

ISTeC (Information Science and Technology Center) Research Advisory Committee  
 Retreat on the Scientific and Engineering Foundations of Information Science and  
 Technology  
 Saturday, May 8, 8:15am to 3:00pm, Lory Student Center

**DOSSIER**

Name:	M. Nazmul Karim
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<p><b>Research Interests (one paragraph):</b> Professor Karim's research interests deal with advanced data analysis, control and optimization of bioprocesses. Dr. Karim is one of the pioneer researchers in the world, who has combined fundamentals of modern biotechnology and process control theories in developing novel ideas regarding "Bioprocess Control." He has developed on-line estimation techniques such neural networks for use as a soft-sensor, or as a fault-detection tool for on-line monitoring, optimization and control of biological systems. His recent interests deal with proteomics, and its implications in metabolic engineering. This is done in the context of genomically integrated <i>Zymomonas mobilis</i> (in collaboration with the National Renewable Energy Laboratory, Golden, Colorado) culture for ethanol production. New pathways and regulatory control are implemented for understanding and analyzing the fermentation process at the cellular level. Advanced data analysis using multivariate clustering techniques are developed and implemented on the proteomic data for better understanding of various regulatory functions of the proteins in the metabolically enhanced microorganism. Dr. Karim has been researching animal cell culture (e.g. CHO cells) and plant cell cultures (<i>Taxus sp.</i>) for the production of pharmaceutically important products. Using recombinant CHO cells, Dr. Karim's group has been studying the production of tissue-type plasminogen activator protein (tPA, the so-called "clot buster"). We are developing the first known computational model, which is based on artificial neural networks, to make predictions whether glycan attachment to a polypeptide is <i>robust</i> or <i>variable</i> and whether the glycan branching has <i>high mannose</i>, <i>complex</i>, or <i>hybrid</i> characteristics. This model will revolutionize the pharmaceutical industry in providing the ability to eliminate heterogeneous glycosylation in cell culture. In another study dealing with CHO cells, Dr. Karim identified key amino acids responsible for apoptotic cell death. By independently varying key amino acids, and using advanced control methodology, his student was able to control apoptosis in a fermentor at any desired value.</p>	
<p><b>Titles of current research projects (funded or not):</b></p> <p><b>–Biotechnology:</b></p> <ul style="list-style-type: none"> <li>• <i>Recombinant mammalian cell culture</i></li> <li>• <i>Control of Programmed Cell Death</i></li> <li>• <i>Understanding and modeling of macro- and micro-heterogeneity in glycoprotein using bioinformatics tool.</i></li> <li>• <i>Effects of glucose in the inactivation of tPA in diabetic patients Recombinant <u>Zymomonas mobilis</u> fermentation</i></li> <li>• <i>Optimization of ethanol production in fed-batch cultivation</i></li> <li>• <i>Genomics and Proteomics and their applications in metabolic engineering of <u>Z. mobilis</u></i></li> </ul> <p><b>–Process Control and Data Analysis:</b></p> <ul style="list-style-type: none"> <li>• <i>Neural Networks and Principal Component Analysis</i></li> <li>• <i>Fault Detection and Isolation (e.g. industrial data)</i></li> <li>• <i>Clustering (bioinformatics)</i></li> </ul> <p><i>Multiple- Models and their applications in Process Control and Biotechnology</i></p>	

Current collaborations inside and outside your department:

1. Dr. Ken Reardon, Chemical Engineering
2. Dr. Tina Rinker, Chemical Engineering
3. Dr. James Linden, Microbiology
4. Dr. Robert Woody, Biochemistry
5. Dr. Tony Rappe, Chemistry
6. Dr. A. Jayasumana, Electrical Engineering
7. Dr. Julian Morris, University of Newcastle Upon Tyne (Data Analysis), UK.

Breakout sessions you would like to attend at the retreat  
(please rank order from 1 to 3):

	Alternative models of computing
1	Computing and information processing in support of basic science and engineering
2	Dense sensor networks
3	Imaging and tracking
	Automatic image, text, and speech recognition for multimodal interfaces and search engines
	Other (Please suggest a title.)

Faculty at CSU whom you would like to see included into your preferred breakout group:

Faculty from computer science and electrical engineering interested in data analysis

One optional paragraph you would like other participants to read before the retreat:

Linkage between biological sciences and engineering