BioSpectrum the business of Bio & Health Sciences

...And now its BioinformaticsÂ

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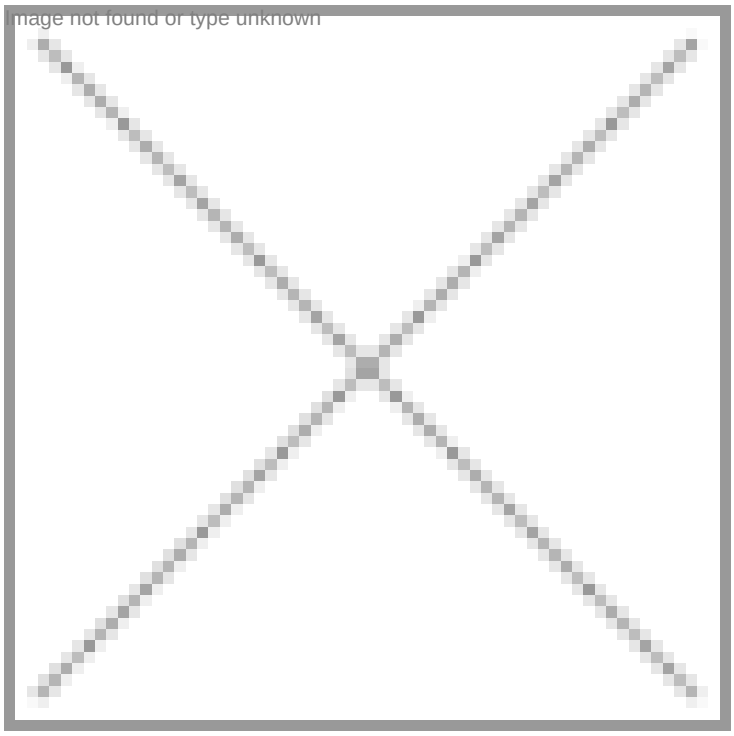

After 11 September and the economic slow down, the Indian information technology companies, which had a good share in the software services market, are looking for alternate revenue streams. One of the alternatives is bioinformatics. Probably, it represents the biggest opportunity for the IT industry since Y2K. Experts in this field observe that if industry and government work together, it is possible for Indian industry to garner five percent share of the global bioinformatics market.

Bioinformatics is the field of science in which biology, computer science, and IT merges into a single discipline. The ultimate goal is to enable the discovery of new biological insights and to create a global perspective from which unifying principles in biology can be distinguished.

Bioinformatics has three important sub-disciplines, such as:

- the development of new algorithms and statistics with which assess relationships among members of large data sets
- the analysis and interpretation of various types of data including nucleotide and amino acid sequences, protein domains and protein structures
- the development and implementation of tools that enable efficient access and management of different types of information.

Concept of database

Bioinformatics today, by general consent, is actually a much latter development from the concept of the database.

The concept of computer database came into practice in1948, through the US defense initiatives. Database is meant to store voluminous information in an orderly fashion. It facilitates addition and deletion of information and provides for its retrieval in any one or more of the several different permutations and combinations as desired by the user. Biologists have taken the advantage of this facility from the very early stages and have used it in different contexts.

The general belief about bioinformatics is that it constitutes only genomics and proteomics. Genomics is the study of total molecular sequencing of one set fall genes of an organism and proteomics is about amino acid sequences and the three-dimensional structure related to the function of proteins. It is concerned with compounds of high molecular weight (HMW), particularly the nucleic acids and proteins. But in recent times cheminformatics (study of low molecular weight (LMW) compounds), glycomics (study of carbohydrates), metabolics (study of metabolic pathways in organism) and drug design through bioinformatics are also being projected as legitimate areas of bioinformatics.

Bioinformatics in India

Studies of IDC points out that India will be a potential star in bioscience field in the coming years after considering the factors like bio-diversity, human resources, infrastructure facilities and government's initiatives. According to IDC, bioscience includes pharma, Bio-IT (bioinformatics), agriculture and R&D. IDC has been reported that the pharmaceutical firms and research institutes in India are looking forward for cost-effective and high-quality research, development, and manufacturing of drugs with more speed.

Bioinformatics has emerged out of the inputs from several different areas such as biology, biochemistry, biophysics, molecular biology, biostatics, and computer science. Specially designed algorithms and organized databases is the core of all informatics operations. The requirements for such an activity make heavy and high level demands on both the hardware and software capabilities.

This sector is the quickest growing field in the country. The vertical growth is because of the linkages between IT and biotechnology, spurred by the human genome project. The promising start-ups are already there in Bangalore, Hyderabad, Pune, Chennai, and Delhi. There are over 200 companies functioning in these places. IT majors such as Intel, IBM, Wipro are getting into this segment spurred by the promises in technological developments.

"Negative growth of pharma drug pipelines and increase in R&D funding have played crucial role in the growth of bioinformatics sector in the country. At the same time there has been a meltdown of bioinformatics companies in the US. This consolidation will continue and only the companies with a clear focus and understanding of pharma-biotech sector will survive," says Dr S Seshadri, CEO, Strand Genomics, the first Bioinformatics company in India.

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Commenting on the scope for bioinformatics sector in the country, Aruradha Acharya, CEO, Ocimum Biosolutions, Hyderabad, says, "bioinformatics is crucial for the advancement of the biotech industry because it can help tremendously to cut the time frame usually required to develop a product. It also helps in bringing about standardization and discipline in the field by automating some tasks and introducing checks in the process. Since it has become standard practice in most countries, those who don't follow it will find it difficult to keep pace with development in this area. "

Government initiatives

Informatics is a very essential component in the biotech revolution. Ranging from reference to type-culture collections or comparing gene sequences access to comprehensive up-to-date biological information, all are crucial in almost every aspects of biotechnology. India, as a hub of scientific and academic research, was one of the first countries in the world to establish a nation wide bioinformatics network.

The department of biotechnology (DBT) initiated the program on bioinformatics way back in 1986-87. The Biotechnology Information System Network (BTIS), a division of DBT, has covered the entire country by connecting to the 57 key research centers. BTIS is providing an easy access to huge database to the scientists. Six national facilities on interactive graphics are dedicated to molecular modeling and other related areas. More than 100 databases on biotechnology have been developed. Two major databases namely coconut biotechnology databases and complete genome of white spota syndrome of shrimp has been released for public use. Several major international data bases for application to genomics and proteomics have been established in the form of mirror sites under the National Jai Vigyan Mission.

The BTIS proposes to increase the bandwidth of existing network and provide high-speed internet connectivity to continue

with its present activities of training, education mirroring of public utility packages, consideration of R&D projects and support to different research activities in this field. The DBT is planning to set up a National Bioinformatics Institute as an apex body for the bioinformatics network in the country. The DBT also proposes to bolster a proper education in bioinformatics through publication of textbooks and monographs by reputed scientists in the field. Collaboration with the industry is also poised to increase in the coming years.

Opportunities

According to Confederation of Indian Industry(CII), the global bioinformatics industry clocked an estimated turnover of $2 billion in 2000 and is expected to become $60 billion by 2005. If the industry and government work together it is possible to achieve a five percent global market share by 2005, i.e., a $3 billion opportunity in India.

The past two years has seen many large multinational pharmaceutical companies acquiring other small companies and developing in the biosciences sector. IDC currently forecasts a compound annual growth rate (from 2001-02 to 2004-05) of about 10 percent in the spending on Information Technology by bioscience organizations. Considering the local market is generally less mature than those in the US and Europe, IDC forecasts more aggressive growth beyond 2005, as many of the organizations attempt to play "catch-up". Enterprise applications including data warehousing, knowledge management, and storage are being pursued by these companies as priorities.

IDC expects IT spending in biosciences in India will cross $138 million by 2005, mainly in the areas of system clusters, storage, application software, and services. Also the governments life science focus provides a great deal of the necessary backbone to develop and deliver innovative products and technologies. This focus will also helps to build fast-growing and lucrative enterprises, attract international investment, and create additional high-value employment opportunities.
Hence the focus of the IT sector should be on products and services that aligns with bioscience needs. Demonstrating a true understanding of the IT requirements of biotechnology processes is the key for IT suppliers to bridge the chasm that currently exists between IT and Science.

Advantages India has

India is well placed to take the global leadership in genome analysis, as is in a unique position in terms of genetic resources. India has several ethnic populations that are valuable in providing information about disease predisposition and susceptibility, which in turn will help in drug discovery.

However, as India lacks the records of clinical information about the patients, sequence date without clinical information will have little meaning. And hence partnership with clinicians is essential. The real money is in discovering new drugs for ourselves and not in supplying genetic information and data to the foreign companies, who would then use this information to discover new molecules.

The genomic data provides information about the sequence, but it doesn't give information about the function. It is still not possible to predict the actual 3-D structure of proteins. This is a key area of work as tools to predict correct folding patterns of proteins will help drug design research substantially. India has the potential to lead if it invests in this area.

Looking at this biotech and pharma companies need tremendous software support. Software expertise is required to write algorithms, develop software for existing algorithms, manage databases, and in final process of drug discovery.

Some major opportunity areas for IT companies include:

- Improving content and utility of databases
- Developing better tools for data generation, capture, and annotation
- Developing and improving tools and databases for comprehensive functional studies
- Developing and improving tools for representing and analyzing sequence similarity and variation
- Creating mechanisms to support effective approaches for producing robust, software that can be widely shared.

As major pharmaceutical and genome-based biotech companies invest heavily in software, Indian IT companies have a great business opportunity to offer complete database solutions to major pharmaceutical and genome-based biotech companies in the world.

Pure cost benefits for the biotech companies will definitely drive the bioinformatics industry in the country. The biotech industry in 2000 has spent an estimated 36 percent on R & D. Success for many will mean a drastic reduction in R&D costs.

Thus biotech companies will be forced to outsource software rather than developing propriety software like in the past. Since the cost of programs for handling this data is extremely high in the west, Indian IT companies have a great business opportunity to offer complete database solutions to major pharmaceutical and genome-based biotech companies in the world.

The IT industry can also focus more on genomics through different levels of participation areas such as hardware, database product and packages, implementation and customization of software, and functionality enhancement of database.
Abraham Thomas, managing director, IBM India Ltd, says, "the alignment of a vast pool of scientific talent, a world-class IT industry, a vigorous generic pharmaceutical sector and government initiatives in establishment of public sector infrastructure and research labs are positioning India to emerge as a significant participant on the global biotech map."

With an objective to help and rise bioinformatics sector to the world map the Bioinformatics Society of India (Inbios) has been working since August 2001. The Inbios already has over 270 members in a short span of one and half years. It has become a common informal platform for the younger generation to learn and contribute to this sun rising field in India.

Kiran Mazumdar Shaw, chairperson and managing director, Biocon India Group says, "bioinformatics is a tool. Peopleshould not confuse bio-informatics as ending in it. It is a very important tool, just like how software is a tool. It is service business. Use bio informatics to mine a lot of knowledge. Create types of new hypothesis and to have a very interesting interpretation of databases of genomics and proteomics. Bioinformatics has a great potential in the service industry."

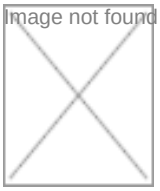
On the other side, Anuradha Acharya, CEO, Ocimum Biosolutions, says," bioinformatics is crucial for the advancement of the biotech industry since it can help to tremendously cut the time frame that is usually required to develop a product. It also helps in bringing about standardization and discipline in the field, by automating some tasks and introducing checks in the process. Since it has become standard practice in most countries, those that don't follow it will find it difficult to keep pace with developments in this area. "

Problems in the sector

The major issue for India is its transition from a recognized global leader in software development to areas of real strength upon which it can capitalize in the biosciences. The identifiable areas are in computation biology and bioinformatics, where a substantial level of development skills are required to develop custom applications to knot together and integrate disparate databases (usually from several global locations), simulations, molecular images, docking programs etc.

The industry people, meanwhile, say that the mushrooming of bioinformatic institutes is creating a problem of finding talented and trained individuals in this industry. While many of them has a superficial knowledge and a certificate, India lacks true professionals in this area.

Most people, who opt for bioinformatics are from the life sciences areas that do not have exposure to the IT side of bioinformatics, which is very important. Another issue is that some companies face shortage of funds and infrastructure. The turn around time for an average biotech industry to breakeven would be around three to five years.



"Bioinformatics has a good future, but this is not a field for the masses. People who get involved should have a strong motivation and desire to remain in this field to see true results. The field is justifiable if a company is expecting revenues up to a few million dollars only," says Anuradha Acharya, CEO, Ocimum Biosolutions

Most of the venture capitals and other sources of funding would not be very supportive, especially if the company is not part of a larger group venture. It would help if the government would take an active role in building infrastructure and funding small and medium entrepreneurs.

To over come the difficulties, Acharya says, "this sector should get some support from the government. Many other countries have solid programs in genome research sponsored by the government. India being a country with such great biodiversity, we are able to do great research. However the investment is more and a result requires more time so it is necessary for the government to be involved. "

She further adds, "the government should also be involved in the education part of it. While a lot of programs have started in

the last few years, not all of them have the same standard. There should be a dedicated effort to standardize education in bioinformatics across the country. This can only be done by consulting the companies who are on the cutting edge of bioinformatics."
Looking at the pace of growth, lots of institutes have mushroomed in different parts of the country. Kiran Mazumdar Shaw, chairperson and managing director, Biocon India Group, the country's first and leading biotech company in India expressed her concern and said that appropriate steps should be initiated at the earliest.

"As the chairperson of CII National Committee on Biotechnology, I have discussed the issue with the concerned officials in government departments. We are waiting for the government's move on our recommendations," says Shaw.

Looking ahead

The hype about the sector has made a lot of difference. This has caused a sudden surge in the number of companies. Thisis normal for any new technology which promises potential, especially as the perceived conception that it was relatively easy to get in with a certain amount of IT expertise. It is better to adopt, wait and watch policy to know who will remain in the market.

Acharya says, "bioinformatics has a good future, but this is not a field for the masses. People who get involved should havea strong motivation and desire to remain in this field to see true results. This field is justifiable if a company is expecting revenues up to a few million dollars only. This would not make sense for a very large organization. As the company grows, it needs to step into other validation areaslike wet lab."

Even DA Prasanna, executive officer, Wipro Healthcare and Lifescience, has the same opinion. He says, "with three Indian pharma majors already having a molecule each to their credit in the drug discovery process, big companies in IT industry will definitely look this as an attractive investment opportunity to leverage on maximum returns."

Commenting on the scope of bioinformatics in near future,Dr Seshadri says, "Bioinformatics is an integral part of drug discovery and development. Most of the pharma-biotech R&D is moving in silico-creating scope for bioinformatics sector. India has a vast pool of talented human resources in computer science and life sciences. Institutes like IIT's, IISc., NCBS etc., produce world-class engineers and life science scientists. Funding is not an issue for companies creating IPR and this is validated by closure of first round funding of Strand."