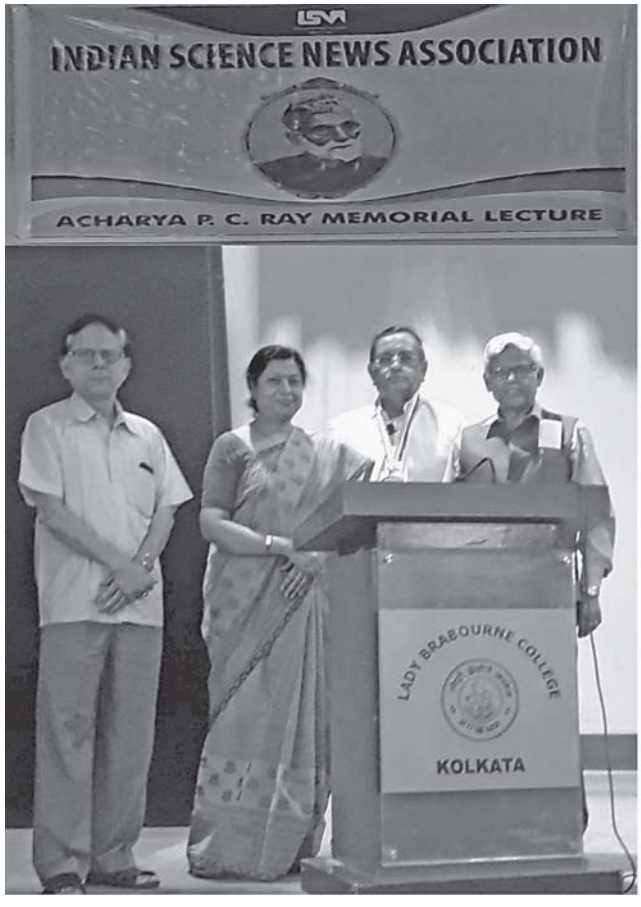
Notes and News

Acharya P. C. Ray Memorial Lecture

Indian Science News Association (ISNA) organized the 6th Acharya P. C. Ray Memorial Lecture jointly with the Lady Brabourne College, Kolkata on 25th March, 2019, in the Auditorium of Lady Brabourne College. Professor Biswapati Mukherjee, Former Executive Director and Professor of Neuroscience, S. N. Pradhan Centre for Neurosciences, University of Calcutta and Vice-President, ISNA delivered the lecture on '*Acharya Prafulla Chandra Ray: A Retrospective'*.

Professor Mandal presented Professor Siuli Sarkar, Principal, Lady Brabourne College a book "*Sir P. C. Ray, the Father of Chemistry Teaching and Research in India, a Philanthropist and an Entrepreneur*" published by ISNA and a copy of the current issue of the journal, *Science and Culture*. *Science and Culture* is a journal published bimonthly by ISNA. Welcome address was delivered by Professor Siuli Sarkar. She highlighted Acharya P. C. Ray's life and contributions to the nation.



From Left: Prof. Manas Chakrabarty, Honorary Secretary, ISNA, Dr. Nupur Basu Lady Brabourne College, Prof. Biswapati Mukherjee, Vice-President ISNA, Speaker, P. C. Ray Memorial Lecture, Prof. Sudhendu Mandal, Honorary Secretary after the lecture. Photo by Chayan Biswas, ISNA

Professor Sudhendu Mandal, Honorary Secretary of ISNA made some introductory remarks about ISNA and the Oration. He highlighted the contributions made by the Indian scientists and also about the establishment of ISNA. He mentioned that Professor Meghnad Saha founded this organization with many other stalwarts like Acharya P. C. Ray, Dr. Prasanta Chandra Mahalanobis, Professor T. R. Seshadri, Professor D. S. Kothari, Professor Sisir Kumar Mitra, Professor B. B. Ray with the object of disseminating the knowledge of science and technology and its application to problems of national interest.

Professor Manas Chakrabarty, Honorary Secretary, ISNA introduced the speaker. After having his M.Sc. degree in Chemistry from the University of Kalyani, Prof. Biswapati Mukherjee obtained his Ph.D. degree in 1968 under the supervision of Late Professor (Mrs.) Asima Chatterjee. He was instrumental in establishing the S.N. Pradhan Centre for Neurosciences and retired from there as S.N. Pradhan Professor as Founder Executive Director of this centre. He has been engaged in science popularisation for the last few decades. Professor Mukherjee has received many honours and awards such as Dr. B.N. Ghosh Memorial Oration Award (Gold Medal) of the University of Calcutta. He is a Fellow of the West Bengal Academy of Science and Technology, and the Phytochemical Society of Asia. Currently, he teaches at NIPER Kolkata in the M.S. (Pharmacy) classes.

In his lecture, Professor Mukherjee covered P. C. Ray's family history, early education in Calcutta, higher education (D.Sc., 1887) in Edinburg, his return to India and teaching and research in Presidency College (1889-1916) and thereafter at the University College of Science, Calcutta University till his death. His epoch making discoveries of mercurous nitrites and many other metal complexes; establishment of Bengal Chemical and Pharmaceutical Works as a proof of his extraordinary ability

as an entrepreneur; his contribution towards spreading of chemical education in undivided India, made him to call as the '*Father of Indian Chemistry*'. His philanthropic activities during devastating flood and famine in our country; his silent support towards freedom movement; his political aptitude including interaction with Mahatma Gandhi; his association with Rabindranath Tagore, Nazrul Islam and Bibhutibhusan Bandyopadhyay; his love for literature, Bengali, English and Sanskrit, culminating publication of two volumes of (*A History of Hindu Chemistry'* (1898, 1902) and seventeen articles on Shakespeare in '*Calcutta Review'* (1939-1941) and innumerable Bengali books and essays; establishment of '*Indian Chemical Society'* (1924), *Indian Chemical Manufacturers' Association,* 1938 (presently Indian Chemical Council) and '*Indian Science News Association'* (1935) made him immortal. The whole lecture was presented with intermittent appropriate songs of renowned singers (recorded) which overwhelmed the audience.

After the lecture Professor Mukherjee was awarded Acharya P. C. Ray Medal by Dr. Nupur Basu, Department of Chemistry, Lady Braboune College on behalf of ISNA. Dr. Papia Ganguly, Head of the Department of Chemistry, Lady Brabourne College offered vote of thanks to the speaker and all other delegates present. ❐

Rinku Debnath
Indian Science News Association

Eleventh Science Communicators' Meet on *Communicating Science in Regional Languages: Challenges and Role of Science Communicators*

The Eleventh Science Communicators' Meet jointly organized by the Indian Science News Association, Kolkata and Vigyan Prasar, DST, Govt of India, New Delhi on the above theme was held on 17th March, 2019 at the Meghnad Saha Auditorium of the CSIR-Central Glass & Ceramic Research Institute, Jadavpur, Kolkata.

The function started with the Welcome Address by Professor Biswapati Mukherjee, Chairman**,** XXXII Training Programme on Science Communication and Media Practice -2018. Dr Amit Krishna De, Convener of the Training Programme, spoke about the objectives of the Meet. Professor Sudhendu Mondal, Honorary Secretary, ISNA talked about ISNA, its role in science communication and projected Rabindra Nath Tagore as a science communicator of top order. Dr. Nakul Parashar, Director, Vigyan Prasar, D.S.T., Govt. of India, New Delhi, graced the occasion as the Chief Guest. He delivered a thought-provoking address, mentioning the role of Bengal in science communication. The function was presided over by Dr. K. Muraleedharan, President, ISNA and the Director, CSIR-CGCRI. Professor Manas Chakrabarty, Hony Secretary, ISNA proposed vote of thanks.

Scientific Session I

This session was chaired by Professor Amalendu Bandyopadhyay, Ex-Director, Positional Astronomy Centre, Kolkata. The Co-Chairperson was Dr Sitendu Mandal, Chief Scientist, CSIR-CGCRI, Kolkata, and Dr Sima Mukhopadhyay was the Rapporteur for the session.

The first speaker, Dr Manoj Patairiya, Director, CSIR-NISCAIR, Govt of India, New Delhi expressed his opinion briefly on the subject of the session 'Science Communication in Hindi: Challenges and Role of Science Communicators'. He mentioned that 'Digdarshan', a monthly magazine published from Shrirampur, West Bengal in three languages simultaneously in Hindi, Bengali and English in 1818 may be credited as the first attempt of science communication or science journalism in Hindi language. According to him, the first full-fledged monthly popular science magazine in Hindi started in 1915 from Vigyan Parishad Prayag under the title 'Vigyan' which is still continuing. He mentioned the names of many science magazines in Hindi. He added that Vigyan Pragati in Hindi is currently the largest circulated popular science magazine in India.

Dr Patairiya highlighted the role of folk media, especially Puppetry, Drama, etc. in science communication for common people in spite of the existence of overpowering electronic media. He analysed the influence of Bengal renaissance in the perspective of science communication and popularizations. He especially mentioned the name and work of Biswakabi Rabindra Nath Tagore and the scientist Jagadish Chanda Bose in this regard.

Second speaker Dr Ankuran Datta, HoD, Communication and Journalism, Gauhati University introduced the theme of the seminar and emphasizeed on science communication in Assam. He explained the historical background of science communication in Assam, tracing the path of science journalism as well as science popularization through the medium starting from print media to electronic media. He mentioned the publication of 'Orunodoi' in 1846 in the region as the benchmark categorizing into Pre-Orunodoi era, Orunodoi era and Post-Orunodoi era.

Dr. Datta said that the growth of science communication and the importance of scientific tempers and practices in Assam are as old as the fifteenth century during the Vaishnavite movement. He added that in Post-Independence era, the coverage of science-related news is comparatively higher in Assam than in any other state of the country, though in recent years Assam has shown a decline of this coverage in newspapers and magazines, especially in the case of vernacular dailies.

At the end of the session, Prof Amalendu Bandyopadhyay, Chairperson explained how delivery of the same topic varies with different target groups in science communication and shared his rich experience in the field of science communication throughout India. Co-Chairperson, Dr Sitendu Mandal offered his overall observations on the session.

Scientific Session II

The Chairperson was Sri Pathik Guha from Ananda Bazar Patrika, the Co-Chairperson was Dr. Sabyasachi Chattopadhyay, HoD, Department of History, Kalyani University, and Dr. Minakshi De from the Department of Microbiology, Surendra Nath College, Kolkata performed the task of Rapporteur for the session.

The first Speaker was Professor Syamal Chakraborty, Department of Chemistry, University of Calcutta. He was the representative of Eastern India for Bengali**.** In his speech, he covered the limitations of a science communicator. A science communicator never provides any information which is primary in nature. He or she looks around, thinks about and then represents the subject according to the capability of oneself. Capability is generated basically from two important wings - understanding of the subject and the efficiency of its presentation - he said. The speaker added that Bengali language had a very long heritage of science communication. The world was not static, interaction of science and technology continuously changed its nature. History of science communication through print media has also been modified. Contributions of Mahendra Lal Sircar, Rabindra Nath Tagore, Bankim Chandra Chattopadhyay and J.C. Bose in this endeavour were also acknowledged.

The next speaker was Ms. Mukta Dabholkar, a Science Communicator who represented Western India for Marathi. Her topic was 'Challenges and Role of Science Communicators'**.** Since she is associated with Maharashtra Andhashraddha Nirmoolan Samite, a voluntary organization, her lecture mainly covered the field of activity of this Samitee which aims at eradicating many superstitions and spreading of scientific temper in day-to-day life. Her organization also provides mental support to the needy people and discourage young people to choose life partners based on horoscope.

The last lecture in this session was delivered by Dr. Kavumbayi Balakrishnan, Publication Convener of Kerala Sasthra Sahitya Parisat and represented South India for Malaylam. He discussed in details Science Communications in Malayalam. According to him, the first article in Malayalam on modern science was published in 1847. The periodicals and magazines eagerly followed suit. In the latter half of the 20th century, publications including Mangalodayam, Mathrubhumi and Desabhimani sourced and encouraged people who could write scientific articles and published many scientific pieces. The speaker mentioned that science writing and communication flourished since 1957. It was a significant year for the state, the nation and the world. Kerala's first Cabinet too was sworn in '57. Sasthrasahitya Samiti, an organization for Science Communication started in the same year which lasted only for one year. Kerala Sasthra Sahitya Parishad (KSSP), a collective science writers' forum was founded in 1962. KSSP started publishing Sasthragati, a popular science magazine, in 1966; Sasthrakeralam for high school students in1969, and Eureka for primary school students in 1970. The speaker also discussed the present day problems of science communication.

The session ended with remarks from Sri Pathik Guha, Chairperson and Dr. Sabyasachi Chattopadhyay, Co-Chairperson.

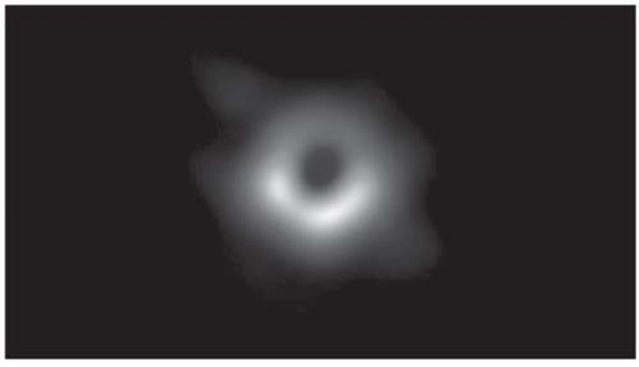
Valedictory Session

The Meet ended with Valedictory session, chaired by Prof S C Roy, Editor in Chief, Science and Culture. He praised the effort of ISNA and the DST for this timely meeting to understand our position as science communicators as well as to understand the challenges that we have in a country like India with diverse cultures and languages. Science communication, as commonly perceived, is required for the masses. But time has come when we need to communicate science not only to the masses but also to scientists, to make them understand that mythological stories and science fictions are two different things. The Co- Chairman Dr. Shankarasish Mukherjee, Assistant Professor, West Bengal State University summarised the events of the day. The session ended with Vote of Thanks by Dr Amit Krishna De, Convener of the Training Programme. ❐

Dr Sima Mukhopadhyay ,
Dr.Minakshi De and Dr Amit Krishna De

First Ever Image of Black Hole Captured: Einstein's Theory Vindicated

On April 10 this year, a team of more than 200 scientists from 13 institutions from across the globe released the first ever pictures of a black hole at the heart of Messier 87 (M87), a galaxy that is about 55 million light-years away in the Virgo galaxy cluster and has nearly 6.5 billion times the mass of sun. The black hole appeared like a gigantic ring of fire creating an essentially circular shadow. Since no single telescope is able to detect a tiny object at such a long a distance, the team of scientists, called the EHT collaboration, explained later, used eight millimetre-wave telescopes in Hawaii, Arizona, Mexico, France, Chile and South Pole and combined their data through 'very-long-baseline interferometry' to create a virtual telescope of the size of earth.



Black hole at the centre of Meissner 87

The origin of the concept of black holes lies in Einstein's theory of relativity which was published in 1915. Months thereafter, a German physicist Karl Schwarzschild put forward a solution for Einstein's equations. He suggested that within a certain distance of an infinitesimal point mass, the gravity would be too strong to allow anything, including light, to escape from it. But this idea about the existence of black holes remained merely a mathematical curiosity until 1939 when J. Robert Oppenheimer *et al.* predicted that a massive star could actually collapse into a point. The idea was rejuvenated with the discovery of dense, spinning neutron stars called 'pulsars' by J. B. Burnell in 1967. Plenty of indirect evidence for the existence of black holes has since been accumulated by the astronomers.

Studies on our Milky Way, known as 'Sagittarius A*' or 'Sgr A*', over the past couple of decades strongly hinted at the possible existence of a supermassive black hole with a mass of nearly 4 million times that of sun at the galactic centre. But the most compelling evidence came in 2015 when LIGO (Laser Interferometer Gravitational-Wave Observatory) scientists detected ripples in space-time emitted by the phenomenal merger of two black holes.

Imaging black holes is a formidable challenge for two reasons. Firstly, their intense gravity prevents light from escaping. Secondly, their 'event horizon' (EH), i.e. the point of no return for anything approaching a black hole is so small (comparatively speaking) that imaging a black hole requires a telescope dish of global dimension. Another difficulty in visualising the environments of massive black holes at galactic centres is that their accretion structure is not known – it may be a thin disk, a thick one, a cloud of gas, jets and the like. Sgr A* and M87 are not active galaxies, so their environments could be a thin disk. It depends also on whether the black hole is rotating or not.

The collaborators working with the global array of eight mm-wave telescopes creating an earth-sized virtual telescope is known as the Event Horizon Telescope (EHT) team. Two years ago the EHT collaborators started recording data on two supermassive black holes – one at the centre of Sgr A* and another at the centre of a nearby galaxy M87 - over five nights (with a clear sky) in April, 2017. They faced difficulties because there was only a tiny window (two weeks) when event horizon could be seen. Nevertheless, nearly 4 petabytes (2^{15}) of data were accumulated by the EHT. To give an idea about the vastness of these data, the data, if stored as music in MP3s, would take 8,000 years to play. The team members have been correlating, calibrating and interpreting the data for the last two years – a monumental task, and the outcome is the first ever picturisation of a black hole.

The imaging of black hole is yet another confirmation of Einstein's theory of general relativity as the correct theory of strong gravity. The results have been announced in six simultaneous press conferences in four continents and also published in *Astrophys. J. Lett.,* **875**, L1-L5 (2019). The EHT team will now turn their attention to the data from Sgr A* which is nearly 1,000 times smaller than the M87 black hole. Looking at the image of the black hole is "*like looking at the gates of hell. This is the end of space and time*," said a member of the EHT team. The 2-year process of working on the data and generating the images "*was the most emotionally difficult period of my life*," said he. ❐

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Universe's First Molecule, Helium Hydride Ion, Detected in Space in a Dying Star's Nebula

An international team of researchers, led by R. Güsten, recently reported the detection of helium hydride (HeH^+) - long known to be the first molecule, actually an ionic molecule, to have been produced in early universe almost 14 billion years ago - in the planetary nebula NGC 7027 which is located 3,000 light-years away near the constellation Cygnus. The results were published in *Nature*, **568**, 357-359 (2019): "Astrophysical detection of the helium hydride ion HeH^+." The signal from this molecular ion was detected by the GREAT (German Receive at Terahertz Frequencies) far-infrared spectrometer onboard the flying observatory SOFIA (Stratospheric Observatory for Infrared Astronomy) which is a Boeing 747SP jetliner modified to carry a 106-inch diameter telescope. It was a joint project of NASA and the German Aerospace Center, DLR.

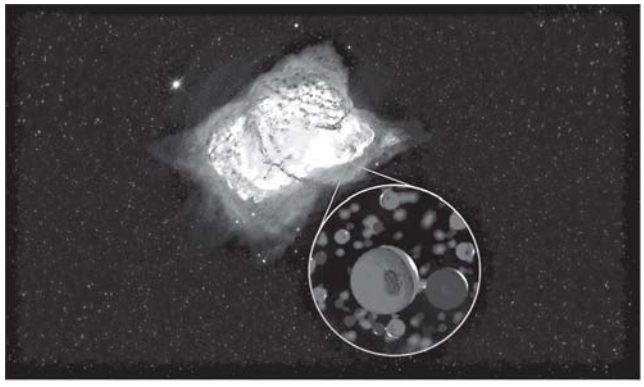

Illustration: HeH^+ in Planetary Nebula NGC 7027

Credits: NASA/SOFIA/L

How and when helium hydride was first formed in the universe is pretty much a common knowledge amongst the physicists and the astronomers, but this is presumably not a common knowledge even to the chemical community at large. A brief clarification in this regard may, therefore, be deemed to be helpful, to say the least. The universe, as we see it today, clocks at some 13.8 billion years after the Big Bang. When the Universe was just a few minutes old, the only nucleosynthesis that took place during this earliest, hottest and densest stage of the Big Bang furnished nearly 75% hydrogen, 25% helium, a tiny fraction of deuterium and helium-3, and a trace amount of lithium by mass. All these species were fully ionized. Things were very hot, and the Universe expanded and cooled for thousands of years thereafter until it was cold enough to enable stable neutral atoms to form.

After about 32,000 years, the universe became cold enough to allow an electron to bind to a helium nucleus (He^{++}), resulting in the formation of He^+ ion: $He^{++} + e = He^+$. After another 1,00,000 years, a second electron did bind to each He^+ to form the first stable, neutral helium atom: $He^+ + e = He$. When the universe grew older, aged between 1,32,000 years and just before 3,80,000 years, a neutral helium atom collided with a hydrogen ion to produce helium hydride ion, the first molecule of the universe: $He + H^+ = HeH^+$. When the universe was around 3,80,000 years old, individual protons and electrons formed bonds to form hydrogen atoms. Hydrogen atoms can easily bond with other hydrogen atoms, producing the molecular hydrogen (H_2).

All of the helium of early universe should have been destroyed when hydrogen became neutral. Also, HeH^+, the universe's first molecule, didn't last long, and it was all gone by the time the universe became around 5,00,000 years old. Consequently, it raises the question as to how helium hydride ion could then be detected, even thought to be detectable, after such a long time, i.e. at the present time. The question is even more relevant because of the fact that helium hydride (HeH^+) was created in the laboratory as recently as in 1925.

More than 40 years ago, planetary nebulae were suggested as homes for helium hydride which emits very low energy photons at 149.1 micron, arising from its rotation. But this far-infrared emission is obscured by earth's atmosphere. That is why the signal from helium hydride could not be detected from ground-based telescopes until the present venture. This time it has been recorded from space, courtesy the SOFIA of NASA. SOFIA flies on board a modified Boeing 747 up to 45,000 ft, which is above the earth's obscuring atmosphere, and it is uniquely suited to record high-quality, high-altitude far-infrared observations while still having serviceable, upgradable instruments on board. When SOFIA was upgraded with the GREAT instrument (which is able to detect the far-infrared signal in space) – a collaboration with the German organisation DLR - after its return to earth, it recorded the unmistakable signature emission from helium hydride ion in the planetary nebula NGC 7027.

The mission was best described by Hal Yorke, the Director of the SOFIA Science Center, "*This molecule was lurking out there, but we needed the right instruments making observations in the right position — and SOFIA was able to do that perfectly*." The final proof of the existence of helium hydride in natural environment of space

was thus secured, which further consolidated the view that this molecule did indeed exist in the early universe. ❐

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Fossils of New Members of Human Family Tree Discovered in Callao Cave, Luzon Island, Philippines

In the April 11 issue of *Nature*, paleoanthropologists reported that they have dug the fossils of one thigh bone, seven teeth, two foot bones and two hand bones (perhaps from two adults and one child) from the Calao Cave of Luzon island in the Philippines. The fossils exhibit an unforeseen mosaic of so called primitive and derived characteristics which led the scientists to claim that the fossils belonged to a new class of the hominins (belonging to human family tree) who inhabited the island nearly 50,000 to 67,000 years ago. This period overlaps with that of us, the *Homo sapiens* and other hominins, viz. the Neandertals, Denisovans and *Homo floresiensis*. They named these hominins *Homo luzonensis*. These new findings additionally cast doubts on the extant evolution and biogeography of early hominins.

Toe bone of *H. luzonensis* Premolars and molars of *H. luzonensis*

Credit: Callao Cave Archaeology Project

The current landmark discovery makes Luzon the third Southeast Asian island in the last 15 years to bear signs of unexpectedly ancient human activity. Armand Salvador Mijares, a graduate student archaeologist at the University of the Philippines Diliman, Quezon city, Metro Manila and the recipient of a National Geographic grant, first excavated Callao Cave on Luzon island, Philippines in 2003. But he dug no more than four feet down, and he found evidence of 25,000-year-old human activity there.

However, the story of the discovery of new hominins (other than *Homo sapiens*) dates back to 2004 when the fossils belonging to a new species, *Homo floresiensis*, also known as the 'Hobbits', was discovered from the Flores island in Indonesia. This new species lived there around 18,000 years ago and was estimated to be just over one metre in height. In 2007, Dr. Mijares, now a Professor at the University of the Philippines, once again excavated Calao Cave and dug out a single fossilised foot bone. The bone was 'petite', comparable in size to the foot bones of the small-bodied Negrito people, an ethnic group with men having an average height of 1.51 metres and women about 1.52 metres inhabiting the Luzon island and other places in Philippines now. The shape of the bone was "really weird". They surmised that the bone came from "something more interesting than a small *Homo sapiens*." In their publication in 2010, they could only conclude that it belonged to the genus *Homo*.

Recent excavations of the Callao Cave by an international team of researchers resulted in the additional recovery of the fossils of 12 assorted bones, as stated in the beginning. 'Molars' or molar teeth - large, flat teeth at the back of the mouth and showing a great deal of diversity in size and shape across mammal groups, played a crucial role in dating the fossils. The shape and extremely small size of the newly discovered molars resemble those of both *H. sapiens* and *H. erectus* (thought to have been the first human relative to have left Africa some two million years ago) found in Asia. The discovered premolars (which precede the molars) are still in the range of those of *H. sapiens* and *H. floresiensis*. But the overall size of the teeth and the ratio between molar and premolar sizes are distinct from those of other members of the genus *Homo*. The shape of the foot bone is also distinct. The scientists claimed, based on these observations, that the fossils belonged to some new hominin species which they named *H. luzonensis*.

The discovery of this new species poses a great problem in fitting it into the human family tree. One view is that the new species descended from a group of *H. erectus*, and their bodies gradually evolved into somewhat different forms enabling them to spend nights on trees. Another view is that the new species may have descended from a line that migrated from Africa before *H. erectus* did. DNA analysis could have solved this problem, but all attempts to extract DNA from *H. luzonensis* failed till date. However, since the bones and teeth of the new species are at least 50,000 years old, the scientists are inclined to think that this new species might have inhabited southeast Asia at the same time as did *H. sapiens*, *H. floresiensis* and the mysterious group of Denisovans whose DNA has been found in contemporary human species.

According to Rebecca Ackermann, a biological anthropologist of the University of Cape Town, the Luzon discovery illustrates the extreme diversity of human

ancestors under the influence of various evolutionary forces during the last few hundred thousand years. ❐

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Bioresource from *Artocarpus* Leaves, Paper Mill Sludge and Prophage Therapy in UTI

The 6th India Biodiversity Meet 2019 and International Conference was organized by Agricultural and Ecological Research Unit, Indian Statistical Institute (ISI), Kolkata during February 14-16, 2019. As a part of this programme, in the Session and Theme 'Biodiversity and Ecosystem Functioning' on 16/2/2019, Dr R. Dutta, Research Fellow at ISI spoke on 'Biowaste to bioresource - a broad spectrum biopesticide from shedded leaves of *Artocarpus lakoocha*' as the first contributory presentation. She spoke on isolation, extraction and purification of hexane, methanol, ethyl acetate and acetone fractions (extracts) from leaves of *A. lakoocha* (monkey fruit); content of tannins, phenols and flavonoids in different fractions/compounds; phytochemical screening of different fractions; methanol fraction having the highest antioxidant activity and also bactericidal and fungicidal activities (against 4 strains of *Aspergillus* sp) at 500-2000ppm concentration; DNA protection assay of methanol fraction against oxidative radical damage. Leaves of the tree *A. lakoocha*, available at ISI campus and other places are rich in bioactive compounds.

Dr R. Ganguly from Department of Zoology, Vidyasagar University spoke on 'Entrepreneur to a green world through vermicomposting - a venture for sludge abatement and ecorestoration'. He discussed on use of Uniglobal paper mill waste (sludge) from Jhargram, Paschim Midnapore for vermicomposting; use of the indigenous earthworm *Perionyx excavatus*; preparation of vermicomposting bed; analysis of vermicomposting assays; less accumulation of zinc and copper and higher accumulation of cadmium in earthworm gut/tissue; accumulation of metals in vermicompost; beneficial microbes (7 strains) and vermicompost obtained on 60th day of treating sun-dried and crushed paper mill waste with earthworms; C/N ratio in vermicompost, enriching its nutrient availability by microbes through activities of enzymes β-glucosidase and leucine arylamidase. Dr Ganguly concluded that paper mill waste is good source of polysaccharides and vermicompost-associated beneficial bacteria can act as good material for biomedical importance.

Dr S. Panda, Professor of Botany, Maulana Azad College, Kolkata spoke on '*Helwingia himalaica* - a threatened ethnomedical plant on the verge of extinction from Darjeeling Himalaya'. He spoke about the plant with blood-red ripen fruits whose flowering occurs at the mid-point of leaf; its availability mostly in eastern Nepal, Darjeeling and Sikkim; total 17 small and discrete (discontinuous) populations of *H. himalaica* found throughout Darjeeling district at nine locations; his field observations based on Count Quadrat Method and report during 2011-2018; populations of this species (along with number of plants) found in Senchal sanctuary and other sites; intense tree felling and plantation of the invasive species maling bamboo *Yushania maling* causing damage to *H. himalaica* population; conservation efforts on *H. himalaica*.

The fourth contributory presentation was made by Dr Snehashis Koley from Department of Biochemistry and Medical Biotechnology, Calcutta School of Tropical Medicine on 'Prophages: an alternative therapy for recurrent urinary tract infection (UTI)'. He spoke on asymptomatic bacteriuria, cystitis and pyelonephritis as three basic forms of UTI; asymptomatic strains of bacteria like *Escherichia coli* 83792 (that has acquired six prophages and can be isolated from urinary bladder) and ABU *E. coli* strain VR50 as potent source of prophage, as they lack essential virulence factors like P. fimbriae; identification of strain of asymptomatic bacteriuria; bacteriophage induction protocol by Top Agar Method; phage lysate preparation and plaque activity as indication of prophage activity; potentiality of phage production in samples of *E. coli* P-54 and P-83; growth of bacteria in presence or absence of mitomycin-C; studies on antibiotic susceptibility tests and MIC to get the sub-optimal concentration of the drug; importance of proper dosage of phage therapy, phage typing and evaluation of dosage amount which is a potential alternative to antibiotic therapy.

In the beginning of this session, Dr Sk. Md. Equeenuddin, Department of Earth and Atmospheric Sciences, NIT, Rourkela gave an Invited Talk on 'Assessment of acid mine drainage (AMD) potential'. AMD (pH 3.0-4.5) is a detrimental byproduct of coal and metal mining for many years and continues to pose a potential problem, affecting microbial soil health. Dr Equeenuddin discussed about factors controlling rate of acid generation; copper mine water inhibiting growth of paddy; adding lime for treatment of acid mine water; dominance of red and

blue algae in alkaline waters and green filamentous algae in acid mine water; criteria for the characterization of post-mining water quality; chemical process by which pyrite is oxidized. Pyrite (FeS_2) is a common precursor of AMD, which, when exposed to air and water, releases water soluble components such as Fe^{2+}, SO_4^{2-} and H^+. Fe^{3+} produced from Fe^{2+} oxidizes pyrite, which is accompanied by the release of additional amounts of acids. Bacterium *Thiobacillus ferrooxidans* catalyzes the rate of Fe^{2+} oxidation, he explained. ❐

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Discussion on Vaccines and Antivirals in MVM 2019 at IIT Kharagpur

The 6th Molecular Virology Meeting (MVM) 2019, organized by School of Bioscience, Indian Institute of Technology, Kharagpur in association with Amity University, Kolkata; Presidency University; ICMR-NICED; CSIR-IICB and NIBMG, Kalyani was held at IIT, Kharagpur during 28th February - 2nd March, 2019. As the 1st speaker in the Session 'Vaccine and Antivirals' held on 2/3/2019, Dr D. Mitra, Director, Centre for DNA Fingerprinting and Diagnostics, Hyderabad spoke on 'Stress proteins as potential targets and repurposing of drugs in the fight against HIV/AIDS'.

Dr Mitra discussed about identification of anti-viral molecules, *i.e.,* molecules targeting the viral enzymes reverse transcriptase (RT), protease, integrase; timeline of anti-retroviral approvals; CCR-5 important in HIV pathogenesis; targeting host factors essential for virus life cycle; identification of genes and proteins important for HIV; host dependency factors required for virus to replicate and produce new virions; HSP-90 important for HIV for its transcription and regulation; using HSP-90 as a target for making antivirals for several viruses; geldanamycin as HSP-90 inhibitor; AUY-922 as 2nd generation HSP inhibitor; efforts to make new less-toxic analogues of AUY-922; identification of novel cellular targets for anti-HIV activity; 177 out of 1280 bioactive molecules screened have shown more than 50% inhibitory activity; characterization of a newly-identified pharmacologically-active molecule/ compound and research on how it can inhibit virus; cytotoxicity and anti-HIV activity of new molecule which efficiently inhibits various HIV-1 isolates at different dosages of virus infection; its pathway is known, has effect on stress protein, *i.e.,* cellular factors, modulation of HSP network and upregulation of HSP-70, induces HSP-90 proteasomal degradation; HSP-90 inhibitor AUY 922 mediated HIV-1 inhibition also leads to induction of HSP-70. Dr Mitra finally highlighted a proposed model for the new compound mediated mechanism of virus inhibition; it can be used with RT and protease inhibitors.

Dr R. Varadarajan, Professor at Indian Institute of Science (IISc), Bengaluru spoke on 'Influenza immunogen design'. He discussed about the 1918 influenza pandemic; haemagglutinin (HA) and neuraminidase proteins in human influenza virus; antibodies (Abs) as influenza vaccines target highly variable regions of these 2 glycoproteins; research on preparation of recombinant head and stem domains of HA as protective immunogens; stem immunogen protects mice from pathogenic challenge; Group-I (subtype H1) immunogen provides significant protection against Group-2 (H3) challenge and elicit neutralizing antibodies; yeast surface display technique; making libraries of different proteins and displaying large libraries on yeast; fluorescent signals produced on account of binding to ligand of broadly neutralized antibody; nanoparticle display for enhanced immunogenicity and crystal structure of nanoparticle ferritin; schematic representation of fusion construct design; immunization studies with nanoparticle construct in mice; different candidate immunogen design (H1, H3, H7); thermostable and bacterially-expressed H1 nanoparticle design; vaccine candidates from the conserved region of stem domain of HA and novel vaccine strategy; glycosylated immunogens and improvement of immunogenicity.

Dr N. M. Dixit, Associate Faculty, IISc spoke on 'Passive immunization for functional cure of HIV infection'. He emphasized on mathematical model and computer simulations for development of drugs for HIV infection; discussed about HIV infection, progression and anti-retroviral treatment; HIV mutants and variants which Abs cannot target; broadly neutralizing antibodies (bNAbs) targeting conserved region of virus and disease control; passive immunization with bNAbs instead of administering immunogens and bringing down disease burden; injecting HIV bNAbs found to enhance potency of host antibody response; understanding mechanism by which external Abs affect the production of endogenous Abs; the germinal center (GC) reaction, selection of B cells leading to affinity maturation (am); stochastic simulation of am process of GC reaction in presence of passively administered Abs to elucidate the mechanism of am in GC; affinity of passive Abs as well as antigen availability tune the GC reaction.

Dr Dixit has applied simulations to predict protocols involving Abs of different affinities for antigen that would maximize the output of GC reaction.

Dr S. Bhattacharya, Scientist at Translational Health Science and Technology Institute, Faridabad spoke on 'Rational design of a novel Dengue virus RNA-dependent RNA polymerase (RdRp) non-nucleoside inhibitor'. He discussed about computer-aided drug design for inhibition of Dengue virus RdRp; developing a drug with low throughput screening; clinical events following onset of Dengue fever; fluid maintenance and platelet transfusion to manage Dengue; pharmaceuticals (indirect and direct antivirals) that have been tested for treating patients; design of potential non-nucleoside inhibitors (NNI) targeting Dengue RdRp at the RNA template entrance site. Dr Bhattacharya discussed about his endeavour to develop a novel molecule targeting the RdRp of Dengue virus, working as a NNI; designing, efficacy testing followed by redesigning to arrive at a molecule that inhibits production of the virus and its accumulation in cells at low μM concentration, also it will exhibit low cytotoxicity.

The 5th presentation in this Session was made by Dr D. Sehgal, Associate Professor at Shiv Nadar University, Uttar Pradesh on 'Setting up the replicative in-vitro Hepatitis-E virus (HEV) culture model to study its replication, translation and effect of antiviral drugs'. He discussed about spreading of HEV through faeco-oral route and contaminated waters; transmission through pigs; four enzymes on HEV genome map responsible for its replication; designing of HEV culture system, development of Baculovirus system, generation of recombinant HEV-BacMam vector (BacMam as carrier of HEV genome into cell); cloning of HEV genome; synthesis of enzymes RdRp, ORF-2, ORF-3 and methyl transferase (MeT) in *in-vitro* culture models; detection of MeT expression in infected cells; molecular docking, cloning, expression and purification of HEV cysteine protease. Dr Sehgal has established *in-vitro* HEV culture system using BacMam technology to introduce the viral genome into hepatic cells which could transcribe, replicate, translate and produce the infectious virions. This system synthesizes all positive-sense RNA, negative-sense RNA and intermediately ds RNA, could translate all four afore-mentioned capsid proteins and this model will be helpful in studying HEV replication and its pathogenesis at molecular level. ❐

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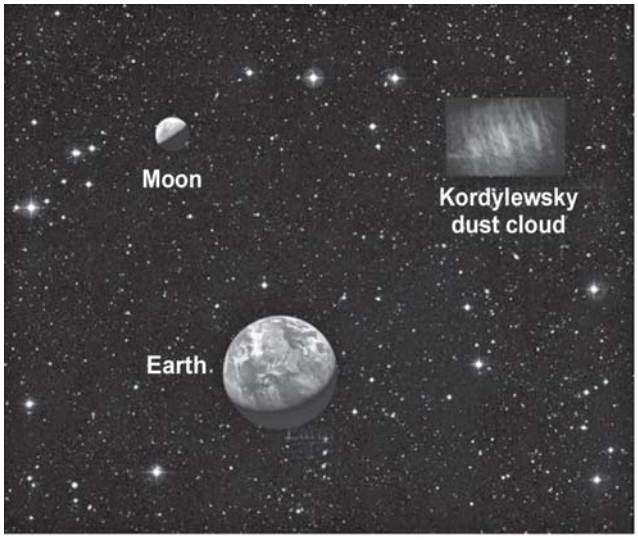
Extra, Hidden 'moons' of Earth Discovered

Hungarian astronomer Judit Slíz-Balogh and physicist Gábor Horváth have made a startling disclosure that the Moon is not our planet's sole natural satellite and claimed that they have confirmed the existence of two Earthorbiting objects entirely made of dust. They have even managed to capture snapshots of the mysterious clouds located just 4,02,336 kilometres away, roughly the same distance as the Moon. Their work was published in the journal Monthly *Notices of* the Royal Astronomical Society on 25 October 2018.



Earth's hidden moon

The dusty clouds have been named Kordylewski clouds after Polish astronomer Kazimierz Kordylewski, who first got a glimpse of the clouds in 1961. According to the new findings, each Kordylewski cloud is about 15°×10° wide as seen from Earth, compared to our Moon's angular size of 0.5°. This means they appear as large as 30×20 lunar disks in the night sky. But despite being large they have remained hidden in the darkness of space until now simply because they are extremely faint. According to the Royal Astronomical Society, given their stability, the Lagrange points L4 and L5 points are potential sites for the location of the orbiting Kordylewski clouds. In other words, the dust clouds orbit approximately in the Moon's orbit, moving ahead of and behind the Moon in orbit. ❐

Biman Basu
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Liquid Water Found on Mars

The journal *Science* reported on 25 July 2018 the discovery of a large reservoir of liquid water under Planum Australe – the southern polar plain on Mars. Till now, presence of water ice in the polar caps of Mars has been known and there have been speculations about the presence of liquid water on the Red Planet, but without any confirmation. A lake of liquid water has been discovered some 1.5 kilometres below the polar ice cap. The discovery was made by a team of Italian scientists using three years' worth of data from the Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS) instrument on the European Space Agency's *Mars Express* orbiter. For the past 12 years the MARSIS instrument onboard the orbiting *Mars Express* has mapped the Martian underground using beams of low-frequency radar pulses, which can penetrate up to several kilometres beneath the surface.

According to the scientists who did the study, the potential lake is at least a few metres deep, and might be a fixed, steady feature of the subsurface. If confirmed, this would be the firstknown reservoir of liquid water on presentday Mars which may provide a vital clue in the search for past or even present life on the Red Planet.

Bright spots beneath Mars's southern ice cap were first detected in 2007. The Italian team reprogrammed MARSIS to employ a more intensive scanning mode and then surveyed Planum Australe 29 times with the instrument between 2012 and 2015. Every time the new MARSIS readings revealed a consistent 20-kilometre-wide bright spot nestled in a bowl-like depression beneath the ice cap in Planum Australe. The team then spent almost a year analysing the data, and another two years writing their paper and attempting to rule out non-aqueous explanations for what they had seen.

Scientists have found evidence that billions of years ago, Mars was much wetter and a more Earth-like place where water pooled in seas, carved enormous canyons and bubbled from hot springs. Mars-orbiting spacecraft have also glimpsed what might be rivulets of water flowing down sun-bathed crater walls at the height of Martian summer. Still, the water that once flowed across the Martian land had to go somewhere. Some of it was likely lost to space due to Mars's weak gravitational field, but scientists believe a significant fraction of the planet's aqueous inventory never really left and may have just frozen below ground. Now it appears not all of that buried watery wealth is frozen after all; rather a large part may be in the form of liquid water. ❐

Biman Basu

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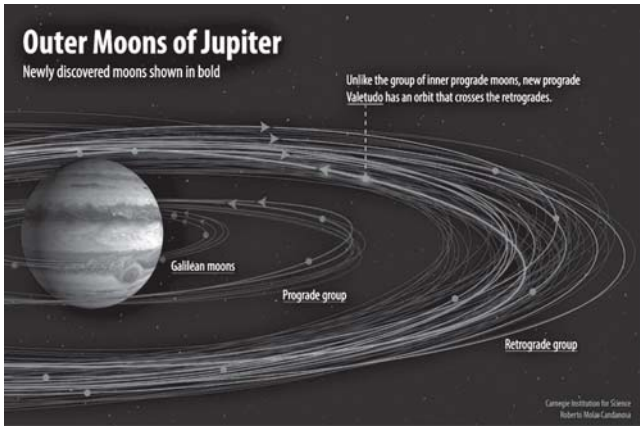
Jupiter gets 12 New Moons

Jupiter is the largest planet of the solar system and it has the largest number of moons. Till recently, the total number of moons of Jupiter was taken to be 67. On 17 July 2018, the International Astronomical Union (IAU) announced the discovery of 10 new moons orbiting Jupiter. These along with two announced earlier in June 2017 bring the total number of Jupiter's known natural satellites to 79. Saturn, Jupiter's closest rival, has a mere 62 moons orbiting around it. The four largest of Jupiter's moons were discovered by the Italian astronomer Galileo Galilei using a small home-made telescope more than 400 years ago, in 1610. Later, over the years, dozens of moons were discovered using more powerful telescopes and space probes.



Jupiter's new moons

The discovery of the new moons came by chance. Astronomer Scott Sheppard of the Carnegie Institution for Science in Washington, DC, USA was looking for Planet Nine, a hypothetical planet many astronomers think should exist in the distant reaches of our solar system beyond Pluto. He and his team have been photographing the skies with some of today's best telescope technology, hoping to catch sight of this mysterious ninth planet. It so happened that around mid-2017, Jupiter happened to be in an area of sky the team wanted to search for Planet Nine.

All the new moons around Jupiter are on average about three kilometres wide, which may be the reason why

they had been left undiscovered until now, till scientists found them using incredibly sensitive telescopes. One of new moons named Valetudo turned out to be an oddball. It moves in an unusual way. It is positioned where Jupiter's outer, retrograde moons are, but it orbits Jupiter in the prograde direction. "It's like it's going down the highway in the wrong direction."

According to the researchers, finding how the objects came to be formed and orbit around Jupiter could shed light on the formation of our solar system.

Biman Basu

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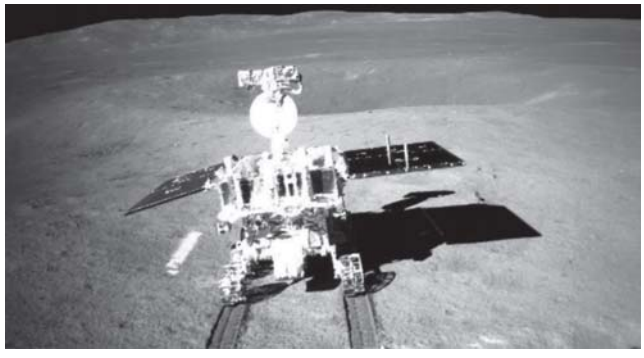
Chinese Craft Makes Historic Landing on Moon's far Side

In a historic first, China landed a rover called *Chang'e*-4 (named after the Moon goddess in Chinese lore) on the far side of the Moon on 3 January 2019. No country has ever landed a space probe on Moon's far side, which is never visible from Earth. From Earth, we can see only one face of the Moon. This happens because the Moon takes just as long to rotate on its own axis as it takes to complete one orbit of Earth " a phenomenon called "tidal locking". Incidentally, though the far side of the Moon doesn't face Earth, it is not necessarily dark because it also sees regular day-night cycles like the visible side. So, the term "dark side" is a misnomer.



China's new lunar rover, Yutu-2, leaves Chang'e lander *to leave first "footprint" on Moon's far side.*

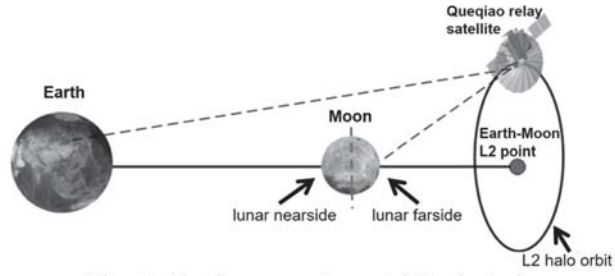
Launched on 7 December 2018, from the Xichang Space Centre in China, *Chang'e*-4 took several weeks to reach lunar orbit. *Chang'e*-4 landed over a special location called Von Kármán crater, a 186-kilometrediameter feature in the South Pole-Aitken basin, full of scientific potential. Scientists say it is home to igneous rocks that may reveal clues about the Moon's internal structure and includes "fascinating volcanic constructs (mantle deposits that resemble the shape of Earth's cinder-cone volcanoes), secondary craters made by the ejecta of earlier impacts, landslides and more".

The spacecraft landed around local lunar sunrise. This timing gives the solarpowered lander and '*Yutu*' rover roughly two weeks of illumination, before they enter their first long lunar night in late January. One of the first images returned after landing showed one foot-pad of the lander sinking slightly into the lunar dust, but stable.

Since we cannot see the far side of the Moon from Earth it is not possible to have direct communication link with *Chang'e*-4. So, a relay satellite has to be used for communicating with the rover on the far side. Chang'e-4 uses a dedicated relay, the *Queqiao* orbiter perched in a halo orbit around the L2 Lagrange point, 60,000 kilometres beyond the Moon, where it remains constantly visible from Earth and can be used for communication.

It may be mentioned here that there are significant differences between the topographies of the near-side and far-side of the Moon. For one, the crust is much thicker on the far side, relative to the near side. "The near side is dominated topographically by the presence of large basins that have been filled to the brim with basaltic lava flows (or mare deposits), making it relatively flat and smooth and erasing any small- to mid-sized craters that may have formed". In contrast, the far side's surface generally looks rougher. Scientists don't know the reason for this difference yet. It is hoped exploration by *Chang'e*-4 will throw new light on the mystery.

The *Chang'e*-4 mission will be examining its new home with a battery of scientific instruments. The 2,200-kilometre-wide South Pole-Aitken basin that Von Kármán crater is embedded within is thought to be a section of exposed lunar mantle. Sampling this region could reveal information about the formation and structure of the Moon. The lander also carries silkworm eggs and plant seeds in a tiny enclosed experiment, to see how they fare growing on



Chang'e-4 lander communicates with Earth via the

Chang'e-4 lander communicates with Earth via the *Queqiao relay satellite placed at Lagrange point L2.*

the Moon. In addition, *Chang'e*-4 will carry out radio astronomy observations from the radio-quiet lunar far side. Thanks to the mission's open data policy, the data collected will be shared with scientists all over the world.

Chang'e-4 is a follow-on and virtual copy of the successful *Chang'e*-3 mission, which landed in the Mare Imbrium on Moon's near side in December 2013. China's next stated goal in lunar exploration is a sample return mission. A heavier *Chang'e*-5 lander, rover, and sample return capsule is scheduled for launch later this year. ❐

Biman Basu

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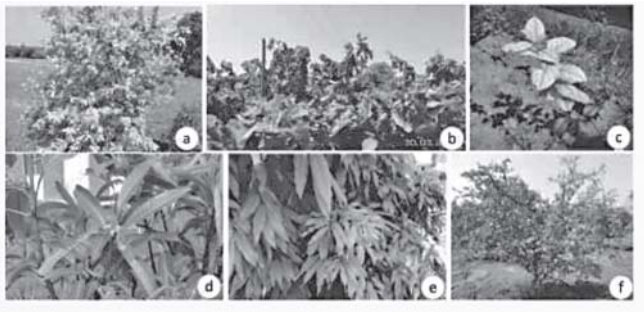
Genetic Diversity of Phytoplasmas Infecting Fruit Species in India

There different groups of phytoplasma were identified and characterized in six fruit croups (litchi, guava, pomegranate, mango, grape and apricot) in Jammu Pune and Delhi during 2016-17, 'Ca, Phytoplasma aurantifolia' (16SrII-D) was found associated with litchi, (little leaf and yellowing), guava (leaf yellowing), pomegranate (leaf yellowing), pomegranate (leaf yellowing and declining) at Jammu; and phyllody associated with Mango at Delhi. '*Ca. P. Asteris'* (16SrI) was found associated with leaf yellows



Field view of symptoms associated with Phytoplasma infection in different fruits crops, namely : (a) gava leaf yellowing; (b) grapevine leaf reddening; (c) apricot leaf yellowing; (d) mango phyllody; (e) litchi little leaf yellowing ; and (f) pomegranate leaf yellowing.

in apricot at Jammu. However, grapevine variaties at Baramati, Pune and IARI, Delhi were found associated wth '*Ca. P. cynodontis'* (16SrXI-B) group. Presence of phytoplasmas were confirmed in all the six fruit samples using polymerase chain reaction with phytoplasma specific primer pairs (P1/P7, R16F2n/R16R2n), pair wise sequence comparison, phylogenetic relationship and virtual RFLP analysis of 16S rRNA gene sequences. Except litchi, all the other reports of phytoplasm diseases are new to India, hence, further studies are planned on epidemiology and management of the disease in respective areas of their occurrence. ❐

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