Genomics and its Relevance to the Indan Pharma Industry

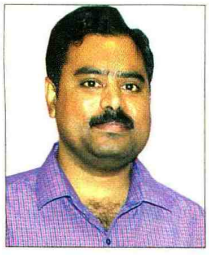
Pub Date:	31 Dec 2016	Publication:	Pharma Bio World	Edition:	National
Journalist:	Bureau	Language:	English	Page No.:	27, 28, 29
CCM:	362.65	MAV:	105000	Circulation	0

features

Genomics and its Relevance to the Indian Pharma Industry

Genomics is a science that studies the structure and function of genomes and, in particular, genes. Knowledge of the human genes and their functions may allow effective preventive measures. Genomics has positively impacted the drug research strategy and drug discovery development processes.

This article focuses on recent progress and innovations in applied genomics and genomics-based technologies impacting drug development.



Dr V L Ramprasad
COO
MedGenome

It was twenty-six years ago, that the National Institute of Health (NIH) and the Department of Energy coordinated with international partners and worked in tandem towards a common objective-to sequence all the 3 billion letters (base pairs), in the human genome, the entire DNA in the human body thus initiating the Human Genome Project. The Project's key goal was to equip the researchers with ample resources to comprehend the genetic factors in human disease, develop new strategies to diagnose, treat and prevent the occurrences of diseases. Genetics analyses the composition and functioning of a single gene. Genomics analyses all genes, how the different genes are related and the impact of that relationship on the growth and development of organisms.

Genomics is the science of studying the genome while Genetics is the study of genes in living things and the role they play in inheriting traits from their parents. Genomics refers to the study of the genome. This has helped scientists to classify novel genes, variations in them, the expression patterns across tissues organisms, variations in genetics and a host of useful elements. Every piece of genomic information sets the pace for detailed studies of the genome.

Next Generation Sequencing (NGS) is a DNA sequencing technology which has transformed genomic research globally. This powerful technology helps in sequencing an entire human genome (thousands to millions DNA sequences in one reaction) within a matter of 24 hours. Since its inception, the cost of DNA sequencing has reduced more than a thousand times its original cost and this has made many individual researchers take recourse to NGS technology.

Nucleotides (bases) in the order of As, Cs, Gs and Ts, make up the DNA of an organism. Genome sequencing is understanding the order of those DNA nucleotides in a genome. The human genome is made up of more than 3 billion genetic letters and hence sequencing the genome is a pre-requisite to understanding it. However, hi-tech machines are required for all large scale ambitious projects of sequencing genomes. Though a genome sequence helps scientists find genes effortlessly and speedily, scientists are still learning how to recognize, interpret and analyze these clues.

The NGS technology enhances the study of India's massive diversity. The medical community will have the ability to manipulate genes, improving the health treatments as well as the diagnostics. There are massive strides being taken in the research and development of gene sequencing and synthetic biology. Accessing genetic information is improving by the day and this will have a positive impact on the treatment of diseases, the production of food and agriculture.

NGS technology is economically viable and a far more speedy than any other used till date. This has helped scientists globally, to sequence the genome of numerous species of animals, plants and microbes. It took 10 years and USD 3 billion to sequence the first human genome (2003) - this is now possible in 10 days and costs a comparatively nominal amount of USD 5,000.

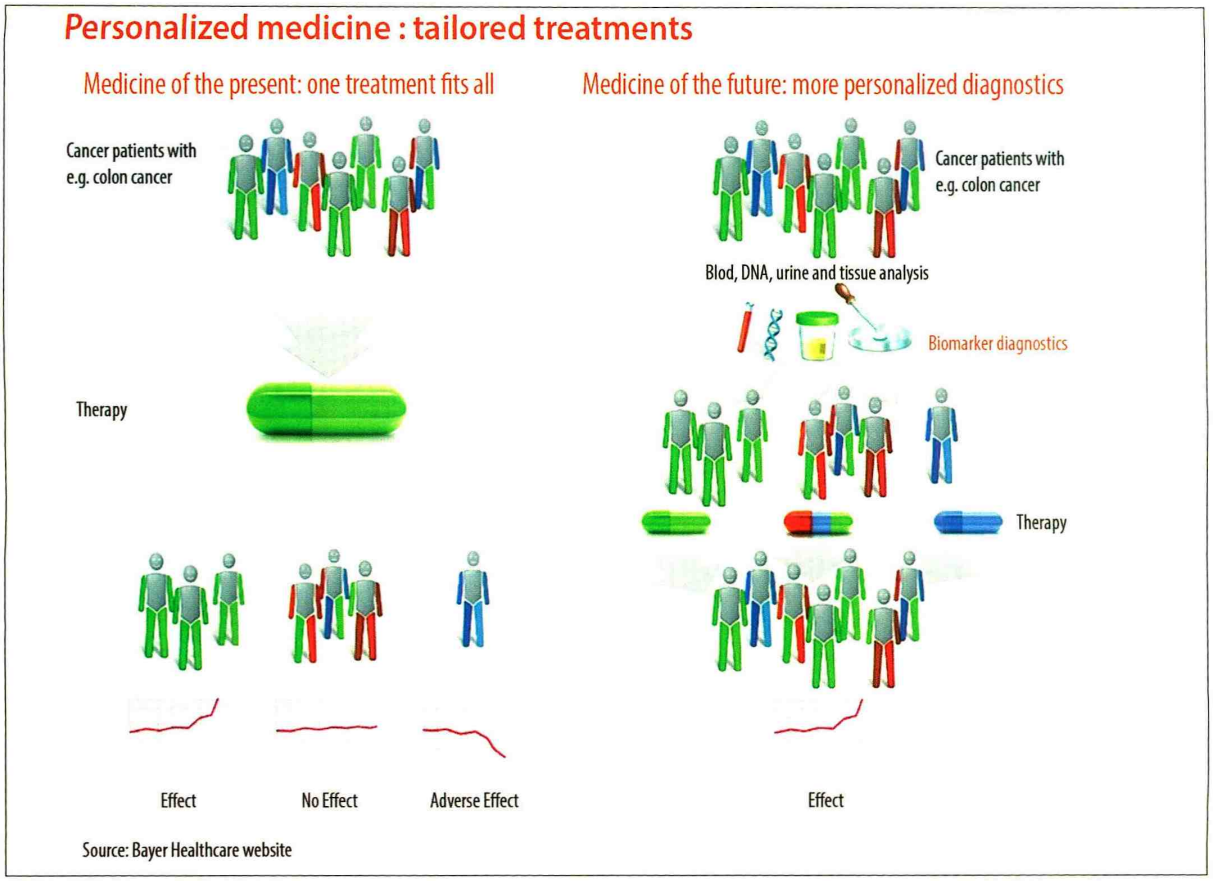
Pharmacogenomics is closely linked to Pharmacogenetics - the former being study of pharmaceuticals and the latter being the study of the inconsistencies in responses to medications because of a variation in single genes. Together, Pharmacogenomics and Pharmacogenetics can lead medical experts to discover and analyze drugs which can be customized to distinct diseases in individuals and can be modified to their genetic make-up.

Applications of Genomics

Genomics is applicable across various sections of our lives prominently amongst which are agriculture, bio-pharma, pharmaceuticals, the control of infectious disease, health care, Pharmacogenomics, clinical diagnostics, environmental biotechnology and biotechnology This is likely to serve immense opportunities to create high-value substances like biodiesel and ethanol from ordinary organisms.

The application of Genomics to biology and applied biology has immense potential and has

features



paved the way for setting up new products and organizations dedicated to further their research and introduce ground-breaking solutions including personalized medicine, nutrition and fitness, saving save millions of lives in the process. Infact, Genomics has generated great excitement at the possibility of creating new life forms through synthetic biology.

Application of Genomics in Controlling Infectious Disease

Genomics has brought us to the threshold of a new era in controlling infectious diseases. The first genome sequence of a pathogen, Haemophilus Influenzae was completed in 1995. Advance research and technology has given a deeper insight into pathogens. The process of understanding an entire genome sequence is now achievable within a few days.

This has helped in the clinical management of infectious diseases and enhance public health intervention around the globe. The analysis of pathogen genes (infectious agents that causes disease to its host), their interaction and expression will lead to the development of new antibiotics, antiviral agents and designer immunizations.

DNA vaccines include genes against a range of pathogens and they could treat those already infected with chronic viral infections. This will play a dominant role in the case of domesticated animals, in which viruses continue to kill billions of dollars worth of livestock every year.

Public health application of pathogen genomics includes:

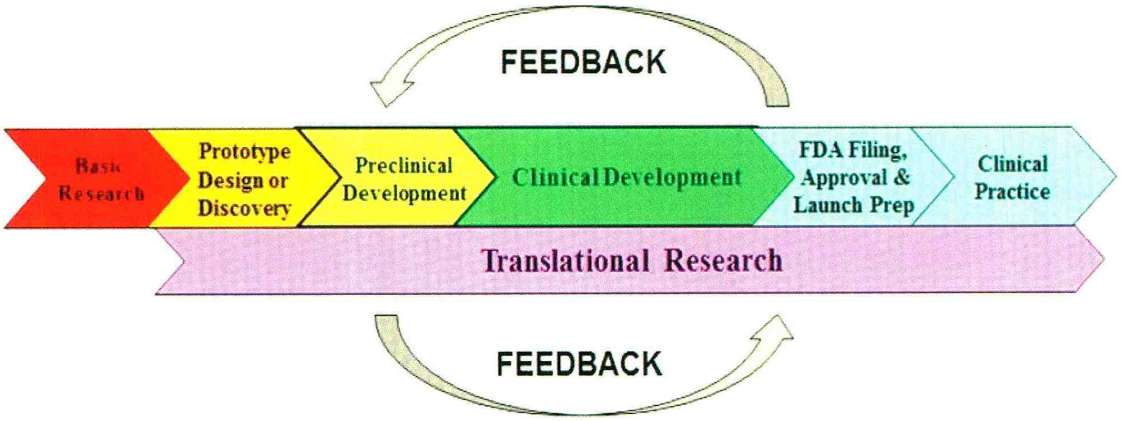
- Diagnosis of the infection
- Examine the infection
- Describing the patterns of transmission
- A constant observation of the anti-microbial resistance

Developing various interventions e.g., vaccines In addition to the above Precision Medicine (Medical professionals resort to distinct treatments to specific diseases ailing individuals) helps into understanding the genome sequence, the health history, dietary habits, individual differences in the genes, lifestyles and other key factors of people.

Applications of Genomics in Healthcare

Scientists are optimistic that their study of the entire genome sequence will offer them a wealth of information in the functioning of the genome. It will help them understand how genes work collectively to direct the growth, development and maintenance of an entire organism and also get an insight into DNA, which isn't actually contributing in beings and whose function remains an enigma.

Genomic sequencing is becoming more accessible and the ability to study the whole human genome has led to a speedy discovery



of human diseases. Genomics has helped the medical specialists to utilize the genetic information to identify genes which are inclined to diseases, defective genes and how they all affect the human body in a positive or negative manner. A family with a genetic history of illness does impact the health in the generations ahead. Genomics assists in the prevention of such occurrences with the appropriate healthcare intervention and targeted treatment.

Applications of Genomics in Genetics

Genetics offers families and individuals insights into how various conditions e.g. cystic fibrosis are inherited in some families, what measures need to be taken e.g. specific medical tests and the available treatments. Genomics helps medical experts understand why some individuals are prone to specific habits and infections e.g. one individual may be very health conscious and follow a strict regimen early in life and still live up to only 40 years whereas another may be a chain smoker, have the worst diet habits and live up to a 100 years! Genomics offers great insights into understanding such anomalies.

Application of Genomics in Preclinical Drug Safety Evaluation

Genomics strategies are being introduced into drug development and genomics further strengthens the various stages of drug discovery and development. Preclinical drug safety evaluation is conducted on laboratory animals like mice, rats, monkeys and dogs. The levels of dosage vary and far surpass the norm of the prescribed dosage which is given over a time frame ranging from a few days and extends to perhaps, 2 years. Such experiments and research studies reveal organ toxicity (the degree to which a substance can damage an organism).

These studies signify the safety margin between the effective dosage and the one which causes an adverse effect. Adverse drug reaction (ADR) is highly important to both regulatory agencies and the pharmaceutical industry. Despite the many techniques utilized to screen the probable risks during the preclinical stage of drug development, it is possible for drugs with safety liabilities to still escape the safety checkpoints and land into the market. Advanced clinical studies help in understanding the safety levels of using the drugs in humans. The benefits that could accrue are numerous but need to be complemented with effective computational methods. Resorting to genomics can ease the various stages of drug discovery and enhanced development.

Application of Genomics in Marine Biology

The marine environment is known to be a large resource of earth, still waiting to be tapped. It is considered to be the core of life as it contains 95 per cent of the world's biomass and at least 39 recognized animal phyla (marine organisms). Marine environment provides 1/3rd of the total oxygen that we breathe. Infact, it has a huge impact on the human environment and assists in protecting the earth from the negative impact of climatic changes. It is an important source of high-protein food, and makes a valuable contribution for the proper functioning of the planet.

The application of genomics in marine biology helps experts to understand the formation and function of marine organisms, providing biological information of the organisms that underlie the ecosystem of the ocean world. The oceans and their coasts are home to a range of varied organisms as well as regions which populate the deep seas notably amongst which are comkelp forests, coral reefs, thermal vent ecosystems, mangroves and more.

This vast biodiversity is a source of rich information which is being studied and researched upon by with a range of genomic applications. This will help researchers and specialists understand how best the resources can be utilized on human terrain and the benefits to humans at large from a medical and health perspective. It will also help understand how the large masses of sea and coastal life contribute towards human life and its protection. ■

Reference

http://genomicmedicine.conferenceseries.com/
http://nature.com
http://sciencedaily.com
http://pubs.sciepub.com/jor/3/1/1/index.html

Contact: jeevarekha@conceptpr.com