Bioinformatics in Bangladesh: An Optimistic View

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The terms bioinformatics and computational biology are often used interchangeably. However, bioinformatics more appropriately refers to the creation and advancement of algorithms, computational and statistical techniques, and theory to solve formal and practical problems arising from the management and analysis of biological data. Computational biology, on the other hand, refers to hypothesis-driven investigation of a specific biological problem using computers, carried out with experimental or simulated data, with the primary goal of discovery and the advancement of biological knowledge. Put more simply, bioinformatics is concerned with the information, while computational biology is concerned with the hypotheses. Bioinformatics is also often specified as an applied sub-field of the more general discipline of biomedical informatics (Barnes and Gray 2003).

Bioinformatics and the use of mathematical tools in the assembly of high-quality genome sequences from fragmentary "shotgun" DNA sequencing: Over the past few decades, major advances in the field of molecular biology, coupled with advances in genomic technologies, have led to an explosive growth in the biological information generated by the scientific community. This deluge of genomic information has, in turn, led to an absolute requirement for computerized databases to store, organize, and index the data and for specialized tools to view and analyze the data. A common thread in projects in bioinformatics and computational biology is the use of mathematical tools to extract useful information from data produced by high-throughput biological techniques such as genome sequencing. A representative problem in bioinformatics is the assembly of high quality genome sequences from fragmentary "shotgun" DNA sequencing (Baxevanis and Ouellette 2005).

Other common problems include the study of gene regulation to perform expression profiling using data from microarrays or mass spectrometry. As the disciplines of bioinformatics and computational biology are gaining prominence day by day, an industry is also emerging fast on their shoulders, estimated at $1.82 billion in 2007 (Nair 2007).

Bioinformatics, The Human Genome Project and Pharmaceutical Industries: Information technology (IT) has become a critical factor in pharmaceutical research and development (R&D). Bioinformatics is the computer assisted data management discipline that helps us gather, analyze, and represent information in order to educate ourselves, understand life's processes in the healthy and disease states, and find new or better drugs. This field has exploded out of the world of molecular biology and the Human Genome Project. Pharmaceutical companies are achieving increased research efficiency by the introduction of new approaches to the design, synthesis, screening and optimization of drug candidates. IT is an important support function for all of those activities and there are certain functions and operations that cannot be performed without IT. Informatics represents the deployment of Information Technology to manage, analyze, and store biological data. Beyond data management, informatics represents the only way to analyze large pools of genomic information. Informatics finds application in target validation, lead optimization, exploratory development etc. In all areas of biological and medical research, the role of the computer has dramatically enhanced in the last five to ten-year-period (Baldi and Brunak 2001).

Major research areas: Sequence Analysis, Genome Annotations, Computational Evolutionary Biology, Measuring Biodiversity, Analysis of Gene Expression, Analysis of Regulation, Analysis of Protein Expression, Analysis of Mutations in Cancer, Prediction of Protein Structure, Comparative Genomics, Modeling of Biol. Systems, High throughput Image Analysis, Protein-Protein Docking, and Data Mining (Aluru 2006).

Bioinformatics potential in BD

In spite of being young, the science of bioinformatics exhibits tremendous potential for playing a major role in the future development of science and technology. This is evident from the fact that modern biology and related sciences are increasingly becoming dependent on this new technology. It is expected that bioinformatics will especially contribute in the future as the leading edge in biomedicine to pharmaceutical companies by expediently yielding a greater quantity of lead drugs for therapy.

Bioinformatics in India and Singapore for improvement of health-economic Conditions: Bioinformatics is a new exciting area of science. India and Singapore are capitalizing the enormous opportunity and significantly improving their health-economic conditions in the Asia-Pacific region. Research and development in this area do not require huge funding to set up a world class laboratory. All it requires is a high speed Internet connectivity with a few powerful computers and a team of enthusiastic talented people. There are tons of genomic,

proteomics and micro-array data freely available from different public websites at various top class laboratories and institutions all over the globe. A collaborative research relationship can be easily established with biological and medical laboratories.

Development of a world class bioinformatics institute in BD with BB scientists: As many Bangladeshi scientists are well placed in various prestigious institutions almost all over the world, we could capitalize this opportunity and develop a world class bioinformatics institute in Bangladesh. Bangladesh has a plenty of talented young scientists hunting for opportunities for overseas employment. This institute can train hundreds of students with high tech cutting-edge technologies virtually from anywhere of the world with a minimum cost. We also can attract international students to take the set of courses online and/or onsite that could boost up our economy significantly. Although, conducting world class research and publishing the findings in the top tier journals and conferences are the fundamental driving force of the institute but it is planning to offer the following services to generate funding for long term survival.

Services BioBD could offer

Consultancy: BioBD could offer various consultancy services from the concept to the implementation level including investment opportunities, project selection, project report preparation, market surveys and setting-up entire projects.

BioBD could assist in technology outsourcing, identification of joint ventures and finally marketing tie-ups for various products and services of pharmaceutical and other products in different organizations.

Information services: BioBD also could act as a vital information retrieving and dissemination facility to the industry and clients through:

- Publication of Newsletters, Journals and Bulletins.
- Conducting seminars, Workshops and Conferences.
- Creation of text books, Online Courses and Information CDs.

Research and development: BioBD could promote bioinformatics software development and its usages related to latest tools and technologies.

Training and placement: BioBD could offer various high quality courses, keeping in mind the latest requirements of software and pharmaceutical industry. BioBD also could offer experienced and qualified bioinformaticians to the industry for local and international job markets.

Content development: BioBD could offer content development services to Private and Public Corporations, Universities and hospitals according to their business requirements. Content could be as course ware, training sessions,

product demonstrations etc. This content could be organized in the form of printed manuals, CD ROMs and as e-learning tutorials.

Conclusion

The governmental support and funding is crucial for this type of initiative. Considering the present political and economic condition of Bangladesh, private initiative is vital to pushing the science ahead with the rest of the world. Now is the best time to start to stay in the race. Together we can achieve more than we can imagine.

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