EVERYMAN’S SCIENCE

Vol. LIV No.- 2 (JUNE - JULY 2019)


Prof. K. S. Rangappa (2020)  Dr. (Mrs.) V. L. Saxena (2021)

THE INDIAN SCIENCE CONGRESS ASSOCIATION, KOLKATA
MEMBERS OF THE COUNCIL FOR 2019-2020

General President
Prof. K. S. Rangappa, Mysore

Immediate Past General President
Dr. Manoj Kumar Chakrabarti, Kolkata

General President-Elect
Dr. (Mrs.) Vijay Laxmi Saxena, Kanpur

General Secretary (Membership Affairs)
Dr. S. Ramakrishna, Bengaluru

General Secretary (Scientific Activities)
Dr. Anoop Kr. Jain, Kanpur

Treasurer
Dr. Sheo Satya Prakash, Patna

Elected Members of the Executive Committee
Dr. Ashok Kumar Saxena, Kanpur
Mr. Gauravendra Swarup, Kanpur
Prof. R. Ramamurthi, Tirupati
Mrs. Rashmi Mittal, Jalandhar
Prof. M. Bhupathi Naidu, Tirupati
Dr. O. N. Paramasivam, Coimbatore
Prof. Sasmita Rani Samanta, Bhubaneswar
Prof. D. Narayana Rao, Guntur
Prof. S. V. Kasmir Raja, Kattankulathur
Prof. K. Byrappa, Mandya.

Representative of Department of Science & Technology, Government of India
Dr. B. K. Shukla, New Delhi

Local Secretaries
Dr. Y. G. Shadakshari, Bengaluru
Dr. K. C. Narayanaswamy, Bengaluru

Past General Presidents
Prof. M. S. Swaminathan, Chennai
Prof. R. P. Bambah, Chandigarh
Prof. C. N. R. Rao, Bangalore
Prof. D. K. Sinha, Kolkata
Prof. S. K. Joshi, New Delhi
Dr. P. Rama Rao, Hyderabad
Dr. (Mrs.) Manju Sharma, New Delhi
Dr. R. A. Mashelkar, Pune
Dr. R. S. Paroda, New Delhi
Dr. K. Kasturirangan, Bengaluru
Prof. Asis Datta, New Delhi
Prof. N. K. Ganguly, Faridabad
Prof. Harsh Gupta, Hyderabad
Dr. T. Ramasami, Chennai
Dr. G. Madhavan Nair, Trivandrum
Prof. K. C. Pandey, Lucknow
Prof. Geetha Bali, Bengaluru
Prof. Manmohan Singh, New Delhi
Prof. Dr. Ranbir Chander Sobti, Lucknow
Prof. Dr. Achyuta Samanta, Bhubaneswar

Past General Secretaries
Dr. (Miss) Shashi Prabha Arya, New Delhi
Prof. H. P. Tiwari, Allahabad
Prof. S. P. Mukherjee, Kolkata
Dr. (Mrs.) Yogini Pathak, Vadodara
Prof. Uma Kant, Jaipur
Prof. B. Satyanarayana, Hyderabad
Prof. B. P. Chatterjee, Kolkata
Prof. S. P. Singh, Kurukshetra
Prof. Avijit Banerji, Kolkata
Dr. Nilangshu Bhusan Basu, Kolkata
Prof. Arun Kumar, Imphal
Prof. Gangadhar, Bangalore
Prof. Premendu M. Mathur, Pondicherry

Past Treasurers
Dr. S. B. Mahato, Kolkata
Prof. Dhyanendra Kumar, Arrah
Prof. Ranjit Kumar Verma, Munger

Sectional Presidents
Dr. Umapanta Behera, Meghalaya
Prof. Prakash Chandra Joshi, Haridwar
Prof. Suresh Bhai M. Makvana, Vallabhvidyanagar
Prof. Diwan S. Rawat, Delhi
Prof. R. B. Singh, Delhi
Dr. Asit Kumar Das, Jamnagar
Dr. Ranbeer Singh Rawal, Almora
Prof. Md. Nurul Hoda, New Delhi
Dr. S. Srikanthaswamy, Mysuru
Prof. S. K. Nimbhorkar, Aurangabad
Dr. Deep N. Srivastava, New Delhi
Prof. Sudip Kumar Ghosh, Kharagpur
Prof. Santhosh Chidangil, Manipal
Prof. (Ms.) Y. Vimala, Meerut

Elected Members of the Council
Mrs. Kumkum Swarup, Kanpur
Dr. Nibedita Chakrabarti, Kolkata
Prof. Sunil Prakash Trivedi, Lucknow
Dr. M. G. Ragnathan, Chennai
Dr. K. T. Chandra Shekar, Mysuru
Prof. C. Muthamizhchelvan, Kattankulathur
Dr. A. M. Saxena, Lucknow

Representative of The Kolkata Municipal Corporation
Mr. Jayoti Prakash Sarkar, Kolkata

Editor-in-Chief of Everyman’s Science
Dr. Ashok Kumar Saxena, Kanpur

Representative of Indian National Science Academy
(INSA) Council
Prof. N. R. Jagannathan, New Delhi
EDITORIAL :

RECENT TRENDS IN CHEMICAL SCIENCES
R. N. Yadava 75-76

ARTICLES :

TESTING OF ADULTERANT USING HOUSEHOLD CHEMICALS
Sunita Bansal and Sangita Aggarwal 77-85

BIODRAINAGE—A SUSTAINABLE WAY TO CONTROL WATERLOGGING AND SALINITY
J. C. Paul and B. Panigrahi 86-92

GRAVITATIONAL WAVES AND LIGO: OPENING A NEW WINDOW TO UNIVERSE
Sumita Singh and Arnav Pushkar 93-98

LIFE SKETCH OF OFFICE BEARERS, SECTIONAL PRESIDENTS AND RECORDERS OF 107TH INDIAN SCIENCE CONGRESS 99-124

KNOW THY INSTITUTIONS 125-127

CONFERENCES/MEETINGS/SYMPOSIA/SEMINARS 128-129

S&T ACROSS THE WORLD 130-136
Plants are unlimited source of natural products. India has immense medicinal plant diversity having vast variety of flora and fauna. All the major system of medicine e.g. Ayurveda, Unani and Homeopathy are largely based on drugs of plant origin. About 80% of the raw material for the drugs used in Ayurvedic and Homeopathic system of medicine, are based on plant based drugs which are the principal support of 70-80% of the world population for their primary health care. At present there is a growing appreciation all over the world for the greater use of Indian traditional medicine to provide comparatively inexpensive and safe health care for the ailing masses. Clinical, pharmacological, and chemical studies of these traditional medicines, which were derived predominantly from plants, were the basis of most early medicines such as aspirin, digitoxin, morphine, quinine, and pilocarpine, etc. Thus, research on plant products is playing a very important role in the drug delivery process of pharmaceutical industry as it is evident that approximately 60% anticancer compounds and 75% of drugs for infectious diseases are either natural products or natural product derivatives. Plant products especially secondary metabolites obtained from medicinal plants may take part in plant-microorganism and plant-plant interactions and are termed as allelochemicals. In plants, allelochemicals can be present in the leaves, bark, root, flowers and fruits. Allelochemicals produced by plants are released into environment which suppress or stimulate the growth of neighbouring plants when they are absorbed by plants. These chemicals include flavonoids, terpenoids, saponins, tannins, alkaloids and aromatic acids, etc. Flavonoids especially their glycosides are the most abundant polyphenols in food and over 15000 flavonoids have been separated and identified from plants. Among various nature-origin phytochemicals, flavonoids have received much attention due to their biological significance. Flavonoids have been reported to have antimicrobial, antiviral, antitumor, cardiovascular, molluscicidal, spermicidal, cytotoxic, antimutagenic, antiulcerogenic, antiinflammatory, antioxidant and antiaging activities. Some flavonols like catechins posseses astringent characteristics and they act as feeding repellants, while isoflavones are important plant protective phytoalexins. Flavonoids play an important role in the ecology of plants. Due to their attractive colors, flavonols, flavones and anthocyanidins are likely to be a visual signal for pollinating insects. Allelopathy is an emerging branch of applied sciences, which studies biochemicals plant-plants and plant-microorganisms interactions. Allelopathy is new technical word derived from the two Greek words Allelo and Pathy (means mutual harm), which
was used in 1937 by the Ausrtrian Professor Hans Molisch. According to him allelopathy is defined as “Biochemical interactions that inhibit the growth of neighbouring plants by another plants”. Allelopathy (E.L. Rice 1984) is defined as “All direct positive or negative effects of a plant on another plant or on microorganism by the liberation of biochemicals into the natural environment”. In 1996 International Allelopathy society (IAS) defined allelopathy as “any process involving secondary plant metabolites produced by plants, algae, bacteria and fungai that influences the growth and development of agricultural and biological systems”. All the secondary plants metabolites are called as allelochemicals and can have beneficial (positive allelopathy) or detrimental (Negative allelopathy) effects on the target organisms and community. It is the new area of multidisciplinary research in which Chemists and Biologists can work together. Those allelochemicals which suppress the growth of the palnts may be used as natural herbicides in weed control management and those who stimulate the growth of the plants may be used as natural fertilizers. Since the use of synthetic fertilizers and synthetic pesticides, causes a variety of fatal diseases like cancer, hepatitis etc. Therefore, these allelochemicals may be used as a good alternative of synthetic fertilizer and synthetic herbicides. For clean environment, to avoid health hazards and for development and sustainability of organic/agriculture, research work in the area of allelopathy is essential for agriculture.

Prof. R. N. Yadava
Pro Vice-Chancellor
Purnea University, Purnia
Bihar

_Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world._

—Louis Pasteur
TESTING OF ADULTERANT USING HOUSEHOLD CHEMICALS

Sunita Bansal* and Sangita Aggarwal

Food is essential for sustenance of life. Health of human being depends on quality of food that they consume and quality of food can be lowered by adulteration. Food is declared to be adulterated when some prohibited or cheaper substance is added/ removed partly or wholly. Sometime food is completely imitated or artificial or other chemicals (like color, processing) are added to improve its appearance and taste. In country like India main cause of adulteration is financial gain to increase the weight of substance and to make it more attractive. Food prepared, packed or stored in unhygienic condition is also one of major cause of adulteration. Food adulteration is punishable act and many rules have been imposed by government agency but still adulteration is reported on daily basis. Awareness and knowledge of detecting common adulterant by some simple methods can prove to be a one of weapon to fight against adulteration. Day to day food can be screened with little basic knowledge, which is discussed here.

INTRODUCTION

The healthy wellbeing of mankind depends on the quality food they consume. Access to good quality food that one eats and how one eat it. Food is adulterated if its quality is lowered or affected by the addition of substances which are injurious to health or by the removal of substances which are nutritious. According to Food Safety and Standards Authority of India (FSSAI)\(^1\), also the technical definition of adulteration is addition or subtraction of substance to or from food substance so that natural composition and quality of food substance get affected. Purpose of adulteration is not only to increase the weight but also to improve taste/ lifetime/appearance/ productivity of food\(^2\). All these above mentioned practices adulterate/contaminate food. The addition and removal of some substances (Physical contamination), is not as harmful as Chemical contamination where chemicals are added during the processing of food beyond permissible level, affects the quality and can prove to be toxic. Food contaminated with microbes (Microbial contamination) is also one of the biggest causes of health problems. Sometime metals may also enter into food through air, water, soil, industrial pollution and other routes (Metallic contamination) and also proves to be fatal if cross certain limits. So the foods that get contaminated by any means, become unfit for consumption, come under the category of adulterated food. The adulteration of the food items can occur at various stages:
EFFORTS BY GOVERNMENT TO CONTROL ADULTERATION

To control adulteration the FSSAI has also been established under Food Safety and Standards Act, 2006 which consolidates various acts and orders that have hitherto handled food related issues in various Ministries and Departments. FSSAI has been created for laying down science based standards for articles of food and to regulate their manufacture, storage, distribution, sale and import to ensure availability of safe and wholesome food for human consumption. Along with the regulations in farming, production, packaging, transportation, etc. they are doing following programs:

• Creating an information network across the country so that the public, consumers, panchayats, etc., receive rapid, reliable and objective information about food safety and issues of concern.
• Provide training programs for persons who are involved or intend to get involved in food businesses.
• Contribute to the development of international technical standards for food, sanitary and phytosanitary standards.
• Promote general awareness about food safety and food standards.

Despite of so many efforts of government agencies consumer are still facing adulterations. Increased demand during festival season leads to rampant adulteration. Paneer, khoya, milk, oils, ghee, etc. are most targeted items. Milk and milk products are generally adulterated with starch which is used to give a thick, rich texture to these products. Urea, washing soda, alkali, etc., are the ingredients which are used to prepare synthetic milk. Mustard seeds and mustard oil is generally adulterated by argemone seeds. Also, ‘palm stearin’, a non-edible by-product of crude palm oil, is used as an adulterant in vanaspati ghee. Artificial colors and dyes are used in the sweets to improve their appearance and aroma. These adulterants can lead to nausea, vomiting, diarrhoea, skin ailments and cause paralysis and cancer in extreme cases. The adulterated ‘ghee’ may cause allergy, tingling of the sensory nerves and allergic arthritis, if consumed for longer period.

Now where do consumers go to have a quality food for their good health? There are many survey reports available which say it is not necessary that if you purchase goods from branded shop, will be safe and free from adulteration; it might be more adulterated to improve its appearance and taste. Consumer wants to be sure that what they are eating is safe so it is very much necessary that one must try to test or get them tested for adulteration time to time. Hence some efforts have been done to develop few tests to check the adulteration in food items at home. These are cost-effective and rapid methods for detection of adulterant using household chemicals. A house maker can easily perform these tests having no knowledge of science.

TESTS OF ADULTERANTS IN VARIOUS FOOD ITEMS

The following food items can be tested for the various adulterants at home with little effort using household chemicals:

1. Spices and pulses
2. Milk and other dairy products
3. Oils
4. Green vegetables
Table-1. Test for spices:

<table>
<thead>
<tr>
<th>ITEMS (Spices)</th>
<th>ADULTERANTS</th>
<th>TEST</th>
<th>REASON FOR ADULTERATION</th>
<th>HEALTH EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilli powder</td>
<td>Brick Powder (increased risk of cancer, especially in the gallbladder and stomach)</td>
<td>1. Brick powder settles fast and chilli powder settles slowly when added into glass of water. Further rubbing the sediments will give the feel of grittiness. 2. To a little powder of chilly add small amount of toilet cleaner and mix to the consistency of paste, dip the rear end of a match stick into the paste and hold over the flame, brick red flame colour due to the presence of calcium salts in brick powder. Water soluble colour can be detected by sprinkling a small quantity of powder on full glass of water. The water soluble colour will start descending in colour streak.</td>
<td>To increase the quantity. To improve the texture and feel of spices. To improve the bulk.</td>
<td>Stomach disorder Can cause cancer Stomach disorder</td>
</tr>
<tr>
<td></td>
<td>Color impurity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Starch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turmeric powder</td>
<td>Any powder (starch, wheat flour etc.) colored with Metanil yellow</td>
<td>Add few drops of toilet cleaner to the sample. Instant pink/violet color, which disappears on dissolution with water, indicates pure turmeric. If colour persists hence metanil yellow is present. Also, If the mixture releases small bubbles, it indicates the presence of chalk powder.</td>
<td>To increase the quantity and texture of powder.</td>
<td>Stomach Disorder, Neurotoxic, hepatotoxic Not very toxic but may causes stomach disorder, kidney stone.</td>
</tr>
<tr>
<td></td>
<td>Chalk powder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lead chromate</td>
<td>1. Mix a teaspoon of turmeric powder in a glass of water. If adulterated, it will immediately leak streaks of water-soluble colour.</td>
<td></td>
<td>Can damage all of the body systems,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEMS (Spices)</td>
<td>ADULTERANTS</td>
<td>TEST</td>
<td>REASON FOR ADULTERATION</td>
<td>HEALTH EFFECTS</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>------</td>
<td>--------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Asafoetida (hing)</td>
<td>Soapstone, other earthy matter</td>
<td>2. Shake ¼ teaspoon with 5ml of water and add a few drops of toilet cleaner. Pink colour indicates the presence of lead chromate.</td>
<td></td>
<td>including the heart, intestines, bones, kidneys, teeth, reproductive organs, and the nervous and immune systems⁹.</td>
</tr>
<tr>
<td>Black pepper</td>
<td>Papaya seeds, light berries etc.</td>
<td>1. Shake a small quantity of sample with water. Papaya seeds will float in water and black pepper will settle down. The results can be further improved if we take spirit or nail polish remover instead of water. 2. Visually black pepper are black in colour and papaya seeds are brownish black and shrunken and oval in shape.</td>
<td>To increase the quantity</td>
<td>To increase the quantity and making more profit</td>
</tr>
<tr>
<td>Jeera</td>
<td>Grass seeds coloured with charcoal dust</td>
<td>Rub cumin seeds on palm, palm turns black</td>
<td>To increase the bulk.</td>
<td></td>
</tr>
<tr>
<td>Dhania powder</td>
<td>Horse dung</td>
<td>1. Soak little dhania powder in water. Horse dung will float and give foul smell. Natural smell of dhania powder will not be there. 2. Keep moist dhania powder for 1-2 days, colonies of bacteria will grow if dung is present in it, it will give foul smell.</td>
<td>To increase the quantity.</td>
<td></td>
</tr>
<tr>
<td>Saffron</td>
<td>Coloured dried tendrils of maize cob</td>
<td>Genuine saffron will not break easily but artificial saffron breaks. Artificial saffron lose colour before lasting whereas real saffron continues to give color till end.</td>
<td>To increase the quantity.</td>
<td></td>
</tr>
</tbody>
</table>
Table-2. Test for Pulses:

<table>
<thead>
<tr>
<th>ITEMS (Pulses)</th>
<th>ADULTERANTS</th>
<th>TEST</th>
<th>REASON OF ADULTERATION</th>
<th>HEALTH EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arhar</td>
<td>Khesari dal</td>
<td>1. Visual test – It is slant on one side and square in appearance in contrast to other dal. 2. Add 3-4 drops of toilet cleaner to small amount of dal in water and keep on simmering water for about 45 min. The pink colour indicates the presence of khesari dal.</td>
<td>To increase quantity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metanil yellow</td>
<td>Add toilet cleaner to small quantity of pulse. Keep on simmering water for about 15 min. The pink colour indicates the presence of metanil yellow.</td>
<td>To enhance texture of yellow dal.</td>
<td>Stomach Disorder, Neurotoxic, Hepatotoxic.</td>
</tr>
<tr>
<td>All yellow pulses (Chana, Arhar, dhuli moong, etc.)</td>
<td>Lead Chromate</td>
<td>Shake 5gm of pulse with 5ml of water and add a few drops of toilet cleaner. Pink colour indicates the presence of lead chromate.</td>
<td>Can damage all of the body systems, including the heart, intestines, bones, teeth, kidneys, and reproductive organs, nervous and immune systems.</td>
<td></td>
</tr>
</tbody>
</table>

By using some tests available in literature for testing the adulterants and by interpretation of the physical and chemical properties of food items a list of chemical tests, physical tests and solubility tests etc. are prepared with modification. Only those modified tests have been reported in this list which can be performed at home.

List of chemicals that are available at home are listed below and tests are reported in table 1-5.

**List of Chemicals used (available at home):**
- a. Toilet cleaner : Dil. /Conc. HCl
- b. Nail paint Remover : Acetone
- c. Washing soda : Na₂CO₃
- d. Edible soda : NaHCO₃
- e. Vinegar : CH₃COOH
- f. Lemon Juice : Citric acid
- g. Turmeric : Indicator
- h. Tincture iodine: Iodine
- i. Wax

**Spices and Pulses:** In wholesome spices and pulses dirt, pebbles, stone, dust, straw, damaged seeds, animal or bird excreta, dead insects may be present. These adulterants can be easily
Table-3. Test for milk and milk products:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ADULTERANTS</th>
<th>TEST</th>
<th>REASON OF ADULTERATION</th>
<th>HEALTH EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>Water</td>
<td>Put a drop of milk on a polished vertical surface (provided some other thickening material is not added into it). The drop of pure milk flows slowly leaving a white trail behind it whereas the drop of milk adulterated with water will flow immediately without leaving any mark.</td>
<td>To increase the quantity of milk</td>
<td></td>
</tr>
<tr>
<td>Synthetic milk (mixture of water, urea, soap or detergent, stabilizer, sodium hyroxide, vegetable oil and salt)</td>
<td>Urea/detergent or soap / sodium hydioxide</td>
<td>Take a small amount of milk. Add ½ teaspoon of soybean or arhar dal powder. Mix up the contents thoroughly. After 5 minutes, add ¼ spoon of turmeric powder in it. A change in colour from yellow to red indicates the presence of urea/ washing powder in the milk.</td>
<td>To make profit/ money</td>
<td></td>
</tr>
<tr>
<td>Khoya, Paneer, other milk products and milk</td>
<td>Starch</td>
<td>Take a small sample of product, add 20ml of water and bring it to boil. Cool to room temperature and add 1-2 drops tincture iodine solution. If the solution turns blue then it indicates the presence of starch.</td>
<td>To give a thick and rich texture</td>
<td>Stomach disorder</td>
</tr>
<tr>
<td>Ghee</td>
<td>Mashed potato, sweet potato etc.</td>
<td>Boil 5ml of sample, cool it and add a drop of tincture iodine solution. Blue colour indicates the presence of mashed potatoes.</td>
<td>To increase quantity and thickness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vanaspati or Margarine</td>
<td>Melt a small quantity of ghee and then add equal quantity of toilet cleaner shake it well for one minute. Now let it stand for five minute. Crimson red colour appears if vanaspati or margarine is added.</td>
<td>To make profit.</td>
<td>Cardiovascular disease(^{10})</td>
</tr>
</tbody>
</table>
Table-4. Test for oil, fats and others:

<table>
<thead>
<tr>
<th>FOOD ITEM</th>
<th>ADULTERANT</th>
<th>TEST</th>
<th>REASON FOR ADULTERATION</th>
<th>HEALTH EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustard Oil &amp; Coconut Oil</td>
<td>Argemone Oil</td>
<td>Heat the mixture of oil with little amount of toilet cleaner for 2-3 min. Red colour appears</td>
<td>To increase the quantity and consistency</td>
<td>Epidemic dropsy, carcinogenic¹¹</td>
</tr>
<tr>
<td>Coconut oil</td>
<td>Cheap oils</td>
<td>Freeze the oil in refrigerator for 1-2 hour, some oil remains in liquid form.</td>
<td>To increase the quantity</td>
<td></td>
</tr>
<tr>
<td>Honey</td>
<td>Sugar syrup, Glucose solution or starch</td>
<td>1. Refrigerate honey bottle if it is pure it will not solidify. 2. Take a cotton wick soak it with honey now burn. If sugar syrup is added, it burn with pop up sound.</td>
<td>To increase the quantity</td>
<td>Harmful for diabetic patients</td>
</tr>
<tr>
<td>Bura Sugar</td>
<td>Washing, chalk powder</td>
<td>1. Effervescence with toilet cleaner. 2. To the solution of bura powder in water add ¼ tea spoon of haldi, will turn red.</td>
<td>To increase quantity and its consistency.</td>
<td>May cause kidney stone</td>
</tr>
<tr>
<td>Tea and Coffee</td>
<td>Iron filling</td>
<td>Move a magnet over tea or coffee, iron filling will stick to it.</td>
<td>To increase quantity and weight.</td>
<td>Stomach disorder</td>
</tr>
<tr>
<td>Jaggery</td>
<td>Metanil yellow</td>
<td>Dissolve Jaggery in water then add toilet cleaner to it, colour changes to Magenta.</td>
<td>To enhance the texture.</td>
<td>Stomach Disorder, Neurotoxic⁷, hepatotoxic⁸.</td>
</tr>
</tbody>
</table>

recognized by eye examination and can be separated just by hand picking. Problem arises when something which cannot be recognized visually and added into it intentionally and smartly to increase the sale of product. Some of the items which are found to be adulterated are given in Table 1 & 2 along with the chemical test which can be performed at home using household chemicals:

Milk and Milk Products: Milk is considered to be the ‘ideal food’ because of its abundant nutrients required by all (young and old). It is one of the best sources for protein, fat, carbohydrate, vitamin and minerals. And everyone wants to consume it and its products in sufficient amount. Unfortunately milk is being very easily adulterated throughout the world. Possible reasons
Table-5. Test for vegetables and fruits:

<table>
<thead>
<tr>
<th>FOOD ITEM</th>
<th>ADULTERANT</th>
<th>TEST</th>
<th>REASON OF ADULTERATION</th>
<th>HEALTH EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green vegetable (Beans, Spinach, Parmal, Capsicum, Lady Finger, Tori, Frozen matar, Bitter gourd, Kakora, etc.)</td>
<td>Sprinkled or dipped in solution of malachite green</td>
<td>Take a cotton piece soaked in liquid paraffin/vegetable oil and rub the outer green surface of a small part of green vegetable. If the cotton turns, green, we can say the vegetable is adulterated with malachite green.</td>
<td>To give attractive and fresh look.</td>
<td>Cause carcinogenesis, mutagenesis, chromosomal fractures, teratogenecity and respiratory toxicity(^{13}).</td>
</tr>
<tr>
<td>Fruits like apple</td>
<td>Coated with wax</td>
<td>Scratch the surface of apple with the help of knife, if some semisolid mass comes out it is coated with wax.</td>
<td>lock the moisture of fruit</td>
<td></td>
</tr>
<tr>
<td>Black berries (Jamun)</td>
<td>Dipped in solution of crystal violet</td>
<td>Dip jamuns in lukewarm water for 5 minutes, purple colour appears in water.</td>
<td>Improve the brightness</td>
<td>Cause mitotic poison, potent carcinogen and clastogene promoting tumor growth(^{14}).</td>
</tr>
</tbody>
</table>

behind it may include-demand and supply gap. The adulteration in milk and its product cannot be seen by naked eye, but it can be tested easily in home by doing following simple tests as given in Table 3:

**Oil, fats and miscellaneous:** Vegetable oils and fats have a big contribution in our diet as cooking or frying oil, salad oil or in food products formulation. These are so expensive, that’s why there is temptation to adulterate them with other lower price vegetable oils and fats to achieve more profit as given in Table 4.

**Vegetables and Fruits:** Vegetables and fruits are coloured\(^{12}\) with the dye and waxed to enhance their colour and their texture. This thing have been noticed by many people while sharing their experience of getting colour during washing of vegetables and fruits (Table 5).

**Conclusion:** Food adulteration is worse in developing and underdeveloped countries due to the absence of adequate monitoring and lack of proper law enforcement. Therefore, consumers have to be alert and check the adulteration by their own time to time using the simple and easy experiments discussed above to keep themself healthy, as we know health is wealth.
REFERENCES

1. FSSAI, Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India, New Delhi, India, 2011
5. S. Abhirami and Radha; *International Journal of recent scientific research* 6, 8, 5938-5943, 2015.
Agriculture makes the largest demand on land and fresh water resources on earth. Sustained irrigated agriculture is not possible without proper drainage to remove excess ground water. The most commonly practiced sub-surface drainage method, in which saline waters are discharged into natural streams pollutes water and is environment-unfriendly. Trees transpire a good deal of water and also remove minerals to some extent from the soil. Properly planned and grown plantations in an irrigated area can help to achieve appropriate water and salt balance so that the ground water table does not rise enough to cause water logging and the minerals brought in the area by irrigation water are all removed by the utilizable bio mass produced from the plantations and agriculture crops. Bio-drainage is a promising and environment friendly option, which would be socially acceptable and a least cost measure to mitigate the problem of water logging and salinity.

INTRODUCTION

Sustainable development is a process, through which the needs of the present generation are met without compromising on the ability of the future generations to meet their needs. Food, fiber and fodder are the three most important agricultural products necessary to sustain life. The future generations will always have more numbers to consume agricultural produce. Its two important production bases—land and water are, however, limited and are also degradable. From the past experience, it can be conclusively said that when water availability is ensured for agriculture, initially it brings in vast improvement in agricultural production. But in many countries, little attention is paid to proper agronomic practices, soil management and the need for drainage. Sumerian empire flourished about four thousand years ago in Mesopotamia, in the plains of rivers Tigris and Euphrates, on the base of highly developed irrigation system. Later, large-scale salinisation rendered the farm lands unproductive and this contributed to the collapse of the empire. In California’s Imperial valley, drainage water from irrigated lands is discharged into the Salton sea, whose salinity is on the increase. Similarly, discharge of drainage water from irrigated lands in San Joaquin Valley, California into the Kestenson reservoir has resulted in problems of toxicity and discovery of selenium in the biota. Extensive irrigation systems from Nile in Egypt and from river Indus in India and Pakistan have endowed great benefits but have also brought about problems of water logging and salinisation, which if not tackled, can undo the benefits of irrigation and cause large scale environmental degradation.

Irrigation, in absence of proper drainage, causes water logging and soil salinisation. Sustained irrigated agriculture is not possible without proper drainage to remove excess groundwater. The most commonly practiced sub-surface drainage method, have two drawbacks, namely, these are costly and
they generate drainage effluents, which will have to be either carefully reused or safely disposed of. Trees transpire a good deal of water and also remove minerals to some extent from the soil. Properly planned and grown plantations in an irrigated area, can help achieve appropriate water and salt balance so that the groundwater table does not rise enough to cause water logging and the minerals brought in the area by irrigation water are all removed by the utilizable bio mass-produce from the plantations.

**IRRIGATION AND DRAINAGE**

India has made great strides in irrigation development since independence and has one of the largest irrigation networks in the world. The irrigation potential has increased from 22.6 Mha in the pre-plan period to about 85.0 Mha at the end of 1993-94 comprising 31.8 Mha under major and medium irrigation projects and 53.2 Mha in minor irrigation schemes. The ultimate irrigation potential of about 178 Mha is expected to be accomplished by 2025 and this will provide irrigation facilities to about 80 per cent of the cropped area. Every year additional areas are brought under irrigation due to development of new irrigation projects. At the same time considerable areas under irrigation are going out of cultivation due to salinisation and bad drainage. An area of roughly 18 Mha suffers from the twin malady of water logging (8.53 Mha) and soil salinity/sodicity (9.38 Mha), which is equivalent to about 13 per cent of the net cultivated area. Majority of the affected areas are in irrigation commands, though some areas in the coastal belt are also affected. Information on the water logged and salt affected areas in some of the states of India are presented in (Table 1).

For the state of Orissa, the total cultivable area is 59.64 lakh ha and the total irrigated area is 16.82 lakh ha from various sources, which is 28.2 per cent of the culturable area. A survey conducted by ORSAC, Bhubaneswar found that 0.85 lakh ha of land is water logged in Orissa.

**BIODRAINAGE**

All plants transpire water. The rate of transpiration depends primarily upon climatic condition, type and species of plantation, and availability of soil moisture in the root zone.

**Table 1. Geographical, water logged and salt affected areas of some states in India**

<table>
<thead>
<tr>
<th>State</th>
<th>Geographical area Mha</th>
<th>Water logged area Mha</th>
<th>Salt affected area Mha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>27.44</td>
<td>0.339</td>
<td>0.813</td>
</tr>
<tr>
<td>Bihar</td>
<td>17.40</td>
<td>0.363</td>
<td>0.400</td>
</tr>
<tr>
<td>Gujrat</td>
<td>19.60</td>
<td>0.484</td>
<td>0.455</td>
</tr>
<tr>
<td>Haryana</td>
<td>4.22</td>
<td>0.275</td>
<td>0.455</td>
</tr>
<tr>
<td>Karnataka</td>
<td>19.20</td>
<td>0.036</td>
<td>0.404</td>
</tr>
<tr>
<td>Kerala</td>
<td>3.89</td>
<td>0.012</td>
<td>0.026</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>44.20</td>
<td>0.057</td>
<td>0.242</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>30.75</td>
<td>0.111</td>
<td>0.534</td>
</tr>
<tr>
<td>Orissa</td>
<td>15.54</td>
<td>0.196</td>
<td>0.400</td>
</tr>
<tr>
<td>Punjab</td>
<td>5.04</td>
<td>0.199</td>
<td>0.520</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>28.79</td>
<td>0.348</td>
<td>1.122</td>
</tr>
<tr>
<td>Tamilnadu</td>
<td>12.96</td>
<td>0.128</td>
<td>0.340</td>
</tr>
<tr>
<td>Uttar Pradesh and Uttaranchal</td>
<td>29.40</td>
<td>1.980</td>
<td>1.295</td>
</tr>
</tbody>
</table>
Agriculture crops consume major part of the irrigation water by transpiration but the water lost in percolation during field application and that lost through seepage in the conveyance system, goes down to the ground water reservoir. As and when the water table level comes up sufficiently high, and is within the reach of roots of trees in plantations, the trees start drawing water from the ground water reservoir through the process of transpiration. This process of withdrawal of ground water by plantations is termed as “Bio-drainage”.

Plantations, particularly in dry arid regions, can transpire large quantity of ground water and can be used to control rise of ground water table. Plantations also draw salts and minerals from the soil to some extent. Where the irrigation water is of good quality, plantations through bio-drainage can help achieve water balance as well as salt balance in the ground water regime.

PRINCIPLES AND IMPORTANT FEATURES OF BIODRAINAGE

PLANNING AND DESIGN

For bio-drainage to be effectively adaptable, the following requirements are to be met:

- Water balance—the quantity of water removed from the ground water annually should equal the quantity of recharge;
- Salt balance—the quantity of minerals removed annually should be nearly equal to the quantity of mineral import;
- Area under plantation—this should not be so large as to affect agriculture;
- Water for plantation—the demand on irrigation water should be minimal;
- Ground water quality—this should not be too saline, say, not more than 12 ds/m; and
- Ground water table depression—its impact should extend to the whole area threatened by water logging.

a) Water balance

Before the introduction of irrigation, the ground water system is in a state of equilibrium. The inflows, mostly from natural precipitation, seepage from water bodies and ground water inflow match the outflows on account of withdrawal of water for agriculture and other uses, ground water outflow etc. There are some fluctuations in the water table level from season to season and from dry year to wet year, otherwise the ground water system over a period of time, reaches a state of equilibrium and remains fairly stable. with the advancement of irrigation when a large quantity of water is brought from outside the area, the state of equilibrium is disturbed and ground water table no longer remains stable. Depending upon the quantity of net incremental recharge, the ground water table starts rising and continues to do so until a new balance is reached. As long as balance is not reached, the water table continues to rise and may come up to ground surface or even higher, causing water logging. Ultimately, evaporation from ground surface in water logged area and from surface of formed water pools along with other withdrawals, strikes a balance with the quantity of recharge. But by this time, large areas may be lost from agriculture use, on account of water logging.

To overcome the above problem, the objective of any drainage scheme, is to achieve water balance before the ground water table rises up to the critical depth, which in general may be taken as 2.0 m below ground level. This would be possible if the annual rate of withdrawal from ground water equals or exceeds the rate of recharge, when or before the ground water table creeps up to the critical depth.

If ‘P’ be the plantation area, $A_{\text{pan}}$, the annual transpiration from trees, then the total tree water use would be $P \times A_{\text{pan}}$ in a year, and if all the
water requirements of trees is met from ground water then the annual withdrawal of water by plantations from ground water \( W_b \) would also be equal to \( P \times A_{\text{pan}} \). For stable water balance, annual withdrawal by plantations should equal the net recharge due to irrigation, i.e. \( W_b = R_c + R_p \). \( R_c \) is the water recharge due to water conveyance loss and \( R_p \) that due to deep percolation from field irrigation in a year.

b) Salt balance

The quantity of minerals imported annually with irrigation water is \( m_w \times V \times 10^{-6} \) tons where \( m_w \) the amount of dissolved minerals in irrigation water in mg/l and \( V \) is the volume in m\(^3\) of imported water used for irrigation. The quantity of minerals removed by agriculture crops in a year is \( m_c \times A \) where \( m_c \) is the percentage mineral content in the crop bio-mass and \( A \) is the total annual biomass produce from agriculture that is harvested and removed from the field. The quantity of minerals removed from tree plantations area \( P \) (in ha) is \( m_p \times b \times P \) where \( m_p \) is the percentage mineral content is utilizable biomass produce and \( b \) is biomass produce in tons/ha/year.

With proper planning of irrigation intensity, crop selection, water management and bio-drainage plantations, it can be possible to achieve salt balance using river water of normal salinity.

c) Area under plantation

For stable water balance, total annual withdrawal of water \( W_b = P \times A_{\text{pan}} \) where \( P \) is the area under plantation and \( A_{\text{pan}} \) is surface evaporation from standard pan, should equal the total; annual recharge \( R = R_c + R_p \), where \( R_c \) is the net annual recharge from water conveyance system and \( R_p \) that in the field during water application.

Irrigation water is supplied to crops to meet evapotranspiration requirement (ET\(_{\text{crop}}\)). The gross irrigation requirement, \( I_R \) is determined taking into account the water conveyance and field application efficiencies.

Therefore, if total culturable area be ‘\( C \)’, the annual irrigation water supply would be \( C \times A_F \times I_R \) and the net recharge to the ground water would be \( R_F \times (C \times A_F \times I_R) \).

If the entire quantity of recharge is to be withdraw by bio-drainage, the requirement of area under afforestation \( P \) would be:

\[
P = \frac{R_F \times (C \times A_F \times I_R)}{A_{\text{pan}}}
\]

or

\[
\frac{P}{C} = \frac{R_F \times A_F \times I_R}{A_{\text{pan}}}
\]

where,

\[\frac{P}{C} = \text{the fraction of culturable area that must be under afforestation}\]

\[R_F = \text{the recharge factor, i.e. ratio of net recharge (to ground water) to total irrigation water supply}\]

\[A_F = \text{the area intensity factor of irrigated agriculture}\]

\[I_R = \text{gross irrigation requirement}\]

\[A_{\text{pan}} = \text{surface evaporation from a standard pan}\]

As an illustration, if \( R_F = 0.3, A_F = 1.0, I_R = 600 \text{ mm} \) and \( A_{\text{pan}} = 1500 \text{ mm} \), \( P/C \) would be 0.12, i.e. 12 per cent of culturable area under afforestation can provide the needed bio-drainage.

The plantation area can be along canals, roads, farm boundaries and in blocks of lands suitably scattered and distributed, within the boundary of irrigated area.

Depending upon the percentage area that is to be brought under plantations, the width and spacing between land strips for afforestation can be decided. For example if 12 per cent area is to be covered with plantations, then the spacing between 50 m wide parallel
plantation strips would be about 400 m. The plantation areas can also be planned in the form of compact blocks in the middle of the irrigation area to provide needed drainage.

d) Water for plantation

The plantations for bio-drainage are proposed to draw almost all their requirement of water from shallow ground water table. Fresh canal water may be needed in a limited quantity in the initial stages and for nurseries. The plantations would therefore not compete with the crops for the supply of irrigation water. As soon as their roots develop and go deep, and are able to draw water from the surface of rising water table, so further irrigation water need be supplied. Thereafter, the trees would transpire water almost fully from the ground water.

e) Ground water quality

In irrigation projects, the quality of irrigation water brought from storages or river diversions is generally quite good. With the introduction of surface irrigation, the ground water table rises and the quality of ground water improves gradually and progressively due to dilution effect. The percolating irrigation water, being less saline and of lighter density, accumulates over the more saline and dense ground water underneath. So long as the ground water table is more than about 2.0 m deep, its salinity level does not have any significant effect on surface irrigated agriculture, horticulture etc. But since the bio-drainage plantations are to meet water requirement from the ground water, the quality of ground water, when it comes up to about 10 m below ground level, becomes important. The salinity of ground water at that stage should be less than what the biodrainage plantations can tolerate.

f) Effect of lowering ground water table

The water table under vegetation falls when discharge (evapotranspiration, surface runoff and groundwater outflow) exceeds recharge (infiltration and groundwater inflow) and stabilizes when they are equal. A depressed water table beneath a tree plantation induces groundwater flow from the surrounding areas (where the water table is higher) towards the plantation area, thus providing water table control to these areas. If tree plantations were planted in parallel strips, the water table profile would be similar to the profile found between parallel, open drainage ditches (Figure 1). The relationship between depression of the water table, rate of recharge, hydraulic conductivity, depth to barrier layer and distance between plantations can be described using equations developed by Hooghoudt (1940, in Dutch), and later applied by Donnan (1946, in English) as follows:

\[ L^2 = \frac{8KY_0h}{R} + \frac{4Kh^2}{R} \]

where:

- \( L \) : distance between parallel plantation strips (m)
- \( R \) : rate of recharge (m/day)
- \( Y_0 \) : height of water table above barrier layer under the tree plantations (m)
- \( K \) : hydraulic conductivity of substrata (m/day)
- \( h \) : head difference (m)

As an illustration, for \( R = 0.0005 \) m/day, \( Y_0 = 10 \) m and \( h = 10 \) m, the distance between tree plantations (L) would be 1,500, 500 and 150 m for K-values of respectively 1, 0.1 and 0.01 m/day. Low-hydraulic conductivity soils require closer-spaced plantation strips than soils with more permeable substrata. However, often-higher intake rates occur in the high-permeability profiles and this would require larger areas to be covered by bio-drainage crops to balance the increased accessions. The plantation strips in areas with high hydraulic...
conductivity could potentially cover large areas of the landscape. Site-specific field data should be collected to estimate the size of and spacing between plantation strips.

**ECONOMY OF AGRO-FORESTRY SYSTEM**

The agro-forestry system can provide comparable or even better returns than from agriculture. There are many studies that show attractive Net Present Worth, Benefit-Cost Ratio and Internal Rate of Return from forestry. The bio-drainage benefit of tree plantations can therefore be a zero-cost benefit or a free bonus. The names of some suitable tree species for biodrainage are *Eucalyptus (E.) cladocayx*, *E. globules*, *E. robusta*, *E. saligna*, *E. sargentil*, *E. wandoo*, *Acasia nilotica*, *Dalbargia sissoo*, *Sesbania grandiflora*, and *Casurina equisetifolia* etc.

**BENEFIT TO USERS (SOCIETY)**

The important benefits of bio-drainage and tree plantations are presented below.

Bio-drainage would:
- Prevent water logging and salinisation
- Make irrigation permanently sustainable
- Be a no-cost remedy

- Improve the environment
- Provide timber, firewood and fodder
- Act as wind breaks and prevent soil erosion
- Provide abode for habitation of birds and animals.

**CASE STUDY IN INDIA**

*Indira Gandhi Nahar Project (IGNP), Rajasthan study*

Tree plantation work was undertaken along the canals primarily to protect the canal embankments from being blown away by high winds and to prevent sand deposits inside the canals. A 1524 m long and 261 m wide strip along the left side of the main canal was selected for case study. Plantation work in this strip was carried out during the years 1987 to 1994. The density of planted trees was about 1900 trees/ha and the important species planted were *Eucalyptus camalaldulensis* and *Acacia nilotica*. A survey conducted in 1991 indicated that the total number of locations where pools of water were permanently formed was 127 covering an area of 900 ha. The plantation trees on growth had a profound impact on the ground water table conditions. By the year 1997, the overall water pool area had reduced from 900 ha to 20 ha. The
plantations acted as bio pump drawing out water at the rate of 3.93 m$^3$ per hr per ha. The Tree Water use was estimated as 3446 mm per year. The drawdown of the ground water table underneath the plantations was 15 m. The drawdown impact was quite significant up to a distance of 500 m. No abnormal increase in salinity levels in soils and ground water was observed underneath the plantations.

**CSSRI Karnal study**

An experiment was conducted at the Central Soil Salinity Research Institute, Karnal using RCC lysimeters of 1.2 m diameters and 2.5 m depth filled with sandy loam soil with provision to maintain water table depth at 1, 1.5, and 2 m from the surface and ground water salinity at 0.4, 3, 6, 9, and 12 ds/m. Three months old saplings of eucalyptus (*Eucalyptus tereticornis*) and bamboo (*Bambusa arendinacea*) were planted in the center of the lysimeter. The applied water entered the lysimeters from below as ground water. Another set of lysimeters with similar combinations of water table and salinity levels but without trees was used to monitor the loss of water through evaporation. The study shows that:

- Tree water use by eucalyptus under abundant water available conditions can be very high as much as between two to three times of potential evapotranspiration.
- Tree water use declined with an increase in ground water salinity. It was about 53 per cent when soil water salinity increased to 12 ds/m.
- The soil salinity in the capillary zone increased by 2 to 6 ds/m during the period of four years but did not affect tree water use. This was because the tree roots had direct access to the ground water of lower salinity.

**CONCLUSIONS**

Water logging and salinity have become major hazards for irrigated agricultural lands and have raised doubts about sustainability of irrigation, particularly in dry arid regions. This threat is generally met by providing sub-surface drainage under fields, by installing perforated pipes to collect water and conveying drainage water to sea, rivers, lakes or evaporation tanks. But discharge of saline drainage water in natural rivers, lakes etc. pollutes them and is objectionable.

Bio-drainage, in which the property of plants and trees to transpire water is used to remove excess ground water, can be a biological option to provide the needed drainage. Trees and plants also remove minerals to some extent from the soil. They act like biological pumps and can help in achieving water balance as well as salt balance to mitigate the problems of water logging and salinisation. Bio-drainage is economically attractive because it requires only an initial investment for planting the vegetation and when established, the system could produce economic returns by means of fodder, wood or fiber harvested along with lowering of water table.

**REFERENCES**

The direct discovery of Gravitational Waves through LIGO has not only proved the Albert Einstein’s idea but also has brought a radical change in how we perceived our future research in the Astronomy and Astrophysics. In this article, the history, idea and the implications of this result is discussed briefly. Also, what it could mean for the Indian scientific prospects, as LIGO comes to our country.

INTRODUCTION

In 1916, Albert Einstein based on his General Theory of Relativity, predicted the existence of ripples of disturbances in the space-time, like waves of gravity pushing things around, by undetectable amounts, due to accelerated mass. These came to be known as the Gravitational Waves or the G-Waves. The General Theory of Relativity, in itself was a revolutionary idea, in face of the Classical Newton gravity, and hence was met with fierce opposition. With time the understanding of the idea grew and with verification of its other predictions, like bending of light due to a massive object, this theory gained the acceptance of brains all over the world. There was yet to be an observation that would verify the ‘Gravitational Waves’.

It was not until 1974, that this prediction would be attested by Taylor and Hulse after their observation of a binary pulsar, which lead them to an indirect proof of gravitational waves and a Nobel Prize in 1993. A first direct detection of these waves was announced on 11th February, 2016, at Washington, and was done using the Advanced LIGO (LASER Interferometer Gravitational-Wave Observatory) which consists of two interferometers: one in Hanford, Washington and other in Livingstone Louisiana, operating in unison to detect gravitational waves.

It was for this, that the Nobel Prize in Physics, for the year 2017 was awarded to Reiner Weiss, Barry C. Barish and Kip Thome for their ‘decisive contribution to the LIGO detector and observation of Gravitational Waves’. The Nobel can be awarded to a maximum of three laureates and they were the pioneers of the idea but it is important to acknowledge the cumulative effort of thousands of scientists and engineers from an over the world which were also a part of this game changing experiment, that opens new windows to observational astronomy and
cosmology, leaving us with enormous amounts of ideas to explore.

But first things first: What exactly are Gravitational waves?

Let’s draw out an analogy between electromagnetism and gravity. We are aware that when an electric charge is in an accelerated motion it emits electromagnetic waves: ripples of distortion in the electromagnetic field travelling through space and time transversely, carrying an associated energy with them, and interacting with matter in its path.

Similarly, the source of gravitational interactions is mass. Thus, when a mass accelerates it loses its gravitational energy in form of ripples of distortion in the gravitational field travelling, pushing and pulling matter on their way, through space-time, carrying energy transversely, travelling at the speed of light in vacuum.

Now, the gravitational interaction, as we know is much weaker than the electromagnetic interaction (approximately $10^{38}$ times weaker), so consequently the energy carried by the g-waves is negligible in comparison to the electromagnetic waves, making them extremely difficult to observe. For instance, as the Earth travels around the Sun in its curved trajectory, it emits gravitational waves. But for the entire Earth, that gravitational wave output amounts to a few hundred watts, not enough to ever be detected. Our sun also emits gravitational waves just as it emits electromagnetic waves, but in comparison to roughly 400 million trillion megawatts it emits as heat and light, it only emits about 79 megawatts as gravitational waves; again the amount is too low to be detected. Fortunately, we have much stronger and much massive sources of gravitational waves. One such source, which was discovered by Joseph Taylor and Russel Hulse, in 1974 was a binary pulsar i.e. a pulsar orbiting another star, which they were almost sure was a neutron star. The exciting measurement in this system was the observation that the two stars’ orbits are shrinking at a rate of 1 cm/day. This shrinkage was caused by the loss of orbital energy due to gravitational radiation, which is a travelling ripple in space-time that was predicted by Einstein’s General Relativity Theory but never previously verified. Observations showed that the pulsar orbit was shrinking at exactly the rate that general relativity predicted it would, if gravity waves existed and were carrying away the expected amount of energy. It was this result that lead the astrophysicists to be secure about the Gravitational Waves and provided them with the confidence required to go forward with direct measurement with large detectors as LIGO.
LIGO Begins: The Origin Story!

Starting in 1960’s American and Soviet scientists conceived the basic ideas of LASER interferometry detection of gravitational waves. In 1967, Rainer Weiss published his analysis of interferometer use, and in the next year Kip Thorne initiated theoretical development at Caltech. Many prototype interferometers were proposed in next two decades, but they failed to acquire funding or to make any further progress technically. Meanwhile, in 1980's the National Science Foundation (NSF) funded a study in large interferometry lead by MIT, and Caltech constructed a forty meter prototype. Under pressure from NSF, these premier institutes came together to lead the LIGO initiative. In 1994, when Barry Barish took over as laboratory direct, LIGO was told that it was its last shot at attaining funding, but a revised theoretical, budget, a project plan was successful in obtaining the green signal and funding. The project, at 395 millir USD, broke first ground in late 1994 and the construction neared completion in 1997.

Initial run of LIGO from 2002 to 2010 detected no such gravitational waves. So, it was close for further advancements in the equipment, increasing its sensitivity by a certain orders of magnitude. It was not until September 2015 that LIGO/aLIGO would begin the second phase. Simultaneously, an Italy based Laser Interferometer, VIRGO also started working in 2015, actively to detect gravitational waves.

To the delight of involved scientists, it detected its first signal on 14th September 2015, emerging due to a merger of two massive black holes having 29 and 36 times the Solar Mass, which merged into a super massive black hole having 62x Solar Mass, which happened in a corner of the universe 1.3 Billion light years away. This lead to dissipation of gravitational energy, form the merger, equivalent to 3 solar masses. These results were published on 11th February 2016, in which LIGO Scientific Collaboration along with VIRGO collaboration confirmed the first direct detection of Gravitational Waves. As of now, till November 2017, LIGO has announced four more detection of similar signals.

![Figure 2: Simplified diagram of an Advanced LIGO detector (not to scale). (a): Location and orientation of the LIGO detectors at Hanford, WA (H1) and Livingston, LA (L1). (b): The instrument noise for each detector near the time of the signal detection.](image)

The Anatomy of LIGO/aLIGO

The LIGO consists of two large interferometers: one in Hanford, Washington and another in Livingston, Louisiana separated by 10 milliseconds of light travel time (approx. 2400 miles). Each primary interferometer consists of two 4 km beam lines orthogonal to each other carrying a test mass to form a Dowre recvedced Michelson Interferometer.

A pre-stabilized Nd:YAG laser source emits a beam of 20 W power of wavelength 1064 nm, which through a beam splitter sends the beam to
the two arms. By the use of partially reflecting mirrors, Fabry-Perot resonance cavities are formed in both the arms, increasing the effective length of the path travelled by light beam. After approximately 280 trips down the 4km arms the light beams recombine at the beam splitter. The equipment is kept such that, these two beams are out of phase and interfere destructively and no light arrives at the photo-diode.

Now, when a gravitational wave passes through the interferometer, it disturbs the test masses in both the arms, shortening and lengthening the anus by a very small distance causing the beams to become slightly less out of phase, causing resonance and some light is detected at the photodiode. The results from both the interferometers were compared and analyzed to be found similar, hence proving that the movement in the test masses were due to a common distortion, not due to any seismic or human activity. Each of these test masses had an extremely sensitive sensors to monitor any form of motion up to one attometer ($10^{-18}$ – $10^{-19}$ m). The sensors could measure a displacement of a $10^{4}$th of a proton. This is equal to measuring the distance to Alpha Centauri with a precision of a hair strand. With this extreme sensitivity, came a drawback: the signal could be disturbed by smallest of seismic activity or even traffic! To nullify the effect, the test masses are equipped with active and passive damping measures. Active damping works similarly to the noise cancelling headphones; a sensor is attached to measure the surrounding noise, and the computer informs the device to move in form so as to cancel the noise. Secondly, the system prevents any motion that is not countered by the active system from reaching the test mass. The test mass (the mirrors) are suspended by a 4 stage pendulum called as the Quad. They are held by a 0.4 mm think fused silica glass fibers. Four vibration damping masses are present in the pendulum which absorb the vibration. The “Main Chain” side faces the laser beam, while the “Reaction mass” side helps to keep the test mass steady from noise not associated with astrophysical sources. Thanks to Inertia, the sheer weight of these masses also contribute to damp the vibration.

So any distortion measured in test mass is now only due to distortion in space-time due to gravitational waves.

Alright, so Einstein was correct; but why are Gravitational waves so important?

Gravitational waves will usher in a new era in astronomy. Most of the astronomy done in the
past has relied on different forms of electromagnetic radiation (visible light, radio waves, X-rays, etc.), but electromagnetic waves are easily reflected and absorbed by any matter that may be between their source and us. Even when light from the universe is observed, it is often transformed during its journey through the universe. For example, when light passes through gas clouds or the Earth’s atmosphere, certain components of the light will be absorbed and cannot then be observed.

Gravitational waves will change astronomy because the universe is nearly transparent to them: intervening matter and gravitational fields neither absorb nor reflect the gravitational waves to any significant degree. Humans will be able to observe astrophysical objects that would have otherwise been obscured, as well as the inner mechanisms of phenomena that do not produce light. For example, if stochastic gravitational waves are truly from the first moments after the Big Bang, then not only will we observe farther back into the history of the universe than we ever have before, but we will also be seeing these signals as they were when they were originally produced.

The physics that went into the creation of a gravitational wave is encoded in the wave itself. To extract this information, gravitational wave detectors will act very much like radios—just as radios extract the music that is encoded on the radio waves they receive, LIGO will receive gravitational waves that will then be decoded to extract information on their physical origin. It is in this sense that LIGO truly is an observatory, even though it houses no traditional telescopes. However, the data analysis that is required to search for gravitational waves is much greater than that associated with traditional optical telescopes, so real-time detection of gravitational waves will usually not be possible. Therefore, LIGO creates a recorded history of the detector data. This provides an advantage when cooperating with traditional observatories, because LIGO has a ‘rev-rind’ feature that telescopes do not. Consider a supernova that is only observed after the initial onset of the explosion. LIGO researchers can go back through the data to search for gravitational waves around the start time of the supernova.

LIGO comes to India!

In an effort to establish a worldwide network of gravitational-waves detector for a more effective observation, LIGO has decided to build one of the three Advanced LIGO in India. LIGO-India or IndIGO (Indian Initiative in Gravitational-wave Observations) will be an international collaboration between LIGO Laboratories and three Indian institutes: Institute of Plasma Research (IPR), Inter-University Centre for Astronomy and Astrophysics (IUCAA) and Raja Ramanna Center for Advanced Technology (RRCAT). LIGO lab would provide the complete design and all the key detector components. Indian scientists would provide the infrastructure to install the detector at a suitable site in India and would be responsible for commissioning it. The proposed observatory would be operated jointly by IndIGO and the LIGO-Lab and would form a single network along with the LIGO detectors in USA and Virgo in Italy. Currently a site in the Hingoli district of Maharastra has been selected, to establish the detectors.

The proposed LIGO-India project will help Indian scientific community to be a major player in the emerging research frontier of GW
astronomy. A major initiative like LIGO-India will further inspire frontier research and development projects in India.

CONCLUSION

The concept of gravitational waves and the history attached to it not only reflects the genius that was Albert Einstein, but also the struggles and processes of pursuing a radical idea. It should be reiterated as many times as possible, that although the Nobel might have been awarded to just Reiner Weiss, Barry Barish and Kip Thorne, due to the technicalities that are associated with the prize, but the results are due to the cumulative efforts of scores of Scientists and Engineers that have worked on this project.

These efforts have pushed us forward into the age of Gravitational Astronomy, which has the potential to unlock most of the mysteries that we associate with Astrophysics and Astronomy, leading to an astronomical surge of Cosmological knowledge in future. With LIGO coming to India, we can be assured of our research and development moving towards good and bright future!

REFERENCES


6. LIGO Caltech: https://www.ligo.caltech.edu/page/ligos-if0


LIFE SKETCH OF OFFICE BEARERS, SECTIONAL PRESIDENTS AND RECORDERS OF 107TH INDIAN SCIENCE CONGRESS

Prof. K. S. Rangappa
General President

Prof. Kanchugarakoppal S Rangappa, born in 1955, obtained his Bachelor, Master and Doctoral degrees from the University of Mysore in Mysore. After completing his Ph.D. (1982), he moved to University of Saskatchewan, Canada for a post-doctoral position (1983-85). He joined the University of Mysore as Lecturer in 1986 and attained positions of Reader, Professor and the Vice-Chancellor. In the meanwhile, he worked as Post-doctoral fellow/Visiting Professor at Miami University, USA (1990-92), Philippus University, Germany (1995), Kyoto University, Japan (1999-2000), Kobe Pharmaceutical University, Japan (2005), Korea Institute of Science and Technology, Korea (2002, 2014), University of Warsaw, Poland (2006), Hokkaido University, Japan (2007, 2009), Seoul National University, Korea (2012), Universite de Montpellier II, France (2012), Russian Academy of Sciences, Russia (2013), and University of Cambridge, United Kingdom (2013). In the subsequent years, he became the Vice-Chancellor of the Karnataka State Open University (2009-2013) and the University of Mysore (2013-2017), Mysore.

He has been awarded the D.Sc. degree by the University of Mysore for his independent research contribution (1998). He is the Fellow of The Royal Society of Chemistry (FRSC), London and Fellow of National Academy of Sciences (FNASc), India. He has made seminal contributions in Bio-organic and Medicinal Chemistry with special emphasis on the synthesis of natural compound analogs and deciphering their molecular mechanism in biological system. He has discovered inhibitors for pharmacological targets such as Aurora Kinase, JAK-STAT, NF-kB, PPAR-γ, PI3K-Akt-mTOR, BAD, Tff3, Heparanase, EGFR, Bel-2, PTP1B, HDAC6 and methionyl tRNA synthetase. He has published more than 450 research papers in national and international peer reviewed journals with 5800 citations and h-index of 37. He has 10 patents in the area of medicinal chemistry and drug discovery. 55 students have been awarded Ph.D. degree under his supervision and presently 07 students are working for their doctoral degree.

Recently, Dr. Rangappa has been appointed as Chief Scientific Adviser to Sinotar Pharmaceutical (Shenzhen) Co., Ltd. He is also serving as distinguished professor and UGC-BSR faculty fellow at the University of Mysore, Mysore, Karnataka, India.

Dr. Anoop Kumar Jain
General Secretary (Scientific Activities)

Dr. Anoop Jain B.Ed, LLB, M.Sc., Ph.D. in Zoology with Specialization in Endocrinology. He is Director of Schools in Farrukhabad, Uttar Pradesh. He was Advisor/ Mentor for implementation of online educational System for Northern India Schools under CBSE/ICSE for an Educational Company. Honorary Educational Director for Asia Pacific for US based Educational Company in Wisconsin USA.

He has received Kanpur Rattan Award from “All India conference of Intellectuals” at Kanpur along with present President of India Mr. Ramnath Kovind. He is elected as President of Jain Samaj, Kanpur. He is Secretary for Jain Mandir in Anandpuri, Kanpur. Chairman for very renowned non profit organization NGO Sw. Shree Paras Das Jain Memorial Society, which provides free education and financial support to unprivileged poor students to achieve their future endeavors. He has published quite a number of papers in Scientific International and National Journals of repute.

Dr. S. Ramakrishna
General Secretary (Membership Affairs)

Dr. S. Ramakrishna is presently working as a Professor of Zoology, Bangalore University, Bangalore. He is having teaching and industry experience spreading over three decades at postgraduate level and various institutions. His research interest includes Sericulture, Cytogenetic, and Toxicology. He has also authored more than 40 research papers in national and international peer reviewed Journals and presented conference papers at national and international levels. He is in the Board of Studies Member in Zoology for the various Universities across the country. He was also the chairman for Board of Examiners in Zoology of Bangalore University several times.

Dr. Ramakrishna is the member of Board of Examiners for various universities across the country and expert committee member for various Universities and Institutions. He has adjudicated Ph.D. thesis and conducted many Ph.D. viva voce examinations of various Universities. He has authored two book chapters published through one national and one international publishers and delivered many invited talks at various conferences at national and international level. He has successfully guided for seven Ph.D. scholars and right now six scholars are pursing Ph.D. under his guidance. He is also life member of various professional/scientific bodies. He has been Convener, ISCA Bangalore Chapter from 2015 -2016 to 2018-2019.
Sheo Satya Prakash passed M.Sc. in chemistry with First Class held in 1975. He did his Ph.D. from Patna University in 1983 with Prof. Amiya Kumar Banerjee, renowned Inorganic chemists. He joined as Lecturer in chemistry in December 1975 and became Reader in 1985 and University Professor in 1991. He retired as university Professor and H.O.D. Chemistry from A. N. College (P.G. Centre) Patna in February 2015 after having teaching experience of 39 years.

He has supervised six students for Ph.D. degree and about more than a dozen have been guided by him. He has twelve research papers published in International and National Journals, mainly in the field of Alkali and Alkaline earth metal complexes with Transition metal complexes as ligand. He has also worked in the field of Analytical Chemistry and organo Metallic complexes.

Prof. Satya Prakash has been associated with the Indian Science Congress Association from last several decades. He has an opportunity to be elected as Sectional Members (two times) and Recorder in Chemical Science Section in 86th and 87th Congress. He has been elected as Council Member in 98th, 99th and 100th Indian Science Congress. Chairing Session in Chemical Science Section of ISCA at 92nd, 93rd, 98th, 99th, 100th, 102nd, 103rd, 104th and 106th Congress. He Served as Convener of ISCA Patna Chapter from October 2015 to March 2019 and organized Six National Seminar in different Places in Bihar within three years.

He presented papers in convention of chemists, Science Congress and several seminar and symposia. He attended and presented a paper at 26th International Coordination Chemistry Conference at PORTO (Portugal) in 1988. Several Articles in I.R. Visible spectroscopy, NMR EPR, Mass spectroscopy and Mossbauer spectroscopy have been presented in orientation, Refresher and Summer Institute programme.

He has been associated with Indian Chemical Society, Kolkata as life Member. Awarded Convention Award (1985) in Inorganic Section of Indian Chemical Society and served as Associate Editor for two terms in Analytical and Industrial Chemistry Section, worked as Scientist in Charge in Industrial Chemistry Section and elected and served as Council Member of Indian Chemical Society for two terms (2006-2010) and (2015-2017). He was elected as Vice President of Indian Chemical Society (2017-2019).

He is life member of several professional bodies. He was Visiting Professor of T. M. Bhagalpur University. Served as a member of Moderation Board in B.R.A. Bihar University Muzaffarpur & T. M. Bhagalpur University and P.G.R.C member of L. N. Mithila University, Darbanga, Bihar.
Agriculture, OUAT, Chiplima, 1982-86; GBPUA&T, Pantnagar, 1987-89; and OUAT, Bhubaneswar, 1990-1993 for H.S.C., B.Sc. (Ag); M.Sc. (Ag); and Ph.D, respectively; Obtained Master in Business Administration in Operations Research from IGNOU, New Delhi, 2009 and Post-Doc. From University of Reading, U.K., 2002-03 and ZALF, Germany, 2012-13.

Dr. UK Behera is the first Dean of the College of Agriculture (Central Agricultural University, Imphal), Kyrdemkulai, Meghalaya since January, 2018. Before to this, he served as Principal Scientist, Division of Agronomy, ICAR-Indian Agricultural Research Institute (IARI), New Delhi.

During his professional career, he was awarded with number of awards and recognitions i.e. Fertilizer Association of India (FAI) Silver Jubilee Award—1997, ICAR Team Research Award—2002; Hooker Award—2009; Soil Conservation Society of India - Gold Medal Award—2014. Gold Medal, Indian Society of Agronomy (ISA)—2016.

Dr. Behera received the Royal Society of London- INSA, New Delhi visiting Fellowship and DFG, Germany and INSA, New Delhi visiting Fellowship for post doctoral research work at United Kingdom and Germany during 2002-03 and 2012-13, respectively under scientific exchange programme. Besides, he also got recognition as Honorary Research Fellow, University of Guelph, Guelph ON, N1G 2W1, Canada. For his outstanding contribution to agriculture and leadership in Science, he has distinguished recognitions as Fellow of Indian Society of Agronomy and Fellow of National Academy of Agricultural Sciences.

Dr. Behera is a committed person for the development of vast farming community in the country, mostly for the small and marginal farmers. For this, he developed integrated farming system model for livelihood security of small and marginal farmers at OUAT, Bhubaneswar, IARI, New Delhi and COA, Kyrdemkulai (Meghalaya) which helped in enhancing/doubling the small farmers’ income and attracted rural youth for entrepreneurship development. Dr. Behera is a front runner in promoting On-farm farmers’ participatory research and technology dissemination and farming systems studies at the ground level (worked in 20 districts across the country).

Dr. Behera has a passion for the teaching and contributed to teaching (> 15 years) as faculty member to both undergraduate and post graduate students. As Chairman of Advisory committee, he guided 15 national and international students for Master and Ph.D. degree, who are highly placed in respectable jobs (ARS) at the national level.

Prof. Prakash Chandra Joshi
President
Section of Animal, Veterinary and Fishery Sciences

Prof. Prakash Chandra Joshi has been working in the field of insect ecology and air pollution since last 30 years. He has extensively worked on insect fauna of Himalayan region including...
Nanda Devi Biosphere Reserve, Pindari forests, Askot, Mukteshwar and Rajaji National Parks, determining the role of insect fauna in sustaining different ecosystems, status of insect pollinators as impacted by anthropogenic activities and decline in oak tasar worm in the Garhwal Himalaya. He has published 122 research papers in journals of high repute and 06 books, completed 10 major research projects sanctioned by different funding agencies. He has been awarded fellowship by British High Commission and the BOYSCAST fellowship by DST, GOI to visit many universities abroad.Visited 14 foreign Universities not only to have collaborative research work but to deliver invited talks.

He has been a recipient of award for best oral presentation in a National Seminar, Gold medal of ZSI, Platinum Jubilee lecture award of ISCA in 2015. He has supervised 23 Ph.D. and 32 M.Sc. Dissertations till today. Presently 05 students are registered for their Ph.D. After the establishment of State Industrial Development Corporation in the state of Uttarakhand, he started collecting data on air pollution and its impacts in and around the city of Haridwar. The findings have been published in reputed journals and are being highly cited world over. He has continuously been writing in daily news papers on issues like loss of biodiversity, pollination, pollution and issues related with conservation of environment in general and creating awareness among masses. At present he is working as Professor, Dept of Zoology and Environmental Sciences, Gurukula Kangri University, Haridwar, besides he is Dean, Green Audit and Deputy Controller of Examinations. He has also acted as Dean Faculty of Life Sciences, Faculty of Health and Physical Education, Chief Election Officer to conduct student’s union elections continuously during 2015 to 2018 sessions, Superintendent of Examinations(2012-14), Joint Superintendent of University’s Evaluation Cell (2014-18), Controller of Examinations and Registrar, Gurukula Kangri University on various occasions.

Dr. Suresh M. Makvana
President
Section of Anthropological and Behavioural Sciences
(including Archaeology, Psychology, Education and Military Sciences)

Professor and Head from since 1st April 2012, Department of Psychology, Sardar Patel University, Vallabh Vidyanagar, District-ANAND-Gujarat after working as Lecturer in Psychology, Shah K.S.Arts & V.M.Parekh Commerce College Kapadwanj, Dist:Kheda-Gujarat from 18-08-’89 to 31-08-2005. He was appointed at Department of Psychology, Sardar Patel University as Lecturer on 01-09-2005 till 31-03-’2009, after he obtained designated Promotion as Reader/Associate Professor from 1-4-2009 to 31-03-2012, Total 30 years experience of teaching and research field at above mention academic institution.

He worked as a 2nd Lieutenant to Captain of “28th Gujarat Battalion, Nadiad” in addition as a N.S.S. Programmer Officer same as institution at Kapadwanj. Obtained Master, M.Phil and Ph.D. degree in subject of Psychology at Sardar Patel University. His area of specialisation is Industrial, Social, Experimental and Organizational behavior in Psychology. His Research development experience includes 2 students is working position and 21 students competed M.Phil degree. Total 7 Students are working and 6 students awarded
doctoral degree under his guidance, 37th Ph.D., research scholars thesis evaluated in different university of India and 14th Ph.D., research scholar conducted Viva-Voce at different university of India, and UGC and other project guided to research scholar.

He received Awards from different agency including Best research paper of Sardar Patel University, scour Prize for research Paper publication of National-organization-2007, best research paper presentation on “Indian Psychological Association” Received Presidential Gold medal on 2013 at Department of Psychology Magadh University, Bodh-Gaya and also 2016, under UGC Sponsored National Seminar at Department of Psychology, Sardar Patel University, Vallabh Vidyanagar, District-ANAND-Gujarat.

He completed one orientation Course and three Refresher Course in different university of Gujarat state. He was elected member of Sectional Committee in 97th Session, Thiruvananthapuram, Kerala and 102nd session of Indian Science Congress Association. 48 number of International/ National/ Local State/Regional Level Conference/ Seminar and Workshop attended. Published 48 research papers in different reputed national and regional research Journals in the India and abroad. He has several chapters in books and delivered lectures at different colleges, University, Ph.D. course work, Orientation/ refresher course.

He is Chief Editor of International journal of Indian Psychology and International Journal of Social Impact. Life Membership of several Professional Bodies: Master of Arts, Commerce, Law, and MSW course Exam coordinator. Coordinator of ASHTA” Parivar organizations, He has successfully served in the Advisory committee of Indian Government, Department of Telecommunication BSNL, G.O.I.

---

**Prof. Diwan S Rawat**  
President  
Section of Chemical Sciences

Professor Diwan S Rawat joined the Department of Chemistry, University of Delhi as a Reader in July 2003, and was promoted to full Professor in March 2010. He obtained his masters from Kumaun University, Nainital in 1993 and was honored with the merit certificate for securing first position in the University. He did his Ph.D. in Medicinal Chemistry from Central Drug Research Institute, Lucknow. After completing his Ph.D., he worked two years in a Pharmaceutical Industry and did postdoctoral work at Indiana University and Purdue University, USA. He was an Assistant Professor (2002-2003) of Medicinal Chemistry at National Institute of Pharmaceutical Education and Research (NIPER), Mohali, before joining University of Delhi in July 2003. Prof. Rawat has published over 136 research papers, authored a book, three book chapters, and nine patents to his credit. His work has been cited over 4050 times with h–index of 39 and i-10 index 93. His work has been highlighted by Synfact and appeared in the cover of page of Tetrahedron Letters and ACS Sustainable Chemistry and Engineering. He has unique distinction of publishing his work in nine different American Chemical Society journals. His research interests lies in the areas of development of small organic molecules as anticancer, antimalarial, antimicrobial and anti-parkinson agents and nano-catalysis.
Prof. Rawat is a recipient of CRSI young scientist award (2007); ISCB young scientist award (2010); Prof. D. P. Chakraborty 60th Birth Anniversary Commemoration Award, Indian Chemical Society (2007); VC’s Pratik Chinha Samman, Kumaun University Nainital (2011); Gold Badge and Diploma, International Scientific Partnership Foundation, Russia (2015); Professor RC Shah Memorial Lecture Award, Indian Science Congress (2015); Professor SP Hiremath Memorial Award, Indian Council of Chemist (2016); and he is a Visiting Professor at Japan Advanced Institute of Science and Technology (JAIIST), Japan. He is Fellow of Royal Society of Chemistry (FRSC) and CChem (London). He has supervised nineteen Ph.D. students.

Prof. Rawat is a national GLP auditor and a member of NAAC peer team. He is member of project advisory committee of Women Scientist Scheme-A (WOS-A) Department of Science & Technology, Technological Intervention for Addressing Societal Needs (TIASN), Department of Science & Technology, International Cooperation Division (ICD), Department of Science & Technology, and a member of UGC SAP of Kolhapur University and Guru Nanak Dev University, Amritsar. Prof. Rawat is a member of Board of Studies of Mizoram University, Kumaun University, Nainital, HNB Central University, Srinagar, Jamia Hamdard University, and Gautam Buddha University, Noida.

Prof. Rawat is an Associate Editor of Scientific Reports (Nature Research Journal), RSC Advances (Royal Society of Chemistry), International Journal of Drug Discovery and also serves on the Editorial Advisory Board of Anti-Cancer Agents in Medicinal Chemistry, and Marine Drugs. He served as a Guest Editor of Anti-Cancer Agents in Medicinal Chemistry and Current Proteins and Peptides.

Prof. R. B. Singh
President
Section of Earth System Sciences

Prof. R. B. Singh is Professor of Geography, Delhi School of Economics, University of Delhi. He is First Indian and Second Asian Elected Secretary General and Treasurer of the International Geographical Union (2018-22), Earlier served as Vice President, IGU during 2012-18; Presently Chair: Research Council, CSIR-CFTRI, Mysore and Member-CSIR-CIMAP, Lucknow, Government of India; Member-International Science Council (ISC) Scientific Committee-Urban Health and Wellbeing. He was invited by National Disaster Management Authority (NDMA) to Chair-Task Force on Landslides Awareness. Prof. Singh has specialized in Land Use, Environmental Studies, Climate Change, Urban Issues, Disaster Management, Remote Sensing and GIS.

He has to his credit 13 books, 34 edited volumes and more than 210 papers published in reputed Journals. He has supervised 34 Ph.D. and 80 M.Phil students. In 1988 the UNESCO/ISSC (Paris) awarded Research and Study Grants Award in Social and Human Sciences. He was invited by UGC to prepare CBCS curriculum for Undergraduate Programme in Geography. He is also Chair of the UGC prestigious committee for preparing Learning Outcome based Curriculum.
Framework in Geography since July 2018. He has been expert in the prestigious Committees of the Government of India-Ministry of Environment and Forests, Department of Science and Technology, National Disaster Management Authority (NDMA), ICSSR, UGC and CSIR etc. He is invited by IAP-Global Network of Science Academies to join Working Group for preparing statement on Science and Technology for Disaster Risk Reduction.

He was awarded Japan Society for the Promotion of Science (JSPS) Fellowship at Hiroshima in 2013 and Several Travel Fellowships/Support for participating and presenting papers, Chairing session and discussing research projects in more than 40 countries. He was also associated with prestigious international collaborative research programmes and awarded Research Projects from ICSSR-IDPAD, CIDA-SICI, DFID and Ministry of Agriculture. He was also associated with Nordic Inst. of Asian Studies, Copenhagen (Denmark) in 1998 and Visiting Professor for delivering invited Lectures at the University of Turku (Finland). He was also associated with Springer Series Editor: 1. Advances in Geographical and Environmental Sciences, 2. Sustainable Development Goals (SDGs). He has delivered several UGC-CEC lectures related to SDGs, Disaster Risk Reduction and Environmental Studies, available on YouTube.

Dr. Asit Kumar Das, born at Jhargram in West Bengal, is a Chemical Engineer and gold medalist in B.Ch.E from Jadavpur University in 1983. He obtained his M.Tech in Chemical Engineering from IIT Kanpur and Ph.D. from Ghent University Belgium.

He worked in Indian Oil Corporation R&D Centre, Faridabad for 21 years since 1985 in different position up to Chief Research Manager. In 2006, he joined Reliance Industries Ltd, Jamnagar and was instrumental in setting up the Refinery R&D Centre there. Presently he is the Head of Refinery R&D and Process Development in RIL R&D group and located mainly at Jamnagar but also having office at Reliance Corporate R&D Centre in Navi Mumbai.

In a span of R&D career over 33 years, Dr. Das has achieved successful commercialization of many innovative technologies. Most noteworthy is the INDMAX technology at Indian Oil R&D which is now a world class technology and implemented commercially in Guwahati Refinery and Paradip Refinery of IOCL. This technology allows to produce high yield of propylene and LPG from low value refinery residues and is being licensed worldwide by McDermott Lummus USA, who are now designing several Indmax units for other Indian refineries also. At Indian Oil R&D, Dr. Das had created a group of Process...
Development team in Chemical Engineering Division, specializing in Fluidized Bed. His team had also served many Indian FCC units on catalyst selection, optimization and hardware revamp, yielding substantial economic benefit to the refineries.

At RIL Refining R&D Centre, a group of about 100 scientist and engineers, Dr. Das and his team have developed and commercialized many new technologies e.g. OFC2 (Olefinic feed co-cracking), EPR (Enhanced Propylene Recovery) and DSO (Disulfide Oil- Anticoking and Sulfiding additive) etc. In DSO technology, a very low value refinery waste DSO is converted to a high value additive substituting DMDS for use in cracker as anticoking and in hydrotreater as sulfiding agent. This is being considered for implementation in many Indian refineries as a part of “Make in India-GOI mission”. His work on Multizone catalytic cracking (MCC) for single step direct conversion of crude to petrochemicals, is in advance stage of commercialization at RIL. His another path breaking work on Catalytic Gasification based on unique solid-solid catalysis is in the demonstration stage. Dr. Das has been working on key areas of sustainable development e.g. continuous process of waste plastic conversion to oil, low cost CO₂ capture process, advance C materials e.g. Needle coke and graphite from refinery streams, CO₂ conversion to chemicals and fuels etc.

Dr. Das has more than 90 national and international patents and authored more than 70 publications in reputed journals and has also co-authored 6 book chapters in FCC and refining areas. He has guided 3 Ph.D. and 12 M Tech students and delivered many lectures in national and international conferences.

Dr. Das is a reviewer of many international journals, is a member of Board of Studies in PDPU Ahmedabad, serving Vice President in SAEST (Society for Advancement in Electrochemical Science & Technology), Karaikudi. Dr. Das is recipient of many awards and honors, most noteworthy are national awards on successful commercialization of Indmax technology at Indian Oil and DSO technology at RIL from Govt of India. His other major awards are from DSIR, Indian Chemical Council, IICHE, FIPi, FICCI etc. His team is the recipient of High Impact Innovation award from RIL in 2015-16. The DSO project has also won Golden peacock award recently in 2019. Dr. Das is recipient of prestigious VASVIK award in 2015.

Among his other contributions to society, Dr. Das is a social worker at root and helped in funding and organizing merit scholarship for rural students. He is also a motivational speaker for mission oriented approach in life, especially on high impact useful applications of technical knowledge for the betterment of society and mankind.

Dr. Ranbeer Singh Rawal
President
Section of Environmental Sciences

Dr. Ranbeer Singh Rawal (b. April 26, 1965), a floristic ecologist by training, has nearly thirty years of experience of conducting field based biodiversity research in the Himalaya. Born and brought-up in a remote hill district of Pithoragarh in the State of Uttarakhand, Dr. Rawal obtained his primary and secondary education from Government Schools near his village in Gangolihat. Subsequently obtained Bachelor in Science (Biology) and Master in Science (Botany) Degree from Kumaun University, Nainital. In 1991, he was awarded with Ph.D. degree in Botany from the same University for his thesis
entitled ‘Woody vegetation analysis along an elevational gradient (1600-3400 m) of upper Sarju catchment, Kumaun Himalaya’.

The initial experience gained from extensive surveys in high altitudes enabled Dr. Rawal in implementing an independent research project as DST young scientist on climate sensitive timberline and snowline vegetation for the first time in Indian Himalaya. Upon his selection as faculty at G.B. Pant Institute of Himalayan Environment & Development, Dr. Rawal as junior-mid level faculty gained experience on different aspects of conservation biology and contributed for: (i) assessment of sensitive plants and critical habitats, (ii) conservation priority identification, and (iv) promoting conservation education. He also underwent extensive training on ‘Regional Ecosystem Monitoring Technology’ to learn contemporary techniques of researches in Japan. Subsequently as senior faculty Dr. Rawal strengthened science management skills to: (i) build team of field researchers, (ii) facilitate researches of societal relevance, and (iii) develop state of the art infrastructure to promote conservation outreach. He also developed management skills to successfully coordinate Multi Country/Multi Institutional International projects. He has gained experience of organizing events at global forums (2 events CBD - CoP XI; 1 event UNFCCC CoP XXII). Dr. Rawal’s research outcomes have been well recognized as research papers (Over 150) in highly reputed scientific journals, as books (15), Manuals (06), booklets (05). Also, he has supervised 12 Ph D thesis.

With his recent focus on landscape conservation and development Dr. Rawal succeeded in establishing value of ecological intensification for addressing issues of food security, and implemented stakeholder driven ecosystem management resulting in augmentation of spring water recharge and co-benefits. Towards promoting participatory conservation and sustainable use he has contributed for development of: (i) an innovative approach of conservation education; (ii) Himalayan young researchers forum, (iii) Nature Interpretation and Learning centre, and field demonstrations as school conservation models and learning sites.

Dr. Rawal has represented India in several international forums, including member for Indian scientific & technologists team for exposure in South Africa. Recently (March 2019) he represented India in expert level meeting of Shanghai Cooperation Organization (SCO) in Beijing. He is recipient of ICFRE Award of Excellence, and ISCA Platinum Jubilee Presentation Award. As lead author for IPBES Asia Pacific Regional Assessment Dr. Rawal contributed significantly.

Presently Dr. Rawal, as the Director of G.B. Pant National Institute of Himalayan Environment & Sustainable Development, is making efforts to develop wider partnerships and collaborations to expedite flow of R&D based evidences for decision support on environment and sustainable development in Indian Himalayan region.

Prof. (Dr.) M. N. Hoda
President
Section of Information and Communication Science and Technology (including Computer Science)

Prof. Hoda is working as a Professor of Computer Science & Director of BVICAM, New Delhi. He has over twenty five years of experience in academics in different capacities. Prior to joining the academics, he has initially worked with corporate as a Software Engineer. He is an expert
member of many board level committees of Govt. of India like DST, CSIR, MHRD, etc. He is a member of Academic Council of GGSIP University, New Delhi, since last 13 consecutive terms from 2006 and also served three terms as the Member of Board of Management and one term as the member of the Court of GGSIP University, New Delhi.

He is the Editor-in-Chief of International Journal of Information Technology and has edited more than 20 volumes of Conference Proceedings, as Chief Editor. He has co-authored many books. He has published over 100 Papers at both National and International levels, in the journals and conferences of repute. He has delivered over 200 Invited Talks, Key Note Addresses at different academic forums on various emerging issues in the field of Information Technology and Innovations in Teaching Learning System. He has organized and conducted over 110 MDPs and QIPs for working executives in the industry and academia. As member of different Committees and Task Forces, he has facilitated more than a dozen of Universities in overall restructuring of IT and Computer Science programmes as well as innovating and re-aligning their teaching learning practices in line with the requirements of the IT industry.

He has been elected as the member of the National Governing Council, The Institution of Electronics and Telecommunication Engineers (ETE), New Delhi, for a period of three years from 2016 and is serving as the Chairman of its Technical Programme Committee. He has served as National Chairman (Division-I) of Computer Society of India (CSI) for two consecutive terms from 2013-2017. Prof. Hoda was elected unopposed as the Chairman, Indian Society for Technical Education (ISTE), Delhi Section for 2012-2014. He has also served as Secretary – cum – Treasurer, ISTE, Delhi Section, for 2009-2011. He was elected un-opposed as Chairman, Computer Society of India (CSI), Delhi Chapter for the year 2009-2010. He has also served as Vice Chairman for the year 2008-2009, as Hony. Secretary for two consecutive terms; 2005-2008. He was appointed as the Returning Officer for IETE Delhi Centre Elections 2012-2014 and 2010-2012.

He holds MCA degree from Aligarh Muslim University (AMU), Aligarh and Doctorate in Information System Audit in Computer Science. His current areas of research are Information System Audit, Software Engineering, Computer Networks, Artificial Intelligence, ICTs and Innovative Pedagogies for 21st Century Teaching Learning System.

He is a Senior Member of IEEE (USA), Member of ACM (USA), Fellow of IETE, Life Member of CSI, Life Member of ISTE. He was awarded Outstanding Achievement Award—2000 by Management Studies and Promotion Institute, New Delhi for his outstanding achievement and contribution to the field of Management and Computer Education in the year 2001 and the Best IT Teacher of the Year during 18th All India Management Congress in 2016 for his outstanding achievement and contribution to the field of Teaching, Research and Institution Building.

Dr. S. Srikantaswamy
President
Section of Materials Science

Dr. Srikantaswamy has made novel and significant contributions to Materials Science Environmental Earth Science, Hydrothermal Technique of Crystal growth, especially in the field of Carbon Nanotube. His research is characterized by both novelty and innovation, and
has led to a substantial body of published work which has received extensive citations. His most important contributions have been towards the synthesis of new materials for Photocatalytic, Biological, Electrical, Optical etc. He has also worked extensively on Bioremediation of heavy metals in environment.

Dr. Srikantaswamy received his Ph.D. degree in Geology in the year 1989 and later 1994 onwards he is working as faculty of University of Mysore. During 1994 to 2003 teaching work was carried in Geology and subsequently engaged in teaching and Research in Environmental Science and Materials Science, University of Mysore. Dr. Srikantaswamy actively taking part in the development of curriculum for the students and he is working on various research works like the pollution problems of water, Solid waste and sediments by using emerging technologies.

Dr. Srikantaswamy was invited to work as visiting scientist at Japan during 1998-2000 in Tokyo Institute of Technology and Research Institute of Solvothermal Technology, Takamatsu, Japan which is one of the exceptional Research Institute in the world and worked on research work in field of Nanotechnology, especially carbon Nanotube. He travelled widely and visit many countries. Apart from the research activities of his own group, Dr. Srikantaswamy has developed several national and international collaborative research programmes. At present he is the Director of College Development Council, University of Mysore and also he is the Co-ordinator of M.Tech in Materials Science, Center for Materials Science and Technology, University of Mysore.

Recently Dr. Srikantaswamy received Prof.W.D.West Memorial Award—2018-2019 in the 106 Indian Science Congress held at Lovely professional university, Jalandar during 03-07 January 2019 for the excellent research work in the field of Experimental Minerallogy, Crystallography and Earth Materials. His research work especially on Carbon based material are highly cited.

Dr. Srikantaswamy has completed four major research projects of cost ~90 lakhs and two ongoing projects funded by UGC under UPE and CPEPA of ~ 75 crore rupees. Over 140 Research papers published in international journals including one major Review in International Journals. Over 05 book chapter and 04 books have published by him in the field of Environmental science, Materials Science and Earth science. Fourteen research scholars have successfully completed their Ph.D. and six research scholars are currently pursuing their Ph.D. work under his supervision. He has organized many national conference/seminar/workshops and chaired national and international conference and seminars. Besides he has presented more than 170 research papers in various countries and delivered invited talk.

Prof. Shriram K. Nimbhorkar
Mathematical Sciences (including Statistics)

Professor Shriram K. Nimbhorkar is retired Professor and Head, Department of Mathematics, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Maharashtra). He. has completed M.Sc. and Ph.D. (Mathematics) from the same university.

His areas of research are Algebra (in particular, rings with involution), Lattice Theory and Graph Theory. He has to his credit 30 research publications. Three students have completed Ph.D. under his guidance and four are working. He served as a member of Board of Studies of North
Maharashtra University, Jalgaon and Maharaja Sayajirao University, Vadodara. He is the Treasurer of the Indian Mathematical Society, and a member of the editorial board for the Journal of the Indian Mathematical Society.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.

Prof. Nimbhorkar is a reviewer for Mathematical Reviews (American Mathematical Society) and for Zentralblatt Fur Mathematik (Germany). He has worked as a referee for many international journals, including Discrete Mathematics, ARS Combinatoria, Kyungpook Mathematical Journal Order etc. Prof. Nimbhorkar was sectional recorder (2006-2008) for the section of Mathematical Sciences of ISCA.

He delivered the Fifteenth Srinivasa Ramanujan Memorial Award Lecture at the 70th Annual Conference of the Indian Mathematical Society, held at J. N. Vyas University, Jodhpur from December 26–29, 2004. Professor Nimbhorkar was awarded Open Arms Travel Grant by the International Mathematical Union to participate in the International Congress of Mathematicians held at Rio de Janeiro, Brazil from August 1 to 9, 2018. He has visited Russia for an academic visit. He has also participated in ICM 2010 held at Hyderabad, India. He has delivered invited addresses in many conferences.
Prof. Sudip K. Ghosh
President
Section of New Biology (including Biochemistry, Biophysics & Molecular Biology and Biotechnology)

Dr. Sudip K. Ghosh is Professor and former Head of Department of Biotechnology at the Indian Institute of Technology Kharagpur and is actively involved in teaching and research. Dr. Ghosh obtained his Bachelor’s degree in Chemistry major from the University of Burdwan. He did his M. Sc. and Ph.D. in Biochemistry from Kalyani University. He did his doctoral research in molecular biology and biochemistry of plant at Bose Institute, Kolkata followed by Post-Doctoral research at Harvard University School of Public Health, Boston, USA in the field of Molecular and Cellular Parasitology and Immunology. He also has served as Visiting Faculty at Boston University School of Medicine in Department of Molecular Cell Biology for one year. He has also visited the University of Kentucky, Lexington, USA as UNDP-FAO fellow during his doctoral work.

During his Ph.D. he worked on Transformation and Expression of Foreign Genes in Transgenic Plants. Since 1995 he is working on protozoan parasite Entamoeba histolytica, the causative agent of human amoebiasis and its reptile counterpart E. invadens, as encystation model of the human parasite. His laboratory uses molecular and cell biological methods to study biochemistry, cell biology, pathogenesis, and evolution of these important human pathogens. The major goal of his laboratory is to understand the mechanism of cyst wall formation. He has identified different cyst wall protein components along with his co-worker. During this study, his lab has developed the double-stranded RNA mediated gene silencing in E. invadens. His lab was also involved in the identification of the enzyme nitroreductase, responsible for the activation of the prodrug Metronidazole from Entamoeba and other protozoan parasite Giardia lamblia and Trichomonas vaginalis. He has contributed to the community based epidemiological study on intestinal amoebiasis in rural West Bengal. Currently, he is engaged in the development of Entamoeba detection kit from human stool sample through IMPRINT program, Govt. of India.

His other ongoing research activities are the development of marker-free Pod borer resistant Chickpea and Pigeon Pea trough transgenic approach and development of dominant nuclear male sterility system in rice for hybrid seed production. Dr. Ghosh is also involved in nanoparticle based drug delivery in cancer cell and biosensor in collaboration with the Department of Chemistry.

Dr. Santhosh Chidangil
President
Section of Physical Sciences

Dr. Santhosh Chidangil., Professor and Head, Department of Atomic and Molecular Physics, Manipal Academy of Higher Education, Manipal, has completed his M.Sc. (Physics) and Ph.D. (Physics) from Banaras Hindu University, Varanasi. Before joining Manipal Academy of Higher Education, Dr. Santhosh worked in the Snow and Avalanche Study Centre (SASE, DRDO), Manali, Mahatma Gandhi College
Dr. Santhosh has carried out extensive theoretical and experimental studies on conformational changes contributing to fundamental aspects of structure and dynamics of several molecules of biological importance. After joining Manipal Academy of Higher Education, he initiated in launching two specialized masters programs (M.Sc. Photonics and M.Sc. Nanoscience and Technology) and later established two centres for interdisciplinary research (Centre for Biophotonics and Centre for Applied Nanosciences) with the support of the university administration.

The Centre for Biophotonics has carried out extensive studies on biomedical application of lasers, interaction of bio molecular species with radiation, ultra trace analysis, ultra fast processes etc. His recent contributions include micro-Raman Spectroscopy combined with optical trapping of live cells, nano-particles toxicity on cells (stem cells, blood cells etc.) and interaction of ultra-short (Femt-second) pulses with biological macromolecules, fabrication of diffractive optical elements for photonics applications, proteomics and protein profiling of physiological samples (early detection and staging of diseases like cancer, which remain clinically silent over a long time), and development of fluorescence and Raman Spectroscopy methods for the diagnosis of various forms of cancer. The femtosecond laser laboratory setup by Dr. Santhosh in collaboration with TIFR has been involved in the research for the fabrication of photonics devices, tailoring of surfaces, diffractive optical elements etc. The Centre for Applied Nanoscience has involved in the fabrication of nanomaterials for a variety of applications; such as fabrication of SERS substrates, nanoimaging, nanotechnology based biosensing etc.

He has designed, developed and extensively tested a portable biophotonics device for in vivo screening for the detection of oral cancer. The device is getting ready for multicenter trial. Presently he is involved in the study detection and discrimination of biological pathogens using micro-Raman spectroscopy. Also associated in setting up a device for the remote monitoring of hazardous materials using laser based techniques. Other area of interest are developing an instrumentation for breath analysis for the early detection of female cancers, optical imaging of blood components, body fluid analysis for the monitoring of markers for the detection and screening of various diseases.

He was a Regular Associate of the Abdus Salam International Centre for Theoretical Physics (AICTP), Trieste, Italy and an awardee of Dr. TMA Pai Endowment Chair for Biophotonics by Manipal Academy of Higher Education. Dr. Santhosh Chidangil has more than 140 peer reviewed journal articles and more than 100 conference presentations. He has successfully completed nine funded (Govt. funding agencies and Industries) research projects and guided nine students for their Ph.D.s and several Post Graduate dissertations. He is a life member of several science societies.

Prof. Y Vimala
Sectional President
Section of Plant Sciences

Y Vimala, born in August 1960, is Professor of Botany, Pro-Vice-Chancellor (Dec.2018 onwards) and Dean, Faculty of Science (2016 onwards) at CCS University Meerut. She worked as Head of Botany Department in the University during 2009-2012 and 2015-18, and Dean, Students’ Welfare during 2013-2019. She has brilliant academic career receiving merit scholarships and attained first position throughout. She topped M.Sc. Botany (1981), CCS University, Meerut and received University Gold Medal for the same. She pursued M.Phil (1982) and Ph.D. (1985) in
Botany from the Institute of Advanced Studies, Meerut University, Meerut under the supervision of Prof. D Banerji. Early in her professional career, she was instituted M.S. Swaminathan and Sahni-Iyengar award for best published paper in Journal of Indian Botanical Society for the biennium 1983-84, and later the Prof. YS Murty Medal (1998). In 1985, she visited Biological Research Center, Szeged, Hungary on a UNESCO fellowship. This was followed by academic visits to Czechoslovakia, Poland and Yugoslavia.

After 10 years as Lecturer, Jiwaji University Gwalior, she joined the Department of Botany at CCS University Meerut as Reader in 1998, and became Professor in 2002. She has mentored 60 M.Phil students and 28 doctoral students, published 69 research articles in peer reviewed journals pertaining to Plant Physiology and Tissue Culture, delivered invited lectures in India and abroad (including ICV-3 in China, at Kecskemet and Szeged in Hungary, Czech republic etc.), Executed R & D Projects sponsored by DBT, CSIR, DST, UGC and was twice awarded Centre of Excellence project awards for her Department by UP Government. She served Indian Botanical Society as Chief Editor of society journal (2007- till date), and organized several national/ international scientific activities.

Her major scientific contributions include: Physiology of plant senescence identifying a possible biomarker for senescence, upscaling secondary metabolites through optimal manipulation of conditions for metabolite-enriched callus development and subcultures using explants preferably from plants surviving on plant degraded soils, finding allelopathic relationships between weeds and crops/cropweeds/trees, etc. for promoting sustainability of agroforestry. She is an elected Fellow of Indian Botanical Society, Society of Reproduction Biology, Linnean Society of London, and Member, National Academy of Science India. She is associated with pivotal administration at the CCS University, Meerut. As Life Member of ISCA since 1991, she was elected as Member of the Plant Sciences sectional committee (2012). She delivered invited lectures, ISCA sessions in 2004 (Chandigarh) and 2011 (Bhubaneswar). She was elected Recorder, Plant Sciences Section during 2016-18.

Dr. Mausumi Raychaudhuri
Recorder
Section of Agriculture and Forestry Sciences

Presently working as Principal Scientist in ICAR - Indian Institute of Water Management (Formerly Water Technology Centre for Eastern Region), Bhubaneswar, Orissa. A National Scholar and earned MSc. (Ag) and Ph.D. (Ag) both the degrees from Calcutta University in 1986 and 1997 respectively.

Started with Soil and Land Use Survey of India (Formerly All India Soil and Land Use Survey), IARI, DOA & Co., MOA, GOI in 1990 as Senior Soil Surveyor, and initiated the application of GIS and Remote Sensing tools in soil survey with several software applications to develop classified images and thematic maps. Joined ICAR in 1992 as Scientist and devoted 14 years of my early service in Manipur Centre, ICAR Research Complex for NEH Region, one of the remote areas of north-eastern part of India. During this period she got an opportunity to address the problems of the farmers through a multidisciplinary farming system approach and developed technologies for amelioration and management of acid soils for better crop
production and introduced Soil Health Card to the farmers. Joined ICAR - Indian Institute of Water Management in 2008 and presently working on prospects of poor quality water use in agriculture, assessment of soil and land quality on the basis of soil physical, hydrological, chemical and biological parameters, development of efficient irrigation and cropping practices under irrigated ecosystems to mitigate excess and deficit water situations in the context of climate change and also developed Decision Support system to assess the suitability of low quality water used in irrigated agriculture on food production in association with Bulgarian Scientists.

Being associated with All India Coordinated Research Project (AICRP) on Irrigation Water Management sponsored by ICAR operational at twenty six centres located at different agroclimatic region gained experience on assessment of surface and groundwater potential using modern tools like GIS and Remote Sensing as well as mathematical models and softwares, artificial recharge techniques for hard rock region and alluvial zones, conjunctive use of groundwater and surface water/canal water under non command /command areas and water pollution. Use of poor quality water for irrigation and their impact on soil, groundwater, crop quality and human health under different agro-climatic region are being carried out through in-house as well as DST sponsored International Project. Decision support system to assess the impact of use of poor quality water is also a prime area of research. Also associated with ‘National Initiative on Climate Resilient Agriculture’ Project where impact of climate variability on groundwater recharge is being assessed and groundwater is being used efficiently through integrated water resource management and multiple uses as well as with National Science Fund project sponsored by ICAR for development of biological filtration system to treat wastewater for irrigation.

Dr. Raychaudhuri has gained administrative experience as Joint Director i/c of Manipur Centre, ICAR Research Complex for NEH Region and at present coordinating the activities of 26 centres of AICRP on Irrigation Water Management operational at different parts of India. She is in possession of 130 publications, 3 copyrights, six International visits under bilateral program, two Society awards, best oral presentation awards, guidance to MSc. students and other R & D activities.

Dr. Randhir Kumar Singh
Recorder
Section of Animal, Veterinary and Fishery Sciences

Dr. Randhir Kumar Singh is basically a Zoologist. He has 18 years of teaching and 21 years of research experience. During last 21 years of research he has worked on different aspects of Fish Physiology, Fish Heamatology, Biochemical Composition of Fishes, Toxicology and most significant being “Bioenergetic Modelling in an air breathing Fish, *Anabas testudineus* (Bloch). He has published more than 35 research papers in the Journal of National and International repute; Edited/Published 03 Books, attended over more than 50 National and International Seminars. He is recipient of many Gold Medals and Fellowship of different Academic Societies. He is life member of many societies. He was elected Sessional Committee Member of the Section of Animal, Veterinary and Fishery Sciences for the year 2012-2013.

He is also one of the Managing Editor of the “Proceedings of the Zoological Society of India” (an official Journal of ZSI) which is not only UGC enlisted Journal but also having NAAS
rating of 4.42. He has also delivered invited lectures during National Seminar and ISCA. At present, he is General Secretary (HQ) of the Zoological Society of India.

Dr. Rajshree Bhargava
Recorder
Section of Anthropological and Behavioral Sciences
(including Archaeology, Psychology, Education and Military Sciences)

Dr. (Mrs.) Rajshree Bhargava (D.O.B. 8th, Jan., 1975) M.Sc. Home Science (Extension Ed.) Ph.D. (Psychology), Dr. B. R. Ambedkar University, Agra. Diploma in Special Education (Mental Retardation) under R.C.I. (Ministry of Social Justice and Empowerment, Govt. of India, New Delhi. Presently she is the Founder Director, Consulting Psychologist and Special Educator of well recognized centre of Psychological Assessment, Guidance & Counselling name ‘Samadhan Kendra’ established in 2000 under Harprasad Bhargava Memorial Educational Society, Agra and this centre is also associated with prestigious Institute, ‘Harprasad Institute of Behavioural Studies’ Hardeep Enclave, Sikandara, Agra and the well known and highly recognized organization of Psychological tests nationwide, National Psychological Corporation, Agra, during 17 years period She has made, ‘Samadhan Kendra’ a reliable and trustworthy centre for psychological & educational services to the needy people, persons with different disabilities and individuals facing various of psychological problems. She has been throughout first class and topper at Master’s level and also qualified state level eligibilities test (SLET) for lecturship in Home Science.

She is actively associated with about 12 professional organizations, participated in about 35, Conferences, Seminars and Workshops, organized about 15 Conferences and Academic programmes about 6 Workshop for the parents and general people. She is also associated as a member of Editorial Board of many Magazines and Journals, prominently Bhragu Manjari Souviner 113 Annual Conference of All India Bhargava Sabha, New Delhi. Joint Editor of quarterly magazine Shikshamitra (0976-3406) since 2009 and Associate Editor of ‘Indian Journal of Psychometry and Education’ since 5 years.

She has prepared and developed about five CD’s and Transparencies on various topics of education, she has also developed and standardized four psychological tools on Career Assessment, Learning Disabilities and ADHD problems. By now, she has edited and authored about 12 books of degree level and references. As a witness of her academic potential and high class intellectual achievements, she has been honoured and awarded about 12 citations of various bodies and organizations of fame.

Prof. Anand S. Aswar
Recorder
Section of Chemical Sciences

Dr. A. S. Aswar born on June 29, 1962 and presently working as Professor & Head, Department of Chemistry, Sant Gadge Baba Amravati University. He obtained his M.Sc. degree in first class with third rank in order of
merit in 1986 and Ph.D. degree in 1989 from Nagpur University, Nagpur. He joined as founder faculty in Chemistry department, Amravati University (then) during Dec 1991 as lecturer and then successively become reader and professor of chemistry during the year 2002 and 2007 respectively. He has pleasure to work as In-Charge for biotechnology department for brief period of one year. Prior to join Amravati University, he has also served as the faculty of Institute of science and Priyadarshini College of Engineering, Nagpur for about 3 years.

He has guided 30 Ph.D’s and 15 M.Phil students and 5 more are working. His research interests are in coordination and solid state chemistry, catalysis, solvent extraction and molecular interactions and published over 180 research papers in various national and international journals of repute and also authored of two text books for B.Sc.III. Dr. Aswar is a referee for several scientific journals in chemistry as well as for Ph.D. thesis of various Indian universities and has also worked on the panel of selection committee in various universities, research institutes and colleges. He has completed Major and minor research projects funded by UGC. Beside his regular teaching and research he is also interesting in popularization of science among masses and he is founder president of Team to Restore Entire Environment ( TREE).

He has organized more than 13 national conferences /workshops/seminars in various thrust areas of chemistry. He also conducted six refresher courses for college teachers and several workshops/seminar/symposia for up gradation of chemistry syllabi in association with various organizations. He has delivered several lectures under teacher exchange programs at different places and in various conferences / seminars/ workshops in India and abroad and presided many technical sessions and worked as a jury also.

Dr. Aswar is a fellow and life member of a number of professional societies and served as council member, associated editor and presently working as scientist-in-charge for Industrial and Applied Chemistry Section in Indian Chemical Society, Kolkata and Council member, ACT, Mumbai. Earlier also Dr.A.S.Aswar availed the position of Sectional president of Inorganic Chemistry, Indian Council of Chemists Conference held at Patan, 2009. He has also worked as panelist in the panel discussion on the “Global Challenge’s –The role of Chemistry in giving their solutions on 13th June, 2011 in ICC Conference held at Bangkok. He has also visited to KAUST, Thuwar, Saudi Arabia as a visiting scientist in 2011.

Dr. A.S. Aswar is working in the Department of Chemistry, Sant Gadge Baba Amravati University since 1991 and considering his significant contribution and services, Amravat University Honored him by Utkrushtha Seva Gaurav Puraskar during 1998.
received Shastri Fellowship of Canadian International Development Agency (CIDA) for the project on Hazard Zone Mapping in Himachal Himalaya and British Columbia, Canada in 1995. He has to his Credit NASA (USA) Financial Grants for Global Land Use Project 2010, International Council for Science (ICSU) Financial Support for Our Common Future Under Climate Change Conference, UNESCO Paris France, Centre for Mountain Studies, Perth College, University of the Highlands and Islands, Crieff Road, Perth, Scotland UK Financial Support for Mountains of our Future Earth’ Conference, Perth, Scotland, UK and Mountain Research Initiative, Institute of Geography, University of Bern, Switzerland Financial support to attend Global Fair of Mountain Observatories and European Commission Financial Support for European Geological Science Congress Participation in 7th EUROGEO Congress at Bologna, Italy He has widely travelled and attended International Conferences and delivered lectures.

Dr. Pandey is specialized in Marginality Analysis and Assessment in High Altitudes, Mountain Natural Resources Conservation and Management, Environmental Hazards and Disasters Vulnerability and Management. He is Deputy Executive in India for International Geoscience Education Organization (IGEO).

Dr. Pankaj Kumar Roy
Recorder
Section of Engineering Sciences

Dr. Pankaj Kumar Roy is Associate Professor in School of Water Resources Engineering, Jadavpur University, Kolkata, India. He is an expert in Hydraulics, Hydrology, Water Quality Modelling and Impact of Climate Change on water resources. He has over nine years teaching experience and provides valuable guidance to Research Scholars of which seven has been awarded. Dr. Roy has attended several national and international conferences. His published works include one hundred forty-seven international reputed journals and thirty-nine national reputed journals along with writing in books. His works have reputed journal reviewer. At present is the member of six Learned Societies and received four awards national as well as international level. He is actively involved in teaching, research and consultancy. His research interests are primarily focused on water treatment, wastewater treatment and reuse, environmental impact assessment, monitoring and modelling of water pollution, geogenic pollutant scavenging etc. He has more than 100 publications in top-ranking International journals and is credited with citations in Scopus.

Dr. Roy is a renowned technical consultant in the arena of environmental engineering having more than forty five completed/on-going projects of national and international importance to his credit. He has developed community based arsenic removal unit (ARU) model for removal of arsenic through application of co-precipitation and adsorption mechanism appreciated the model and intend to recommend the model for its application nationwide in the rural drinking water supply scheme in the arsenic affected villages. Based on the performance of the first four ARUs installed and commissioned in the arsenic affected villages in the district of Murshidabad, West Bengal, the Public Health Engineering Department (PHED), Govt. of West Bengal has expressed its willingness requesting for providing technical expertise to up-scale the model for serving the bigger community (villages in cluster) in arsenic affected areas.

Dr. Pankaj Kumar Roy

Recorder
Section of Engineering Sciences
Dr. Priyanka Priyadarshani
Recorder
Section of Environmental Sciences
Priyanka is presently working at ICFAI University Jharkhand Ranchi as an Assistant Professor. Her research interests include Microfinance, entrepreneurship, sustainability and rural development. She has been working on Green Microfinance to explore the synergies between sustainability and microfinance. She received the Best Poster award in the Environmental Section in the 104th Indian Science Congress held in Tirupati, 2017. She holds an MBA from ICFAI Business School and Ph D from IUJ, Ranchi.

Dr. Ajay Kumar Thakur
Recorder
Section of Information and Communication Science
Technology (including Computer Science)
Ajay Kumar Thakur, received his M.Sc. degree in Physics with specialization in Radio Physics and Digital Electronics and as well as also, he did his Ph.D. degree on the topic “Generation of Time Domain SC Networks and study of their performance” from L.N.M.U, Darbhanga, Bihar. Dr. Thakur has published more than 50 papers in national and international journals and more than 40 papers in National and International conferences/ workshops/ seminars. He has also published a book entitled- Synthesis and Applications of Nanocrystalline Materials”, He is a member of editorial board of the Indian Journal of Research ANVIKSHIKI, bi monthly International Journal of All Research, STM Journal of Physics and Editor in chief of weekly Science International Journal, Solapur, India.

Dr. Thakur is also a member of different research organizations / associations. Dr. Thakur is recipient of Best Poster Presentation award in 98th India Science Congress, 2011 held at SRM University, Chennai, India. He has received Best poster presentation award in National Seminar, Sponsored by University Grants Commission (UGC), New Delhi, Award of Excellent Performance for his contribution to research work and other extra activities at C. M.Sc. College, Drbhanga and several awards like Bharat Jyoti Award” for meritorious services, outstanding performance & remarkable role, “Glory of India Gold medal” for individual excellence in recognition of sterling merit excellent performance, Best Citizen of India Award -2013 by International Publishing House, Delhi and Best Teacher Award by MTC Global, Bangalore -2017. Dr. thakur has taken 30th teachers training programme for community education. Several talks of Dr. Thakur have been broadcasted by Darbhanga Radio Station.

Dr. Thakur has worked as Project Fellow in Major Research Project, in the Dept. of Physics of C.M.Sc. College, Darbhanga, where he has worked for the improvement of Broadband of compact dielectric resonator antenna in the area of technology innovation for the emerging information and communication technology (ICT) for socio-economic development. Currently, he is engaged as a faculty member in Mobile communication section of Community College, C.M. Science College, Darbhanga-846004, affiliated to A.K. University, Patna, Bihar. His current research interest is in the field of Microwave technology, circuit simulations and in the field of ICTs for greener and smarter devices.
Prof. Guduru Prasad
Recorder
Section of Materials Science

Prof. Guduru Prasad obtained M. Sc. in Physics from Osmania University, Hyderabad and Ph.D. from Indian Institute of Technology, Kharagpur. He joined as lecturer in Physics at St. Joseph’s College, Bangalore and then as lecturer in Materials Science in Mangalore University, Mangalore.

In 1989 he joined as Assistant Professor in Physics at Osmania University, Hyderabad and became Professor in 2007. He has vast teaching experience and a number of publications in national and international journals. He is a member of several professional bodies and has been invited to deliver lectures in India and abroad.

Dr. Anil Kumar Vashisth
Recorder
Section of Mathematical Sciences (including Statistics)

Dr. Anil K. Vashisth is presently Professor and Chairman (Head), Department of Mathematics, Kurukshetra University, Kurukshetra. He has been Dean Students’ Welfare; Director, K.U.P.G. Regional Centre; Associate Dean; Deputy Proctor; Programme Coordinator, Youth Red Cross and Vice- Chairman, K.U. Cultural Council, Kurukshetra University, Kurukshetra. He was born on October 2, 1964. He obtained M.Sc. (Mathematics) in 1987 and M.Phil. (Mathematics) in 1988 from Kurukshetra University. He has completed his Ph.D. in the field of Applied Mathematics on ‘Effect of Loose Boundaries on Wave Propagation in Porous Solids’ from Kurukshetra University in the year 1993. He has a teaching experience of 28 years and research experience of 30 years.

He has done research work in the areas of Poro-Mechanics, Theoretical Seismology, Solid Mechanics, Fluid Mechanics, Differential Equations and Wave Propagation in Smart Materials. He has introduced the concept of loose boundaries in the studies of wave propagation in porous solids. His work on the formalism of multilayered porous solids, using transfer matrix method, has attracted many citations and applications in the areas of sound absorbing materials and non-destructive techniques. He has provided a theoretical model to incorporate imperfect interfaces in the study of multi layered poroelastic and poro-visco-elastic materials and could obtained analytical solutions also.

He has established the constitutive equations for porous piezoelectric materials. It is a known fact that majority of the pressure sensors, i.e., piezoelectric materials have a residual porosity. First time, a theoretical model to incorporate this porosity of piezo ceramics, which are widely used as sensors and actuators, was established by him in a study on ‘Vibrations of Porous Piezoelectric ceramic plates’ and then on ‘Wave propagation in transversely isotropic porous piezoelectric materials’ in the year 2009. This work has provided a realistic model to study wave propagation, vibrations problems and to study
crack problems of piezo ceramics. He has also worked in the area of numerical and asymptotic methods to solve singularly perturbed differential equations. He has published 50 research papers in International Journals and has published nearly 30 research papers in National Journals and Conference Proceedings etc. He has contributed to three edited books. He has been invited in many national and international conferences and has delivered 43 invited talks at the national and international levels.

He has successfully completed two research projects, one was funded by the DST, Govt. of India and the other has been funded by the UGC. He has guided 5 Ph.D. theses 34 M.Phil. Dissertations. He has been Reviewer for many International Journals and presently he is on the panel of Editors of two International journals. He has served as External Expert on the Boards of Studies of many universities. He is a life member of several National bodies. He was conferred with Associate Fellow of International Academy of Physical Sciences recently. He was offered Post-Doctoral position at Laboratoire Central des Ponts et Chausses (LCPC), Nantes, France in the year 2005. He has visited Belgium and France on academic assignments. He has attended nearly 62 International and National conferences. He has organized Refresher Courses and Conferences.

Besides this, Prof. Vashisth has undertaken number of administrative assignments at the university level. He has been member of organizing committee in holding National and International programmes at the university. He has acted as a Nodal Officer, SVEEP programme of Election Commission of India; Nodal Officer, Online Students Grievances Redressal Cell—UGC; Coordinator, recruitments and Convener, Students Grievances Redressal Cell, K.U. Kurukshetra.

Prof. (Dr.) Sujata Maiti Chowdhury
Recorder
Section of Medical Sciences (including Physiology)

Prof. (Dr.) Sujata Maiti Choudhury is a Professor in the postgraduate department of Human Physiology with Community Health of Vidyasagar University, West Bengal, India. She is the In-charge of Biochemistry, Molecular Endocrinology and Reproductive Physiology Laboratory of the above said department. She graduated in 1984 from Midnapore College, and completed M.Sc. in Physiology, in 1986 and M.Phil. degree in Environmental Science in 1988 from University of Calcutta, Kolkata. She was awarded Research Fellowship in 1987 from ICMR, Govt. of India in the Dept. of Pharmaceutical Technology, Jadavpur University, Kolkata. She started her independent position as a Lecturer in the Department of Physiology, Midnapore College in 1990. She was awarded Doctor of Philosophy in 1995 from Jadavpur University, Kolkata. In 2006, she joined in the postgraduate Department of Human Physiology with Community Health of Vidyasagar University. She was also graced as the Founder Director of Women’s Studies Centre, of Vidyasagar University (2010-2015).

Teaching physiology along with biochemistry and cancer biology to undergraduate and postgraduate students has been a passion for her. She has been External Examiner of M.Sc. Curriculum (Physiology) in Calcutta University, Tripura University, Kalyani University, Burdwan University, Vidyasagar University and North Bengal University.
She is actively engaged in researches and her primary focus of work covers Cancer therapeutics and Molecular drug development with particular interest in nanomaterial or nanocojugate and phytomedicine mediated drug fabrication; Toxicological studies on mycotoxin and synthetic pyrethroids and their remedial interventions. She has presented her research findings in various national and international conferences. She has several International and national research publications in peer-reviewed journals. She has completed several major research projects and supervised several Ph.D. thesis.

Dr. Maiti Choudhury has been awarded Travel Award for 3rd conference of South Asian Association of Physiologists (SAAP-3), 2012, Colombo, Sri Lanka; ‘Shiksha Rattan Puraskar’—2012 from India International Friendship Society; Fellow award from Society for Applied Biotechnology, India in 2012; A. K. Mukherjee Oration award from The Physiological Society of India (PSI), 2016;) and as ‘Exchange Visitor Researcher’ in Central Michigan University in 2018. Dr. Maiti Choudhury has organized several seminars, workshops, science exhibitions involving the students for elevating scientific aptitude and knowledge among students and common peoples.

Before joining to CSIR-NBRI Dr. Sandipan has worked as a Post-doctoral Research Fellow at the National Changhua University of Education under Prof. Hon Man Lee. Prior to that, he has worked a few months in Dabur Pharma (DRF) in process chemistry division in the area of process development of generic anticancer drug molecules. Before joining DRF he has worked as a researcher at Organic Chemistry division of Indian Institute of Science (IISC), Bangalore under the supervision of Prof. Govardhan Mehta in the development of complex natural product synthesis. Prior to joining IISC he has completed his Ph.D. with Prof. B. P. Chatterjee and Prof. A. K. Guha at Indian Association for the Cultivation of Science (IACS). His Ph.D. work comprises sustainable production of carbohydrate Natural Polysaccharides Chitosan utilizing industrial waste and its application. Till date, Dr. Sandipan has published 22 international research papers with av. Impact factor 3.5± with total no. of citation ~1700. His current (2019) H-index is 16 as calculated by Google scholar.
Dr. Vineet Kumar Rai
Recorder 
Section of Physical Sciences

Dr. Vineet Kumar Rai S/o Late Dhirya Nath Rai; resident of village & post-Sathiaon, District-Azamgarh, Uttar Pradesh, passed B. Sc. & M.Sc. in first division from Postgraduate Shibli National College, Azamgarh, Uttar Pradesh. He has qualified the National Eligibility Test (NET) in Physics conducted by CSIR, New Delhi in 2001. He did Ph.D. from Banara Hindu University (BHU) under the supervision of well known Spectroscopist & Professor Dr. Shyam Bahadur Rai. He worked as a Research Associate at Department of Physics, BHU and a Post Doctoral Fellow at Departamento de Fisica, UFPE, PE – Brasil under a CNPq program by Brazilian Government.

Currently, Dr. Rai is working as an Associate Professor at Department of Applied Physics, Indian Institute of Technology (Indian School of Mines), Dhanbad. His current area of research interest is on synthesis and optical characterization of lanthanide doped glasses & nanophosphors/nanomaterials and their wide applications in temperature sensing, LEDs, optical devices, biological fields, upconverters, optical nano heater, etc. He is familiar with handling of various sensitive and sophisticated equipments. He has delivered talks at different academic places and organized various professional academic activities like, conferences, training programs, etc. He is member/life member in the journal editorial board and various academic societies. He has research interactions with various research & academic institutions in India and abroad. He has been awarded as Outstanding JAP Author for the research contribution and Recognized Reviewer Status in recognition of the review made for journal by different reputed journals viz. ACS, Materials Research Bulletin, Journal of Industrial and Engineering Chemistry, etc. The interesting results obtained from his research group serve the purpose of the temperature sensor, fluorescence labeling, bioimaging, fingerprint detection, optical bistability, optical nano heater, etc.

Dr. Rai has published more than 130 research papers of international repute in international journals, several book chapters & papers in conference proceedings and participated in number of national/international conferences. By his research contributions Dr. Rai has given a new direction to the scientific community. Dr. Rai is having total citations of more than 2900, h-index-30 and i 10 index-78 (as per the google scholar citation report 2018). He has been awarded by Bharat Shiksha Ratan Award in 2013, by GSHEG, New Delhi and Canara Bank Research Publication Award for the recognition of excellence in research in 2015 & 2016 at IIT (ISM), Dhanbad.

Prof. Sunil Kumar Chaturvedi
Recorder
Section of Plant Sciences

Prod Sunil Kumar Chaturvedi, was born on 10th July, 1955 in Mainpuri district of Uttar Pradesh. After obtaining B.Sc. and M.Sc. (Botany) degree from Allahabad University in 1974 and 1976
respectively, he obtained D.Phil. degree in Botany in 1984 from Allahabad University. He was selected as young Scientist of DST, Govt. of India for 1985 to 1987 and 1988 to 1990. In 1996 appointed as Research scientist of DST, Govt. of India, New Delhi and in 1997 he joined the post of Reader in the Department of Botany, Nagaland Central University, Lumami, Nagaland, and was promoted to the post of Professor of Botany in the year 2007. He was selected for “Best Teacher Award 2001”, by the Post Graduate Student Union, Nagaland University. In the year 2012 he joined Guru Ghasidas Vishwavidyalaya, (A Central University) as Professor of Botany on lien for three years and taken over as Dean Life Sciences in 2013. In November 2015, he returned to Nagaland University as Professor of Botany and in February 2016 he was appointed as Dean, Research development and Consultancy (Dean, RDC) in Nagaland University, Lumami. In the year 2009, Dr. Chaturvedi was appointed as Dean, Student welfare, Nagaland University, Lumami.

Prof. Chaturvedi is Fellow of six Scientific Societies (FBS, FBRS, FIAT, FBSA, FISPRB, FEHST) and life members of twelve National and International scientific Societies. He has completed eleven Research Projects, participated in 88 National and International Conferences and presented research papers. He has been invited to deliver lectures at National and International conferences and Refreshers/orientation courses. He is having research and teaching experience in the field of plant morphology, anatomy and embryology of spermatophytes. He was conferred with the best paper Presentation award at conference held at PUSA, New Delhi, India, in 2014. He was invited to deliver Professor R.P. Singh memorial lecture at Botanical Survey of India, Eastern Circle, Shillong (Meghalaya), during the Annual Conference of EHSST held from March 8-9, 2018.

Prof. Chaturvedi has published 65 research papers in National and International Journals, 21 research papers in edited books, 3 popular articles and one book. For his contributions in the field of Flora biology/ Pollination biology of Indian Asclepiads and Orchids, Dr. Chaturvedi was conferred with five Gold Medals, including Y.S. Murthy award medal 1991 and Professor S.C. Maheshwari medal 2016, of Indian Botanical Society. So far six students have been awarded Ph.D. degree and eight students are enrolled for Ph.D. degree under his supervision. He was elected member of sectional committee of Plant Sciences of ISCA for 2004-2005. He was nominated member of SSC (IUCN) from 2009-2012. He is selected reviewer in various reputed National and International journals. He was elected member of executive committee of Indian Botanical Society from 2004-2007 and 2011-2014. He has visited abroad seven times in connection with his research work. He was Head, Department of Botany and Chairman of BPGS and BUGS, Nagaland University for 10 years 3 months and HOD, Botany at GGV, Koni, Bilaspur for 3 years. He was Coordinator SAP- DRS I & DRS II from 2004-2009 and 2009-2012 respectively, at Nagaland University Lumami.

Dr. Chaturvedi was appointed Director, IQAC, Nagaland University, Lumami, from 2011-2012. He was Director, centre for Biodiversity study, Nagaland University, 2005 -2010. He was appointed Nodal officer of AYUSH for Nagaland state in 2009. He was appointed Group leader of Botany for DBT BUILDER programme worth Rs. 4.68 crores, at GGV, Koni, Bilaspur (CG). Time to time worked as VC in-charge Nagaland University. His field of research is Conservation and Reproduction biology of Plants with special emphasis on Pollination Biology. He is the first Indian to work on Pollination biology of Orchids of North-East India. He is pioneer in field of studies in Pollination biology of Indian Asclepiads and has made a video film on pollination of Indian Asclepiads.
University of Agricultural Sciences, Bangalore, a premier institution of agricultural education and research in the country, began as a small agricultural research farm in 1899 on 30 acres of land at Hebbal, Bengaluru, donated by Her Excellency Maharani Kempa Nanjammanni Vani Vilasa Sannidhiyavaru, the Regent of Mysore. This developed into a Residential School in 1913 at Hebbal which offered “Licentiate in Agriculture” and diploma in agriculture from 1920; this School was upgraded to Agriculture College in 1946 which offering a degree programs in Agriculture. The University of Agricultural Sciences (UAS – B) patterned after the Land Grant College system of USA was established in 1963 through an Act of Legislature.

Inaugurating the University on 21 August 1965 Dr. Zakir Hussain set forth the lofty objectives of the university in the following words: “By bringing about significant improvement in every phase of rural life, by much needed change in methods of production, by influencing the whole outlook of the rural community and rural home, by giving them a new vision and new hope, this University will be able to make great contribution to national welfare”.

The university at inception had Colleges of Agriculture at Hebbal (Bangalore) and Dharwad, the Veterinary College at Hebbal and 35 Research stations located in different parts of the state. In 1969 a College of fisheries at Mangalore and an Agricultural Engineering Institute at Raichur were added. This was followed by the addition of
Home Science College at Dharwad and College of Post-Graduate Studies at Hebbal. Over the years the monolithic State Agricultural University was carved out into several universities to meet twin objective of the growing needs of agriculture and allied sectors and ruralization of higher education in agricultural sciences.

The University of Agricultural Sciences, Dharwad was established in 1986, followed by Karnataka veterinary Animal and Fishery Sciences University, Bidar in 2004; University of Horticultural Sciences, Bagalkot in 2010 and University of Agricultural and Horticultural Sciences, Shimoga in 2013. The University of Agricultural Sciences-Bangalore had ten southern districts of Karnataka under its jurisdiction.

EDUCATION

The University currently offer six Under-Graduate Degree programs in Agriculture, Sericulture, Food Technology, Agricultural Marketing & Cooperation, Agri-Biotechnology and Agricultural Engineering and Master’s Degree programme in 22 disciplines and Doctoral degree programme in 15 disciplines across its five campuses in Bengaluru, Hassan, Chintamani, Mandya and Chamarajanagara. The University also offers Diploma and Certificate courses to meet the human resource needs of technology, services, marketing and extension in agriculture and allied sectors. The curriculum in all academic programmes in dynamic and backed by University’s five decades of experience in higher education.

RESEARCH

Over the past six decades, UAS-B has developed several locally relevant production technologies that have substantially enhanced farm productivity in the state and beyond. In less than half a century, UAS-B has released over 200 varieties in diverse crops. The major flag bearers of these are unique varieties in finger millet (ragi), pigeonpea, groundnut, cowpea, sugarcane and hybrids in paddy, sunflower & maize. Production technologies developed for Dry land Agriculture have helped to stabilize farm productivity even in rain sparse years.

EXTENSION

The University has a well established outreach wing that is in the forefront of transfer to new technology to the farmers and all the stakeholders including the officers of the State Department of Agriculture. The University has seven Krishi Vignana Kendras under its jurisdiction besides an Extension Education Unit, Agricultural Technology Information Centre, Farmers’ Training Institute, a Bakery Training Unit, a Communication Centre and a Staff Training Unit. The extension activities of the University have also served to identify problems of farmers and help in prioritizing research at the University.

INSTITUTIONAL AWARDS / RECOGNITIONS

The University has been recognized by several awards and recognitions for its achievements in education, research and extension programmes.

- Sardar Patel Outstanding ICAR Institution Award – 2001 & 2012
- One among the three SAUs awarded PURSE by DST
- The University is the highest recipient of DST-FIST Grants next only to IISc, Bengaluru
- Two ICAR Niche Area of Excellence programmes
- Advance Centre for Drought Research (DBT)
- National Productivity Council Awards - Kabbalanala Model Watershed, Mittemari Model Watershed and Bakery Training Unit
- ICAR Best KVK Awards: 3 times
- Chaudhary Devi Lal Outstanding AICRP Award
- Environmental Excellence Award - 2012 by KSPCB
- NSS Best University Award
- National Education Award 2017
- AICRP on Agro- Meteorology - Best center during 2017-18

SPORTS & CULTURE

The University has a strong support system to encourage co-curricular activities for overall personality development. Students on their part, have excelled in sports and cultural activities by dancing and leaping their way to championships at the national level.

COLLABORATIONS

The UASB has entered into academic and research collaborations with several international institutions; of them following are the important ones.

- Georg-August-University, Gottingen Stating, Wilhelmsplatz, Germany
- Purdue University, College of Agriculture, West Lafayette, Indian, USA
- University of Kassel & Gottingen, Germany
- Western Sydney University, Australia
- Ghent University, Belgium
- The Deutsche Forschungsgemeinschaft (DFG), Germany
- Kirkhouse Trust SCIO, Long Hanbrough, Oxfordshire, UK
- Chiba University, Japan
- Carretera Mexico-Veracruz, Mexico
- International Centre for Research in Agroforestry, Nairobi, Kenya
- East African Seed (U) Ltd. Kampala, Uganda
- Ministry of Higher Education, Govt. of Islamic Republic of Afghanistan
- Al Neelain University, Khartoum, Sudan.
- International Atomic Energy (IAEA), Vienna.

CONTACT:
Dr. S. Rajendra Prasad
Vice-Chancellor
University of Agricultural Sciences, GKVK, Bengaluru-560 065
Ph. 080-23332442, 080-23330153 (Ext. 265 & 266)
FAX: 080-23330277
E-mail: vc@uasbangalore.edu.in
vceuassb1964@gmail.com
CONFERENCES/METEINGS/SYMPOSIA/SEMINARS

INTERNATIONAL AND INDIAN PSYCHOLOGY SCIENCE CONGRESS, 18-20 OCT, PANJAB UNIVERSITY, CHANDIGARH

SUB THEMES:

- Trauma and Crisis across Age and Culture
- Criminal and Forensic Psychology
- Community & Health Psychology
- Environmental Psychology
- Gender Psychology
- Counselling Psychology
- Behavioural Economics
- Organizational Psychology
- Special Education
- Positive Psychology
- Spirituality and Religiosity
- Clinical Psychology
- Peace Psychology
- AYUSH: Ancient Mechanism of Well Being
- Sports Science and Well Being
- Anthropology and Well being
- India International NGOs: Grass root Agents of Well Being
- Disaster psychology
- Developmental Psychology
- Military Psychology
- Geriatric Psychology
- Health psychology

Contact:
Email: ipsc019@gmail.com; Web Link: http://www.napsindia.org

NATIONAL CONFERENCE OF INDIAN ASSOCIATION OF PRIVATE PSYCHIATRY, 14-17 NOV 2019, MUMBAI

Topics:

- CD - Recent Advances
- Polypharmacy in Schizophrenia
- Bollywood Movies in Office Psychotherapy
- Running a Private Rehabilitation Centre-Challenges
- Migraine - what psychiatrists must know
- Sleep Disorders - Recent Advances
- Setting Up Effective Child Guidance Clinics
- Spiritually Augmented CBT
- Borderline Personality Disorder
- Neuro-Radiology Case Based Discussion
- Anxiety Disorders - New Paradigms
- L-Carnosine in Psychiatry
- OCD - Polypharmacy
- Smoking Cessation Therapy - Recent Advances
- Depot Preparations in Substance Abuse
- Cognitive Enhancers in Clinical Practice
- Vitamins and Psychiatry
- Diet, Nutrition and Psychiatry
- Yoga and Psychiatry
- Arts Based Therapy

Contact:
Organising Secretary, Dr. Avinash De Sousa, Email: avinashdes888@gmail.com Cell: +91 9820696828; 1001, 10th Floor, Sunteck Grandeur, SV Road, Andheri West, Mumbai, Maharashtra 400058, Tel: +912261053811 /34 Email: info@medisquire.com
EIGHTH INTERNATIONAL CONFERENCE ON AGRICULTURAL STATISTICS (ICAS-VIII), 18-21 NOVEMBER 2019, NEW DELHI

Theme: Statistics for Transformation of Agriculture to Achieve the Sustainable Development Goals (SDGs)

Topics:
1. Data Analysis / Data Integration
2. Data Sources / Data Collection/ Data Quality
3. Data Dissemination & Communication
4. Use of statistics for policy making & research
5. Food Security, Poverty, Rural Development and Social Dimensions of Agriculture
6. Sustainable Agricultural Production and Consumption
7. Natural Resource use in Agriculture
8. Climate Change and Environmental Issues
9. Social Protection and Risk Mitigation Measures in Agriculture
10. Capacity building in Agricultural Statistics
11. Monitoring the SDGs
12. Other

Contact:
ICAS VIII, ICAR-Indian Agricultural Statistics Research Institute, Library Avenue, Pusa, New Delhi, 110012
Phone: +91 11 2584 1479; Email: secretary.icas2019@icar.gov.in; icas2019@icar.gov.in

INTERNATIONAL CONFERENCE ON ADVANCES IN COMPUTERS & SMART TECHNOLOGIES, 13-14 DEC, 2019, REVA UNIVERSITY, BENGALURU, KARNATAKA

Topics:
- High Speed Networking and Information Security
- Artificial Intelligence
- Expert Systems
- Gaming and Animation
- Genetic Algorithms
- Image Processing
- Fuzzy and Soft Computing
- Data Engineering
- Virtual Reality
- Wireless Communications
- Smart City
- Intelligent Resource Management
- Smart Grid
- Embedded Systems
- Mobile App Development
- Smart Healthcare
- Smart Vehicles
- Intelligent Transportation
- Ambient Intelligence
- Robotics and Computer Vision
- Theoretical Computer Science
- Machine Learning
- High Performance Computing

Contact:
Dr. Vishwanath R. Hulpalled, vishwanath.rh@reva.edu.in :+91 9448239726 https://reva.edu.in/icaest-2019/
EATING A LOT OF FIBER COULD IMPROVE SOME CANCER TREATMENTS

What you eat can affect how well immune therapies work against cancer. High-fiber diets may change gut microbes and make these therapies more effective, but taking probiotics could do the opposite.

Researchers looked at people with melanoma skin cancer who were getting a kind of immune therapy called PD-1 blockade or checkpoint inhibition (SN: 10/27/18, p. 16). Those who ate a high-fiber diet were five times as likely to have the therapy halt the growth of or shrink tumors as those on diets low in fiber, researchers reported February 27 in a news conference held by the American Association for Cancer Research.

High-fiber diets seem to foster a more diverse collection of gut microbes, which is associated with better outcomes from PD-1 blockade therapy, said Christine Spencer, a research scientist at the Parker Institute for Cancer Immunotherapy in San Francisco. But probiotic supplements — pills or food supplements that are supposed to contain helpful bacteria — actually reduced the diversity of microbes in cancer patients’ guts, the researchers found.

Only about 20 to 30 percent of cancer patients see their tumors stop growing or shrink with PD-1 blockade immunotherapy. Spencer and colleagues had previously determined that bacteria in the Ruminococcaceae family seem to improve responses to the treatment, but the researchers didn’t know why some people have more of those helpful bacteria than others.

Diet is one way to change a person’s microbiome, the collection of bacteria, fungi and other microbes that live on and in the body (SN: 5/30/15, p. 18). So Spencer and colleagues at MD Anderson Cancer Center in Houston surveyed 113 people with melanoma about their diets, including use of probiotics, and collected fecal samples from each participant.

The 46 patients who consumed the highest amount of fiber in their diets, including fruits, vegetables and whole grains, tended to have more of the bacteria associated with a response to the immune therapy, the team found. And, in fact, those patients tended to get a positive effect from the therapy. Participants who ate more processed meat and excess sugar had fewer of those bacteria, and their tumors were more likely to grow despite immune treatment.

More than 40 percent of patients said they were taking probiotics. Those people had lower gut microbe diversity than people who didn’t take the supplements. “A lot of people have perceptions that probiotics will have health benefits, but that might not be the case for cancer patients,” Spencer said.

She and her colleagues will present more data from the study, including on probiotics’ effect on immune therapy, on April 2 in Atlanta during the cancer research association’s annual meeting.

The new work adds to a growing number of recent studies that have hinted that probiotics may not offer the health benefits doctors and patients have hoped for.

While the data are preliminary, the study suggests that there may be ways to improve immunotherapy for cancer patients, says Cynthia Sears, an infectious diseases specialist at Johns Hopkins University School of Medicine. “It’s intriguing and should definitely be followed up,” she says.
Many studies have linked high-fiber diets to decreased cancer risk and other health improvements. Even if eating more fruit and vegetables doesn’t boost immune therapy’s effectiveness, Sears says, “the upside is you’re probably not hurting anyone with a high-fiber diet.”


THE KILOGRAM JUST GOT A REVAMP. A UNIT OF TIME MIGHT BE NEXT

The new kilogram has finally arrived.

Updates to scientists’ system of measurement went into force May 20, redefining the kilogram and several other units in the metric system. The revamp does away with some outdated standards — most notably, a metal cylinder kept in a vault near Paris that has defined the kilogram for 130 years.

Tinkering with units allows scientists to more precisely measure weights, temperatures, electric currents and other quantities laid out in the International System of Units used around the globe. The kilogram, the basic unit of mass, is now defined by a quantum quantity known as the Planck constant. That value, an immutable constant of nature, is the same everywhere in space and time. That’s an improvement over the Parisian artifact, which could have changed slightly if gunk or scratches marred its surface.

Also redefined, according to an agreement reached in November 2018 at the 26th General Conference on Weights and Measures in Versailles, France, are the kelvin, the unit of temperature; the ampere, the unit of electric current; and the mole, the unit for an amount of substance.

Scientists now have their sights set on updating the unit of time: the second.

Currently, the second is defined by atomic clocks made of cesium atoms. Those atoms absorb a certain frequency of light. The wiggling of the light’s electromagnetic waves functions like the pendulum on a grandfather clock, rhythmically keeping time. One second is defined as 9,192,631,770 oscillations of the light.

But a new generation of atomic clocks, known as optical atomic clocks, outdo the cesium clocks. “Their performance is a lot better than what currently defines the second,” says physicist Andrew Ludlow of the National Institute of Standards and Technology in Boulder, Colo. Because those optical atomic clocks operate at a higher frequency, their “ticks” are more closely spaced, making them about 100 times more precise than cesium clocks. Ideally, the length of a second should be defined using the most precise timepieces available. A switch might happen in the late 2020s, Ludlow says.

The change to the kilogram’s definition was carefully orchestrated so that it wouldn’t affect normal people: A kilogram of flour still makes the same number of biscuits. Any change to the second will be similarly coordinated.

So, sorry, there’ll be no chance to squeeze any extra seconds into a day.


NASA’S TESS MISSION FINDS ITS SMALLEST PLANET YET

NASA’s Transiting Exoplanet Survey Satellite (TESS) has discovered a world between the sizes of Mars and Earth orbiting a bright, cool,
nearby star. The planet, called L 98-59b, marks the tiniest discovered by TESS to date.

Two other worlds orbit the same star. While all three planets’ sizes are known, further study with other telescopes will be needed to determine if they have atmospheres and, if so, which gases are present. The L 98-59 worlds nearly double the number of small exoplanets — that is, planets beyond our solar system — that have the best potential for this kind of follow-up.

“The discovery is a great engineering and scientific accomplishment for TESS,” said Veselin Kostov, an astrophysicist at NASA’s Goddard Space Flight Center in Greenbelt, Maryland, and the SETI Institute in Mountain View, California. “For atmospheric studies of small planets, you need short orbits around bright stars, but such planets are difficult to detect. This system has the potential for fascinating future studies.”

A paper on the findings, led by Kostov, was published in the June 27 issue of The Astronomical Journal.

L 98-59b is around 80% Earth’s size and about 10% smaller than the previous record holder discovered by TESS. Its host star, L 98-59, is an M dwarf about one-third the mass of the Sun and lies about 35 light-years away in the southern constellation Volans. While L 98-59b is a record for TESS, even smaller planets have been discovered in data collected by NASA’s Kepler satellite, including Kepler-37b, which is only 20% larger than the Moon.

The two other worlds in the system, L 98-59c and L 98-59d, are respectively around 1.4 and 1.6 times Earth’s size. All three were discovered by TESS using transits, periodic dips in the star’s brightness caused when each planet passes in front of it.

TESS monitors one 24-by-96-degree region of the sky, called a sector, for 27 days at a time. When the satellite finishes its first year of observations in July, the L 98-59 system will have appeared in seven of the 13 sectors that make up the southern sky. Kostov’s team hopes this will allow scientists to refine what’s known about the three confirmed planets and search for additional worlds.

“If you have more than one planet orbiting in a system, they can gravitationally interact with each other,” said Jonathan Brande, a co-author and astrophysicist at Goddard and the University of Maryland, College Park. “TESS will observe L 98-59 in enough sectors that it may be able to detect planets with orbits around 100 days. But if we get really lucky, we might see the gravitational effects of undiscovered planets on the ones we currently know.”

M dwarfs like L 98-59 account for three-quarters of our Milky Way galaxy’s stellar population. But they are no larger than about half the Sun’s mass and are much cooler, with surface temperatures less than 70% of the Sun’s. Other examples include TRAPPIST-1, which hosts a system of seven Earth-size planets, and Proxima Centauri, our nearest stellar neighbor, which has one confirmed planet. Because these small, cool stars are so common, scientists want to learn more about the planetary systems that form around them.

L 98-59b, the innermost world, orbits every 2.25 days, staying so close to the star it receives as much as 22 times the amount of energy Earth receives from the Sun. The middle planet, L 98-59c, orbits every 3.7 days and experiences about 11 times as much radiation as Earth. L 98-59d,
the farthest planet identified in the system so far, orbits every 7.5 days and is blasted with around four times the radiant energy as Earth. None of the planets lie within the star’s “habitable zone,” the range of distances from the star where liquid water could exist on their surfaces. However, all of them occupy what scientists call the Venus zone, a range of stellar distances where a planet with an initial Earth-like atmosphere could experience a runaway greenhouse effect that transforms it into a Venus-like atmosphere. Based on its size, the third planet could be either a Venus-like rocky world or one more like Neptune, with a small, rocky core cocooned beneath a deep atmosphere.

One of TESS’s goals is to build a catalog of small, rocky planets on short orbits around very bright, nearby stars for atmospheric study by NASA’s upcoming James Webb Space Telescope. Four of the TRAPPIST-1 worlds are prime candidates, and Kostov’s team suggests the L 98-59 planets are as well.

The TESS mission feeds our desire to understand where we came from and whether we’re alone in the universe.

“If we viewed the Sun from L 98-59, transits by Earth and Venus would lead us to think the planets are almost identical, but we know they’re not,” said Joshua Schlieder, a co-author and an astrophysicist at Goddard. “We still have many questions about why Earth became habitable and Venus did not. If we can find and study similar examples around other stars, like L 98-59, we can potentially unlock some of those secrets.”

Source: https://www.sciencedaily.com/releases/2019/06/190627114113.htm

---

MORE THAN 50 NEWLY DISCOVERED LAKES BENEATH THE GREENLAND ICE SHEET

Researchers have discovered 56 previously uncharted subglacial lakes beneath the Greenland Ice Sheet bringing the total known number of lakes to 60.

Although these lakes are typically smaller than similar lakes in Antarctica, their discovery demonstrates that lakes beneath the Greenland Ice Sheet are much more common than previously thought.

The Greenland Ice Sheet covers an area approximately seven times the size of the UK, is in places more than three kilometres thick and currently plays an important role in rising global sea levels.

Subglacial lakes are bodies of water that form beneath ice masses. Meltwater is derived from the pressure of the thick overlying ice, heat generated by the flow of the ice, geothermal heat retained in the Earth, or water on the surface of the ice that drains to the bed. This water can become trapped in depressions or due to variations in ice thickness.

Knowledge of these new lakes helps form a much fuller picture of where water occurs and how it drains under the ice sheet, which influences how the ice sheet will likely respond dynamically to rising temperatures.

Published in *Nature Communications* this week, their paper, “Distribution and dynamics of Greenland subglacial lakes,” provides the first ice-sheet wide inventory of subglacial lakes beneath the Greenland Ice Sheet.
By analysing more than 500,000 km of airborne radio echo sounding data, which provide images of the bed of the Greenland Ice Sheet, researchers from the Universities of Lancaster, Sheffield and Stanford identified 54 subglacial lakes, as well as a further two using ice-surface elevation changes.

Lead author Jade Bowling of the Lancaster Environment Centre, Lancaster University, said: “Researchers have a good understanding of Antarctic subglacial lakes, which can fill and drain and cause overlying ice to flow quicker. However, until now little was known about subglacial lake distribution and behaviour beneath the Greenland Ice Sheet.

“This study has for the first time allowed us to start to build up a picture of where lakes form under the Greenland Ice Sheet. This is important for determining their influence on the wider subglacial hydrological system and ice-flow dynamics, and improving our understanding of the ice sheet’s basal thermal state.”

The newly discovered lakes range from 0.2-5.9 km in length and the majority were found beneath relatively slow moving ice away from the largely frozen bed of the ice sheet interior and seemed to be relatively stable.

However, in the future as the climate warms, surface meltwater will form lakes and streams at higher elevations on the ice sheet surface, and the drainage of this water to the bed could cause these subglacial lakes to drain and therefore become active. Closer to the margin where water already regularly gets to the bed, the researchers saw some evidence for lake activity, with two new subglacial lakes observed to drain and then refill.

Dr Stephen J. Livingstone, Senior Lecturer in Physical Geography, University of Sheffield, said: “The lakes we have identified tend to cluster in eastern Greenland where the bed is rough and can therefore readily trap and store meltwater and in northern Greenland, where we suggest the lakes indicate a patchwork of frozen and thawed bed conditions.

“These lakes could provide important targets for direct exploration to look for evidence of extreme life and to sample the sediments deposited in the lake that preserve a record of environmental change.”

Source : https://www.sciencedaily.com/releases/2019/06/190626124956.htm

A MYSTERIOUS DEMENTIA THAT MIMICS ALZHEIMER’S GETS NAMED LATE

It’s possible about a quarter of people age 85 and older have the newly described disease

A newly described dementia strikes people in their last decades of life. The disease, aptly named LATE, comes with symptoms that resemble Alzheimer’s disease, but is thought to be caused by something completely different.

An international team of scientists and clinicians describe the disease and officially christen it LATE, which stands for the more technical description, “limbic-predominant age-related TDP-43 encephalopathy,” online April 30, 2019 in Brain. Study coauthor Peter Nelson, a neuropathologist at the University of Kentucky in Lexington, helped organize a meeting last year that addressed a growing realization among doctors and scientists: “There’s this disease, and it doesn’t have a name,” he says.
LATE comes with memory trouble and dementia — symptoms that mirror Alzheimer’s, Nelson says. But instead of the plaques and tangles that mark the brains of people with Alzheimer’s disease, LATE is characterized by a lesser-known protein called TDP-43. In LATE, that protein accumulates and spreads through parts of the brain that are key to thinking and memory, including the amygdala and hippocampus.

In *Brain*, Nelson and his colleagues describe the signs of LATE in the brain in a series of stages, from less severe to most severe. But the trouble is that these signs, which include the spread of TDP-43 and occasionally signs of damage to the hippocampus, can be found only after a person has died.

There are currently no surefire clinical tests that identify LATE in a living person. LATE is diagnosed largely after other disorders have been ruled out, making it a “diagnosis of exclusion,” says neurologist Michael Greicius of Stanford University, who was not involved in the study.

The researchers hope that giving the disease a name and description will make it easier to spot. Take a hypothetical 80-year-old patient with memory loss who tests negative for signs of Alzheimer’s in the brain, and whose MRI shows a smaller-than-normal hippocampus. “There, I think this notion of LATE is going to start rising quickly to the top,” Greicius says. Still, he cautions that “this is a disorder that we’re beginning to get a handle on. We’re not quite sure yet.”

Greicius also points out that brains, particularly older ones, often contain a mixture of different problems, each of which might be contributing to dementia. That makes pinning symptoms on TDP-43 a challenge. “The minute you have other pathologies in there, it’s really hard to tease those out of the picture,” he says. Many brains with LATE also show some of the signs of Alzheimer’s disease, a comingling that may confound easy diagnoses, the researchers write in the new study.

As scientists gain more tools that pinpoint various brain diseases, one thing is becoming clear, Nelson says: “It’s complicated.” There’s a growing realization that many different — and perhaps interconnected — pathways can lead to dementia. “Grappling with this complexity is necessary,” Nelson says, and could ultimately point to subsets of people who could be treated for their particular form of dementia, should a therapy become available.

That complexity may also be behind some of the recent failures of drugs to treat Alzheimer’s disease, Nelson says. People who actually had LATE — not Alzheimer’s — may have been included in those clinical trials, masking potentially positive results, he says. That’s a problem for Alzheimer’s research, but also for people with LATE, who may want to participate in trials of their own.

For now, with the new description of LATE, scientists and doctors at least have a starting point for understanding the disease, says Nina Silverberg who directs the Alzheimer’s Disease Centers Program at the National Institute on Aging in Bethesda, Md. “This is the beginning.”

*Source:* https://www.sciencenews.org/

**BRAIN SPOTS** Accumulation of a protein called TDP-43 (brown spots, left) in a postmortem brain and shrunken brain areas revealed by MRI (bottom of brain, right) are hallmarks of LATE. P.T. Nelson *et al/Brain* 2019
There are currently no surefire clinical tests that identify LATE in a living person. LATE is diagnosed largely after other disorders have been ruled out, making it a “diagnosis of exclusion,” says neurologist Michael Greicius of Stanford University, who was not involved in the study.

The researchers hope that giving the disease a name and description will make it easier to spot. Take a hypothetical 80-year-old patient with memory loss who tests negative for signs of Alzheimer’s in the brain, and whose MRI shows a smaller-than-normal hippocampus. “There, I think this notion of LATE is going to start rising quickly to the top,” Greicius says. Still, he cautions that “this is a disorder that we’re beginning to get a handle on. We’re not quite sure yet.”

Greicius also points out that brains, particularly older ones, often contain a mixture of different problems, each of which might be contributing to dementia. That makes pinning symptoms on TDP-43 a challenge. “The minute you have other pathologies in there, it’s really hard to tease those out of the picture,” he says. Many brains with LATE also show some of the signs of Alzheimer’s disease, a comingling that may confound easy diagnoses, the researchers write in the new study.

As scientists gain more tools that pinpoint various brain diseases, one thing is becoming clear, Nelson says: “It’s complicated.” There’s a growing realization that many different — and perhaps interconnected — pathways can lead to dementia. “Grappling with this complexity is necessary,” Nelson says, and could ultimately point to subsets of people who could be treated for their particular form of dementia, should a therapy become available.

That complexity may also be behind some of the recent failures of drugs to treat Alzheimer’s disease, Nelson says. People who actually had LATE — not Alzheimer’s — may have been included in those clinical trials, masking potentially positive results, he says. That’s a problem for Alzheimer’s research, but also for people with LATE, who may want to participate in trials of their own.

For now, with the new description of LATE, scientists and doctors at least have a starting point for understanding the disease, says Nina Silverberg who directs the Alzheimer’s Disease Centers Program at the National Institute on Aging in Bethesda,
भारतीय विज्ञान कांग्रेस संस्था
14, डॉ बिरेन्गु हुआ स्ट्रीट, कोलकाता-700 017, भारत
dूरभाष : (033) 2287-4530, 2281-5323
फैक्स : 91-33-2287-2551
वेबसाइट : http://sciencecongress.nic.in
ई-मेल : es.sciencecongress@nic.in

सदस्यता की शर्तें और सदस्यों की विशेषाधिकारः
संस्था की सदस्यता उन सभी लोगों के लिए खुली है, जो स्नातक या उसके समान स्तर पर शैक्षणिक योग्यता अर्जित कर चुके हैं, और जिन्हें भारत में विज्ञान की तस्करों में रूचि है।

1. वार्षिक सदस्य : जो व्यक्ति नये रूप से वार्षिक सदस्यता ग्रहण करना चाहता है उसे वार्षिक सदस्यता शुल्क र 200/- के साथ भर्ती शुल्क र 50/- (विदेशों के लिए** U.S. $ 70) मात्र देने पड़ेगी। वार्षिक सदस्यता शुल्क प्रयोग में वर्ष के 01 अगस्त को देने हो जाएगा। जो भी 15 जुलाई के भीतर अपनी सदस्यता शुल्क नहीं अदा कर पाएगा वह उस साल के लिए अपनी वोट देने की क्षमता से वैधित हो जाएगा और वह वर्ष के लिए संस्था के कार्यालय की भी नियंत्रण नहीं कर पाएगा। वार्षिक सदस्य अपनी सदस्यता दोबारा अगले साल 15 जुलाई के भीतर निर्णय दिए पुनः अपनी सदस्यता प्राप्त कर सकता है।

सदस्यगण अपने पेपर कांग्रेस सत्र के समय पेश कर सकतें हैं। उन्हें वार्षिक विज्ञान कांग्रेस सत्र की कार्यवाहिनी को एक प्रति बिना मूल्य में प्राप्त कर सकते हैं। इसके साथ वे संस्था के राजनीतिक "एवरीमैंस साइंस" की प्रति भी बिना मूल्य उस साल के लिए प्राप्त कर सकते हैं। सदस्यता के नवीकरण के लिए कृपया ISCA वेबसाइट से फॉर्म डाउनलोड करें।

2. सत्र सदस्य : वर्ष के कुछ कारणों द्वारा वार्षिक सदस्यता है उस वर्ष के 15 जुलाई के अंदर दोहराना भुगतान करेगा, तो उनकी सदस्यता, सत्र सदस्यता के रूप में निर्धारित कर दी जाएगी। सत्र सदस्यता र 200/- (विदेशों के लिए $ 50) अदा करने पड़ेगी। एक सत्र सदस्य को लेख या पेपर प्रस्तुतिकरण का अधिकार प्राप्त होता है जिस कांग्रेस सत्र का वह सदस्य है। एक सत्र सदस्य वोट क्रियान्वयन में भाग लेने के योग्य नहीं है। सत्र सदस्य को विभागों के व्यवसायी वैज्ञानिकों और साधारण वैज्ञानिकों में भाग लेने की योग्यता प्राप्त नहीं है।

3. छात्र सदस्य : जो व्यक्ति स्नातक सतर से नीचे पढ़ाई कर रहा है, उसे वार्षिक सदस्यता शुल्क र 100/- मात्र देने पड़ेगी। अपने नाम छात्र सदस्य के रूप में निर्धारित कर दिया जाएगा, जिसके अंदर उस्के आवेदन पत्र पर उसके प्राप्ति/विभागाध्यक्ष संस्थान के साथ संपर्क करें। एक छात्र सदस्य को वह अधिकार दिया जाएगा कि वह अपने पेपर कांग्रेस सत्र के समय पेश कर सके। उसे वोट करने का अधिकार होगा। छात्र सदस्य को विभागों के व्यवसायी वैज्ञानिकों और भाग लेने की योग्यता प्राप्त नहीं है।

4. आर्जीवन सदस्य : एक सदस्य अपने सत्ता की सारी वार्षिक सदस्यता शुल्क एक बार में र 2,000/- (विदेशों के लिए U.S. $ 500) मात्र अदा करके पा सकता है। एक व्यक्ति जो 10 साल या उससे अधिक निर्धारित रूप से सदस्यता प्राप्त कर चुका है, उसे उसकी संयुक्त सदस्यता शुल्क के ऊपर प्रति वर्ष र 50/- की छूट दी जाएगी। उसके के संयुक्त शुल्क र 1,200/- से नीचे न हो (विदेशों के लिए U.S. $ 12.50 और U.S. $ 300 क्रमशः।) एक आर्जीवन सदस्य को उसके पूरे जीवन काल में सदस्यता को सारे विशेषाधिकार प्राप्त होगे।
5. संस्थान सदस्य : एक संस्थान जो ₹ 5,000/- सदस्यता शुल्क के रूप में दे वही संस्था के संस्थान सदस्य उस विभाग चली, के लिए तो सदस्य करता है। (विदेशीयों के लिए U.S. $ 2,500)। इसमें वह विज्ञान कांग्रेस के वार्षिक सम्मेलन में अपने एक व्यक्ति का नाम नामांकित कर सकता है, जो उनका प्रतिनिधित्व हो। एक संस्थान सदस्य को वार्षिक विज्ञान कांग्रेस सम्मेलन के बारे में कार्यवाहिक की एक पूर्ण प्रति बिना मूल्य में प्राप्त हो सकती है। इससे अधिक में संस्था के रोजनामों "अर्थमान्य साइंस" की प्रति भी बिना मूल्य प्राप्त कर सकते हैं।

6. दाता : कोई भी व्यक्ति जो एक साथ ₹ 10,000/- (विदेशीयों के लिए U.S. $ 5,000) मात्र देने, वह संस्था के दाता बन सकते हैं। एक व्यक्तिगत दाता को वह सारे अधिकार और विशेषाधिकार मिलते जो एक सदस्य को उसके पूर्ण जीवन काल में भरत होते हैं।

एक संस्थान जो एक साथ ₹ 10,000/- (विदेशीयों के लिए U.S. $ 5,000) मात्र देने, सम्मेलन के लिए इस संस्था के संस्थान दाता बन सकते हैं, जिसे वह एक व्यक्तिगत दाता करके उसप्राप्त कर उसके अपने संस्थान के प्रतिनिधित्व के रूप में विज्ञान कांग्रेस के वार्षिक सम्मेलन में भेज सकते हैं। एक संस्थान/व्यक्तिगत दाता वार्षिक विज्ञान कांग्रेस के कार्यवाहिक और संस्था के रोजनामों "अर्थमान्य साइंस" की प्रति भी बिना मूल्य प्राप्त कर सकते हैं।

* भर्ति शुल्क ₹ 50/ निर्दिष्ट एक नये वार्षिक सदस्य के लिए जुर्जी नहीं है।
** (एक विदेशी सदस्य का अर्थ है, जो भारतीय के बाहर का नागरिक हो।)

(1) पेपर पेश करना : एक पूर्ण पेपर की प्रति उसके साथ लीन सांस्कृतिक की प्रति जो 100 शब्दों से ज्यादा न हो और जिनमें कोई अंग्रेजी या फाइनल न हो, वह प्रथम वर्ष 15 अगस्त के अंदर अनुभवी अध्यक्ष तक पहुँच जाना चाहिए।

(2) संस्था के पुस्तकालय में सभी वर्गों के सदस्य जो विज्ञान कांग्रेस सम्मेलन में भाग लेने के परवर्ती लीटर सम्मेलन के दिनों में रियायत प्राप्त कर सकता है, बसाया कि उनकी यात्रा के खर्च का योग्य भाग स्वायत्त (कैश, एक रुपया या रुपये), कोई कानूनी स्तर या कोई विश्लेषण या कोई नागरिकता न उठाए और उनकी कुल कमाई या परिवर्तन विदेशीयों ₹ 5,000/- (प्रति माह पूर्ण हार्ड रुपये) से अधिक नहीं है।

(3) संस्था के विदेशाधीन सम्मेलन में सभी वर्गों के सदस्य को पढ़ने की सुविधा मुख्य 10.00 बजे से शाम को 5.30 बजे तक सभी काम के दिनों में (शामिल और सिवाई) को छोड़कर प्राप्त होगी।

(4) सम्मेलन के विदेशाधीन सम्मेलन में सभी वर्गों के सदस्य को संस्था के दिनों में प्राप्त होगी।

(5) विभाग में भारतीय विज्ञान कांग्रेस संस्था के साक्षरता परिवर्तन सम्मेलन, सम्मेलन और वार्षिक कांग्रेस में सभी वर्गों के सदस्यों द्वारा भाग लेने के लिए अपनी—अपनी सदस्यता पद को लाने जुर्जी होगा।

(2) भारतीय विज्ञान कांग्रेस संस्था के लिए मनोपालित, आई. पी. ओ, ए. सी. संस्था या चेंक से भुगतान ग्रहण नहीं किया जाएगा। कोई भी सदस्यता निर्धारित सदस्यता फार्म (आवेदन-पत्र नई सदस्यता सदस्यता की नवीकरण के लिए) में विभिन्न विना भरने से नहीं लिया जाएगा।

(3) नकदी नकदी ISCA मुख्यालय में हाथ से लिया जाएगा। कृपया डाक द्वारा लिफाफे के भीतर नकदी नहीं भेजें।

(ii)
भारतीय विज्ञान कांग्रेस संस्था
14, डॉ बिरेश गुहा स्ट्रीट, कोलकाता-700 017, भारत

दर्शाल : (033) 2287-4530, 2281-5323
फैक्स : 91-33-2287-2551
वेबसाइट : http://sciencecongress.nic.in
ई-मेल : es.sciencecongress@nic.in

सदस्यता के लिए नया आवेदन पत्र

सेवा में
महासचिव (सदस्यता कार्य)
भारतीय विज्ञान कांग्रेस संस्था
14, डॉ बिरेश गुहा स्ट्रीट,
कोलकाता-700 017

महोदय,

मैं भारतीय विज्ञान कांग्रेस संस्था का आजीवन सदस्य/वार्षिक सदस्य/सत्र सदस्य/छात्र सदस्य/संस्थान सदस्य/व्यक्तिगत दाता/संस्थागत दाता अपना नाम लिखनावं चाहता/चाहती हूँ।

मैं इसके साथ ————— सदस्यता शुल्क के रूप में नकद ₹ ———/बैंक ड्राफ्ट संख्या ——— दिनांकित ——— प्रचालक बैंक ——— 01 अप्रैल 20—— से 31 मार्च 20—— तक भेज खा/ही हूँ।

मैं निम्नलिखित विभाग में सूची रखता/रखती हूँ (कृपया किसी एक में निशान लगाएँ)।

विभाग

1. कृषि और वानिकी विज्ञान
2. पशु, पशुचिकित्सा और मल्य विज्ञान
3. मानवशास्त्रीय और व्यवहारस्पर्श विज्ञान (जिसमें सम्मिलित, हैं, पुरुषव-विज्ञान, मनोविज्ञान, शैक्षिक विज्ञान और सेवा विज्ञान)
4. रसायन विज्ञान
5. भू-पदाति विज्ञान
6. अभियंता विज्ञान
7. वन्यवर्ण विज्ञान
8. सूचना और संचार विज्ञान और प्रौद्योगिकी (जिसमें कंप्यूटर विज्ञान भी सम्मिलित है)
9. भौतिक विज्ञान
10. गणित विज्ञान (जिसमें सांख्यिकीय सम्मिलित है)
11. चिकित्सा शाखा (जिसमें सरीर विज्ञान भी सम्मिलित है)
12. नया जीवविज्ञान (जिसमें जीव रसायन, जीव भौतिकी और आणविक जीवविज्ञान और जीव-प्रौद्योगिकी भी सम्मिलित है)
13. भौतिकोय विज्ञान
14. वनस्पति विज्ञान

(कृपया टिकित करें या ब्लॉक अक्षरों में भरें)

नाम (ब्लॉक अक्षरों में) :
श्री/सु/श्री/श्री/श्रीमती/डॉ॰प्रो॰ (कृपया टिक करें)

कुलनाम प्रथम नाम मध्य नाम

शैक्षणिक योग्यता :
(अंतिम शैक्षणिक योग्यता प्रमाण-पत्र अंक-सूची का स्वतःसत्यापित जिक्रक्स प्रति संलग्न करना है)

पदनाम
सम्पर्क का पता :
(राज्य, शहर/नगर और पिन कोड सहित)

dरभाष संख्या/मोबाइल संख्या और ई-मेल :

किसी भी सरकारी अनुमोदित पत्रचार पत्र (अनिवार्य) :

बर्तनमान वर्ष विश्वविद्यालय प्रवेश-पत्र :

स्थायी पता :

दिनांक :

भवनदीव

हस्ताक्षर

ध्यान दें : (i) सभी बैंक झुकट The Indian Science Congress Association के नाम से ही लिख जाएँ, सदस्यता के विषय में बैंक झुकट प्राप्त और जो कोई कानून के किसी भी शाखा में देन हो।

(ii) सभी सदस्यता और सदस्यता के नवीकरण के लिए आवेदन-पत्र आवेदकों को अपने खुद के पते उपलब्ध कराने करने चाहिए तथा देखभाल के पते प्रस्तुत करने चाहिए।

(iii) भारतीय शुल्क ₹ 50/- फिर एक नये वार्षिक सदस्य के लिए जुटी है। वह सदस्य/आवेदन सदस्य/संस्थान सदस्य/छात्र सदस्य/दाता के लिए जुटी नहीं है।

(iv) सदस्यों से यह निवेदन किया जा रहा है कि वे अपनी सदस्यता संख्या का उल्लेख भारतीय विज्ञान कांग्रेस संस्था के कार्यालय के साथ पत्रांचार के समय अवश्य करें।

(v) भारतीय विज्ञान कांग्रेस संस्था द्वारा मनीआउंड, आई. पी. और, इं. सी. एस. या चेक से भुगतान प्राप्त नहीं किया जाएगा।

(vi) कोई भी सदस्यता निर्धारित सदस्यता फार्म (आवेदन-पत्र नई सदस्यता/सदस्यता की नवीकरण के लिए) में विनियमित निम्न भरने से नहीं लिया जाएगा।

(vii) नकदी केवल ISCA मुख्यालय में हाथ से लिया जाएगा। खुद झुकट द्वारा लिपिबद्ध के भीतर नकदी नहीं भेजें।
Membership of the Association is open to persons with Graduate or equivalent Academic Qualifications and interested in the advancement of Science in India.

1. **Annual Member**: A person willing to be enrolled as a new Annual Member has to pay an annual subscription of ₹ 200/- along with an admission fee of ₹ 50/- (for foreign** U.S.$ 70) only. The annual subscription of a Member shall become due on the 1st April of each year. Anyone who fails to pay the subscription on or before the 15th July in any year shall lose the right of voting and/or holding any office of the Association for that year. A member failing to pay the annual subscription by the end of March of the following year shall cease to be a Member. Annual members can renew their Membership without paying the admission fee in the next year by remitting subscriptions in time i.e. within 15th July. Members may contribute papers for presentation at the Science Congress. They will receive, free of cost, reprints of the Proceedings of the Session of any one section of their interest and also the bi-monthly journal of the Association Everymans Science for that year only. For Renewal of Membership please download the form from ISCA website.

2. **Sessional Member**: If for some reasons, Annual Members fail to renew their Membership by remitting subscription prior to 15th July each year, their Membership for the year would be restricted to Sessional Membership without voting right. Sessional Member has to pay ₹ 200/- (for foreign $50). A Sessional Member shall have the right to present paper/poster at the session of the congress of which he/she is a member. A Sessional Member shall not be eligible to participate in the voting process. A Sessional member shall not be eligible to participate in the Business meetings of the Sections and the General Body.

3. **Student Member**: A person studying at the under-graduate level may be enrolled as a Student Member by paying an annual subscription of ₹ 100/- only provided his/her application is duly certified by the Principal/Head of the Institution/Department. A student member shall have the right to submit papers for presentation at the Session of the Congress of which he/she is a member, provided such papers be communicated through a Member, or an Honorary Member of the Association. He/She shall not have the right to vote or to hold any office. A student member shall not be eligible to participate in the Business Meetings of the Sections and the General Body.

4. **Life Member**: A Member may compound all future annual subscriptions by paying a single sum of ₹ 2,000/- (for foreign** U.S. $ 500) only. Any person who has been continuously a member for 10 years or more, shall be allowed a reduction in the compounding fee of ₹ 50/- for every year of such membership, provided that the compounding fee shall not be less than ₹ 1,200/- (for foreign** U.S. $ 12.50 and U.S. $ 300 respectively). A life Member shall have all the privileges of a member during his/her lifetime.
5. **Institutional Member**: An Institution paying a subscription of ₹ 5,000/- (for foreign** U.S. $ 2,500) only, can become an Institutional Member of the Association for that financial year. It shall be eligible to nominate one person as its representative to attend Annual Session of the Science Congress. An Institutional Member shall be eligible to receive, free of cost, a copy of the complete set of Proceedings of the Annual Science Congress Session as also a copy each of the Associations journal Everymans Science.

6. **Donor**: Any person paying a lump sum of ₹ 10,000/- (for foreign** U.S. $ 5,000) only, can become an Individual Donor of the Association, an **INDIVIDUAL DONOR** shall have all the rights and privileges of a member during his/her lifetime. An Institution paying a lump of ₹ 50,000/- (for foreign** U.S. $ 25,000) only, can become an **INSTITUTIONAL DONOR** of the Association forever, which shall have the right to nominate one person as its representative to attend Annual Session of the Science Congress. An Institutional/Individual Donor shall be eligible to receive, free of cost, a copy of the complete set of Proceedings of the Annual Science Congress Session as also the Associations journal Everymans Science.

* Admission fee of ₹ 50/- is needed only for becoming a new Annual Member and not for Sessional Member/Life Member/Institutional Member/Student Member/Donor.

** (A Foreign Member means one who is normally Resident outside India).

(A) **Presentation of Papers**: A copy of complete paper accompanied by an abstract in triplicate not exceeding one hundred words and not containing any diagram or formula, must reach the Sectional President latest by September 15, each year.

(B) Members of all categories are entitled to **Railway Concession** of return ticket by the same route with such conditions as may be laid down by the Railway Board for travel to attend the Science Congress Session provided that their travelling expenses are not borne, even partly, by the Government (Central or State), Statutory Authority or an University or a City Corporation and their total earning of or emoluments drawn do not exceed ₹ 5,000/- (Rupees Five Thousand per month). Please download the Railway Concession form from ISCA Website.

(C) Members of all categories are entitled to reading facilities between 10.00 a.m. to 5.30 p.m. on all weekdays (except Saturdays & Sundays) in the library of the Association.

(D) Members of all categories may avail Guest House facilities, Lecture Hall hiring at the rates fixed by the Association from time to time.

(E) Members of all categories should bring the Membership Card always for attending any Seminar, Conference and Annual Congress organized by ISCA in future.

**Note**: (1) All Bank Drafts should be drawn in favour of *The Indian Science Congress Association*, membership subject to realisation of the bank draft, Payable at any branch in Kolkata. Members are requested to mention their Membership No. while making any correspondence to ISCA office.

(2) No money order, I.P.O., ECS or cheque will be accepted by ISCA. No Membership will be taken without duly filled in prescribed Membership Form (Application From for New Membership/Application for Renewal of Membership).

(3) Cash will only be taken by hand at ISCA Hqrs. Pl. do not send the Cash by Post within the envelop.
Application Form For New Membership

To
The General Secretary (Membership Affairs)
The Indian Science Congress Association
14, Dr. Biresh Guha Street,
Kolkata-700 017

Dear Sir,

I like to be enrolled as a Life Member/Annual Member/Sessional Member/Student Member/Institutional Member/Individual Donor/Institutional Donor of The Indian Science Congress Association. (Pl. Tick)

I am sending herewith an amount of ₹ in payment of my subscription by Cash/Bank Draft No. dated issuing bank from the year 1st April 20_____ to 31st March 20_____.

I am interested in the following section (Please tick any one).

Sections

1. Agriculture and Forestry Sciences
2. Animal, Veterinary and Fishery Sciences
3. Anthropological and Behavioural Sciences (including Archaeology, Psychology, Education and Military Sciences)
4. Chemical Sciences
5. Earth System Sciences
6. Engineering Sciences
7. Environmental Sciences
8. Information and Communication Science & Technology (including Computer Sciences)
9. Materials Science
10. Mathematical Sciences (including Statistics)
11. Medical Sciences (including Physiology)
12. New Biology (including Bio-Chemistry, Biophysics & Molecular Biology and Biotechnology)
13. Physical Sciences
14. Plant Sciences

(Please type or fill up in Block Letters)

Name (in Block Letters):
Mr./Ms./Shri/Shrimati/Dr./Prof. (Please tick)

Surname                First Name                Middle Name

Academic Qualifications:
Self attested xerox copy of last educational certificate/marksheet must be attached

Designation

Address of communication:
(including state, city/town and pin code)

Phone No./Mobile Number & E-mail:

Any Govt. approved ID Card (Mandatory):

Current Year University Admit Card:

Permanent Address:

Date: Yours Faithfully

Signature

Note:
(i) All Bank Drafts should be drawn in favour of The Indian Science Congress Association, membership subject to realisation of the bank draft, Payable at any branch in Kolkata.
(ii) All Application Forms for Membership and the renewal of Membership must be submitted by providing the address of the applicants themselves only and not any care of address.
(iii) Admission fess of ₹ 50/- is needed only for becoming a new Annual Member and not for Sessional Member/Life Member/Institutional Member/Student Member/Donor.
(iv) Members are requested to mention their Membership No. while making any correspondence to ISCA office.
(v) No Money Order, I.P.O., ECS or Cheque will be accepted by ISCA.
(vi) No Membership will be taken without duly filled in prescribed Membership Form (Application Form for New Membership/Application For Renewal of Membership).
(vii) Cash will only be taken by hand at ISCA Hqrs. Pl. do not send the cash by Post within the envelope.
GUIDELINES FOR SUBMISSION OF MANUSCRIPTS

1. Everyman’s Science intends to Propagate the latest message of science in all its varied branches to its readers and through them, to every one interested in Science or Engineering or Technology. Research articles usually meant for publication in periodicals devoted to particular branches of Science & Technology and addressed to specialised sections of the readers, are not appropriate for Everyman’s Science. Instead, popular or easily intelligible expositions of new or recent developments in different branches of Science & Technology are welcome.

2. Manuscripts should be typewritten on one side of the paper with double spacing. Articles should be written generally in non-technical language and should not ordinarily exceed 2000 words. Articles must be understandable by the average enthusiastic readers with some modest scientific background but outside the field. It should not be a review article in a specialised area. Without being too technical, it must also reflect state of the art situation in the field. A summary in 50 words should be submitted along with the paper highlighting the importance of the work. Two copies of the manuscript complete in all respects should be submitted. The title should be written in capital letters and name(s) of the author(s) should be given along with the Department, Institution, City and Country of each author.

3. Illustration & Tables: the size of illustrations should be such as to permit reduction to about one-third. Legends and captions should be typed on a separate sheet of paper. Photographs should be on glossy paper with strong contrast in black and white. Typed tables should be separate pages and provided with titles and their serial numbers. The exact position for the placement of the tables should be marked in the script. Authors are specially requested to reduce the number of tables, illustrations and diagrams to a minimum (maximum of 3).

4. References: References to be given on a selective basis, (maximum of 10) and the order of placement should be numerically with (a) name(s) of the author(s) (surname last), (b) name of the journal in abbreviated form according to the ‘World list of Scientific Periodicals’ and in italics, (c) volume number (in bold) (d) page number and (e) year of publication.

For citations of books the author’s name should be followed by the (a) title of the book, (b) year of publication or edition or both, (c) page number, (d) name of publishers, and (e) place of publication.

5. The Indian Science Congress Association and the Editors of Everyman’s Science assume no responsibility for statements and opinions advanced by the contributors to the journal.

Reprints: The communicating author with receive 1 copy of the journal and 10 reprints free of cost.

All manuscripts and correspondences should be addressed to the Hony. Editor, Everyman’s Science. The Indian Science Congress Association 14, Dr. Biresh Guha Street, Kolkata-700 017. Email: iscacal@vsnl.net, iscacal_2004@yahoo.com, Fax: 91-33-2287-2551
PUBLICATIONS OF INDIAN SCIENCE CONGRESS ASSOCIATION

1. A Short History of the Indian Science Congress Association ₹ 10/-
2. A decade (1963-1972) of Indian Science Congress Association in India ₹ 10/-
3. Science and Integrated Rural Development ₹ 10/-
4. Survey, Conservation and Utilisation of Resources ₹ 10/-
5. Science and Technology in India during the Coming Decades ₹ 15/-
6. Impact of the Development of Science and Technology on Environment ₹ 150/-
7. Basic Research as an Integral Component of Self Reliant Base of Science and Technology ₹ 90/-
8. Man and the Ocean ₹ 140/-
9. High Altitude Studies ₹ 75/-
10. Indira Gandhi on Science, Technology and Self Reliance ₹ 100/-
11. Environmental Priorities in India and Sustainable Development ₹ 25/-
12. Resources and Human Well Being : Inputs from Science and Technology ₹ 25/-
13. Scientific Research in India Progress in Earth Sciences ₹ 120/-
14. Frontiers of Science and Technology, the Indian Context Vol. I ₹ 50/-
15. Frontiers of Science and Technology, the Indian Context Vol. II ₹ 175/-
16. Natural Disaster Management : The West Bengal Scenario ₹ 45/-
17. A Tribute to Prof. P. C. Mahalanobis ₹ 35/-
   Part-I-Physical Sciences ₹ 100/- ₹ 150/- ₹ 165/-
   Part-II-Biological Sciences ₹ 90/- ₹ 175/- ₹ 225/-
   Part-III-Engineering & Earth Sciences ₹ 70/- ₹ 128/- ₹ 240/-
   Part-IV-Social Sciences ₹ 50/- ₹ 85/- ₹ 130/-
20. PROCEEDINGS of Annual Session of Indian Science Congress ₹ 1200/-
22. EVERYMAN’S SCIENCE Published Bimonthly
   Individual- ₹ 300/- Institutional- ₹ 500/-

For Order, Write to : ISCA, 14 Dr. Biresh Guha Street, Kolkata-700 017
Fax : 91-33-2287-2551, E-mail : es.sciencecongress@nic.in
Website : http://www.sciencecongress.nic.in

* Members are entitled to 33.33% discount on the above prices