Emerging Trends and Opportunities in Chemical Sciences & Biotechnology

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PREFACE

Chemistry and Biotechnology are complement to each other in addressing the essential needs of human beings-Water, Food, Health, Waste Management and Energy. Human diseases, for example, are treated by either small molecule drugs produced by chemistry or protein-based drugs produced by biotechnology, and environmental contaminants can be cleaned up either using chemistry or microbes. Whether a chemistry or biotechnology solution works best depends on the specific nature of the problem, and often both approaches to the problem are necessary for optimal resolution.

While technology generally aims to create tools to empower man, biotechnology aims to change man himself, to better fit him to the world. Simply put, biotechnology with the assistance of Chemistry is the application of advances made in the biological sciences, especially involving the science of genetics and its applications. Biotechnology has helped to improve food quality, quantity and processing. It also has applications in manufacturing, where simple cells and proteins can be manipulated to produce chemicals. But biotechnology is most important for its implications in health and medicine. Through genetic engineering – the controlled alteration of genetic material – scientists have been able to create new medicines, including interferon for cancer patients, synthetic human growth hormone and synthetic insulin, among others. In recent years, scientists have also attempted to employ the methods of genetic engineering to correct certain inherited conditions, and have been making great strides in their ability to manipulate genetic materials. These advances suggest the prospect of human control over the very genetic makeup of man, and thus the ability to manipulate our inherited traits. The consequences of man's growing power over human genetics are enormous, and they become ever more immediate each day. Many observers have suggested that just as the late 20th century has been the age of computer technology, so the early 21st century will be the age of biotechnology.

The deliberations from the expertise people in the field of Biotechnology and Chemistry made the National Seminar a fruitful one. The outcome that is the recent advancement in the fields of Biotechnology and Chemistry will definitely cater the needs of academicians, researchers, scientists, industrial management and more particular to governmental agencies while formulating the public policies with regard to public health and environmental protection. This Seminar stands as a forum to exchange the expertise knowledge with the participants and all the Technical Sessions for two days motivated the students to go further studies in research. Biotechnology and Chemistry plays pivotal role in pharmaceutical sector which directly linked with human health. The forum felt the need of tremendous research in Biotechnology and Chemistry which should bring the medicine and treatment to the common man at his affordable prices.

This book is a collection of research and review articles presented at the National Seminar. The article covers various facets of Biotechnology and Chemistry and its allied fields. The contributors besides describing the present state of the role of Biotechnology and Chemistry and have provided constructive suggestions in enhancing the importance of the subject in green synthesis. Hope the literature contained in this book would definitely add substantial knowledge and opportunities to go for research for betterment of human life and to achieve Green World where the people live in the conditions of without deprivation of any in human and unhygienic conditions and also achieve all round personality development in all spheres of life.

We here with acknowledging our sincere gratitude to AP Commissionerate of Collegiate Education, Amaravathi, AP State Council of Higher Education, Hyderabad, University Grants Commission, SERO, Hyderabad, **Dr.N.Rangaswamy**, Principal, **Dr. P. Padmasree,** Vice Principal and College administration. Finally, I express my heart felt gratitude to **Dr.T.S.Shyam Prasad**, Lecturer in Political Science, Government College (Autonomous), Anantapuramu for his continuous patronage in bringing this volume.

Dr. V. Saleem Basha

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While it seems the spider silk idea has been put on the shelf for the time being, it is a technology that is sure to appear again in the future, once more information is gathered on how the silks are woven.

CONCLUSION

From all the facts that have been discussed above biotechnology is known to influence every aspect of human health. Biotechnology has offered modern medical devices for diagnostic and preventive purposes, which include diagnostic test kits, vaccines and radio-labeled biological therapeutics used for imaging and analysis. Malnutrition mainly arises due to the lack of essential nutrients and vitamins in food and ultimately results in death. Biotechnology has play a major role in eliminating these problems by producing nutrients enriched food such as Golden Rice, Maize, potato and soybean etc. Pollutants and untreated waste are a great hazard to human health and are potential cause of cancer. Biotechnology has evolved numerous strategies to biodegrade these pollutants by making use of microorganism. Precipitation of heavy metals and bioremediation of pollutants are the major advantages of biotechnology UNICEF and Organization.

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26. Role of Computers in Life Sciences- A Sudy

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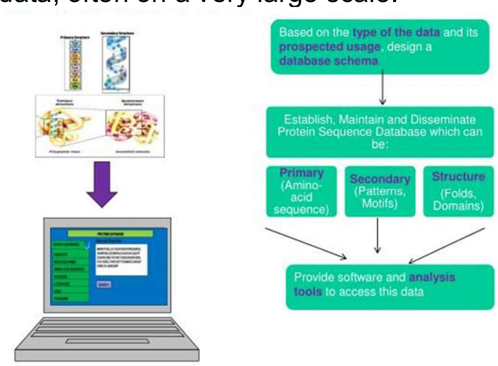
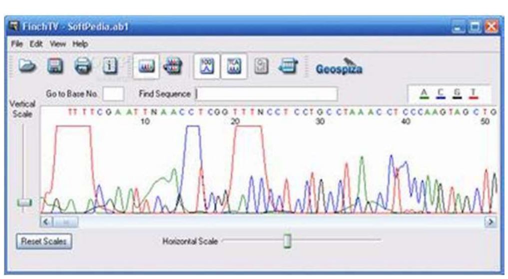
Computational biology

Computational biology, a branch of biology involving the application of computers and computer science to the understanding and modeling of the structures and processes of life. It entails the use of computational methods (e.g., algorithms) for the representation and simulation of biological systems, as well as for the interpretation of experimental data, often on a very large scale.

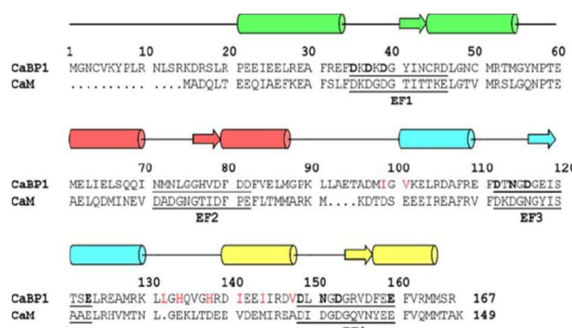


The beginnings of computational biology essentially date to the origins of computer science. British mathematician and logician Alan Turing, often called the father of computing, used early computers to implement a model of biological morphogenesis (the development of pattern and form in living organisms) in the early 1950s, shortly before his death. At about the same time, a computer called MANIAC, built at the Los Alamos National Laboratory in New Mexico for weapons research, was applied to such purposes as modeling hypothesized genetic codes. (Pioneering computers had been used even earlier in the 1950s for numeric calculations in population genetics, but the first instances of authentic computational modeling in biology were the work by Turing and by the group at Los Alamos.)

By the 1960s, computers had been applied to deal with much more-varied sets of analyses, namely those examining protein structure. These developments marked the rise of computational biology as a field, and they originated from studies centered on protein crystallography, in which scientists found computers indispensable for carrying out laborious Fourier analyses to determine the three-dimensional structure of proteins.



Starting in the 1950s, taxonomists began to incorporate computers into their work, using the machines to assist in the classification of organisms by clustering them based on similarities of sets of traits. Such taxonomies have been useful particularly for phylogenetics (the study of evolutionary relationships). In the 1960s, when existing techniques were extended to the level of DNA sequences and amino acid sequences of proteins and combined with a burgeoning knowledge of cellular processes and protein structures, a whole new set of computational methods was developed in support of molecular phylogenetics. These computational methods entailed the creation of increasingly sophisticated techniques for the comparison of strings of symbols that benefited from the formal study of algorithms and the study of dynamic programming in particular. Indeed, efficient algorithms always have been of primary concern in computational biology, given the scale of data available, and biology has in turn provided examples that have driven much advanced research in computer science. Examples include graph algorithms for genome mapping (the process of locating fragments of DNA on chromosomes) and for certain types of DNA and peptide sequencing methods, clustering algorithms for gene expression analysis and phylogenetic reconstruction, and pattern matching for various sequence search problems.



Beginning in the 1980s, computational biology drew on further developments in computer science, including a number of aspects of artificial intelligence (AI). Among these were knowledge representation, which contributed to the development of ontologies (the representation of concepts and their relationships) that codify biological knowledge in “computer-readable” form, and natural-language processing, which provided a technological means for mining information from text in the scientific literature. Perhaps most significantly, the subfield of machine learning found wide use in biology, from modeling sequences for purposes of pattern recognition to the analysis of high-dimensional (complex) data from large-scale gene-expression studies.

Applications of computational biology

Initially, computational biology focused on the study of the sequence and structure of biological molecules, often in an evolutionary context. Beginning in the 1990s, however, it extended increasingly to the analysis of function. Functional prediction involves assessing the sequence and structural similarity between an unknown and a known protein and analyzing the proteins’ interactions with other molecules. Such analyses may be extensive, and thus computational biology has become closely aligned with systems biology, which attempts to analyze the workings of large interacting networks of biological components, especially biological pathways.

A Partially sequence genome

Biochemical, regulatory, and genetic pathways are highly branched and interleaved, as well as dynamic, calling for sophisticated computational tools for their modeling and analysis. Moreover, modern technology platforms for the rapid, automated (high-throughput) generation of biological data have allowed for an extension from traditional hypothesis-driven experimentation to data-driven analysis, by which computational experiments can be performed on genome-wide databases of unprecedented scale. As a result, many aspects of the study of biology have become unthinkable without the power of computers and the methodologies of computer science.

Distinctions among related fields

How best to distinguish computational biology from the related field of bioinformatics, and to a lesser extent from the fields of mathematical and theoretical biology, has long been a matter of debate. The terms *bioinformatics* and *computational biology* are often used interchangeably, even by experts, and many feel that the distinctions are not useful. Both fields fundamentally are computational approaches to biology. However, whereas bioinformatics tends to refer to data management and analysis using tools that are aids to biological experimentation and to the interpretation of laboratory results, computational biology typically is thought of as a branch of biology, in the same sense that computational physics is a branch of physics. In particular, computational biology is a branch of biology that is uniquely enabled by computation. In other words, its formation was not defined by a need to deal with scale; rather, it was defined by virtue of the techniques that computer science brought to the formulation and solving of challenging problems, to the representation and examination of domain knowledge, and ultimately to the generation and testing of scientific hypotheses.

Computational biology is more easily distinguished from mathematical biology, though there are overlaps. The older discipline of mathematical biology was concerned primarily with applications of numerical analysis, especially differential equations, to topics such as population dynamics and enzyme kinetics. It later expanded to include the application of advanced mathematical approaches in genetics, evolution, and spatial modeling. Such mathematical analyses inevitably benefited from computers, especially in instances involving systems of differential equations that required simulation for their solution. The use of automated calculation does not in itself qualify such activities as computational biology. However, mathematical modeling of biological systems does overlap with computational biology, particularly where simulation for purposes of prediction or hypothesis generation is a key element of the model. A useful distinction in this regard is that between numerical analysis and discrete mathematics; the latter, which is concerned with symbolic rather than numeric manipulations, is considered foundational to computer science, and in general its applications to biology may be considered aspects of computational biology.

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27.Biodiversity & Human Sustainability

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Biodiversity's important

Biodiversity reflects the number, variety and variability of living organisms. It includes diversity within species, between species, and among ecosystems. The concept also covers how this diversity changes from one location to another and over time. Indicators such as the number of species in a given area can help in monitoring certain aspects of biodiversity.

Biodiversity is everywhere, both on land and in water. It includes all organisms, from microscopic bacteria to more complex plants and animals. Current inventories of species, though useful, remain incomplete and insufficient for providing an accurate picture of the extent and distribution of all components of biodiversity. Based on present knowledge of how biodiversity changes over time, rough estimates can be made of the rates at which species become extinct.

Ecosystem services are the benefits people obtain from ecosystems. Biodiversity plays an important role in the way ecosystems function and in the many services they provide. Services include nutrients and water cycling, soil formation and retention, resistance against invasive species, pollination of plants, regulation of climate, as well as pest and pollution control by ecosystems. For ecosystem services it matters which species are abundant as well as how many species are present.

Biodiversity loss is an anxiety

Biodiversity provides many key benefits to humans that go beyond the mere provision of raw materials.

Biodiversity loss has negative effects on several aspects of human well-being, such as food security, vulnerability to natural disasters, energy security, and access to clean water and raw materials. It also affects human health, social relations, and freedom of choice.

Society tends to have various competing goals, many of which depend on biodiversity. When humans modify an ecosystem to improve a service it provides, this generally also results in changes to other ecosystem services. For example, actions to increase food production can lead to reduced water availability for other uses. As a result of such trade-offs, many services have been degraded, for instance fisheries, water supply, and protection against natural hazards. In the long term, the value of services lost may greatly exceed the short-term economic benefits that are gained from transforming ecosystems. Unlike goods bought and sold in markets, many ecosystem services are not traded in markets for readily observable prices. This means that the importance of biodiversity and natural processes in providing benefits to humans is ignored by financial markets. New methods are being used to assign monetary values to benefits such as recreation or clean drinking water. Degradation of ecosystem