



Archana Sharma Foundation of Calcutta (ASFC)

Newsletter (2019-2020) 2ND Edition

FROM PRESIDENT'S DESK

It gives me immense pleasure to present the second issue of the Newsletter of the Archana Sharma Foundation of Calcutta. The Newsletter mirrors the team work of the members and gives me the opportunity to present before you the activities of the Foundation during 2019-2020.

At the onset I would like to mention that the publication of the Journal '*The Nucleus*' is going on full swing as envisioned by our mentors. The print version of the volume 62 was published within the stipulated time, which includes a special theme issue on "Environmental and Occupational Genotoxins", Edited by Prof. Anita Mukherjee and Dr. Manosij Ghosh. This theme issue is a tribute to Prof. Archana Sharma, the Co-founder of the journal '*The Nucleus*'. Prof. (Mrs.) Sharma had introduced Human Genetics, Environmental Mutagenesis and Genetic Toxicology in the post-graduate curriculum and initiated active research in these areas at the University of Calcutta, since the year 1972.

Keeping our focus on the objectives of the society, I am happy to state that we were successful in organizing seminars and workshops either individually or in collaboration with other scientific organization, namely the All India Congress of Genetics and Genomics. In addition, the foundation had extended financial help to the less privileged, needy girl students of Sri Sarada Math, Dakhineswar in their academic activities. In reverence to our mentors, the second Archana Sharma and AK Sharma oration was organized on the 30th April 2019, at the Department of Botany, University of Calcutta. Professor Amit Ghosh, JC Bose Distinguished Professor, an eminent scientist delivered his talk on "Gut Microbiome, Brain and Behaviour". The oration was well attended by a large number of students, faculty and scientists of the University of Calcutta and different Research Institutes in and around Kolkata.

We have sincerely tried our best to project our activities in this Newsletter and seek your active interest and support in fulfilling the future endeavors of the foundation.

Amita Pal

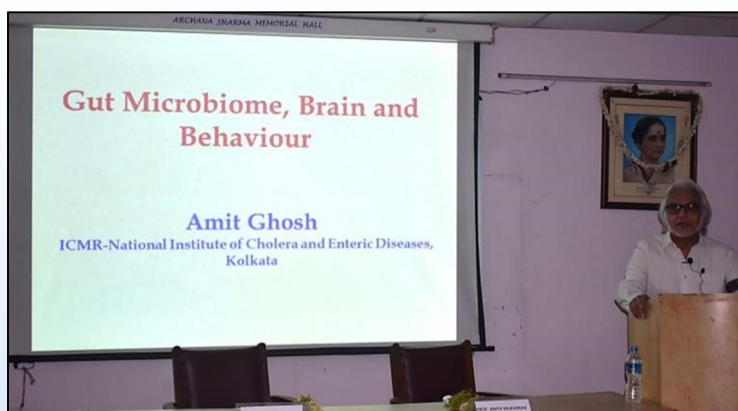
Date: 19th August , 2020



ASFC organized the second Archana Sharma & AK Sharma oration on 30th April 2019 at the Department of Botany, University of Calcutta. Dr. Amit Ghosh, J C Bose Distinguished Professor, delivered the lecture on this occasion, entitled, *“Gut Microbiome, Brain & Behavior”*.



Inauguration of the event by lighting the lamp:
President Prof. Amita Pal, Vice-President Prof. Anita Mukherjee and HoD, Prof. Ruma Pal



Professor Ghosh delivering the lecture



Felicitations of Prof. Ghosh by Prof. Pal



Audience at the talk



The summary of the talk:

It has been known for a long time that there exist pathways of communication between the gut and the brain. The first clue for this came from the work of an American army surgeon, William Beaumont, who in the late 19th century observed that the process of digestion could be affected by emotion (1). This concept that gut function can be influenced by ‘emotion’ was subsequently put on a firm basis by Walter Cannon, considered to be the father of the study of gastro-intestinal mobility (2). The evidence for the reverse process, gut function ‘influencing’ brain, came not only from the observations of the clinicians, who noted that bowel disorders often lead to anxiety and depression but also from a number of animal studies which involved the use of pathogenic microbes. For example, it was seen that mice infected with *Campylobacter jejuni* displayed altered anxiety like behaviour during the early phase of infection, much before any significant immune response was mounted by the host (3).

Human are home to around 4×10^{13} bacteria (4), majority of which reside in the gut. Gut microbes are of crucial importance to humans as they perform numerous essential functions necessary for their survival and well-being. To cite an example, human genome codes for a fewer than twenty enzymes capable of utilising complex carbohydrates, which means that humans on their own are incapable of digesting most of the carbohydrates present in their diet and that this task is carried out by the microbes present in the gut. However, in spite of their ‘huge’ presence, the role of gut microbes, if any, in the bi-directional communication between the gut and the brain (as alluded to in the previous paragraph), remained unknown until a few years ago. But, as gut also harbours a network of 200-600 million neurons, it seemed reasonable to hypothesize that there could be a nexus of communication between them and the gut microbiota and that this might have influence on the gut-brain communication. The first confirmation of this hypothesis came when a group of Japanese scientists led by Nobuyuki Sudo showed, using germ-free mice (mice free of all microbes), that exposure to stress led to ‘heightened’ release of stress hormones in the germ-free mice compared with the normal ones (5). They also observed that the effect of the stress in germ free mice could be relieved by colonising them (mono-association) with *Bifidobacterium infantis*, a probiotic. Although this landmark experiment clearly established that gut microbiota has a role to play in gut-brain communication, it did not provide any evidence to show that it influences behaviour too. Seven years after Sudo’s work three groups of scientists working independently in Ireland, Canada and Sweden followed the work up at a behavioural level. Mice have a natural tendency to avoid well-lit areas. It was observed by these workers that while normal mice exhibited this behaviour in ‘Light-Dark Box’ tests, germ-free mice liked to spend more time in the ‘lighted’ areas, indicating a lower level of anxiety in germ free mice (6, 7, 8). Although these experiments clearly established that gut microbiota has influence on behaviour, these results appeared to contradict the result obtained by Sudo *et al*, who detected an exaggerated release of stress hormones in germ-free mice in response to stress.



Continued from previous page.....

Although the reason for this discrepancy is not clearly understood, later studies seemed to indicate that ‘gender’ could have a role to play. Subsequently, using BALB/C and NIH Swiss mice, the same observation that gut microbiota influences behaviour was confirmed. BALB/C mice are timid and less-exploratory whereas NIH Swiss mice display a high level of exploratory drive. It was observed that when germ-free BALB/C and NIH Swiss mice were colonised respectively with the microbiota from NIH Swiss and BALB/C mice, they started displaying the behaviour pattern of the donor strains, that is, BALB/C mice like NIH Swiss and NIH Swiss mice like BALB/C (9). Beginning from these pioneering studies subsequently, similar observations that gut microbiota place a role in gut brain communication have been made with respect to the different facets of social behaviour.

Even though majority of such studies have been performed with mice, interesting findings though limited in number, have been made with humans too. Possible role of microbiota in autism, emotion and depression have been examined. It appears that autistic children have a higher proportion of bacteroidetes in their gut compared with the normal children (10). In a study involving Belgian and Dutch volunteers, it was observed that two kinds of bacteria, *Coprococcus* and *Dialister*, present in the gut of ‘normal’ individuals were missing in the gut of the depressed people (11).

This being an relatively new field of research a lot of work is going on in this area, and it appears that more the researchers are looking for connections between gut microbiota, brain and behaviour more examples of such links they are finding. But most of the work so far has remained at the level of phenomenology and huge gaps remain in our knowledge on how the tiny microbes present in the gut communicate with the brain and thereby control behaviour. Real challenges in coming years would be to find this out.

References:

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Lecture on the topic “An overview of FISH and its Applications at different Resolutions” was delivered by Dr. Ruby Banerjee from “The Wellcome Sanger Institute”, UK on 29th May 2019, 11am at the Archana Sharma Memorial Hall, Department of Botany, University of Calcutta.

Fluorescence in situ hybridisation (FISH) is a molecular cytogenetic technique developed in the 1980s. It is based on the principle of DNA hybridisation when single stranded DNA anneal to complementary strands. It provides information on localization and copy numbers of specific stretches of nucleic acids on a single cell level. FISH complements data obtained from very popular Next Gen Sequencing (NGS), which provide information on the genetic content of millions of cells at a time.

FISH is used at different resolutions of chromatin, ‘Metaphase FISH’ resolves probes over approximately 5 – 10 Mb apart, ‘interphase FISH’ resolves probes which are less than 50 Kb apart and is suitable for ordering and orientation of clones. Whereas, ‘Fibre FISH’ (both alkaline and molecular combing) resolves probes which are 2-5kb in size or within a range of 500 kb. By bridging a technical gap between gross chromosomal aberrations and sequence specific alterations, fibre FISH helps in clone ordering but more importantly in ascertaining genomic structural variations like copy number changes, duplications and deletions.

One of the predominant techniques used in the lab for both mouse and human cell lines (primary and commercial) is M-FISH (Multiplex or multicolour fluorescence in situ hybridisation) on metaphase chromosomes. Using combinatorial labelling which is resolved by computer aided separation of spectra, flow sorted chromosomes are labelled with Atto 425, Cy5, Texas red (Cy3.5), Cy3 and FITC to produce M-FISH paint (probe). M-FISH helps to characterise cell lines. Chromosomal aberrations both numerical and structural are characterised in cancer cell lines, elucidating instability and intra-tumour heterogeneity reflecting tumour evolution. Chromosomal aberrations in low frequencies are often discerned otherwise missed in genomic data (unless resolved by single cell sequencing). Thus, karyotype heterogeneity information enables a better understanding of data generated by techniques like aCGH and NGS which use pools of cells.

With the aid of a powerful technique like FISH, molecular cytogenetics, in the growing era of ‘cytogenomics’, continues to play a dominant role in medical research and diagnostics.



Moments of the day



Lecture on the topic “Specific inhibition of IP6K1 ameliorates metabolic syndrome in mice” was delivered by Dr. Sarbani Ghosal, Assistant Professor, Department of Biological Science and Geology, QCC-City University of New York, USA, on 21st August 2019, at the Archana Sharma Memorial Hall, Department of Botany, University of Calcutta.



Introduction of the speaker by HOD Prof. K Acharya

Summary of the talk

In obesity, fat accumulation exceeds the storage-capacity of adipose tissue depots. Obesity is also the primary risk factor of type 2 diabetes. Our laboratory originally showed that insulin stimulates the inositol phosphate kinase IP6K1 to produce IP7 (5-diphosphoinositol-pentakisphosphate), which in turn inhibits insulin sensitizing enzyme Akt. Today’s lecture will focus on phenotypes and mechanisms by which IP6K1 can be pharmacologically inhibited to modulate energy expenditure and insulin signaling pathways.



Felicitations of the speaker by Prof. S. Mukherjee and one of our student



International Symposium on “Air pollution and its Impact on Human Health” jointly hosted by Archana Sharma Foundation of Calcutta and All India Congress of Genetics and Genomics, in collaboration with Indian Institute of Chemical Biology, Kolkata, held on December 2-4, 2019



Inaugural function of the 19th AICGG, Kolkata. From left: Prof. Samit Chattopadhyay, Director CSIR-IICB, Kolkata and Chairman, Organizing Committee, 19th AICGG, Prof. Asis Datta, President AICGG, Dr. Ashok K. Giri, Secretary Convener AICGG and Organizing Secretary 19th AICGG, and Prof. Anita Mukherjee, Secretary, AICGG.

Archana Sharma Foundation of Calcutta (ASFC) joined with All India Congress of Genetics and Genomics (AICGG) in hosting an International Symposium on December 2-4, 2019 in collaboration of Indian Institute of Chemical Biology (IICB) at the Dr K S Ray auditorium of IICB. ASFC contributed Rs. 100,000.00 to AICGG towards the expenditure of inviting overseas scientists. The convenor of the symposium was Dr. Ashok Kr Giri, one of our General Body members.

The opening session of the conference was dedicated as Memorial Lecture session in the names of Professor A K Sharma and Professor G K Manna - the founders of the ASFC and AICGG, respectively. The first technical session comprised of 12 lectures presented by the eminent and distinguished scientists, followed by a poster session and orations of



young scientists. These lectures were delivered by international and national scientists who were experts in the area of genetics and genomics as well as in the field of environmental biology.

The participants in this International Symposium included 100 registered delegates well attended by research scholars and scientists from India and abroad. A total of 40 posters of high scientific merits on cancer biology, transcriptomes, DNA methylation and genomics of human diseases were represented by the young delegates. It was a platform to recognise and encourage young, bright and ambitious researchers. There was young scientist award session where young scientists were awarded for the best paper presentation. Best posters of the young researchers were also selected for the awards. Awardees from India and abroad were honoured with certificate and cash prize. Such scientific platform will definitely help the young minds to inculcate and disseminate the knowledge acquired during the deliberations in the symposium once they go back to their respective work places.



Glimpses from the International Symposium



One day seminar – workshop was organized on 26th December 2019 on 'Phytochemicals as potential drugs, an *In Silico* Approach'



**Moments
of the day**

Medicinal plants containing secondary metabolites can be utilized for the production of drugs in treating diseases ranging from minor diarrhoea to mighty cancer. The yield and effectiveness of the phytochemicals largely depend on the method of extraction and the solvents used. The screening of such phytochemicals based on their efficacy and biosafety is a necessary but daunting step that has now been made easier through modern analytical techniques such as molecular docking study. The workshop on 'Phytochemicals as Potential Drugs, an *In Silico* Approach' was organized by Prof. Rita Kundu to enlighten the research scholars about the different processes of phytochemical extraction and isolation that are broadly used in pharmaceutical research, ranging from supercritical fluid extraction to chromatographic procedures, through a riveting lecture by Prof. Santanu Paul (Department of Botany, University of Calcutta), and to give a hands on training about the docking study between 3dimensional structures of phytochemicals and target proteins under the supervision of Dr. Anish Nag (Department of Life Sciences, Christ University, Bangalore). The 3D structures of different phytochemicals as well as proteins to be demonstrated were downloaded from the servers Pubchem and RCSB Protein Data Bank, respectively. Followed by optimization of structures using open source software, namely Avogadro (for phytochemicals) and UCSF Chimera (for proteins). Finally, conformation of phytochemical (as ligand) and its binding position and orientation with the sites of the targeted receptor protein was predicted using the online server Patchdock-Rigid Body Docking. Visualization of such molecular graphics helps to explore the plausible biological macromolecule structure. The workshop thus proved to be quite productive and informative for the research scholars and post-graduate students.



Our tribute to Sir on his 96th Birthday (31st December 2019)

Moments of the day



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