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EDITORIAL

EMERGING TRENDS IN GENOMICS : APPLICATIONS IN HEALTH AND DISEASE



Genomics- the branch of science which deals with understanding the genetic makeup of humans and other organisms- has been at the forefront of biological research in the last decade since it promises to revolutionize our understanding of human health and disease. From the unraveling of the human

genome sequence about ten years back to the very recent personal genome sequencing, genomics research has on one hand ushered in new knowledge about biological processes in humans and other organisms and on the other hand raised exciting new questions as well.

Over the last few years, Institute of Genomics and Integrative Biology (IGIB), one of the constituent institutes of the Council of Scientific and Industrial Research (CSIR), India, has taken measured but firm steps towards developing core competence in genomics and establishing itself as one of the major focal points of genomics research in India. This special issue highlights some of the recent developments in genomics research carried out at IGIB with emphasis on both the global scientific scenario as well as implications in the Indian context.

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The first article discusses some of the important findings that emerged from a pan-CSIR effort (with IGIB in the forefront) in creating a “genetic map” of India. This work is important since it resulted in new knowledge about relatedness in Indian population with implications in diseases, personalized medicine and pharmacogenomics. This effort has also acted as a major stepping stone towards placing India alongside other global players of genomics research in the world. Subsequently, we have participated in pan-Asian efforts towards mapping human diversity in Asia and also became one of the six countries in the world to have completely sequenced a human genome.

An amalgamation of knowledge of traditional Ayurvedic medicine of India with insights generated from advanced genomics research is being developed as a new approach towards personalized and preventive medicine

at IGIB. Ayurveda, whose basic tenet relies on inter-individual variability for predicting disease susceptibility, response to external environment, diet and drug, provides a complementary approach towards achieving personalized medicine through understanding genomic variations. Researchers from IGIB and CSIR are involved in creating this new field of research coined as “Ayurgenomics”.

The approaches used and some of the interesting results that have recently emerged have been discussed in the second article.

Human health is not only about the genome itself, but also the environment which can influence our “nature” as well. Such interplay of genes and environment is best exemplified in diseases like asthma where the environmental factors like air pollution as well as altered dietary habits can induce the disease in individuals with natural genetic predisposition. The approaches towards tackling such challenges are discussed in the third article.

Information on the genomes of pathogenic microbial organisms has ushered in hope for more effective ways of treatment for microbial diseases. However, treatment for tuberculosis has eluded researchers despite the availability of the genome sequence of the pathogenic *M. tuberculosis*. CSIR, along with IGIB as a major contributor, has started an open collaborative model of drug discovery primarily for this disease where young as well as experienced minds from around the world participate in various modules of the program starting from drug target identification to lead optimization using a virtual

laboratory on a web-based platform. Significant highlights of the project are described in the next article.

An amalgamation of knowledge of traditional Ayurvedic medicine of India with insights generated from advanced genomics research is being developed as a new approach towards personalized and preventive medicine at IGIB resulting in a new field of research named as "Ayurgenomics".

Research at IGIB does not pertain only to human health but also involves caring about our environment through the knowledge of genomics. Scientists at IGIB are exploring the rich microbial diversity of India and using this resource to develop biotechnological applications pertaining to environment and energy. The vast reservoir of

“unculturable” bacteria present in various ecological niches in India is being utilized to create metagenomic libraries for generating novel enzymes (with high and specific catalytic property) and other bioactive compounds. The last article aims to highlight the recently developed metagenomic approaches in environmental and industrial microbiology world-wide with special emphasis on research at IGIB.

Munia Ganguli
Rajesh Gokhale
Guest Editors



Munia Ganguli is a scientist at Institute of Genomics and Integrative Biology, Delhi working in the area of bionanotechnology. She and her group are involved in designing and developing different cationic nanocarriers based on cell penetrating and membrane perturbing peptides and polymers for efficient nucleic delivery as well as understanding the different intracellular and extracellular barriers involved in the process of cellular delivery of nanomaterials. She has done her M.Sc. in Chemistry from Jadavpur University, Kolkata and Ph.D. from the Solid State and Structural Chemistry Unit, Indian Institute of Science, Bangalore. After a brief post-doctoral stint at the Philipps Universitaet, Marburg, Germany, Dr. Ganguli joined IGIB as a scientist in 2004.



Rajesh Gokhale is the Director of Institute of Genomics and Integrative Biology (IGIB), Delhi and is an HHMI International Research Scholar in India. He completed his doctoral degree from Indian Institute of Science, Bangalore and then moved to Stanford University, USA for Postdoctoral studies. He was then a faculty at National Institute of Immunology, New Delhi. Dr Gokhale has studied biochemical pathways in assembly of complex lipidic metabolites in *Mycobacterium tuberculosis* leading to the discovery of a new family of enzymes fatty acyl-AMP ligases. This has pioneered the understanding of dichotomy in fatty acid activation in several biological systems. In continuation with his interest to understand metabolic diversity and molecular complexity, his group is investigating Skin Pigmentation Biology with specific interest in understanding Vitiligo aetiopathogenesis. He is recipient of several awards including Swarnajayanti Fellowships, Shanti Swaroop Bhatnagar Prize in Biological Sciences and National Bioscience Award for Career Development. He is also an honorary Faculty member at Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore and is a Fellow of the Indian Academy of Sciences.

Editor's Note : This issue has been sponsored in part by the Institute of Genomics and Integrative Biology, Delhi.

Letters to the Editor

Dear Dr. Roy,

I liked reading Incognito's "Second Class Language" – how true and sensible a piece – very much. He is clearly a most cultured and sensitive young person.

"Preserving Our Planet" is a good and important editorial.

With regards

Uma Das Gupta

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Institute, Kolkata)*
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June 21, 2010

Dear Professor Roy

A few days back I received the latest issue of Science & Culture. I enjoyed going through your article on Liberalization and Globalization. You have raised important issues. I personally feel that in our teaching institutions (particularly in IITs and other engineering colleges) we have not been able to inculcate "entrepreneurship" in our students; I guess we teachers are responsible for that. Whatever may be the reason, may be it is one of the important issues that we have to seriously think about in our educational and R&D institutions.

I found the article on Ronald Ross quite interesting.

Best regards

Yours sincerely

September 19, 2010

Ajoy Ghatak
Former Professor of Physics
Indian Institute of Technology,
Delhi

Dear Dr. Sir,

Your recent issue (Vol. 76 No. 7-8) is excellent. The two articles dealing with nuclear energy are excellent. And

so is your article on globalization. Congratulations for keeping the standard of the journal admirably high.

With warm regards

Yours sincerely

Prof. Hem Shankar Ray
*(Formerly at Central Glass
and Ceramic Institute, Kolkata)*
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New Alipore
Kolkata 700 053

August 28, 2010

Respected Professor Roy,

I have read the editorial carefully. Everything is written and argued professionally. It is beyond my knowledge and authority to comment on your editorial. What I like most is the last part of it. The last paragraph is in itself masterpiece and MESSAGE FOR BENGAL MEN/WOMEN OF SCIENCE AND LETTER. I hope the readers understand it and take step. I can assure you, I shall enhance my research in this direction.

Much needed to be done and can be done on DM Bose. Perhaps we should explore possibilities for a "small cooperation between you and our research group" in Germany; and take the first step!!! I shall be glad, if such a cooperation is possible.

Will you allow me to make a small remark? Could it be that you meant Gustav Hertz (on page 491) instead of Heinrich Hertz!

I am thankful that you gave publicity to my research work.

With my best regards

Yours sincerely

December 6, 2010

Rajinder Singh
*University of Oldenburg
Oldenburg, Germany*