

## Celebration of “World Immunization Week” – Achievements and Future Challenges

World Immunization Week, spearheaded by the World Health Organization (WHO), is observed between 24-30<sup>th</sup> April every year. This year’s theme was “Protected Together, #VaccinesWork”, which was aimed at highlighting the collective action needed to ensure that every person is protected from vaccine-preventable diseases.

The World Immunization Week focuses on encouraging people at every level – from vaccine suppliers to the general public – to push further in their efforts to increase immunization coverage for the greater good of mankind. Moreover, it stresses upon the importance of immunization and filling the remaining gaps left in global coverage.

The importance of vaccines is underscored by the fact that they not only prevent infectious diseases, but also help to eradicate them. Smallpox is a golden example where vaccination erased the disease from the face of the Earth. Polio is also on the verge of eradication. It only remains endemic in three countries now – Pakistan, Afghanistan and Nigeria. Next in line is measles.

Vaccines licensed by the WHO are absolutely safe as they are rigorously evaluated in clinical trials before making them available in the market. These licensed vaccines generally produce an immune response similar to the natural infection, but do not cause the disease, nor produce any risk of potential complications in the immunized person.

All childhood vaccines are safe and effective as utmost care is taken to thoroughly evaluate them clinically prior to mass vaccination. At the time of birth, newborns are sensitized to most of the killer diseases that strike infants within the first few years of life. Some of these childhood vaccines that are administered at birth till 2 years of age, as per the recommendation of the Indian Academy of Pediatrics (IAP), include the following:

- *Bacillus Calmette-Guérin (BCG)* TB vaccine
- Oral polio vaccine (OPV)
- Injectable polio vaccine (IPV)
- Hepatitis B (Hep B) vaccine

- Diphtheria – Tetanus – Pertussis (DTP) vaccine
- *Haemophilus influenzae* type B (Hib) vaccine
- Rotavirus vaccine
- Pneumococcal conjugate vaccine (PCV)
- Mumps – Measles – Rubella (MMR) vaccine
- Typhoid conjugate vaccine

Some facts about immunization are the following :

- Global immunization coverage has stalled at 86% without any increase over the past few years.
- Approximately 19.5 million infants worldwide have been missing out on essential vaccines.
- In 2016, an estimated 116.5 million infants below one year of age received three doses of the DTP vaccine.
- However, in the same year, there were 19.5 million children who did not receive this DTP vaccine. Almost 60% of these children were from low and middle-income countries (LMIC).
- Intense immunization efforts save approximately 2 to 3 million lives annually from infectious diseases such as diphtheria, tetanus, pertussis (whooping cough), and measles. An additional 1.5 million lives could be saved, if global vaccination coverage improves.
- Immunization helped the African population cope with Meningitis A. The vaccine is now being integrated into their routine national immunization programs.
- A new vaccine has been developed against dengue by the vaccine giant Sanofi-Pasteur. This vaccine has already been successfully evaluated in several countries in Asia and Latin America, and is scheduled to undergo pilot studies in three African countries later this year.
- Measles deaths have decreased by 84% from nearly 550,000 deaths in 2000 to 89,780 in 2016. Accelerated and intense immunization efforts have had a major impact in reducing measles deaths.

- Neonatal and maternal tetanus have been eliminated from WHO South-East Asia Region in 2016 by vaccination efforts with the tetanus toxoid vaccine.

From the foregoing discussion, it goes without saying that no single preventive measure has been more efficacious and cost-effective than immunization. Vaccines do a lot more than just prevent human suffering and deaths associated with infectious diseases. They also help in setting-up goals for national priorities, such as education and economic development. These efforts require sustained funding. Therefore, the government needs to be more proactive and increase investment in vaccine research, vaccine manufacture, and vaccine delivery, coupled with a strong political will and commitment towards preventing infectious diseases. □

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## World Environment Day

**W**orld Environment Day (WED) is the United Nations' most important day for encouraging worldwide awareness and action for the protection of our environment. Since it began in 1974, it has grown to become a global platform for public outreach that is widely celebrated in over 100 countries. It is a platform for action.

As has been said above, WED serves as the 'people's day' for doing something to take care of the Earth or become an agent of change. That 'something' can be focused locally, nationally or globally; it can be a solo action or involve a crowd – everyone is free to choose. Each WED is organized around a theme that focuses attention on a particularly pressing environmental concern.

WED highlights the environmental challenges facing us, and supports the effort to address them.

Through decades of WED celebrations, millions of people from all over the world and from all sectors of society have taken part in environmental action. By bundling their energy, WED has the power to generate hugely positive impacts on the planet.

The booming illegal trade in wildlife products is eroding Earth's precious biodiversity, robbing us of our natural heritage and driving whole species to the brink of

extinction. The killing and smuggling is also undermining economies and ecosystems, fuelling organized crime, and feeding corruption and insecurity across the globe.

This year's theme for WED – Go Wild for Life – encourages you to celebrate all those species under threat and take action of your own to help safeguard them for future generations. This can be about animals or plants that are threatened within your local area as well as at the national or global level - many local extinctions will eventually add up to a global extinction! Whoever you are, and wherever you live, show zero-tolerance for the illegal trade in wildlife in word and deed, and make a difference.



**Orangutan Mother with her baby**

Wildlife crime endangers iconic elephants, rhinos, tigers, gorillas and sea turtles. In 2011, a subspecies of Javan rhino went extinct in Vietnam, while the last western black rhinos vanished from Cameroon the same year.

Huge efforts to counter the illicit trade is required including stronger policies, awareness campaigns and investments in community conservation and law enforcement- have scored some great successes. However, many species remain at risk and it will take a dedicated and sustained effort by each and every one of us to turn the tide.

More people need to understand the damage this illicit business is doing to our environment, livelihoods, communities and security. We must change our habits and behaviour so that demand for illegal wildlife products falls. More awareness and action pushes governments and international bodies to introduce and enforce tougher laws and combat those still willing to break them. □

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## National Seminar on Recent Trends in Fishery and Ecological Sciences

The National Seminar entitled 'Recent Trends in Fishery and Ecological Sciences' was organized by NESA, WB Chapter in collaboration with ISNA and held at Meghnad Saha Auditorium, University College of Science, Rajabazar campus on 19/5/2018. It was organized in memory of Late Prof. Naresh Chandra Datta (died on 19/3/2018), a renowned academician, research guide and former teacher of zoology of University of Calcutta (CU) with areas of specialization being fish biology, aquatic ecology and fishery science. In the inaugural session, Dr A. K. De, Executive Secretary, ISCA mentioned that Prof. Datta was a teacher of high 'altitude', sympathetic to everybody and an exemplary of simplicity. Prof. Sudhendu Mandal, Hony. Secretary, ISNA highlighted the contributions of Prof. Datta to ISNA for being Hony. Secretary and member of Editorial Board of Science and Culture for ten and fifteen years respectively. Prof. Datta categorically translated his research through his students and colleagues, took persistent effort in pursuit of research and teaching in ichthyology and zoology, and was much admired for being an acclaimed zoologist, having authentic knowledge depth and for his generosity.

Dr D. Roychaudhuri, formerly Professor of Zoology, CU recalled the statements of inspiration and well wishes which he received from Late Prof. Datta at CU. Dr A. Chowdhury, formerly Professor of Marine Sciences, CU informed us that Prof. Datta often had to stay at night with Assistant of Fishery Lab at CU in the ground floor laboratory room at Science College during his PhD work. Prof. A. Mira, Chairman, NESA WB Chapter also spoke in inaugural session.



Dignitaries on dais in inaugural session

In 1<sup>st</sup> technical session, Dr B. P. Mohanty, Principal Scientist, ICAR-CIFRI, Barrackpore spoke on 'Omics technology for identification of biomarkers of arsenic (As) toxicity using fish models'. He spoke on presence of As in freshwater ecosystems in Bengal delta, and how its exposure lesions in experimental fishes exposed to As at different concentrations, generalized immune suppression in Rohu due to As toxicity, evaluation of ameliorative potential of curcumin supplemented feed against arsenicosis in fish, significance of omics (transcriptomics, proteomics, genomics) technology in understanding molecular mechanism of As toxicity. Dr B. K. Mahapatra, Principal Scientist, ICAR-CIFE Kolkata Centre spoke on 'Ornamental fishery resources in India – diversified option for livelihood improvement'. He discussed on genetic resources of freshwater ornamental fish (OF), marine OF, freshwater exotic livebearers and egg layerers and exotic marine OF in India, sexual dimorphism of the fishes, breeding and larval rearing methods in ponds and cement cisterns, livelihood opportunities through ornamental fisheries, trade value of fishes. He showed photos describing the contributions and memorable moments of professional life of Late Prof. Datta.

Dr A. Mitra, Advisor of Oceanography Division, Techno India University spoke on 'Ecosystem services of mangrove associated flora'. He explained the ecological and health care services of mangrove-associated floral species, features of global warming, medicinal benefits of the aromatic plant *Ocimum sanctum* (tulsi) and described an innovation called 'tulsi rasogolla'. A team of researchers-cum-entrepreneurs under his supervision have developed the technology and Satyanarayan Mistanna Bhandar, located at Singur has catered the technology to ground level. In the 2<sup>nd</sup> technical session, Dr B. B. Jana, Professor at Centre for Ecological Engineering, Kalyani University spoke on 'Ecosystem resilient-driven green and sustainable technologies for managing downstream problems and turning wastes into wealth'. He described the concept of ecological engineering, its approach towards water resource management, low-cost wastewater reclamation strategies, use of reclaimed water for fish farming, dynamics of sewage-fed fish ponds in Kalyani town, use of human urine as potent primary fertilizer and nourishment of zooplankton in fish ponds.

Dr R. K. Trivedi, Professor at FFS, WBUAFS spoke on 'Climate resilient aquaculture strategies for coastal areas with special reference to Indian Sundarbans'. He explained the impacts of climate change on inland aquaculture, climate change trend in Basanti and Sagar Blocks in Sundarbans, adaptation strategy for climate resilient freshwater aquaculture in coastal region, right kind of fish species combination for pond farming, climate-adaptive integrated fish farming. Dr S. Biswas, Dy. Director of Fisheries, Govt. of West Bengal spoke on 'Trends in fisheries sector in WB - scope and hope'. He stated the activities of State Department to enhance fish production, important schemes implemented at Block level, development and welfare measures taken in freshwater, brackishwater and marine sectors, features of important fisheries Acts and Rules. □

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### **International Conference on 'Emergence of Modern Science in Colonial India'**

The International conference on 'Emergence of Modern Science in Colonial India' was held at the Indian National Science Academy (INSA), New Delhi during March 14-16, 2018 under the sponsorship of the History of Science Division of INSA. This International conference brought together experts from all over the world to take history of science studies in India forward.

The conference was inaugurated by Dr. A.K. Bag, the Editor of IJHS with a brief address summarising the objectives and importance of the conference. Prof. Deepak Kumar (Ex-JNU) delivered the key note address on the role of the colonisers and the growth of Indian science during that period which set the tune of the conference. Deepak Kumar's address was followed by speeches from Ms. Gulfishan Khan (AMU) on the effect of Persian and Urdu on Indian science and Ms. Abhidha Dumatkar on Prof. B.P. Modak (1847-1906) who wrote books in vernacular, an exception for that period.

In the next session chaired by Prof. R. Anderson, Prof. Louradusamy (IIT, Madras) spoke on Dr. M.L. Sircar and Sir Asutosh Mukherjee as institution builders. John Mathew (IISER, Pune) spoke on Sir Ronald Ross whose major work was done in Calcutta. Rahul Bhaumik (Ph.D. Scholar, JU)

and Apalak Das (Research Scholar, JU – Asiatic Society) spoke about studies on snake venoms and school of Tropical Medicine respectively.

The third session was chaired by Prof. Arun Murthy (IISER, Mohali). Eminent historian Prof. Dhrub Raina (JNU) spoke on confluence of European mathematics and Indian mathematics. Other speakers were Maidul Rahaman (Assam University), Prof. Suvobrata Sarkar (Burdwan University) and Sri K.V. Sriharsha who spoke respectively on history of veterinary science, electrification of Calcutta and importance and history of Ayurveda studies in India during colonial period. Prof. Irfan Habib (Ex-NISTADS) spoke on clash of cultures and its effect on History of Science.

Tea break was followed by the fourth session where Prof. Sekhar Pathak (Ex-Professor of Kumaun University) spoke on Nain Singh Rawat while Dr. G.S. Sodhi (Khalsa College, New Delhi) delivered a very interesting lecture on how the use of fingerprinting developed in colonial period in Kolkata.

There was a lively discussion on digitisation and archiving of resource materials on History of Science in India at the end of the day.

The first session of the second day was chaired by A. Ramanath. The speakers were Prof. Subrata Dasgupta (University of Louisiana, USA) who spoke on creative and cognitive aspects of Sir J.C. Bose's discoveries and Prof. Shyamal Chakrabarti (CU) spoke on Sir Prafulla Chandra Ray: 'A visionary entrepreneur of British India'. In absence of Dr. Rajinder Singh (a last minute decision because of his sudden indisposition) Prof. Arnab Raichoudhuri presented his 'Raman Paper'.

The second session, chaired by Prof. John Mathew, had presentations on 'The early History of IISC' by T.A. Abhinandan (IISc.), on 'Curzon & Technical Education India' jointly by Ms. Sunayana Maiti and Ms. Sujata Banerjee (Asiatic Society), and on N.R. Dhar by Ms. Madhumita Mazumdar (Gujrat). Prof. Gautam Gangopadhyay and Prof. Anirban Kundu (CU) presented two papers on 'History of Physics Department of Calcutta University'. Many archival materials were presented during these two lectures.

Post lunch session started with Prof. D. Balasubraminian (Chair, National Commission on History of Science) in the chair. In this session Prof. Atri Mukhopadhyay (SINP) spoke about Meghnad Saha's scientific achievements, Prof. DCV Mallick (Institute of

Astrophysics, Bengaluru) spoke on Sir C.V. Raman's collaborator, Dr. K.S. Krishnan and another paper of Dr. Rajinder Singh on 'D.M. Bose, S.K. Mitra and B.B. Ray' was presented by Prof. Arnab Raichoudhuri.

Post tea session was chaired by Prof. Deepak Kumar. Dr. Biman Nath (Raman Research Institute) talked on Indian Astronomy research during colonial period, while Ms. Sneha Nath (Pune) presented the 'Role of Indian Science Congress Association'. Prof. Malabika Sarkar and Prof. Sabyasachi Bhattacharya (both from Ashoka University) joined and participated in the discussion on starting a course on History of Science and its modalities.

Dinner was served in honour of Prof. Robert Anderson and Prof. Deepak Kumar, both of whom gave short speeches on their journey along the path of knowledge called 'History of Science'.

The last and third day started with lively presentations from Prof. Sabyasachi Bhattacharya and Prof. Malabika Sarkar showing the strong need for a combined science and humanities blend in education with pictorial depiction of Milton-Galileo connection. This was important for history of science studies as planned in India.

The next session started with Prof. Abha Sur (MIT) in the chair. Presentations were made by Prof. Robert Anderson (Canada) on Bhatnagar's role in power structure of Indian Science in pre and post colonial phases. Prof. Arnab Raichoudhuri (IISc.) presented how FRS award played a role in development of Indian Science. A lecture on Prasanta Chandra Mahalanobis and Indian Statistical Institute was given by Prof. Samir Kumar Saha (formerly JU), Prof. Balasubraminian (INSA) gave his talk on Organic Chemists in India.

The pre-lunch session was chaired by Prof. Irfan Habib and presentations were made by Prof. Ashok Sahni on Birbal Sahani's work in Punjab during the colonial period and by Aparajith Ramnath (Amrut School of Management) on Technology in Colonial India. Prof. Abha Sur (MIT) talked about Women Scientists in India and how they were discriminated against.

The speakers in the concluding session were Anup Kumar Dhar who talked on 'Psychoanalysis, Freud and G.S. Bose', Indranil Chatterjee on 'History of Forest Conservation' and Ms. Baisakhi Bandyopadhyay on 'Emergence of Environmental Science in India'. The concluding session was followed by a round table discussion on formation of a Society for History of Science in India.

At this point, it must be mentioned that a book exhibition (of the books published by speakers and also by INSA) was on display at the venue from the first day onwards and this novel concept created a lot of enthusiasm among the participants.

The Convener of the conference was Prof. Arnab Raichoudhuri of Physics Department of IISc., Bengaluru and the whole activity was co-ordinated by an Organising Committee of Prof. Deepak Kumar, JNU; Prof. Suprakash Roy, Editor-in-Chief, Science and Culture; Dr. Rajinder Singh of Oldenburg University, Germany. He was ably assisted from the INSA side by Mr. Madhvendra Narayan, Associate Editor & Member Secretary of IJHS editorial board. □

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### **Jan Ingenhousz : the Discoverer of Photosynthesis**

Who isn't aware of photosynthesis – the process by which plants (as also algae and cyanobacteria) turn sunlight into energy? But very few are knowledgeable about its discoverer, Jan Ingenhousz (or John Ingen-hosz), a Dutch physician of the 18<sup>th</sup> century. We would not have known much about this scientist who has almost gone into oblivion unless Google Doodle celebrated his 287<sup>th</sup> birthday on December 8, 2017.

Ingenhousz was born in Breda, Netherlands on December 8, 1730. At the age of 16, he began studying medicine at the University of Louvain. He developed a keen interest, almost a passion, in smallpox inoculation, the precursor to modern vaccination. In 1764, he travelled to England to specifically learn the technique from a long-time family friend, John Pringle who also a Physician. By 1767, he acquired a commendable skill in inoculation. There was an outbreak of smallpox in Hertfordshire village in England, and Ingenhousz inoculated about 700 people there and saved their lives.

During that era, inoculation was somewhat controversial in Austria, and the medical community in Austria was firmly opposed to it. Impressed by the successful, Herculean effort of Ingenhousz in England, Maria Theresa, the then Empress of Austria, desired the Royal family to be inoculated (a wise decision indeed!)

and invited Ingenhousz to Vienna in 1768 to get the job done. Ingenhousz accepted the invitation, did the job and became the Royal Physician to the Habsburg family.

It was a comfortable, full-time job which perhaps allowed Ingenhousz to broaden his curiosity beyond medicine. Since his student days at the University of Leiden, Netherlands, Ingenhousz was interested in, *inter alia*, electricity (what a hobby!). In Vienna, he studied electricity and other topics in physics and chemistry. A Doctor was being transformed into a scientist.

In 1771, he made a trip to England. During this trip, he had thought-provoking discussions with Benjamin Franklin and others, which diverted the formidable curiosity of Ingenhousz into a new target – plants. In England, he visited Joseph Priestley who, in the recent past, had discovered that the *leaves of plants absorb and emit gases*. Expressed differently, Priestley discovered that plants had the power to restore ‘goodness’ to air that animals had depleted. This scholarly meeting between the two stalwarts

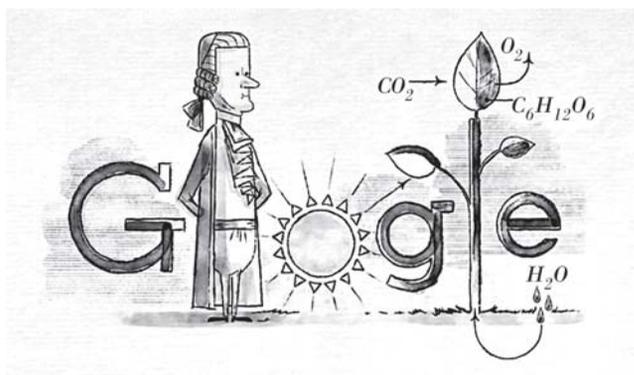
motivated Ingenhousz to eventually discover what is known as photosynthesis.

Undeniably, Ingenhousz can’t be wholly credited with the discovery of photosynthesis. In the 1660s, Jan Baptista van Helmont, a Belgian chemist, physiologist and physician, partially discovered photosynthesis. Based on a 5-year experiment involving a willow tree, he concluded (wrongly) that water, and not soil nutrients, contributes to the growth of plants.

In the late 1770s, Ingenhousz noticed through a series of experiments that when submerged plants were placed in sunlight, bubbles were produced; but when the plants were transferred to the shade, bubbles were not being produced any more. He concluded that (i) only the green parts of plants, i.e. leaves absorb sunlight which was necessary for the growth of plants and (ii) plants ‘damage’ (now known as carbon dioxide) the air in darkness and ‘restore’ (now known as oxygen) the damage in sunlight. He further discovered that plants, like animals, had cellular respiration. Ingenhousz published his findings in a groundbreaking paper in 1779.

Pertinently, Ingenhousz also made the first quantitative measurements of how much heat metal rods could conduct. He found out that silver was one of the best metals and lead was one of the worst metals for conducting heat. He also helped improve an apparatus for generating large amounts of static electricity.

Ingenhousz died in 1799 at Bowood House, Calne, England and was buried in the churchyard of St. Mary the Virgin. □



Google Doodle celebrates Jan Ingenhousz's life



Jan Ingenhousz (Source: Britannica)

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### Solar and Stellar Magnetism: Past, Present and Future

A large international congress with hundreds of participants offers a great opportunity for brief, focused and less formal satellite or splinter meetings, bringing together leading experts in a narrower scientific subject who would otherwise not have congregated for this purpose alone. This opportunity is not always realized and exploited but Professor Dibyendu Nandi, IISER Kolkata, who was a member of the Local Organizing Committee of the 340th Symposium of the International Astronomical



Arnab Rai Choudhuri cutting a cake during the felicitation ceremony at the end of the workshop

Union, held in Jaipur during 19-23 February 2018, recognized with a keen eye that this rare concentration of world-leading experts is an occasion not to be missed. A one-day workshop to discuss out standing challenges and future prospects in our understanding of the origin of solar-stellar magnetism was thus organised on 18 February, the day before the official start of the large conference.

A formal occasion for the meeting was provided by the 60th birthday of the renowned Indian astrophysicist Professor Arnab Rai Choudhuri (Indian Institute of Science, Bengaluru). During his distinguished career, starting from his student days at Presidency College of Kolkata through prolonged and productive stays in leading American centres of excellence in astrophysics (Chicago, Boulder) to his decades long, school-forming activity at IISc, Professor Choudhuri made landmark contributions to many of the key issues in solar and stellar magnetism. The workshop focusing on this topic, then, was as much an apt celebration for this outstanding Indian scientist as a great opportunity for measuring up where we stand and what stands ahead of us in our exciting research field. It is no surprise, then, that many leading international experts in the field were glad to accept the invitation to discuss the relevant problems in a friendly, informal atmosphere.

Seven leading scientists gave invited discourses on key issues of solar and stellar magnetism, with many outstanding scientists in audience taking a major role in the extensive discussions between the talks.

Given the topic of the main conference the workshop was attached to, it was inevitable that the workshop had a solar “bias”: five out of the seven keynote talks discussed aspects of solar magnetism. Issues in stellar and cosmic

magnetism were covered by two speakers. Professor Kandaswamy Subramanian (IUCAA, Pune) discussed the nature and origins of cosmic magnetic fields, with an emphasis on cosmological and galactic magnetism. His enlightening talk offered much in sight into the mechanisms involved in the amplification and maintenance of magnetic fields in the course of the 14 billion years long history of the universe. Professor Kazunari Shibata (Kyoto University), on his turn, focused on a special problem of stellar magnetism that has recently

attracted much interest: the possibility of super flares—eruptions with energies exceeding those seen on the Sun by orders of magnitude. The statistical studies of Professor Shibata’s team indicate that superflares just represent the upper end of a continuous scale of eruptions where the frequency of events decreases with increasing energy. While several participants emphasized the need to avoid unnecessary scare mongering, on the basis of the stellar results it cannot be excluded that rare but catastrophic super flares may from time to time (perhaps on a time scale of millennia or longer) occur on our Sun as well.

The series of talks focusing on our Sun was opened by Professor Sarbani Basu (Yale University) with a very clear overview of recent results from helioseismology. Just like terrestrial seismology, helioseismology allows inferences on processes in the solar interior from the detection of waves on the solar surface. Among the many exciting open issues of particular interest for the topic of the workshop are those related to the dependence of oscillation properties on solar magnetic cycles and to the meridional circulation in the deeper layers of the convective zone.

In their extremely information-rich presentations, the following three speakers (Robert Cameron, Göttingen; Alexei Pevtsov, Boulder; Kristof Petrovay, Budapest) discussed solar magnetic cycles, magnetic helicity and the emergence of magnetic flux through the solar envelope – three issues of key importance for the solar dynamo. Among the many exciting ideas presented, special emphasis was given to the availability of direct measurements of the toroidal (East-West-oriented) magnetic field near the solar surface, and to the recent suggestion that the solar dynamo

may be, on astronomical time scales, on the verge of dying: comparison with other stars seems to indicate that stars whose rotation has become even slower than that of the Sun display a rather sudden drop in their level of activity. Among the interesting open questions in the field of helicity, a reliable determination and interpretation of the relation between the magnetic energy and magnetic helicity of solar magnetized regions was stressed. In the field of flux emergence, the recent break through in simulating the fragmentation of rising flux bundles in subsurface layers was highlighted and the importance of constraints imposed on the models by sunspot proper motions was brought into focus.

Finally, the last keynote science talk in the workshop by Professor Sacha Brun (Saclay) represented a nice synthesis of the solar and stellar view points, discussing state of the art simulations of solar and stellar dynamos in a common frame work.

The series of keynote talks was followed by a panel discussion, expertly led by Professor Nandi. The lively discussion focused on a few selected controversial issues of key importance, like the physical significance of the widely used flux transport dynamo model of the solar cycle. Following the panel discussion Professor Rai Choudhuri gave an interesting, light-hearted presentation under the title “My Life and My Journey through Solar Physics”, recalling many fond or amusing memories from his career and interactions with fellow scientists, including such giants as Professor E. N. Parker, the discoverer of the solar wind, who was Choudhuri’s Ph.D advisor. This, and the following celebration gave an upbeat end to the workshop. Participants left with many new ideas and, no doubt, many questions, and a long-lasting boost in motivation that will undoubtedly increase their activity in their further career as it already did in the conference that followed. □

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### **Seminar on Pros and Cons of Use of Antibiotics in Aquaculture**

**T**he Seminar on ‘Pros and Cons on Use of Antibiotics in Aquaculture’ was organized by Office of Dy.

Director of Fisheries (Microbiology & Parasitology), GoWB on 22/2/2018. Dr M. K. Sahu, DDF spoke on antibiotic resistance (AR), which occurs when different species of pathogenic bacteria characteristically change in response to improper and uncontrolled use of antibiotics. Dr S. Das, Principal Scientist (PS), ICAR-CIBA, Kakkdwip spoke on ‘Use of chemotherapeutics and disinfectants in aquaculture’. Disinfectants as common disease management aids in aquaculture systems should have wide antimicrobial activity and effect minimum extent of toxicity to non-target organisms. He discussed the pond application characteristics of chemicals like  $\text{KMnO}_4$ , bleaching powder,  $\text{CuSO}_4$  and others judiciously, use of  $\text{KMnO}_4$  for pond bottom treatment, in bacterial infection in fishes, dip treatment of infected fishes, use of bleaching powder (with 10-20ppm available chlorine), effectiveness of malachite green against fungus and keratinolytic bacteria, formaldehyde to combat ectoparasitic infection, maximum residue level (MRL) of permitted antibiotics in fish and shellfish products (50-300 microgram/kg), application and mode of functioning of gut probiotics (*Bacillus* sp., *Vibrio parahaemolyticus*), water probiotics (*Nitrosomonas* sp.) and soil probiotics in ponds.

Dr T. J. Abraham, Professor at Department of Aquatic Animal Health Management, WBUAFS spoke on ‘Prudent use of antibiotics in aquaculture’. Three major causes of fish diseases are unsatisfactory aquatic environment, presence of pathogen in environment and low disease resistance power of fishes. If we prevent entry of pathogen into farm ponds, then we can prevent occurrence of diseases and use of chemicals and antibiotics will not be relevant. Farm management practices must be properly recorded, prioritization on biosecurity measures both at hatchery and farm. The ‘multiple stocking - multiple harvesting’ method of fish farming provides an opportunity for microorganisms to enter into pond along with fish fingerlings (collected from more than one source) at different time. In fish farming sector, widespread use of antibiotics for treating bacterial diseases has led to development of AR in *Aeromonas hydrophila*, *A. salmonicida*, *Edwardsiella tarda*, *Vibrio anguillarum* and *Yersinia ruckeri*.

We were informed about Good Hygienic Practices and Better Management Practices to control the spread of AR in fish and shellfish pathogens, withdrawal period of antibiotics from farmed fishes; which should be known before using the same. It is the time taken by body to break down the antibiotic until it is no longer present. Microbes will increase in human body along with increase in AR in bacteria. In Norway, 887mg antibiotic was used

to produce every 1kg fish in 1987 but 0.4mg was used to produce 1kg fish in 2014. Use of antibiotic has decreased which is desirable.

Dr S. K. Manna, PS, ICAR-CIFRI, Barrackpore spoke on 'Present and future prospect of aqua-medicine in respect of aquaculture in West Bengal'. Dr Manna gave a thorough conception about presence of 25-27 trillion cells in human body, 3-4 bacteria present over each of it (about 10 bacteria present over each body cell in weak persons), involvement of mitochondria (in animal cell) and chloroplasts (in plant cell) from free-living bacteria small in size *via* symbiosis within a eukaryotic host cell. He spoke about importance of presence of fat and incorporation of fatty acids in supplementary feed meant for early stages of cultivable fishes, significance of the activity of histone coiling of human chromosome so to repel most of the bacteria present over cell membrane, application dosage of oxytetracycline (80mg/kg and 150-200mg/kg in feed for finfish and shrimp respectively).

Due to increase in organic matter content in water body, bacterial load in aquatic environment increases and consequently concentration of methane, ammonia and nitrite increase. We have to decrease it and enhance fish cell energetics. ATP is produced across the inner membrane of bacteria and they release ATP *via* flagella in order to survive under stressful condition. As a result of decrease in rate of body metabolism in fishes during winter {mucus thickness (mt): 0.1 micron}, mucus production-cum-secretion occurs at a low rate in comparison to summer months (mt: 1 micron). Glycopeptide present over fish skin mucus acts as first line of defense; this cease to exist in winter. Gut probiotic bacteria in fishes secrete bacteriocin, which inhibits proliferation of harmful bacteria. Application of antibiotics *via* fish feed leads to destruction of mitochondria in fish body cells, thereby hampering fish cell energetics. In aquaculture, probiotics are superior to antibiotics. Fish farmers experience good profit margin initially, but it decrease later on, disease incidences become frequent; due to decomposition of accumulated organic matter in pond system, pathogen load increase and bacteria infects fishes under culture year after year.

Dr D. Roy, Technical Officer, MPEDA Centre, Purba Medinipur (PM) spoke on 'Current and potential future hazards to public health of antibiotic usage in aquaculture'. He discussed on item-wise marine products export from India, list of 20 antibiotics and pharmacologically active substances banned for use in aquaculture, elaborated on shrimp consignment rejections on quality grounds due

to antibiotic contaminants, heavy metals, microbial and bacterial residues since 2009-2010 till date. In 2016-'17, out of 80 consignments rejected from India, 24 were specified for antibiotic contamination; again out of these, 3 were from PM of this state. Chloramphenicol, furazolidone, neomycin, nalidixic acid and sulphamethoxazole are banned. Pre-harvest test (PHT) of farmed shrimp was introduced to ensure the absence of banned antibiotic residues in aquaculture products (AP) before it is harvested. PHT is mandatory for export of all AP to EU countries. □

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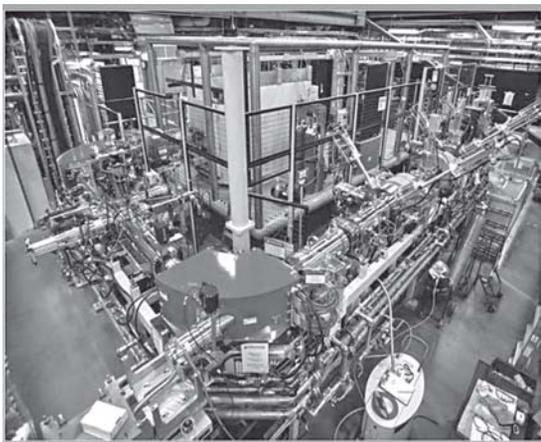
## An Earthly Search for Gold's Cosmic Origins

**H**uman craze for gold has long been known. One of the rarest and precious metals on Earth, gold is one of the heaviest stable, naturally occurring elements found on Earth. Apart from its common use in jewellery for its glitter and permanence, gold remains incredibly valuable for its scientific, physical and chemical properties as well.

But the origin of gold has remained a mystery. Although it has been speculated that the yellow metal is formed within stellar interiors, it did not provide the full explanation. While it is true that stars like our Sun fuse light elements into heavier ones, that will typically produce only a handful of elements: helium, carbon, nitrogen, oxygen, and then neon, magnesium, silicon, sulphur, iron, nickel and cobalt; nothing heavier. That is, nuclear fusion is only responsible for a tiny fraction of the elements known today.

But there could be another source – a supernova, the last stage of a very massive star. At the end of its life the core of a massive star will implode, creating a spectacular type II supernova explosion! This runaway reaction produces either a neutron star or a black hole at its centre, and causes a runaway fusion reaction in the outer layers, which blows the star apart. In addition to blowing the star apart, however, it also produces tremendous numbers of free neutrons, and it produces them extremely rapidly, enabling much heavier elements like gold to be made and in much greater abundance. Vast amounts of cosmic gold come from supernovae, but there is still one more method

that is more productive the collision of neutron stars, the first of which was observed in August 2017.



One of the two beamlines at the Facility for Rare Isotope Beams (FRIB) at Michigan State University in USA (Credit: Matthew Dae Smith/Lansing State Journal)

In August 2017, astronomers announced that they had observed two neutron stars merge, giving rise to gravitational waves that were detected by the US-based Laser Interferometer Gravitational-Wave Observatory (LIGO). The event was simultaneously observed in multiple electromagnetic wavelengths – gamma rays and X-rays. For the first time in history, an astronomical phenomenon has been first observed through gravitational waves and then seen with telescopes. But the more curious fact was the observation that the neutron star merger also created heavy elements such as gold and platinum, spewing them into space.

Neutron stars are the smallest, densest stars known to exist. A teaspoon of a neutron star has a mass of about a billion tons. To find out how neutron star collision produces heavy elements, nuclear physicists at Michigan State University in USA are building an atom smasher – the \$730 million Facility for Rare Isotope Beams (FRIB) – that could decipher exactly how those elements are forged in neutron star collision. The 500-metre-long linear accelerator of FRIB will provide intense beams of rare isotopes (that is, short-lived atomic nuclei not normally found on Earth) to shoot a graphite target to blast out shortlived new isotopes. The researchers hope FRIB data will be the key to understanding how neutron-star mergers make heavy elements (*Science*, 24 November 2017 | DOI: 10.1126/science.358.6366.981).

According to astrophysicists, a single neutron star-neutron star merger can create about 20 times the mass of the Moon in gold alone, meaning that even though there may be thousands of times more supernovae than neutron

star-neutron star mergers, the latter is the primary source of elements at the highest end of the periodic table like gold, platinum, tungsten as well as the radioactive elements like thorium and uranium here on Earth. □

*Biman Basu*

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## How Geckos Regrow its Tail

Some species of geckos have an interesting defence mechanism of “dropping” their tail when they feel threatened. The dropped tail will actually wiggle and twitch on the ground as though it were still attached to the body of the gecko to distract potential predators and allow the gecko to get away while the predator is left with just the tail. Tail dropping is a type of defence called autotomy. Gecko tails are designed to do this and have special connective tissue inside them that creates a location where the tail breaks off readily. If a gecko drops its tail, the blood vessels to the tail immediately constrict and very little blood loss occurs. Geckos are able to re-grow a new tail within 30 days – faster than any other type of lizard.

The interesting thing about this unusual behaviour of geckos is that the animal can self-detach their tails without employing much effort, making them incredibly easy to study. This is what prompted Matthew Vickaryous, a developmental biologist at the University of Guelph in Canada to explore the process. Vickaryous’ team studied this phenomenon by literally pinching a bunch of geckos’ tails and seeing what happened on the cellular level.



Geckos will regrow their tail but it might look different from its original colour. (Credit: Auscape / UIG / Getty Images)

It has been known that a gecko’s tail is actually an extension of its spinal cord. Scientists knew the gecko’s spinal cord could regenerate, but did not have any idea about which cells were playing a key role. However, based on previous research on other limbregenerating species, scientists had assumed that some types of stem cells must

be involved. Stem cells are essentially cells that can grow into a variety of different cell types – like skin, muscle, or heart cells – depending on the need. The researchers discovered that the spinal cord of the tail houses a special type of stem cell known as the radial glia, which have been identified as a major source of neurons during development. These stem cells are normally fairly quiet, “but when the tail comes off everything temporarily changes. The cells make different proteins and begin proliferating more in response to the injury. Ultimately, they make a brand new spinal cord. Once the injury is healed and the spinal cord is restored, in the span of a month, the cells return to a resting state”.

Most intriguing, they found, was that when the tail comes off, a blood clot quickly develops, sealing in the injury. If the team attached a piece of skin to the area as the clot was forming, the tail would fail to regenerate. They say this suggests that the open wound itself helps send out the signal that something needs replacing. If you cover that wound, those signals are halted, which stops the regeneration process.

Now that researchers have a better understanding of what cells make this regeneration process possible, they think this information could help us find better ways for humans to heal themselves. They are hopeful that understanding the secrets of gecko tails could help find ways to heal human spine injuries. □

**Biman Basu**

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### **There is Order in Complex Patterns of River Deltas**

If we look at an image of the Ganges delta taken from space we see what looks like a maze of randomly arranged channels. Although they appear to have been formed by random processes, an international team of scientists from the University of California, Irvine and other institutions in the US, Switzerland and Italy have found order in the apparent chaos. Through field studies and mathematical modelling, they have concluded that deltas “self-organise” to increase the number, direction and size or diversity of sediment transport pathways to the shoreline, boosting their ability to withstand human disturbances and naturally occurring factors. The scientists used concepts from information theory to show that “a range of field and numerically generated deltas obey an optimality principle for self-organisation” (*Proceedings of the National*

*Academy of Sciences*, 16 October 2017 | doi/10.1073/pnas.1708404114).



Part of the Ganges Delta as seen from space.

River deltas are critically important geological features at the land-water interface that occupy only 1 percent of the world’s land surface; but they are home to more than half a billion people and are the source of vast amounts of food and other natural resources. Deltas are highly productive regions that support extensive agriculture and aquaculture and diverse ecosystems and contains natural resources such as hydrocarbon deposits. Deltas exhibit complex channel networks that decide how water, sediment, and nutrients are spread over the delta surface. In the last few decades, many deltas of the world have come under threat from a range of stress factors, including sea-level rise caused by climate change, human actions like upstream dam construction, and local exploration. These have had deleterious effect on these landscapes, necessitating a thorough understanding of these complex systems and their response to perturbations.

Lead author of the *PNAS* paper Alejandro Tejedor wanted to find out “if there could be some common ‘goal’ on the part of deltas to sustain their existence by diversifying the spread of their fluxes to build land on their way to the ocean”. He sought to solve this riddle by applying statistics and mathematical modelling. Looking at 10 major river deltas around the world, the researchers determined the probability of flows dividing into smaller channels and merging again at confluences and discovered that all but one, the Niger Delta in Africa, exhibited a large diversity of delivery pathways to the sea. The team confirmed these findings through numerical models, demonstrating that even when change in course of major channels take place – leading to network reorganisation – flows tend to re-create diverse water routes there by maintaining the flow of water and sediments. □

**Biman Basu**

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# THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, DR. BIRESH GUHA STREET, KOLKATA-700 017

## NOMINATIONS/APPLICATIONS FOR AWARDS : 2018 - 2019

Nominations / Application in prescribed forms are invited from Indian scientists for following Awards :

- Asutosh Mookerjee Memorial Award
- C.V.Raman Birth Centenary Award
- Srinivasa Ramanujan Birth Centenary Award
- Jawaharlal Nehru Birth Centenary Awards
- S.N.Bose Birth Centenary Award
- S.K.Mitra Birth Centenary Award
- Birbal Sahani Birth Centenary Award
- S.S. Bhatnagar Memorial Award
- M.K.Singal Memorial Award
- Vikram Sarabhai Memorial Award
- D.S. Kothari Memorial Award
- Jawaharlal Nehru Prize
- Millennium Plaques of Honour
- Excellence in Science and Technology Award
- R.C.Mehrotra Memorial Life Time Achievement Award
- B.C.Guha Memorial Lecture
- G.P.Chatterjee Memorial Award
- Professor Hira Lal Chakravarty Award - Plant Sciences
- Pran Vohra Award - Agriculture and Forestry Sciences
- Professor Umakant Sinha Memorial Award - New Biology
- Dr.B.C.Deb Memorial Award for Soil/Physical Chemistry
- Dr.B.C.Deb Memorial Award for Popularisation of Science
- Professor R.C.Mehrotra Commemoration Lecture - Chemical Sciences
- Prof.(Mrs.) Anima Sen Memorial Lecture - Psychology & Educational Sciences
- Dr.(Mrs.) Gouri Ganguly Memorial Award for Young Scientist - Animal ,Veterinary and Fishery Sciences
- Prof.G.K.Manna Memorial Award - Animal ,Veterinary and Fishery Sciences
- Prof.Sushil Kumar Mukherjee Commemoration Lecture - Agriculture and Forestry Sciences
- Prof.S.S.Katiyar Endowment Lecture - New Biology/ Chemical Sciences
- Prof.R.C.Shah Memorial Lecture - Chemical Sciences
- Prof.Archana Sharma Memorial Award - Plant Sciences
- Dr.V.Puri Memorial Award - Plant Sciences
- Prof. W.D.West Memorial Award-Earth System Sciences
- \*\*\*Infosys Foundation-ISCA Travel Award
- \*Asutosh Mookerjee Fellowship
- \*\*ISCA Fellowship

**\* Last date 15th July, 2018; \*\*Last date 10th September, 2018 ; \*\*\*Last date 15th November, 2018**

Last Date for receiving of Nominations / Applications for different other ISCA Awards and Lectures of 2018-2019 is **July 31, 2018**. For proforma of application forms and necessary information, please write to the General Secretary ( Membership Affairs ). The Indian Science Congress Association, 14, Dr. Biresb Guha Street, Kolkata-700 017, E-mail :iscacal@vsnl.net.

The form also can downloaded from- <http://www.sciencecongress.nic.in>