Notes and News

Discussion on AMR and Human Microbiome and Microbiome in Non-Communicable Diseases

The India-EMBO Symposium on Human Microbiome - Resistance and Disease was organized by National Institute of Biomedical Genomics, West Bengal in association with J. Craig Venter Institute, USA during November 9-12, 2019. As a part of this Symposium, in the Session 'Anti-microbial resistance and human microbiome', Dr B. Bhattacharjee, Ramanujan Fellow, NIBMG spoke on 'Taking a closer look at AMR carriage among hospitalized preterm neonates'. She aimed to find out what pathogens do to preterm neonates admitted to Sick neonatal care unit in hospitals with respiratory distress carry in their nares, and how much of antibiotic (Ab) resistance found in bacterial isolates from hospital effluents. She discussed about Gm-negative bacteria *Acetobacter baumannii*, *Klebsiella pneumoniae* and *E. coli* showing resistance against Meropenem (Mrp), Cefotaxime (Cft), 3rd gen Ciprofloxacin and to Colistin used as growth promoter in animal husbandry; non-susceptible isolates of bacteria tested against these Ab(s); *E. coli* having highest amount of resistance in hospital water; %age of resistance of these bacteria to Ab(s) and 3 different Beta-lactamase (bla) gene variants (genotypic expression); burden of Ab resistance in Indian neonates; nasal carriage of pathogens among neonates; Amikacin, Cft, Tazobactem and Mrp used for babies in SNCU; high levels of multidrug resistance shown by *Acinobacter* sp, *E. coli*, *Enterobacter* sp and *Klebsiella* sp to different Ab(s); bla profiles of different isolates; disinfectants used in hospitals to kill *Klebsiella* sp; biofilm associated infection in babies; Mrp-resistant *Klebsiella* isolates from nares of babies.

Dr Bhattacharjee also explained antimicrobial (bactericidal) effectiveness of different dosages of lactic acid against planktonic cells and biofilm-forming cells of Mrp-resistant *K. pneumoniae* isolates. Dr M. Y. Giovanni, Scientist at National Institute of Allergy and Infectious diseases, a division of National Institute of Health, USA spoke on 'NIAID data driven strategies for AMR'. She discussed about novel approaches to address AMR (manipulating microbial communities, rapid diagnostics, antivirulence strategies, harnessing immune system). We were informed about innovative data driven and system strategies for infectious, immune and allergic diseases; influence of microbiome in development and maintenance of immune system; creation of large data set that characterized human microbiome in 15 body sites from 300 individuals; genome-based machine learning models for clinical diagnostics for AMR; mechanistic links between microbiota and susceptibility to enteric infections; transfer of single human bacteria *Clostridium scindens* confers resistance to *C. difficile* infection; gut bacteria enhancing immune response to seasonal influenza and polio vaccine in mice; enlisting commensal microbes to resist Ab resistant pathogens; microbiota-derived Ab restores resistance against Vancomycin-resistant *Enterococcus* sp; healthy infants harbour intestinal bacteria that protects against food allergy.

In the Session 'Microbiome in non-communicable diseases', Dr L. M. Oldfield, Asst. Professor at J. Craig Venter Institute, Maryland, USA spoke on 'Human microbiome and cancer: potential for improved cancer diagnostics and therapeutics'. She discussed about hallmarks of cancer (genomic instability, cell polarity, disregulated cell growth, proliferation, prevention of apoptosis); ongoing JCVI projects on acute lymphoblastic leukemia (ALL) and oral squamous cell carcinoma (OSCC) examining cancer microbiome; *Fusobacterium* sp virulence and Ab-resistant genes enriched in OSCC tumour tissue; *Ruminococcus gnavus* overgrowth associated with inflammation and disease; gut microbiome for ALL patients have lower α diversity and do not fully recover in one year; potential microbiome related therapeutic strategies to rebalance the microbiome or eliminate cancer-causing bacteria; generating multiple changes to Herpes virus BAC and its genome-wide engineering; reconstitution of EBV in HEK-293 cells; microbial (*Salmonella* sp, *Clostridium* sp, *Listeria* sp) -based cancer therapeutics.

Dr S. Mukherjee, Asst. Professor, NIBMG spoke on 'Host-microbiome interactions in chronic diseases'. He highlighted on innate immunity genes and skin microbiome, discussed about ratio of human cells and microbiome, which earlier estimated to be 1:10 but now 1:1; microbiome diversity across body regions; 16s rRNA gene (1500 bp) as the most widely-accepted housekeeping genetic marker for bacterial phylogeny; selection of 16s for amplicon sequencing; abundance and scarcity of *Bifidobacterium* sp

and *Treponema* sp in gut of Africans and Italians; skin and its commensal microbiome that regulates complement protein system (CS); dysbiosis (microbial disbalance) associated with Atopic Dermatitis (AD) and Psoriasis; skin microbiome resists colonization/invasion of opportunistic or pathogenic microbiota and regulates expression of CS genes; microbiome across different skin types in humans and its inter-individual variability; experiment on microbiome sequencing from forehead and cheek region, sample collection and microbial DNA isolation, measurement of sebum and hydration levels in healthy female volunteers; temporal variability in skin microbiome profile; statistical analysis of microbiome data (α and β diversity) and number of phyla identified; higher and lower occurrence of *Streptococcus* sp and *Corynebacterium* sp in skin of Indian and European individuals.

Dr Mukherjee also spoke about understanding the contribution of microbiome dysbiosis in different host genetic backgrounds; host skin microbiome, dysbiosis and proposed model of host-microbiome interaction in AD. Dr R. Mitra, Research Scientist at UniLever R & D, Bangalore spoke on 'Role of skin microenvironment in shaping the microbiome'. He discussed about ecosystem services, resilience, diversity, absence of known pathogens and presence of principal commensals leading to balanced microbiome in body; significant increase of *Staphylococcus aureus* in AD and presence of *S. epidermis*, *S. hominis* and *Cutibacterium acnes*; *S. aureus* survives at higher pH in comparison to other 2 *Staphylococcus* species; skin's microenvironment and role of pH; skin's defenses, action of keratinocyte supernatant with different microbes, which secrete factors that differentially inhibit the microbes; gene expression of antimicrobial peptide in skin; HaCaT cells support growth of *S. epidermis*. Emphasizing on 'Live microbes in cross talk with cells', he informed that *S. aureus* destroys the tight junction (barrier marker) in skin as in AD, down-regulates filaggrin protein pathways and suppresses HDAC-3 gene expression, whereas *S. epidermis* mitigate the ill effects of *S. aureus*, increases filaggrin and HDAC-3 gene expression. ❐

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Innovative Agriculture Extension and Biocontrol Agents in IPM

In the National Seminar on Agro-chemical Inputs and its Extension Approaches towards Food and Biosecurity - Prospects and Challenges, organized by SAMETI, Ramakrishna Mission (RKM) Ashrama, Narendrapur and IRDM Faculty Centre, RKM Vivekananda Educational and Research Institute, Narendrapur during November 15-16, 2019, Prof. R. K. Samanta, Former Vice Chancellor of Bidhan Chandra Krishi Viswavidyalaya (BCKV), WB gave Lead Lecture on 'Innovative extension to combat future challenges of agriculture'. It was in the Session 'Extension approaches for eco-friendly pest management and judicious use of agrochemicals for modern agriculture'.

Prof. Samanta spoke about managing knowledge and technology to bring change upto expectations; described poverty, hunger, economic growth, food production, degradation of natural resources and climate change as major challenges in agriculture; facilitating innovations on climate-smart agriculture (CSA); convergence of skill and knowledge and mitigation of disasters as major job of agriculture extensioners; agriculture extension and farmers' livelihood security; assisting farming families in adopting their production and marketing strategies to rapidly changing social and economic conditions; knowledge, seed, planting material – all technologies should be converted into action for farmers. In addition to knowledge and information, farmers must have enough money for proper marketing, he opined. As challenges for future extension managers, he spoke about management of knowledge in context of CSA. According to him, agriculture extension must meet 5 basic needs of farmers, which are awareness of innovative technologies (IT) and its improved management practices, capacity building skill and knowledge upgradation to adopt IT, necessary production inputs and credit facilities, post harvest services & value addition and marketing services for maximizing their income.

He also spoke about innovative extension strategies, emphasizing on farmer's field level condition (soil, water, crops), sustainability in agriculture ensuring food and nutritional security, biosafety concern with transgenic crop varieties adoption, mainstreaming women in agriculture and rural women empowerment, changing strategy of transfer of technology, ITK and IPR production concern. He emphasized on integrating livestock, fisheries and horticulture with crop production system and encouraging small holding farmers for increasing income; changes needed in extension education curriculum to empower future extension managers; participatory methodology inspires capacity building among all sectors; facilitating development and managing partnership for collective action of research-extension-farmers' systems; extension perspectives to learn from farmers. Prof. Samanta ended

by quoting: '*What is life? You have born in this world to give the meaning of life and make things happen*'.

The other Lead Lecture in same session was given by Dr S. K. Mandal, Retd. Professor of Agricultural Entomology, Faculty of Agriculture, BCKV on 'Biocontrol agents in IPM and judicious use of agrochemicals'. We were informed that out of 6158 insectivorous insects {natural enemies (NE) or predators} introduced worldwide (110 in India) for biological control of 588 target insect pests till year 2010, 620 resulted in satisfactory control of 172 pest species. He described direct (poisoning) and indirect effects (elimination of host/prey, reduction of NE in a particular area) of insecticides; order of toxicity of different formulations of pesticides {dusts>water dispensable granules>emulsifiable concentrate(C)>soluble C>granules}; organochlorine, organophosphates, carbamates and synthetic pyrethroids are highly toxic to natural enemies whereas neonicotinoids and dioxides are less toxic; LC_{50} value of Rynaxypyr, Flubendiamide and Imidacloprid on NE *Trichogramma chilonis* pupae and *Bracon brevicornis* adults. He stated that Carbofuran 3G at recommended dose killed spiders and spiderlings in rice fields; biopesticides, botanicals, insect growth regulators are relatively safer to NE and destruction of flowering weeds may reduce production of adult predators and parasitoids (insects that parasitizes insect pests).

Dr Mandal also discussed about impacts of sub-lethal (sl) doses of insecticides on biology of NE (altered predation or parasitism behaviour, loss of longevity, coordination and others); pesticides may affect sequence of their egg laying and release of sperm, males exposed to sl doses of deltamethrin do not respond to signals of unmated females; experiment on number of generations completed by the 2 species of NE following repeated exposure to sl doses of Chlorpyriphos, Tolfenpyrad, Imidacloprid, Rynaxypyr at every generation and ill-effects upon their biology getting intensified in successive gen; development of Chlorpyriphos-resistant and Imidacloprid-resistant strains of *T. chilonis* through repeated exposure of NE to sl doses of pesticides. In the end, Dr Mandal spoke about tactics like use of selective chemicals, special pesticide formulations, use of lower doses of pesticides, site-specific application, application at longer intervals and others, which are helpful in reducing adverse effects of pesticides upon NE. ❐

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Pomegranate Chemical can Slow Down Aging

Pomegranate is a fairly common fruit which is known to be nutritious – rich in vitamin C, potassium, and fibre. The fruit has also been claimed to have anti-aging properties, but up to now, scientific proof has been fairly weak. Now, scientists from the Swiss Federal Institute of Technology Lausanne (Ecole Polytechnique Fédérale de Lausanne, EPFL), Switzerland, and the Swiss Institute of Bioinformatics (SIB) have discovered that urolithin A (UA), a metabolite of biomolecules found in pomegranates formed by microbes in the gut, enables muscle cells to protect themselves against one of the major causes of aging. In experiment with nematodes and rodents, reported in 2016, the effect was nothing short of amazing. Result of clinical trials with humans have just been published.

Pomegranate contains ellagitannins, a diverse class of hydrolysable tannins. When ingested, these molecules are converted into urolithin A in the human gut.

In clinical trials, when UA was orally administered in both single and multiple (4 weeks) daily dosing to 60 healthy elderly subjects in a double-blind, randomised, placebo-controlled study, significant improvement in muscle function was observed. Significantly, there were no adverse effects. There are currently no effective solutions to treat age-related decline in muscle function other than months of exercise (*Nature Metabolism*, 14 June 2019 | doi: 10.1038/s42255-019-0073-4).

According to the researchers, UA is the only known compound that reestablishes cells' ability to recycle defective mitochondria. In young people, this process happens naturally. But as we age, our body starts to lose its power to clean up dysfunctional mitochondria, causing sarcopenia (loss of skeletal muscle mass) and the weakening of other tissues. The Swiss team focussed on slowing, or even reversing, this natural effect of aging and found that administration of UA indeed helps.

A paper published in 2016 had shown that the lifespan of nematode worms exposed to UA increased by 50 per cent – from around 20, to 30 days – when compared with the control group. Likewise, older mice showed 40 per cent better endurance while running after two weeks of treatment with UA. ❐

Adapted from the article of Biman Basu in Dream 2047, November 2019, Vol. 22 No. 2

Bees are Meat Eaters

Many of us may have experienced a bee sting and know how painful it can be. A bee sting is not a bite but a defence mechanism to protect their hives or themselves from attack by humans. Normally bees sustain on nectar and pollen and are an efficient agent of pollination so essential for production of fruits and vegetables we eat, and seeds that create more plants. Female bees deliberately collect pollen, along with nectar, to feed their babes.

Till now, bees have been widely thought to derive all protein directly from floral resources – nectar and pollens. But recent findings suggest this is largely untrue. Studies have revealed that bee larvae feed extensively on pollen-borne prey – mainly microbes – as well as on the pollen, itself. This larval food choice is part of what defines a bee. When a larval bee consumes aged pollen, the bee is consuming both 'microbial meat' and plant biomass, assimilating the amino acids of microbial prey as well as those of the plant material – analogous to "eating bacon bits in a salad".

Prarthana Dharampal of the University of Wisconsin-Madison and Shawn Steffan, who works jointly at the university and the U.S. Department of Agriculture's Agricultural Research Service (ARS), assessed 14 different bee species in six of the seven bee families. They found that bees eat substantial amounts of microbes, enough to change how they fit within food webs (Proceedings of the Royal Society B, 12 June 2019 | doi.org/10.1098/rspb.2018.2894).

The mason bee (so named for their habit of using mud or other "masonry" products in constructing their nests) results suggest that bees could suffer or starve if certain microbes disappear from their diet.

It is well-known that failing bee populations can cripple the crops and wild plants they help to pollinate. Around three fourths of the earth's flowering plants and crops benefit from animal pollinators, including 87 of the 115 leading global food crops. The 20,000 species of bees in the world are not the only animals that pollinate, but they are top pollinators for many staples. According to the researchers, knowing the role of pollen microbes may eventually help solve conservation challenges by, for example, directing flower choices for habitat restoration. ❐

Adapted from the article of Biman Basu in Dream 2047, December 2019, Vol. 22 No. 3

Distant Star Named After Dr. Bibha Chowdhuri

This year, the centenary year of the International Astronomical Union (IAU), the IAU in collaboration with the Astronomical Society of India (ASI), named two astronomical objects from the names through votes from names suggested by Indian youngsters. This was done as a part of an international campaign by IAU. Here a sun-like yellow-white dwarf star HD 86081 in the constellation *Sextans* south of the celestial equator was named *Bibha* (after Dr. Bibha Chowdhuri). The star was observed in November 2005 and its first planet was discovered on April 17, 2006. It is bigger and more massive than our Sun. The exoplanet was named Santamasa ('clouded in Sanskrit').

The committee is pleased at this name being clearly voted as a winning one and highly favours its use for this unique celestial system.

Courtesy : The Public Outreach & Education Committee of the Astronomical Society of India (ASI-POEC)

Through this naming of HD 86081 as Bibha, the National Commitee unanimously believes that it highlights the importance Indian women's contribution in science. It honours the largely forgotten Indian physicist Bibha Chowdhuri (1913-1991), whose exceptional research on elementary particle physics and cosmic rays constitutes some of the most pioneering work in Indian science. Lately the books "A Jewel Unearthed: Bibha Chowdhuri" and "D.M. Bose- A Scientist Incognito", by Rajinder Singh and Suprakash Chandra Roy refreshed the memories of scientists and astronomers.

Bibha Chowdhuri, in collaboration with Debendra Mohan Bose, at Bose Institute, observed a new particle from the tracks using Ilford New Halftone photographic plates exposed to Cosmic Rays at Sandakphu near Darjeeling at an elevation of 12,000 ft. They named it *mesotron* and ascertained that it had a mass which varied between 149 to 265 times the mass of the electron using

their new technique involving grain spacing on photographic plates. They published their results in Nature (A photographic method of estimating the mass of the

mesotron, D.M. Bose and Biva Choudhuri, *Nature* 148 (1941) p 259-260; Cosmic-ray meson spectra, D.M. Bose, Bibha Choudhuri, M. Sinha, *Physical Review* 65 (1944) p 341-343). Cecil Powell, who received the Nobel Prize (1950) for his discovery of the *pion* (1947) acknowledged the priority of Bose and Choudhuri's work. In addition to measuring the charge to mass ratio from the curvature of particle tracks, Chowdhuri and Bose developed a method where they could compute the masses of particles on the basis of grain spacing by studying proton and other particles. She had also assisted the Nobel-winning physicist Prof. Patrick Blackett during her doctoral studies in the 1940s. She was interviewed by the Manchester Evening News, where she commented that "it is a tragedy that we have so few women physicists today" ("The woman who could have won a Nobel" by Amitabha Bhattacharya).

After returning to India after her PhD, she worked at Tata Institute for Fundamental Research for eight years after which she joined the Physical Research Laboratory where she became involved with Kolar Gold Fields experiments. She later joined Saha Institute of Nuclear Physics.

Unlisted in the record of Indian eminent scientists for years, Bibha Chowdhuri has finally received this stellar recognition after 30 years of her death. ❐

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TO ALL READERS OF THIS JOURNAL

You might be knowing that UGC had delisted many of the journals from the UGC list of approved journals, including ours. We had been following up with UGC since then for reversing the decision based on the arguments that it is a peer-reviewed journal, is listed in the Thomson Reuters Master List of journals, has eminent members on its editorial board, and is available on-line on a website maintained by us.

UGC has replaced the old approved list of journals by the recent UGC-CARE (Consortium for Academic Research and Ethics) list with effect from 14th June, 2019. There are four categories of journals in this new list, from A to D. UGC recognized the academic integrity of our journal and has now included it in **Group A**. To explain what Group A means, I quote from the UGC website:

"*Research journals from all disciplines indexed in Scopus (Source list) or Web of Science (Arts and Humanities Citation Index Source Publication, Science Citation Index Expanded Source Publication, Social Science Citation Index Source Publication). No further analysis of these journals will be done by the UGC cell and all such journals are included in the UGC-CARE list.*"

The journal has been placed in the broad category of "**Multidisciplinary Sciences**" covering the areas of **Arts and Humanities, Science and Social Sciences**.

All articles published in this journal are now DOI (Digital Object Identifier) compliant. DOI increases the visibility of articles globally because interested readers can now easily locate a document digitally through a search engine.

Therefore all authors, especially young researchers, are requested to contribute their original research papers to Science and Culture as the published papers will be duly recognized by the competent authority for any assessment procedure.

S.C. Roy
Editor-in-Chief, Science and Culture