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The arrival of next generation sequencing

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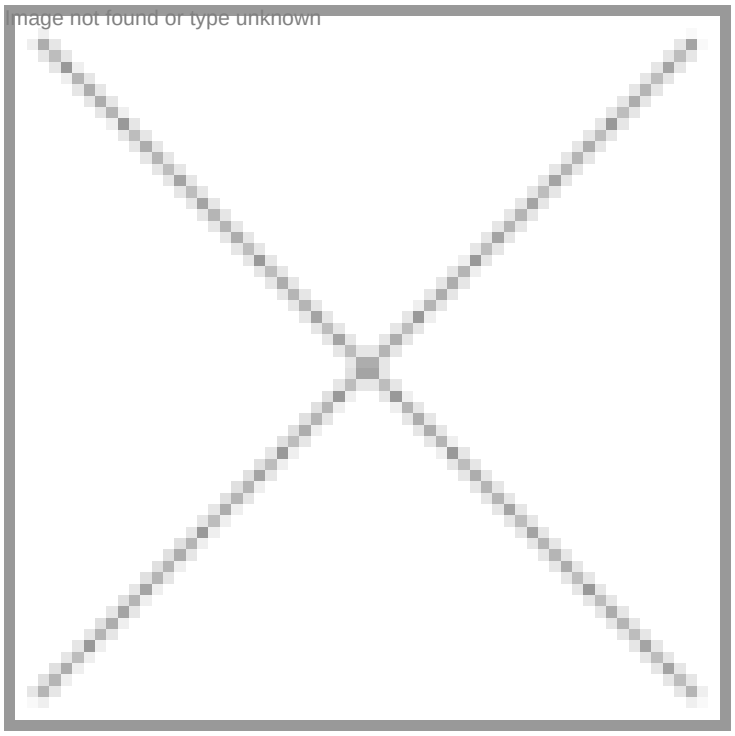

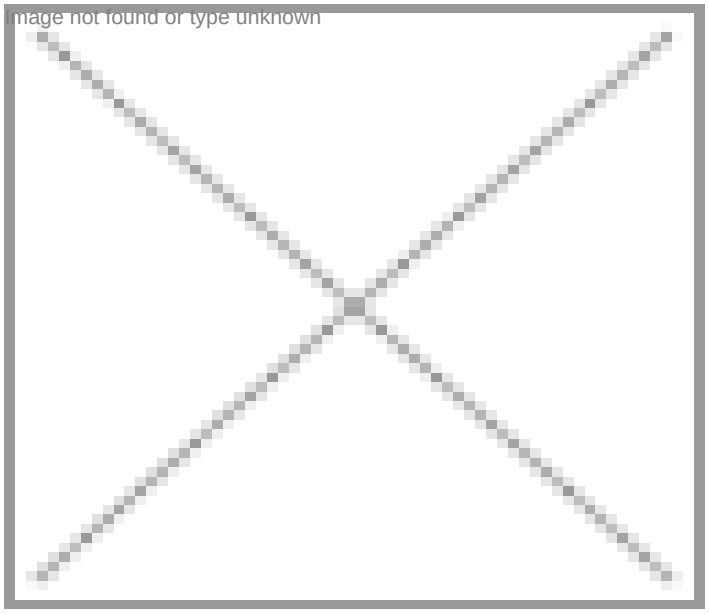

Indian scientific research in recent times has witnessed two major breakthroughs. A common bridge between these breakthroughs is the next-generation sequencing technology from the US-based company—Illumina

The Zebrafish genome which is about half the size of the human genome, containing about 170 crore DNA base pairs, is the

first eukaryotic genome that was sequenced by the Council for Scientific and Industrial Research (CSIR) scientists in India. The research team at Institute of Genomics and Integrative Biology (IGIB) generated over 89 gigabases of DNA sequences in two months time resulting in over 20x coverage of the Zebrafish wildtype strain genome. This humongous exercise was made possible with the CSIR supercomputing facility at IGIB.

Another breakthrough happened when the first human genome sequencing was completed in India by CSIR scientists. During this exercise 51 gigabase data was generated leading to 13x coverage of human genome. Indian scientists have also successfully carried out small RNA chip sequencing, methylation sequencing, transcriptome sequencing and digital gene expression studies for human and non-human species.

Now what forms a common bridge between all these events is the technology used to sequence all these genomes. Thenext-generation sequencing technology from the US-based Illumina has enabled massively parallel sequencing of millions of genomic fragments ranging from 36 to 76 base pairs, which are then mapped back to the reference genome. Illumina's Genome Analyzer has been adopted across genome centers worldwide, as well as individual research labs, core and service facilities, and biotechnology and pharmaceutical companies. The Genome Analyzer offers the highest rate of daily output and the simplest, most user-friendly workflow. It supports the broadest set of applications, including those used to profile and discover novel transcripts, to create high-resolution genome-wide maps of DNA-protein binding sites and to sequence entire human genomes to greater than 30x coverage.

In India, Illumina launched its operation in 2005 and got its first platform that is Bead Array installed at IGIB in 2007. Currently, Illumina is represented exclusively in India by Premas Biotech based out of Manesar, Gurgaon, and has more then 11 installations of its flagship genetic analysis platforms.

Microarray-based Iscan Platforms are installed at seven centers including a service provider named Sandor Proteomics in Hyderabad. Four Genome Analyser platforms and a Bead Express array platform were also installed. Sandor and IGIB have both carried out pioneering GWAS studies using Illumina and more then 9,000 samples have been processed till date. IGIB scientists are currently using it for genotyping and expression analysis. Indian scientist have used Illumina for human, plants and animal genetics studies.

"This technology has been readily acceptable to people and it is the second generation genome analyzer in true sense,"says Rajeev Sindhi, managing director, Sandor Proteomics, Hyderabad.

"The genome analyzer in a single run, spanning nine days, can generate upto 50 gigabytes of data," says Praveen Gupta, vice president — business development, Premas Biotech, Haryana.

Currently, a couple of de-novo sequencing projects are using Genome Analyser in India. Illumina has made immense contribution for research in India by reducing the SNP genotyping and gene expression costs and increasing the throughput majorly by multiplexing. Illumina offers both custom genotyping as well as whole genome genotyping solutions.

— Rahul Koul in New Delhi