitive Magnetometers based on Optical Coherence

It is clear from Table-1 that the EIT and CPT based magnetometers are capable of providing sensitivity far better than other magnetometers. We therefore discuss here some of the salient features of this class of magnetometers. As has been discussed earlier, the basic principle of atomic/optical magnetometer is to measure accurately the Zeeman shift caused by the ambient magnetic field. In alkali atoms, this shift is typically a few Hz/nT. Shift of this magnitude cannot be measured in a standard spectroscopy experiment, i.e., absorption or fluorescence, due to masking by broad Doppler widths, (typically a few hundreds of MHz). The basic idea behind EIT/CPT magnetometers is to generate a spectrum of an ultra-narrow line width (tens to hundred of Hz), which facilitates measurement of the tiny Zeeman shift. In CPT/EIT, such ultra-narrow line widths are generated through laser induced coherence in atomic systems.



**Fig 2. Schematic representation of three level system coherently driven by two lasers.**

The origin of ultra-narrow line width in EIT experiments may be discussed by considering an excitation scheme consisting of three levels in an atomic system, as shown in Fig. 2. In this figure, a strong pump laser excites  $|2\rangle \rightarrow |3\rangle$  transition and a weak probe is scanned over  $|1\rangle \rightarrow |3\rangle$  transition. Such a three-level configuration is popularly referred to as  $\Lambda$  systems. The action of the strong coherent pump is to dress  $|2\rangle \rightarrow |3\rangle$  transition and that results into two dressed states  $|D_{\pm}\rangle$  which are superposition of levels  $|2\rangle$  and  $|3\rangle$ . The probe laser now addresses  $|1\rangle \rightarrow |D_{\pm}\rangle$  transitions simultaneously. Quantum interference between these transitions results into cancellation of absorption and an ultra-narrow transparency window appears at the position of  $|2\rangle \rightarrow |3\rangle$  resonance.

EIT is thus a “non-absorptive” resonance, which is not affected by the natural linewidth of atomic transitions. This in essence is the principle of performing 'subnatural' line width spectroscopy. CPT occurs when both lasers in the excitation scheme of Fig.2 are of strong intensity so that all the levels are dressed to form three dressed states,  $D_0$  and  $D_{\pm}$ . One of these dressed states, e.g.  $D_0$ , under specific experimental conditions becomes a “trapped” state in a sense that it remains isolated from the laser atom interaction process. Accumulation of population in this trapped state gives rise to an ultra-narrow transparency window, a non-absorptive or

“dark” resonance. The ultra-narrow dark resonances obtained in EIT. CPT experiments can now be used as a sensitive probe for measuring the tiny Zeeman shifts and correlate them to the ambient magnetic field.

Magnetometer Type	Sensitivity
Fluxgate	1 - 0.1 nT/Hz <sup>1/2</sup>
Proton	0.1 - 0.01 nT /Hz <sup>1/2</sup>
Overhauser	0.01 nT/Hz <sup>1/2</sup>
<sup>3</sup> He, <sup>4</sup> He	0.01 nT/Hz <sup>1/2</sup>
SQUIDs	0.5 fT/Hz <sup>1/2</sup>
Optically pumped	14 fT/Hz <sup>1/2</sup> (Cs, Rb), 10 fT/Hz <sup>1/2</sup> (K)
Hanle Effect	1.8 fT/Hz <sup>1/2</sup>
NMOR	0.3 fT/Hz <sup>1/2</sup>
CPT,EIT	12 fT/Hz <sup>1/2</sup>
CPT,EIT +SERF	160 aT/ Hz <sup>1/2</sup>

Table1. Comparison of sensitivities of various magnetometers.

Magnetometer based on dark resonance is schematically shown in Fig.3.

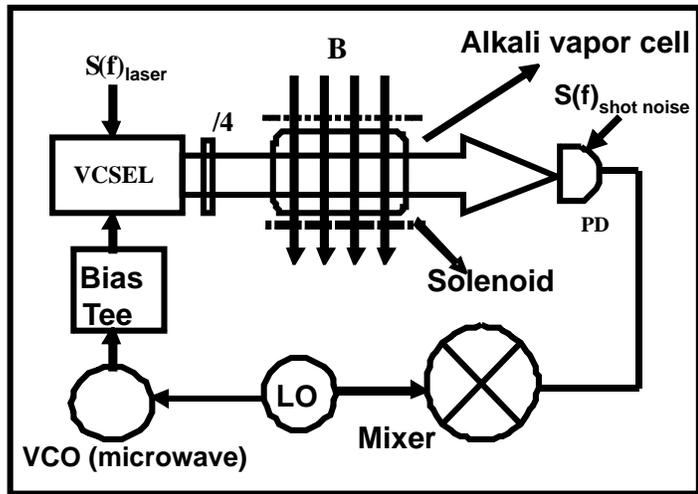


Fig. 3. Experimental set up for CPT based magnetometer. Here VCSEL = vertical cavity surface emitting laser, λ/4 = quarter wave plate, B = bias magnetic field, LO = local oscillator, VCO = voltage controlled oscillator, PD = photodiode and S(f) = Noise power spectral density.

Here a vertical cavity surface emitting lasers (VCSEL) is used as the pumping source. VCSEL drive current is

modulated at the frequency equal to the separation between the ground hyperfine levels of alkali atoms. The carrier and one of the first order sidebands serve as the pump and probe beam for the preparation of dark state. A solenoid, which generates small magnetic field (~ few mG) in the longitudinal direction, is wrapped around the vapor cell. A low frequency modulation (~ kHz) is applied to the drive current of the VCSEL to facilitate frequency modulation of laser and subsequent harmonic detection of Zeeman components of EIT signal. The fluctuations of error signal at the phase sensitive detector output used for locking VCO (voltage controlled oscillator) gives a measure of magnetic field.

All the optical magnetometers suffer from a common problem of spin relaxation due to collisions with the walls of the cell, which may limit their sensitivities. SERF magnetometers resolve this problem to a very large extent by operating the cell with a suitable buffer gas and coating the walls of the cell with appropriate paraffin. The inclusion of SERF technique with dark resonance magnetometers enhances their sensitivities by many orders of magnitude. We may mention here that these advances have resulted in achieving sensitivity of 0.16 fT/Hz<sup>1/2</sup> which surpasses the sensitivity of SQUID magnetometers.

**6. Miniaturization and Future Directions**

Current trend in magnetometer design and development is constantly towards realizing devices with smaller size, lower power consumption, and lower cost. These issues are extremely important for space magnetometry. In this context, we may mention the recent work on chip scale magnetometer of a size of 12 mm<sup>3</sup>. Power consumption of this device is 0.195 W and the sensitivity of a few pT/Hz<sup>1/2</sup>. Another development undergoing is the use of photonic crystals in these devices, which will increase the interaction between atoms and optical field, and in turn increase the sensitivity by many orders of magnitude. An additional development is the use of quantum entangled states, which demonstrates magnetic field sensing beyond quantum limits

Small sized atomic magnetometers are poised to revolutionize the medical field. Very recently a very sensitive (0.2 fT/Hz<sup>1/2</sup>), safe, portable, cheap, and flexible atomic magnetometer based MRI scanner has been demonstrated which has a good image quality. Developments such as this will eventually replace the costly and power intensive SQUID magnetometers for MRI, thereby making the cost affordable to billions of people.

In conclusion, atomic/optical magnetometers have revolutionized the field of ultra-sensitive magnetometry. Due to their small size, low power consumption and wide dynamic range, they are poised to replace the existing magnetometers for various applications, which include fundamental science, space, atmospheric and geomagnetic research and also in medical applications.

**Suggested Reading**

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systems. She has gathered many awards and honors during her career as a student and as a faculty. She received a Bronze medal of the chemical research society of India, the B. M. Birla Science award in chemistry and the INSA medal for young scientists. She is also a recipient of Swarnajayanti fellowship of DST in 2003-2004 and she is a fellow of Indian academy of sciences, Bangalore.

Prof. Chakravarty has successfully guided 5 students for their PhD thesis and ~12 students for doing M.Sc. project. Currently there are 5 Ph.D. students and one M.Sc. project student working in her laboratory. Her major research interests include development of path integral Monte Carlo simulation techniques to study quantum clusters, liquids and solids as well as classical Monte Carlo and molecular dynamics simulations applied to understand phase transitions, anomalous diffusional behavior in zeolites, Her recent work has been focused on understanding structure, entropy and diffusivity relations in liquids, specially with reference to understanding the anomalous properties of water and the associated implications for hydration.

She is married to Prof. R. Ramaswamy who is a Professor in School of Physical Sciences, Jawaharlal Nehru University, Delhi and has a 10 years old daughter. She feels that, with some degree of family and institutional support, combining both personal and professional goals is becoming increasingly more possible. She feels that multiple mechanisms to support and integrate women in various professions are very important, with appropriate mentoring and opportunities for developing professional networks playing an important role. In this regard, she feels that networks such as the IWSA can play a crucial role.

## WOMEN SCIENTISTS HONOURED BY BHATNAGAR AWARD

From 1958 to 2009, out of 443 awardees, only 11 are women scientists. The names of these awardees and the details are given below.

- (1). **Charusita Chakravarty**, Chemical Sciences- 2009
- (2). **Rama Govindarajan**, Engineering Sciences - 2007
- (3). **Sujatha Ramdorai**, Mathematical Sciences -2004
- (4). **Vijayalakshmi Ravindranath**, Medical Sciences- 1996
- (5). **Shashi Wadhwa**, - Medical Sciences-1991
- (6). **Sudipta Sengupta**, Earth Sciences-1991
- (7). **Manju Ray**, - Biological sciences -1989
- (8). **Parimala Raman**, - Mathematical sciences 1987
- (9). **Indira Nath** - Medical Sciences 1983
- (10). **Archana Sharma**, - Biological sciences -1975
- (11). **Asima Chatterjee**, - Chemical sciences 1961

## Women Achievers



**Charusita Chakravarty**  
- Bhatnagar Award- 2009

Prof. Charusita Chakravarty from IIT, Delhi, is the recipient of the Shanti Swarup Bhatnagar award in Chemical Sciences, in 2009, from the Council of Scientific and Industrial Research.

She has been a faculty member of the Department of Chemistry, Indian Institute of Technology, Delhi since 1994. She obtained her Ph.D. in Chemistry from University of Cambridge, UK in 1990 and did postdoctoral research in the University of California, Santa Barbara, USA. She works in the area of physical and theoretical chemistry, focusing on quantum and classical simulation methods for chemical

News update

### **Synthetic genome brings new life to a bacterial cell**

Research feasibility of making artificial organisms has resulted in building up a synthetic bacterial chromosome and expressing it in another bacterium, where it replaced the native DNA and began replicating and making a new set of proteins characteristic of the synthetic genome. This was achieved by Dr. Daniel Gibson and his team from Craig Venter Institute at California, USA. This step was achieved at a great expense- at an estimated \$ 40 million with 20 people working for more than a decade and represents an important milestone in the field of biotechnology.

Dr. Gibson synthesized the genome of *Mycoplasma mycoides* consisting of 1.1 million base pairs. After assembling it in a yeast cell, they transplanted it to a closely related bacteria *Mycoplasma capricolum* and it produced proteins characteristic of *Mycoplasma mycoides*.

The researchers initiated building this bacterial chromosome by first doing DNA shopping. They purchased more than thousand 1080 base sequences, which covered the whole of *M. mycoides* genome with the ends of 80 bases overlapping its neighbors. They used yeast to assemble the synthetic DNA in stages and the researchers stitched together 10,000 base sequences, followed by 100,000 base sequences and finally the complete genome. Then they introduced it into *M. capricolum* and selected for a blue coloured colony (blue showed that the cells were using the new genome). The colony grew and produced *M.mycoides* protein. The designed bacteria had the "synthetic DNA" including "watermark" sequences and the new cells were capable of continuous replication.

The work has shown that design, synthesis assembly and transplantation of synthetic chromosomes will no longer be a barrier for synthetic biology. As synthetic genome applications expand, it is anticipated that such work will raise ethical and philosophical issues which will have societal impact.

### **ABSTRACTS INVITED**

Indian Women Scientists' Association (IWSA) has announced the 'XI All-India Meeting of Women in Science' to be held at Navi Mumbai from 28<sup>th</sup> to 30<sup>th</sup> January, 2011. The theme of the conference is '**SCIENCE & TECHNOLOGY: ETHICAL ISSUES**'. Last date for submission of 'Abstracts' for oral presentation is 30<sup>th</sup> October, 2010 and intimation of acceptance will be by 30<sup>th</sup> November, 2010.

**(Please see page 5 for detailed announcement)**

### **THE INDIAN JOURNAL OF MEDICAL ETHICS**

#### **NATIONAL BIOETHICS CONFERENCE, 2010**

**Venue:** All India Institute of Medical Sciences,  
New Delhi

**Theme:** Governance of healthcare - ethics,  
equity and justice

**Date:** 17-20 November 2010

The NBC provides a space for researchers, clinicians, ethics committee members, students, teachers and activists to build a productive dialogue on governance in healthcare. Over the four days of the conference, participants will listen to plenary speakers giving overviews on important issues; present papers and posters on their own work and share their experiences; engage in discussions, and participate in workshops for skills building, information sharing and development of guidelines.

Please visit <http://nbc3.ijme.in/> for information on the conference, fellowships and registration.

### **Update your data on the internet Management Information System (MIS)**

The IWSA members' database is now available on the web and can be accessed on line. The site address is [iwsa.net/members](http://iwsa.net/members), which gives a list of ALL the members whose data has been entered. Anyone can view the data of members and search as well.

You can view the registered members. This is alphabetic (first name wise). Once you locate your name, click to view details for viewing your details. You have a name and password (password is same as name). Using this name and password, you can login as a registered user, view your details, make changes / update your own data and save in the database. All members please note that this updating is absolutely important as, in many cases updated data is not available.

We urge you to update your data ASAP. In case you need any assistance, kindly contact IWSA office at [iwsahq@gmail.com](mailto:iwsahq@gmail.com) or Tel. No. 022 27661806.

You can search the database. The following searches have been incorporated:

**Search By Name**  
**Search By Location/Branch**  
**Search By Highest Qualification**  
**Search By Area of Interest**  
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*Inauguration of SGPW-2010 National Conference, Kolhapur.*



*Field visit to Solid Waste Management sites  
Dr. Sharad Kale with participants.*

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