



On the Trail of Genomic Pioneers



Meet Dr. Achuthsankar S. Nair
Hon. Director, Centre for Bioinformatics
University of Kerala

1) Can you tell us a bit about your research interests?

I am basically an electrical engineer and because of my background I possibly have a very constrained interest in research in bioinformatics. My basic strength is in using digital signal processing and I try to look at sequences from this angle. A class of problems in biology can be addressed by mapping the DNA, RNA and amino acid sequences into digital signals and then applying the well established engineering tools. A good example for a very productive use of such a method is that of gene finding which is popular and we followed this up with some work on classification of hub proteins, sub cellular localization, miRNA target prediction etc. The research group which I lead has worked on all these areas.

2) Which research study or work has strongly influenced your thought and research goals ?

I must say I was profoundly influenced by the paper on *Genomics and Proteomics: A Signal Processor's Tour* by P P Vaidhyathan published in IEEE Circuits and Systems Magazine. This is the paper which laid out the plan for the use of digital signal processing in bio sequence analysis.

3) What are the unique features of the biotech department?

My centre is not a biotechnology institution. It is an interdisciplinary centre which has involvement from Department of Zoology, Botany, Biochemistry and Computer Science. We have two programs: one is M. Phil. Bioinformatics, which admits students from both Computational and Life Science background and we also have a unique M. Sc. program in Computational Biology, which admits only students with technical background that is mathematics or computers and allied areas. The uniqueness of our department is trying to not limit the study and research in bioinformatics to very generic domains. This is the reason why we try to differentiate between Bioinformatics and Computational Biology. Our University admits life science students to Bioinformatics Masters program and Computer Science students to Computational Biology programs. This way it is possible for us to hone the skills of the students to a level of mastery that is required in a masters program.

4) What are the new initiatives you have taken to incorporate and help early stage researchers and students to develop research temper?

As far as research is concerned, our centre is in its infancy. We have started a Ph. D program just three years back and we have so far had two research scholars submitting their thesis and we have about a dozen research scholars persuing their work in various stages. One of the



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ways we try to motivate and encourage research is by ensuring that our researchers have interactions with world class researchers. Their exposure is not limited to the local faculty. Fortunately the Government of Kerala has some programmes which encourage this. There is an “erudite program” under which renowned scholars can be invited to have face to face interaction with students not as a part of seminars but as free flowing and free wheeling discussions. Our department has had Dr Pawan K Dhar, Editor in Chief, Systems and Synthetic Biology Journal, Riken Yokohama Institute, Japan, and Prof Alessandro Giuliani, the eminent computational biologist from TCE laboratory, Rome, coming for such an interaction. In addition to this, we have a prestigious event which is Bioinformatica Indica conducted twice, 2008 and 2010. This has been a major impetus to our researchers.

5) What are your collaborations with the Industry? How do you think Industry can develop better collaborative models with Academic Research efforts?

I think this is a very important area which any academic institution in the modern times needs to spend lot of time and thought on. In area such as Bioinformatics which has tremendous impact in industry, there needs to be a very synergistic connection between academy and industry. The Centre for Bioinformatics had incubated a small company by the name of Sooryakiran

Bioinformatics Private Limited in 2006-2008. This company now operates from the Technopark campus and our linkage with industry has mainly been through this company. We have had collaborative projects which were funded by Government of India as well as student project in which students were supported by this industry and we hope that these models can be taken forward in the years to come. Industry can help collaborative models by having very planned student project taken up with academic institutions. Many times it is the students who go hunting for projects. But instead of that, with every academic institution, based on detailed discussion, we have long term projects into which students are continuously fed and even research scholars can get involved, then possibly a collaborative effort will be very fruitful in the long run.

6) Can you tell us about research projects that students or faculties have initiated at your department?

We have developed an online tool named GEN-SNiP for finding polymorphisms especially SNPs in a set of DNA sequences with respect to a reference sequence, n-cornered polygon visualization tool named CGREx for plotting the CGR plots of DNA and amino acid sequences with hundred ways of clustering methods is another significant research work from our Centre. Prediction of hub proteins in a protein-protein interaction network using the fractal dimensions of amino acid sequences is yet another important area of study where amino acid sequences were mapped into numeric sequences using data from Amino Acid index.



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These numeric sequences were then plotted to form images and the fractal dimensions of these images were then calculated. An ANN was used to predict hub and non-hub proteins. Another important contribution is a Bioinformatics tool for subcellular localization of proteins by studying the atomic composition of amino acid sequences. Another relevant work is molecular modeling and docking studies on Hepatitis C virus in which we have modeled the three dimensional structure of NS3 Serine protein and the studies is available on PDB with accession No:2IJS. We had also discovered new module which can inhibit viral replication that can be considered as drug. These molecules are in the process of patenting. Several more initiatives have been undertaken and our main effort is to concentrate chiefly on Use of Digital Signal Processing in Genomic and Proteomic Sequence Analysis, Protein Structure Prediction, Sonification of Biological Sequence Data, and Micro-array image processing.

7) What are initiatives taken by the institutes to familiarize the students with the industry?

We generally advise our students to do their projects in external institutions including industry to get a feel of work culture in these organizations and we also invite people from industry for seminars and conferences whereby these interactions takes place.

8) Anything you want to say to the students that will inspire them to pursue career in biotechnology?

Event though I am not a biotechnologist I would like to say that and I believe that the 21st century is the century of biotechnology or in a large perspective a century of life sciences. I would like to recommend the students to read the very famous futuristic work of Jermy Rifkin titled "The Biotech Century" and if you are a computer scientist then I would like to quote Donald Knuth who said that computer scientists have 500 years of work to do in biology.

9) What are the new genomic tools or technologies you used for you research ?

Being an institutions which focuses on computational biology which involves algorithm development and software development, we mostly do our research and development work on rapid program development environments like Matlab and Scilab. We of course use Bioinformatic Software such Blast, SwissPDBviewer, Dotter, ClustalX Phylip, Modeller, JPred. We also use Gold, Silver as a mini-grid system for molecular docking studies in drug discovery.

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