

## COVID-19 Research Update

While vaccines are critically important for ending this pandemic, development of effective therapeutics are equally essential for keeping people out of hospitals and improving survival. This week, NIAID announced the start of five sub-studies under two master protocols of the *Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) partnership*. This brings the total ACTIV and ACTIV-associated trials to 27 studies testing 20 therapeutic agents, with several already showing promising results.

A new sub-study announced this week as part of the *ACTIV-3 inpatient master protocol* will evaluate the safety and efficacy of ADZ7442, a combination of two investigational long-acting monoclonal antibodies developed by AstraZeneca. Initial participants will be hospitalized patients with mild-to-moderate COVID-19 and fewer than 13 days of symptoms.

NIAID also announced the addition of four sub-studies under the *ACTIV-2 outpatient protocol* to test interventions for safety and efficacy in participants who have tested positive for SARS-CoV-2 within 10 days and started experiencing symptoms within 8 days of enrolling, but do not require hospitalization. Participants also must have a risk factor that puts them at higher probability of progressing to severe COVID-19. The investigational agents being tested are SNG001, an inhalable beta interferon developed by Synairgen that is delivered by nebulizer; AZD7442, a long-acting monoclonal antibody combination developed by AstraZeneca that will be studied as both an infusion and an intramuscular injection; and Camostat mesilate, an orally administered serine protease inhibitor developed by Sagent Pharmaceuticals that may block SARS-CoV-2 from entering cells.

With best wishes for the President's Day weekend, and thanks for all you do for NIH and the American people. □

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## Agriculture in the 21<sup>st</sup> Century\*

We can look back with pride and satisfaction on the revolution which our farm men and women have brought about in our agricultural history. Writing about the role of our farm families in initiating the Wheat Revolution in India, I wrote in the *Illustrated Weekly of India* in 1969 that:

*“Brimming with enthusiasm, hard-working, skilled and determined, the Punjab farmer has been the backbone of the revolution. Revolutions are usually associated with the young, but in this revolution, age has been no obstacle to participation. Farmers, young and old, educated and uneducated, have easily taken to the new agronomy. It has been heart-warming to see young college graduates, retired officials, ex-armymen, illiterate peasants and small farmers queuing up to get the new seeds. Atleast in the Punjab, the divorce between intellect and labour, which has been the bane of our agriculture, is vanishing”.*

While we can and should rejoice about the past achievements of our farmers, scientists, extension workers and policy makers, there is no room for complacency. We will face several new problems and I would like to mention some of them.

- First, increasing population leads to increased demand for food and reduced per capita availability of arable land and irrigation water.
- Second, improved purchasing power and increased urbanization lead to higher per capita food grain requirements due to an increased consumption of animal products.
- Third, marine fish production is tending to become stagnant and coastal aquaculture has resulted in ecological and social problems.
- Four, there is increasing damage to the ecological foundations of agriculture, such as land, water, forests, biodiversity and the atmosphere and there are distinct possibilities for adverse changes in climate and sea level.

- Five, while dramatic new technological developments are taking place, particularly in the field of biotechnology, their environmental, food safety and social implications are yet to be fully understood.
- Finally, Gross Capital formation in agriculture is tending to decline in both public and private sectors during the present decade. The rate of growth in rural non-farm employment has been poor.

Since land and water will be shrinking resources for agriculture, there is no option in the future except to produce more food and other agricultural commodities from less per capita arable land and irrigation water. In other words, the need for more food has to be met through higher yields per units of land, water, energy and time. It would therefore be useful to examine how science can be mobilized for raising further the ceiling to biological productivity without associated ecological harm. It will be appropriate to refer to the emerging scientific progress on the farms as an “ever-green revolution”, to emphasise that the productivity advance is sustainable overtime since it is rooted in the principles of ecology, economics, social and gender equity and employment generation.

The green revolution has so far helped to keep the rate of growth in food production above population growth rate. The green revolution, was however, the result of public good research, supported by public funds. The technologies of the emerging gene revolution in contrast, are spearheaded by proprietary science and can come under monopolistic control. How can we take the fruits of the gene revolution to the unreached? □

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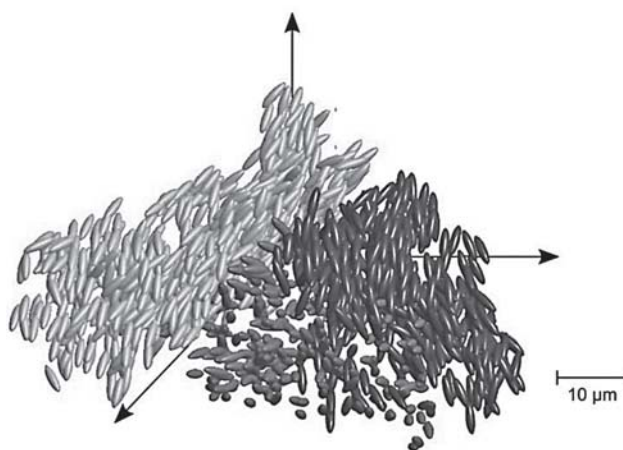
## Liquid Glass: A New State of Matter

All of us are aware of three states of matter, viz. solid, liquid and gas since our schooldays. Later we came to know about a fourth state of matter, viz. plasma which arises when a gas is subjected to extremely high

temperature. But now scientists have claimed to have unveiled a new state of matter, designated ‘liquid glass.’ This new state lies between a solid and a colloid – a homogeneous mixture of microscopic particles whose sizes are bigger than atoms and molecules, thereby rendering this state much easier to be studied. [‘Observation of liquid glass in suspensions of ellipsoidal colloids’, Jörg Roller, Aleena Laganapan, Janne-Mieke Meijer, Matthias Fuchs, and Andreas Zumbusch, *PNAS*, 118 (3) e2018072118; January 19, 2021; <https://doi.org/10.1073/pnas.2018072118>.]

The scientists were studying, using confocal microscopy, the effect of shape on ‘glass transition’ in 3D suspensions of tailor-made, ellipsoidal colloids. Their experiments, supported by simulation studies and theoretical analysis, revealed a hitherto unknown new state of matter: liquid glass. For their study, they made tiny, plastic ellipsoidal colloids mixed together in a solvent.

Let us go deeper into it. When a material in a liquid state is transformed into a solid state, the molecules constituting the material assume a crystalline pattern – they can neither move nor rotate. In contrast, the molecules (ellipsoidal colloids) in liquid glass are locked in a disordered state – they can move, i.e. their translation is free, but they can’t rotate, i.e. their orientational degrees of freedom are frozen. It is the ellipsoidal colloids, instead of conventional spherical colloids, with similar orientations that cluster in groups but obstruct each other inside the material.



Ellipsoidal particles in clusters in liquid glass.  
Image credit: Group of Zumbusch and Fuchs

The completely new properties of liquid glass crop up from the orientation of the ellipsoidal colloidal particles which, in turn, arise from their distinct shapes. As explained by the scientists, two competing liquid-to-solid transitions interact in liquid glass, resulting in a mixture of different properties. According to them, the shape of the

particles and their concentration appear to be crucial in creating this new state of matter.

Pertinently, scientists have been predicting the existence of this new state of matter for the last two decades. This discovery is important for two reasons. Firstly, its study will help us to have a better understanding of how glass transitions work at very small scales. Also, it is likely to help us gain insight into any unexplained behaviour across the micro- (biological cells) and macro-environments (cosmological systems).

A hearty welcome to this post-COVID discovery! □

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### 247 Zeptoseconds: Shortest Time Span Ever Measured

Ultrafast phenomena are matters of extreme importance to physicists and chemists. Examples of such phenomena are femtosecond-dynamics of electrons, melting and vaporization of metals, chemical reactions, processes occurring in plasma, etc. Since ultrafast phenomena are too fast to be monitored directly by electronics, physicists are continuously trying to develop newer techniques to measure very short time spans ranging from nanoseconds ( $10^{-9}$  sec) to picoseconds ( $10^{-12}$  sec) to femtoseconds ( $10^{-15}$  sec) to attoseconds ( $10^{-18}$  sec) to zeptoseconds ( $10^{-21}$  sec). Ultrafast optics is employed to monitor such phenomena.

A few months ago, a group of physicists from Goethe University, Frankfurt in collaboration with colleagues at the particle accelerator facility ‘DESY’ (Deutsches Elektronen-Synchrotron) at Hamburg and the Fritz-Haber Institute, Berlin have reported *for the first time* a process – the propagation of light within a molecule – that lies in the zeptosecond time frame. [S. Grundmann, D. Trabert, K. Fehre, N. Strenger, A. Pier, L. Kaiser, M. Kircher, M. Weller, S. Eckart, L.Ph.H. Schmidt, F. Trinter, T. Jahnke, M.S. Schöffler and R. Dörner. ‘Zeptosecond Birth Time Delay in Molecular Photoionization’, *Science*, 2020, Vol. 370 (6514), 339-341 (2020); DOI: 10.1126/science.abb9318].

They measured the time required by a single photon (particle of light) to travel across the two hydrogen atoms of a single hydrogen molecule. They shot x-ray from PETRA III (a brilliant source of x-ray radiation) at DESY to a

hydrogen molecule (which consists of two protons and two electrons). They set the energy of the x-ray such that the photon knocked two electrons – one at a time – out of the molecule. The situation resembles a pebble skipping over the top of water surface in a pond. These interactions resulted in an interference pattern (a wave pattern) which as well as the position of the hydrogen molecule throughout the experiment were detected by the researchers using a COLTRIMS (Cold Target Recoil Ion Momentum Spectroscopy) reaction microscope, a highly sensitive particle detector able to record extremely fast atomic and molecular reactions. They then precisely calculated the time taken by the photon to travel from the first hydrogen atom to the second one. The result – 247 zeptoseconds – created a record because the last time a somewhat close time span recorded was 850 zeptoseconds (*Nature Physics*, 1916). The present observation can certainly be considered as a quantum jump from the first femtosecond-measurements reported by the Egyptian Nobel Laureate (1999), Ahmed Zewail who studied, using LASER, the movement of atoms during a chemical reaction.

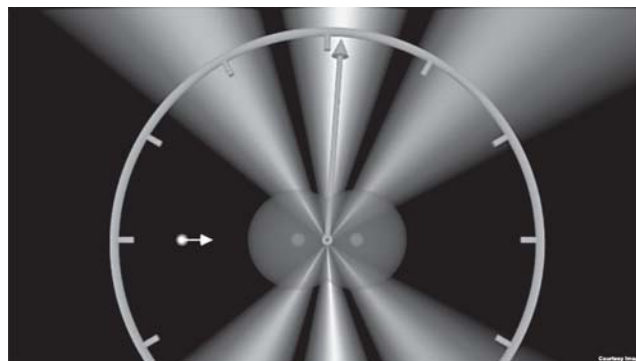


Image: © Sven Grundmann

It is rather heartening to know that the lead researcher in the present piece of research, Sven Grundmann, is in fact a doctoral student at the University of Rostock, Germany. Besides, the present experiment, which essentially measured the speed of light within a molecule, demonstrated for the first time that “*the electron shell in a molecule does not react to light everywhere at the same time.*” In other words, information within a molecule spreads only at the speed of light.

In NBC News, Denise Chow rightly described the recorded time as “*Blink and you’ll definitely miss it.*” Welcome to the world of zeptoseconds. □

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## Remembering Fishery and Aquaculture Scientist Dr. Hiralal Chaudhuri on Birth Centenary Year

Year 2021 is one-hundredth anniversary of the birth of 'Father of Induced Fish Breeding in India' Late Dr Hiralal Chaudhuri, DSc, Former Senior Fishery Scientist at ICAR-Central Inland Fisheries Research Institute, Barrackpore, India and Ex-Chief Technical Advisor in Aquaculture, FAO/UNDP at Laos PDR. On his honour, 10<sup>th</sup> July is celebrated annually as National Fish Farmers' Day and we acknowledge the contribution made by professional fish farmers and fish breeders in different states to India's food supply chain and in increasing production of table-sized major carps and other economically-important cultivable inland foodfishes. Architect of first induced breeding (IB) and spawn production of carp *Cirrhinusreba* in captivity on 10<sup>th</sup> July sixty-four years ago, i.e., in 1957, Dr Chaudhuri's unique success generated unprecedented fish culture activity insub-urban and rural India leading to prosperity among fish farmers. West Bengal moved ahead and produced 22891 million healthy carp fry (22-26mm) in 2018-2019 with 1<sup>st</sup> position in India; having 454nos private carp hatcheries and 5nos under State Govt. Such production and prospect owes much to Dr Chaudhuri. It was mentioned in ICAR-CIFRI Annual Report 1959-1960: 'During the 1959 fish breeding season (May to August), work on IB by injection of pituitary hormones was taken up at Cuttack in Orissa and Joysagar in Assam under CIFRI's Pond Culture Division. Breeding was successfully induced in Catla, Rohu, Mrigal, Sarpunti and Calbasu and commercial production of large number of spawn and fry achieved for the 1st time by this method'.

Dr Chaudhuri was born in Sylhet town in the then Colonial Assam (now in Bangladesh) on 21/11/1921 and died on 12/9/2014. The backdrop, time and site of Dr Chaudhuri's discovery; significance and widespread application of IB technology; his life sketch, career and pivotal scientific contributions have been discussed in many programmes and published in books, magazines and documents (Fishing Chimes Vol. 24 No. 10 in Jan 2005; SEAFDEC Asian Aquaculture Vol. XX No. 2 in April 1998 and others). In brochure published by Kolkata Centre of ICAR-Central Institute of Fisheries Education entitled 'Celebration of Fish Farmers' Day at CIFE Kolkata Centre', two rare black & white photos captured attention of author where Dr Chaudhuri in his early days with half-sleeve white shirt found preparing fish pituitary extract and carefully

injecting it into a brooder IMC, helped by his colleagues.

The 31-page article 'History of induced breeding in fishes and its application to aquaculture' authored by him and published in Proc. Zoological Society Vol. 47 No. 1 in 1994 provides clear understanding of successful experimental works on IB of Indian inland fishes. His article 'Modern aquaculture - its contribution to human nutrition' published in Souvenir of National Symposium on Finfish and Shellfish Farming organized by Dept of Zoology, University of Calcutta during July 17-18, 1998 is comprehensively written for UG/PG students. During this time, author was in BSc 2<sup>nd</sup> Year in Fisheries, read and heard about Dr Chaudhuri and in this programme had opportunity to see him from rear end during Sir's address as Chief Guest. In Current Science, Dr Chaudhuri's works on IB and intensive composite carp culture were published in Vol. 26 No. 12 in Dec 1957 (co-authored by Dr K. H. Alikunhi) and Vol. 43 No. 10 in May 1974 (with five coauthors) respectively; in *Science and Culture*, Vol. 25, year 1959.

In the Book 'Reminiscence CIFRI 1947-2007' published on 10/7/2007 by ICAR-CIFRI, Dr Chaudhuri is seen (in two black & white photos) standing in knee-depth water holding white rectangular enamel tray and observing hatched-out carp larvae obtained from controlled breeding in hapa enclosures in pond and examining the developing embryo inside fertilized egg under simple microscope on wooden tool wearing gumboots. Such noteworthy moments of the past of distinguished persons inspire author as an extension worker greatly, who understands Dr Chaudhuri did laboratory and field work painstakingly with great dedication, perseverance and sincerity in late 1950s, 1960s and 1970s in less-favourable conditions as compared of today. In this Book, 1st chapter was contributed by him entitled 'My journey from breeding a mud goby to global aquaculture through CIFRI', where he writes: 'CIFRI during 1948 had primitive facility, without electricity, instruments; even drinking water was difficult to get. Throughout the night under light of hurricane lantern, I sat watching the developing fertilized eggs of small fish *Gobiopureschuno* in petridish under microscope and drew sketches of embryonic stages. My excitement had no bounds when I saw some eggs hatched out in about two days and live goby hatchlings wriggle out'.

Nowadays commercial aqua-products Cleaner, Supercleaner are available to kill aquatic insects and undesirable organisms in fish ponds but Dr Chaudhuri during 1951-1954 formulated safe soap-oil emulsion method



to eradicate such predatory insects from nursery ponds before stocking carp spawn and increase its survivability. It is still practiced in many nurseries associated with hatcheries and fish seed farms in WB. He devised pond zooplankton culture method to increase availability of natural live food for growing spawn. In 'Aquaculture Beyond 2000: New Horizons', Dr Chaudhuri writes: 'I have always been averse to name, fame and public appreciation for whatever I have achieved little in my scientific endeavours'. Admiring the knowledge of elderly fish farmers, Dr Chaudhuri used to tell his colleagues: 'If you want to know how to distinguish between matured male and female of *P. sarana* before administering injection, you have to meet the semi-literate elderly farmers who will make you understand it clearly. Perhaps they know more than us'. After revisiting at few of lesser-known facts and moments, finally, without boasting, author brings into remembrance the happy feelings upon receiving handwritten affectionate Bengali inland letter from 'Sir' Dr Hir Lal Chaudhuri on 30/8/2000 with words of inspiration and blessings and expresses homage humbly to this great person with reverence in his birth Centenary year, to whom Indian pisciculture sector will remain ever grateful. □

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## **Medicinal and Aromatic Plants for Human Health and Wellbeing**

The National E-Workshop on 'Functional food, bioactive compounds and phytochemicals for better nutrition' was organized by Dept of Biochemistry, Uttar Banga Krishi Viswavidyalaya, Dist. Coochbehar, WB and Society for Plant Biochemistry and Biotechnology, IARI, New Delhi during December 9-11, 2020. In this event, Plenary Lecture was delivered by Dr. A. K. Tripathi, Professor of Biotechnology & Director, Institute of Science, Banaras Hindu University and Formerly Director, ICAR-Central Institute of Medicinal and Aromatic Plants, Lucknow; scientific understanding on the subject matter was very well highlighted.

In the topic 'Medicinal and aromatic plants for human health and wellbeing', Dr. Tripathi in beginning shared the satisfaction he gained while being associated with happy

farmers; improved variety of plants and techniques have contributed to improving quality of their lives. Outlining famous statement of Hippocrates: 'Let food be thy medicine and medicine be thy food', he informed that picking out bioactive compounds from functional foods (that cures health-related problems) turns into nutraceuticals in form of pills, capsules. Useful bioactive compounds contained in 'healing herbs and spices' been used to prevent or cure diseases. Each component of 'Medicine cabinet in our kitchen' has more-than-one ingredient with multiple beneficial health effects. The functional food-drink 'Turmeric Latte', containing milk, turmeric, cinnamon and ginger, can prevent COVID-19 menace. Triphala Rasayana having Amlaki, Bibhitaki and Haritaki improves population of probiotic bacteria in our gut if taken regularly, besides other health benefits. Drug-cum-nutraceutical 'Ayush', an anti-diabetic formulation developed by ICAR-CIMAP contains extract of six medicinal plants and herbal immunomodulator and anti-diabetic NBRMAP-DB jointly with CSIR-NBRI. In Ayurvedic Dashamularishtra, roots of tree and shrub species (five each) used but continuous exploitation of these may lead to non-availability of raw materials in future. Here biotechnology-based root multiplication system is sought that can give needed secondary metabolites, Dr. Tripathi opined.

He further stated that Chyawanprash contains 47 plant-derived ingredients, the main active ingredients present should be studied. Presently 80% of Asian and African population use herbal medicine as some aspect of primary health care. He lucidly discussed about useful plant secondary metabolites categorized into terpenes, phenolics, N-containing compounds and their subdivisions; long process of activity-guided fractionation of bioactive compounds derived from medicinal plant extracts; systems of medicine (phytopharmaceutical, AYUSH drug, modern medicine). Trikatu formulation contains *Piper longum*, *P. nigrum* and *Zingiber officinale*; compound piperine (bioavailability enhancer) reduces bacterial antibiotic resistance against Rifampicin (Rfp), inhibits bacterial efflux pumps and now mixture of Rfp and piperine commercialized as Risorine. Different species of bhumi-amlaki exists but useful phyllanthidine (with hepatoprotective effect) present in *Phyllanthus niruri* only. Reserpine is synthesized in roots of *Rauwolfia serpentina* but one must be sure about its presence, before roots are marketed.

Dr. Tripathi continued discussing about different FDA-approved drugs (compounds) derived from ethnobotanicals that cannot be chemically synthesized; five plants useful as nervine tonics and their active ingredients

(saponins, alkaloids, propanoids); garlic and other plants that prevents obesity and weight-reducing nutraceuticals; bittergourd seed extract and other plants described in Ayurveda for treating Madhumeha; major active compounds (withanolides) isolated and characterized from different species of Ashwagandha having specific health-related effects; that spread of COVID-19 prevented if its root extract is mixed with milk and intaken; drumstick *Moringa* sp pod extract mixed with Rfp enhances efficacy of latter to inhibit *Escherichia coli*. Guggul plant has several useful properties, its activity shown in both polar & non-polar solvents and normally extracts are considered more effective than pure compound. Pain-killer Aspirin prepared from salicyclic acid present in leaves of *Spiraea ulmaria* tree and now acetyl salicyclic acid prepared by Bayer company; digoxin and digitoxin obtained from foxglove are useful for heart patients. In *in-silico* study, withanone and caffeic acid phenethylester predicted to interact with main protease of SARS-CoV-2 and inhibit its activity. Allyldisulphide and other compounds characterized from garlic essential oil binds to and inhibit ACE-2 receptor of virus.

Ayush-Kaath (mixture of tulsi leaves, dalcini, sunthi/ adrak and kalimirch) is recommended for immunity enhancement in wake of COVID-19 outbreak; *in-silico* study made on possible targets of 12 phytochemicals in it against different SARS-CoV-2 proteins. These get superimposed on active sites of SARS-CoV-2 main protease and also on different locations of its spike protein. Dr. Tripathi discussed about established health benefits of essential aromatic plant oils in ancient text; methods of use of characterized ingredient of essential oils specifically for 14 ailments/disorders (overcoming anxiety, depression, aggressiveness, headache, insomnia, general pain, etc) and effects; spray of essential oils of *Eucalyptus polybractea* and *Melaleuca alternifolia* (vapourizers) can bind to SARS-CoV-2 in rooms and make them inactive; their efficacy tested in eliminating airborne influenza droplets and same of essential oil blend against influenza H1N1 virus in cell culture plates. He ended by saying that many Indian farmers are now cultivating medicinal plants and it will be beneficial and profitable if quality is assured. Scientific tools and techniques will help to characterize that herbs they are cultivating are standard and of good quality, thus their value will go up in market.

This 3-day E-Workshop comprised four technical sessions and thematic areas were 'Bioactive compounds: characterizations and health perspective; Food-derived phytochemicals; Nutraceuticals and its bioavailability and Functional food. Much could be learnt. Lectures were

delivered by invited eminent scientists and University teachers on topics concerning general conception and emerging avenues of research; registered participants in digital platform were additionally benefitted in hands-on training (demonstration) session arranged and conducted by organizers to disseminate theory and functioning of important biochemical techniques *viz.* AAS, HPLC, Electrophoresis, GC-MS. □

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### National Science Day Celebration by ISNA and NESa, WB Chapter

National Science Day is celebrated every year in India on February 28 to mark the discovery of the Raman Effect by the Indian Physics Nobel Laureate, Sir. C.V. Raman. This year, Indian Science News Association (ISNA) and National Environmental Science Academy (NESa), West Bengal Chapter, jointly observed and celebrated this day by conducting an webinar on February 28, 2021 on the focal theme as “*Science Technology and Innovation: Impacts on Education, Skill and Work.*” The event was supported technically by the Turiya Communications.

The introductory speech was given on behalf of Turiya Communications by Ms. Sandhya Sutodia, who emphasised the significance of National Science Day celebration and discussed briefly about the theme of the webinar. She also explained the use of different modes of science communication to reach the community at large. Thereafter, Dr. Amit Krishna De, Founder Secretary NESa W.B. Chapter, Council Member of ISNA and moderator of the webinar, addressed the audience and explained the very onset of National Science Day celebration by the initiative of DST, India. With this he went on to invite Prof. Sudhendu Mandal, Hony. Secretary, ISNA, to deliver his welcome address. The warm and informative address of Prof. Sudhendu Mandal included the early innovative ideas of the other Indian Literary Nobel Laureate, Rabindranath Tagore, who established the scientific temperament in his various science articles during 1874. He went on to elucidate the involvement of Indian Association for Cultivation of Science in 1976 and the scientific works of yet another Nobel Laureate Donald Ross in inculcating the ideas of scientific temper from the city of Kolkata itself. The legacy of communicating science, in this part of the country, went on to its heights by the great works of

Acharya Prafulya Chandra Ray and Prof Meghnad Saha, who started the science journal *Science and Culture* which is still carrying out the noble work of disseminating scientific works to the society. With these words he heartily thanked members of NESa for their very initiative to observe this day in such scholastic manner. Then Dr. Amit Krishna De, moderator of the webinar, read out the message from Dr. J Ahmed, President, NESa, who regretted his absence and much congratulated the organisers and speakers of the webinar. His message tried to incorporate a ray of hope that the discussions in the webinar and future collaborative works might bring out some solution to the present burning global issues. After this, Dr. De, invited Dr. Krishnendu Das, Vice President, NESa, W.B. Chapter, to deliver his address.

Thereafter, the first speaker of the session, Dr. Prabir Aditya, CEO and Co-founder of Sprinriver Technology Private Limited, Kolkata, was invited and introduced to deliver his much awaited talk. In his address he delightedly mentioned that keeping in tune with the significance of the day, how the very first work of his life was related to the real life application of Raman spectral equation. He went on to explain the transition of knowledge to technology to innovation and how these have impacts on the education, skill and workers of the society. His talk included that how the change in the mode of knowledge transformation, ultimately leads to the inception and dominance of artificial intelligence which will eventually be applied to all the different sectors of the society. Dr. (Mrs.) Mausumi Raychaudhuri, Principal Scientist, ICAR - Indian Institute of Water Management, Bhubaneswar (IIWM), was the second and the last speaker of the session. The topic of her informative talk was the application of science, technology and innovation in the agricultural field of India. She mentioned India to have the second largest irrigation facility and yet the farmers do face challenges due to climate change and like. The elaborative presentation included the present scenario and the future prospects of STI in agricultural domain and also mentioned their lab to field based experimental ventures in bringing about a change.

After the lectures, the Convenor of NESa W.B. Chapter, Dr. Sudhendu Patra, proposed the formal vote of thanks. The well attended and organised webinar came to an end with the concluding words of Dr. Amit Krishna De and Ms. Sandhya Sutodia. □

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## **Ten-Day Online Workshop on Research Methods & Data Analysis: A Brief Report**

The ten-day workshop on “Research Methods and data Analysis” was organized by A. K. Dasgupta Centre for Planning and Development, Visva-Bharati dated from 22<sup>nd</sup> February to 3<sup>rd</sup> March, 2021. The workshop was successfully held online through Google Meet platform. 18 participants actively attended the workshop. The group was made small so that each one of the participants can learn the software clearly, thus hands-on training can be provided easily. The workshop was divided into two sessions each day comprising total of twenty sessions in ten days.

22<sup>nd</sup> February, 2021: In the inaugural session, Prof. Daya Shankar Kushwaha, Secretary of Professor A.K. Dasgupta Centre for Planning and Development, Visva-Bharati welcome the participants and asked to introduce themselves. He briefly stated the objectives and the utility of the workshop to researchers and faculty members. His inaugural speech was followed by Dr. Pravesh Tamang, Department of Economics, Presidency University as the resource person. The session included introduction to R and R Studio. Installation of R and R studio was well explained by him. R is a programming language and open source software developed by Ross Ihaka and Robert Gentleman in 1993. R possesses an extreme catalog of graphical and statistical methods. R is used for statistical inference, Data analysis, Machine learning algorithm. R is available for Windows, Mac and Unix systems (such as Linux). Big companies, geographers, psychologists, management people use R for data analysis because of the robustness of R. Data analysis with R can be done using a series of steps. These steps are programming, transforming, discovering, Modelling and communicating. For the second session as well, Dr. Pravesh Tamang was the resource person where he explained the data structures or data types in R Programming, which are vectors (logical, character, numerical), matrices, data frames, scalars, lists. He then discussed how to create a data frame in R, how to append a column to data frame, how to select a column of a data frame, how to subset a data frame, variables, arithmetic and logical operators.

23<sup>rd</sup> February, 2021: The first resource person of the first session of the day two was Prof. Athar Ali Khan, Chairman, Department of Statistics, Aligarh Muslim University, Aligarh. In his talk he mentioned techniques for the documentation and deployment of the work. R markdown is package which is considered as a great tool

for producing excellent milestone documentation. The speaker of the Second session of the day was Dr. Arindam Gupta, Department of Statistics, University of Burdwan. In his lecture he demonstrated the Statistical techniques used in research with the help of software R. R is considered as an efficient language by bridging between software development and data analysis due to its flexible nature. He pointed out the basics of R.

24<sup>th</sup> February, 2021: Prof. Athar Ali Khan, Chairman, Department of Statistics, Aligarh Muslim University, Aligarh was the speaker of the morning session of the online workshop. His lecture was focused on how R packages can be used for designing of experiments and analysing of data from the experiments. In many areas (agricultural fields, industrial experiments, computer experiments, clinical experiments) experimental design is being applied. Depending on specific areas, various experimental design packages have been developed. Dr. Arindam Gupta, Department of Statistics, University of Burdwan was the second speaker of the day. His lecture included detailed information regarding Parametric and Non-Parametric Tests. In terms of determining a statistical test, we should consider the hypothesis on which the main study depends. If there is no hypothesis, there is no statistical test. Parametric tests can be defined as the tests which make assumptions about the parameters of the population distribution from which the sample is being drawn. This is often the assumption that the population data are normally distributed. On the other hand Non-parametric tests are distribution-free and, can be used for non-Normal variables.

25<sup>th</sup> February, 2021: The resource person of the morning session was Dr. Bholanath Mondal, Department of Plant Protection, Visva-Bharati, who explained hands-on training on the workshop. Prof. Suresh Sharma, Department of Statistics, Punjab University, Chandigarh was the second resource person who focused on basic statistical analysis (Cluster analysis and Discriminate analysis). The purpose of this analysis is to place objects into clusters or groups suggested by the data and not defined by priori, such that objects in a given cluster tend to be similar to each other in some sense and objects in different clusters tend to be dissimilar. The example of this kind is, in revising a question-naire on the basis of responses received to a draft of the question-naire. On the other hand discriminate analysis is a technique that is used to analyze the research data when the criterion or the dependent variable is categorical and the predictor or the independent variable is interval in nature. Example of

this kind involves the identification of patients at high or low risk for heart attack as performed by a doctor.

26<sup>th</sup> February, 2021: The speaker of the first session of the day was Prof. Suresh Sharma, Department of Statistics, Punjab University, Chandigarh who explained multiple regression and multi-collinearity in detail. The most common form of linear regression analysis includes multiple linear regression. This regression analysis is performed to explain the relationship between one continuous dependent variable and two or more independent variables. Assessment of the relationship between a dependent variable and several predictor variables as well as the relationship with each predictor variables can be determined by performing multiple regression analysis.

27<sup>th</sup> February 2021: Prof. Gautam Bandhopadhyay, Department of Management Studies, NIT, Durgapur was the resource person for the morning session of day six who focused on the topic “Factor Analysis with R”. In the afternoon session of the sixth day, Dr. Samiran Sur, Department of Management & Business Administration, Aliah University delivered his lecture on “Text Analysis with R”. He discussed, Text has immense power in research, day to day life, finding out the customer review and brand image. In order to survey the Text, it is necessary to quantify the text. Text as well as Market basket analysis can be carried out using R, Python, Swift software which are common in these days for Data Science. Google, Facebook also use R.

28<sup>th</sup> February, 2021: Prof. Suresh Sharma, Department of Statistics, Punjab University, Chandigarh was the speaker for the entire day covering morning and afternoon sessions. The topic of the morning session included Basic Statistics and Introduction to SPSS. Although people call SPSS as Statistical Package for Social Sciences but in real it stands for Statistical Product and Service Solutions. In the afternoon session, Prof. Suresh Sharma’s lecture was focused on “Estimation & Testing of Hypothesis”. He explained t-test, F-test, Correlation, Regression, one-way ANOVA, Two-way ANOVA, repeated ANOVA using IBM SPSS software.

1st March, 2021: Dr. Anirban Sarkar, West Bengal State University, Barasat was the speaker for the entire day covering morning as well as afternoon session. He explained hands-on training on “Parametric” and “Non-parametric Test” using IBM SPSS.

2<sup>nd</sup> March, 2021: Dr. Kaushik Kundu, Department of Management & Business Administration, Aliah University



was the resource person for the morning session, briefly discussing “Categorical Principal Component Analysis” (CATPCA) which is appropriate for data reduction when variables are categorical i.e. ordinal and researcher is concerned with identifying the underlying components of a set of variables or items while maximizing the amount of variance accounted for in those items by the principal components. Dr. Supravat Bagli, Presidency University was the resource person for the afternoon session of the same day of the online workshop demonstrating “Cluster Analysis”. Clustering or Cluster analysis is the grouping of set of objects in such a way that objects in the same group (known as cluster) are more similar to each other than to those in other groups or clusters.

3<sup>rd</sup> March, 2021: The first speaker of the morning session of the last day was Dr. Hari Charan Behera, Indian Statistical Institute, Kolkata. He provided an introduction on how to use IBM SPSS for statistical data analysis. Another goal of his lecture was to show how SPSS can be used to understand and interpret the results of research. Dr. Arup Kr. Baksi, Department of Management & Business Administration, Aliah University was the last speaker of

the entire workshop. The topic of his lecture was “Factor Analysis” which is a statistical technique used for reducing large number of variables into fewer number of factors.. Factor analysis is commonly used in marketing, product management, biology, operations research, finance psychometrics and personality theories.

The ten-day online workshop ended with valedictory address by Prof. Daya Shankar Kushwaha. He shared his words regarding the importance of the workshop to both scientists as well as researchers coming from different fields such as Agriculture, Social Sciences, biology.

I found all the lectures given by the eminent speakers were very helpful for the researchers, faculty members. Methodologies discussed in the workshop regarding the use of software were very informative and beneficial. □

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