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Mr. Carlos Ghosn, Chairman and CEO, Renault Nissan in an interactive session with faculty and students at IIT Delhi on 9th November, 2009.

CONTENTS

Namaste 2010!

Year 2009 indeed showed resilience and some resurgence. Whether that is on a strong sustainable base will be testified by time alone when the economic stimuli or its effects start wearing out ! No matter the economic conditions, we have to keep digging in and remain the eternal hopefuls at least on the occasion of New Year. Beyond the metaphorical resolutions and greetings, it is important for us to gird up and consistently be on the path of sustainable development. Copenhagen may have belied the high hopes but, it should not make us lose sight of the tremendous responsibility we have towards our own community and eco-system. Without compromising on genuine developmental requirements, we can easily adopt and embark on green practices – in products, processes and services. Whatever is required in this direction whether by virtue of state policy or technology intervention should not only be addressed but, encouraged as a regular way of life.

The present issue fleetingly captures a multi-dimensional flavour of some research in the area of bio-sciences and technology at the Institute particularly amongst the younger scientists. This may interest some sections of the biotechnology industry to engage with us. The year gone by has not disappointed us at FITT and our stakeholders need to constantly support us for still more progress. Management of development projects and the Institute IPR has been on a strong footing. The year ahead should see increasing value generation from our inventions. Apart from providing a fillip to creation of technology ventures, FITT is increasingly fostering the entrepreneurial spirit amongst the younger generation more particularly the Institute student community. In fact, technology and entrepreneurial skills will drive our economy vigorously towards greater prosperity. Availability of varied seed supports, primarily by the Government, should fire the imagination of many a young mind and start-ups. However, we are yet to see the deluge. But, are hopeful and positive as one ought to be on the New Year.

-Anil Wali

Quality by Design (QbD) has gained great popularity in the last 5 years. Intended to be an initiative to modernize pharmaceutical manufacturing and make it more efficient, the elements of QbD have been presented in the FDA's *PAT - A Framework for Innovative Pharmaceutical Manufacturing and Quality Assurance*[1] as well as the International Conference on Harmonization (ICH) guidelines: ICH Q8 *Pharmaceutical Development*[2], ICH Q9 *Quality Risk Management*[3] and ICH Q10 *Pharmaceutical Quality System*[4].

In the traditional approach to biotech production, manufacturers would define a process and run it consistently such that the critical parameters are controlled within a narrow range so as to make the product with consistent quality. As seen in Figure 1, the major downside of this approach is that since the process controls are fixed, variability in raw materials and process manifests as variability in product quality and results in lot failures[5]. In the QbD paradigm, the first step is to identify the critical quality attributes (CQA) for the product that impact its safety and efficacy in the clinic. Next, the process is designed such that it has adaptive controls and is capable of managing the incoming variability in raw materials and the process to deliver product of satisfactory quality consistently[6].

Figure 1

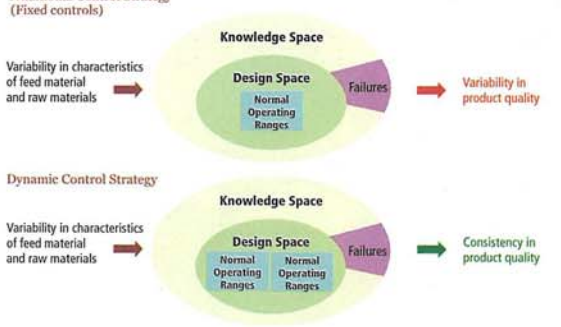

Illustration of different approaches towards establishing control strategy for a biotech process. Traditionally biotech processes are operated with fixed controls, thereby passing the variability in inputs and feed materials to the variability in product quality. In the QbD paradigm, a dynamic control strategy would allow for operating the process differently and thus, manage the variability in inputs and feed materials to get consistent product quality. Adapted from reference 6.

A case study illustrating the benefits of QbD is shown in Figure 2[7]. In this application, NIR analysis allows for trending of raw material lot quality in real time and early detection of any shifts in quality. The subsequent extrusion unit operation is monitored continuously in-line for temperature and active ingredient concentration. Off-line, an ultra-performance liquid chromatography test is performed to test the material for presence of a degradation product. Particle size distribution is continuously monitored during milling for process consistency and controlled via feedback control for compressing performance as a function of particle size. Finally, the weight, thickness, potency and hardness are tested at-line at the tablet press for continuous quality verification and feedback control of compression. This approach reduces quality risk and variability while increasing process understanding and a real time profile for the manufacturing process at each step or unit operation can be generated. If the reported profile is consistent with historical data, based on population analysis, real time release of product can be considered. Fundamentally, only those lots that fall outside the known population of data would require additional off-line testing or be rejected. Such an approach can result in very significant cost savings.

QBD IMPLEMENTATION IN INDIA

Historically, the Indian biotech companies have demonstrated their

Quality by Design for Manufacturing of Biotech Products

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Figure 2

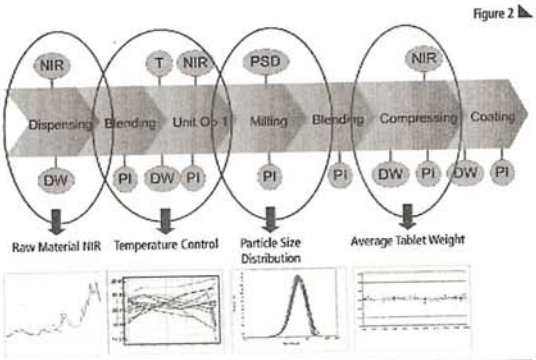

Illustration of an enhanced process scheme for making a solid dosage drug product in a pharmaceutical process. Adapted from reference 7.

capability to manufacture biotech drugs safely and effectively. India is already the world's top vaccine manufacturer and is widely recognized as a potential leader for manufacturing of other human therapeutic biotech drugs[8]. Most of the drugs are those called as "biosimilars", meaning copies of drugs that are already on the market[9]. However, the sales of such biosimilars manufactured in India have primarily been limited to developing and under developed countries. As the Indian biotech industry gears up for getting approvals for selling the biosimilars to the European, North American and other developed markets, it will be necessary for the manufacturers to raise their technical, quality and compliance systems to the expectations of the regulatory agencies such as the US FDA and the European Medicines Agency (EMEA). Implementation of Quality by Design is one such initiative that will assist in making this leap. The Indian biotech industry realizes this and most of the key players are embracing QbD by integrating its principles into their internal systems.

QBD RELATED ACTIVITIES IN INDIAN INSTITUTE OF TECHNOLOGY DELHI

Our laboratory in the Department of Chemical Engineering is focusing on various facets of QbD aimed to facilitate its adoption by the Indian as well as global biotech industry. Our vision is to create best practices in process development and manufacturing that facilitate successful commercialization of safe and efficacious biotech products. We wish to achieve it in collaboration with the major biotech solution providers (GE Healthcare, Sartorius Stedim, etc.), the funding agencies (Department of Biotechnology and Department of Science and Technology) and the major Indian biotech companies (Biocon Ltd., Intas Biopharmaceuticals, etc). Some of the major research projects that we are planning to initiate include:

1. Multivariate data analysis (MVDA) of bioprocessing data as an approach for gathering process understanding, process monitoring and for root cause analysis.
2. Development of Process Analytical Technology (PAT) based control schemes that use online analysis to facilitate real time decisions during processing that are based on the quality attributes of the product.
3. Development and commercialization of new bioseparations technologies such as high throughput process development tools and use of membrane adsorbers for protein purification.
4. Mechanistic modeling of bioseparations unit operations including process chromatography and membrane separations.

The future success of the Indian biotech industry will be significantly impacted by how quickly it adapts to the higher expectations of the regulatory authorities of the developed nations. Quality by Design is likely to play a key role in this transition.

REFERENCES

1. PAT Guidance for Industry - A Framework for Innovative Pharmaceutical Development, Manufacturing and Quality Assurance, US Department of Health and Human Services, Food and Drug Administration (FDA), Center for Drug Evaluation and Research (CDER), Center for Veterinary Medicine (CVM), Office of Regulatory Affairs (ORA), September 2004.
2. ICH Harmonised Tripartite Guideline: Q8(R1) Pharmaceutical Development, November, 2008, http://www.ich.org/LOB/media/MEDIA4986.pdf.
3. ICH Harmonised Tripartite Guideline: Q9 Quality Risk Management, November, 2005, http://www.ich.org/LOB/media/MEDIA1957.pdf.
4. ICH Harmonised Tripartite Guideline: Q10 Pharmaceutical Quality System, June, 2008, http://www.ich.org/LOB/media/MEDIA3917.pdf.
5. A.S. Rathore and H.Winkle (2009) Quality by Design for Pharmaceuticals: Regulatory Perspective and Approach. *Nature Biotechnology 27, 26-34.*
6. A.S. Rathore (2009) A roadmap for implementation of Quality by Design (QbD) for Biotechnology Products. *Trends in Biotechnology 27, 546-553.*
7. A. S. Rathore, A. Saleki-Gerhardt, S. H. Montgomery, and S. M. Tyler, Quality by Design for Pharmaceuticals: Industrial Case Studies on Defining and Implementing Design Space for the Process, *BioPharm Intl.*, Part 2: January (2009).
8. S. Natesh and M. K. Bhan (2009) Biotechnology Sector in India: Strengths, Limitations, Remedies and Outlook. *Current Science 97, 157-169.*
9. A.S. Rathore (2009) Follow-on Protein Products: Scientific Issues, Developments and Challenges. *Trends in Biotechnology* 27, 546-553.

Biological Membranes: Not DNA or RNA or Proteins!

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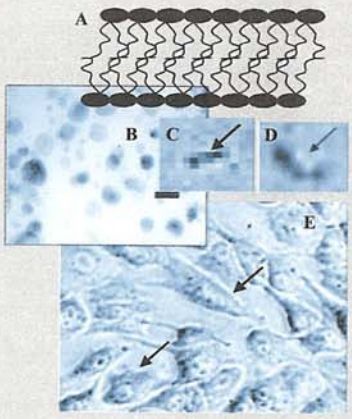
Life is an enigmatic scientific reality that continues to remain elusive through the complexity of its diverse components. The challenge of understanding living systems has transformed the scientific investigation of why life originated to how the interplay between the diverse components leads to a living organism. Much of what we know about life relies on the fact that water is the key ingredient providing a "base" or a "medium" essentially driving molecular interactions comprising of a system that can be classified as living. From the elementary point of view in biology, there are three components of a living system: (a) Nucleic acids – DNA or RNA that store and/or transfer the information required to sustain and replicate a living system, (b) Proteins – polymers that are workhorses responsible for catalyzing the well coordinated dance of a variety of molecular interactions that combine together in defining a living system, and, (c) Phospholipids – a class of amphipathic molecules that are responsible for creating segregated environments, which not only qualify as a living system as a whole, but also comprise of individually defined parts of the living machinery (see Fig. 1).

Figure 1



(A) Cartoon representation of a pure phospholipid bilayer. Each molecule is amphipathic with a phosphate "head-group" (shown as filled oval) that can interact with water, and two acyl (hydrocarbon) chains that are excluded by water. The height of the bilayer is 3-5 nm. (B) A negatively-stained Transmission Electron Microscopy (TEM) image of 100-300 nm "vesicles" created by assembly of pure phospholipid bilayers in aqueous environment. (C) An optical microscopy image of a ~2 μm long *E. coli* bacterial cell. (D) An optical microscopy image of a ~ 4 μm long magnetotactic bacterial cell. (E) An optical microscopy image of ~20 μm long human cancer cells. Note that biological membranes are comprised pre-dominantly of molecules shown in (A), but also have other embedded constituents such as proteins and small molecules like cholesterol.

The first two components of living systems, i.e. nucleic acids and proteins, have provided a constant source of intellectual livelihood in the global research scenario for the past century. Additionally, they have also brought numerous peer-reviewed accolades including several esteemed Nobels to members of the scientific community dedicating their lives to these molecules. While biological researchers in the areas of nucleic acids and proteins continue to grow trying to unravel the language of these molecules, a small scientific community originating with a handful of members in the late 1960s, with interest in the third component of living systems, is growing at a rapid pace in the last couple of decades. Phospholipids are the major constituents of the "boundaries" that enclose a specific aqueous environment (containing nucleic acids, proteins and other molecules) separating the "inside" from the "outside", thereby rendering the encapsulated contents to form a living system. They (i.e. phospholipids) do so because of their amphipathic nature – one part of each of the molecules is hydrophilic (i.e. interacts with water) and the other part is of the molecule is hydrophobic (i.e. is excluded by water). By virtue of their amphipathic nature, phospholipids assemble as a bilayer (two layers) in aqueous environments such that the hydrophobic lipid parts are excluded by water to form the core of a fluid boundary called a biological membrane.

Biological membranes encapsulate whole living systems in sizes ranging from as small as 50 nm to as large as the range of meters. The most fascinating aspect of biological membranes is, that unlike all other molecular entities found in nature (or even man-made), their formation is not driven by any physico-chemical interactions such as hydrogen/electrostatic bonds, covalent bonds or electro-magnetic forces. Instead, the primary interaction that keeps such a large size range of structures intact is exclusion of the lipid moieties of individual phospholipids molecules by water. Remarkably, it is the lack of ability of parts of molecules to interact with water, rather than their ability to interact with anything else (including themselves) that leads to formation of biological membranes. Thus, life, as we know it, is defined by water-driven assembly of a boundary encapsulating a "living" system thereby separating it from the outside "non-living" world. It is hence no wonder that even an idea of any extra-terrestrial life can originate only after evidence of extra-terrestrial water.

The exclusion of molecular moieties (or whole molecules) by water structure is often termed as the hydrophobic effect. Interestingly, the hydrophobic effect that drives formation of biological membranes is also one of the key players in formation of functional protein structures. It is essential to appreciate that both by definition and fact there is no concept such as hydrophobic "force", i.e. two hydrophobic molecules do not attract or repel each other. If these molecules are put in any "oil", they will form a "solution" in oil. However, in water, they will be excluded by water molecules, thereby bringing them together to form concentration dependent structures. Biological membranes are examples of such structures that exhibit several properties that are fascinating on the one hand, and integral to their role in forming a living system on the other hand. For example, while individual molecular constituents of biological membranes are not "bonded" to each other, yet whole biological membranes show all properties exhibited by elastic materials. This provides these boundaries of living systems a variety in dictating the flexibility/conformability of a living system. Another great property of biological membranes by the virtue of their assembly in water is their behavior as capacitors, since their

oily and fluidic core is non-conducting. This helps biological membranes maintain a desired potential difference between the living world that they encapsulate and the outside environment. This potential difference is often utilized to regulate transport/exchange of materials between the inside and outside.

Biological membranes are often termed as "semi-permeable". This is because they selectively allow molecules to pass through them. However, as discussed above, molecules cannot simply pass through these structures. In fact, specific "holes" or channels are embedded in these membranes that allow only selected molecules to pass through them, on the basis of a variety of physico-chemical properties (e.g. charge, size, structure). Even water requires specific channels embedded in membranes to pass through them in a timely manner. While passage of molecules through channels takes place simply based on concentration gradients, biological membranes also contain specific "pumps" that transport molecules against concentration gradients. The most common example highlighting the role for such channels and pumps comes from the well coordinated transport/exchange of sodium and potassium ions across biological membranes. Living systems (e.g. cells) often maintain low sodium and high potassium inside compared to the outside. Thus, on the one hand biological membranes are key to formation of a living system by the virtue of the encapsulation they provide, on the other hand, they are key to maintaining a molecular homeostasis that is essential to a functional survival of a living system also.

It is only within the last decade or two that biological membranes have invoked a substantial interest from pure biologists. Initial interest in these structures was limited to physicists and a few chemists who were fascinated by these non-protein and non-nucleic acid components of living systems. Now there is a large appreciation for not only the importance, but also the larger scientific challenge in unraveling the mysteries behind assembly of biological membranes. Working on biological membranes requires inter - and multi-disciplinary approaches and more importantly an open perspective. Specific rules have been discovered and described for assembly and working of nucleic acid and protein structures. None exist for biological membranes. The key question is: what is the structural approach that leads to formation of a functional biological membrane? This question, I believe, is at the heart of understanding the origin of life. In fact, understanding biological membranes may also be a crucial step in creating artificial life like features, if not artificial life itself.

News

CBSE seeks tie-ups with industry to help students get jobs

The Central Board of Secondary Education (CBSE) is looking to help students who finish school find jobs. The CBSE plans to hand out vocational degrees to students finishing class XII in its affiliate schools, a first in the history of the school education system in India.

Vocational courses taught at the school level will come attached with a certificate jointly awarded by the board and an industry partner to enhance the job prospects of students and make them employable. Some educationists argue that the plan would counter efforts to promote academics and research in Indian universities.

"What we are looking at is a minimum industry certification for students who take up the course," CBSE chairman Vineet Joshi said in an interview. "That's why we are trying to forge industry linkages for these courses. We are also trying to ensure guaranteed employment for them, some sort of a help given to kids in terms of jobs. Not every child likes to take up research."

The courses, currently being evolved in consultation with industry lobbies such as the Federation of Indian Chambers of Commerce and Industry (FICCI) and the Confederation of Indian Industry (CII) will be offered in hospitality management and catering, healthcare and aviation...

● *Pallavi Singh*
from Mint Dec 19, 2009

Youngsters to lead India's tech revolution

Washington: Saying that the U.S. needs to wake up to the reality of India's technological revolution being led by IIT-educated "young men and women under the age of 27", President Barack Obama's nominee for deputy commerce secretary said countries like India, China, Brazil and Russia were going to pose a major challenge to American dominance in the coming years.

"Today, we find ourselves competing not only with companies of great capacity, but countries intent on establishing dominance in the growth areas of the 21st century," Dennis Hightower, Obama's nominee for deputy secretary of commerce, said at his confirmation hearing Wednesday.

"Countries such as Brazil, Russia, India and China -- often referred to as the BRIC countries -- are now employing aggressive industrial policies reminiscent of Japan's strategic commitment to the electronics industry in the 1960s," he said.

Referring to his recent business travels in India, Hightower said he was "floored by that country's commitment to reinvesting in technology and the implications for the United States".

Visiting "a veritable who's who of global technology giants" in Bangalore, the would-be Obama official said he "was struck not only by the technological inroads being made in newly designed, avant-garde factories and laboratories, but also by the fact that this technological revolution was often being led by young men and women under the age of 27.

"By and large, these young people were not educated in the United States like many of their fathers -- at MIT, Cal Tech, or Rennselaer, for example -- but at the Indian Institutes of Technology."

IANS; August 6, 2009

News

Bringing sustainable development back to the centre stage

Lost in the hubbub last week over the government's detailing of its "constructive" position on climate change was an important announcement that may have great significance for poor people in the country, namely a national biomass cook-stoves initiative. It is a sign of the times that the media, which is besotted with the climate issue, barely paid any attention to an initiative that has the potential to provide clean cooking energy for more than half of our country's population. Importantly, this initiative also has implications for climate change and, as a corollary, for how we might think about our climate negotiating position.

Currently around 75% of rural households and 22% of urban households in the country, according to the National Sample Survey's 61st survey, still use biomass for their cooking needs. In fact, an estimated 80% of the residential energy in India comes from biomass, much of it burnt in traditional *chulhas*.

The socio-economic and health implications of this form and scale of energy use are enormous. The World Health Organization has estimated that in the year 2000, household biomass-fuel air pollution was responsible for around 400,000 premature deaths per year among women and young children in India; this health impact ranked third in India, after only malnutrition and poor water/sanitation. Women and children (mainly girls) also spend significant time gathering fuel resources every day. The inefficient combustion of biomass also means extra expenditure for households (that buy biomass).

And on the climate front, many products of incomplete combustion that are emitted from traditional cook-stoves have greenhouse implications—while each household might emit only a small amount, together these cook-stoves can add up to a relatively sizeable contribution, although still only a fraction of the emissions from fossil fuels that supply energy for wealthier people. (There also remains some uncertainty about the exact global warming potential of black carbon, a greenhouse pollutant emitted, among other sources, from biomass combustion that recently has received increasing attention. But it is clear that shorter-lived pollutants from biomass combustion contribute to atmospheric heating on regional scales—and, therefore, their reduction will result in tangible national benefit.)

This promising new cook-stove initiative, therefore, must be seen not only as an initiative that can help improve access to clean and high-quality energy services for the poor and the vulnerable, but also contribute to climate mitigation.

The approach that is being envisaged by this initiative focuses on all elements of the innovation chain, not only emphasizing development of cleaner combustion units and improved biomass-processing technologies, but also focusing on issues such as innovative delivery models. By partnering with academia, the private sector and non-governmental organizations, the programme will also draw upon the strengths of these various groups. Such an approach, hopefully, will increase the likelihood of success of this initiative and also allow the development of technologies and delivery models that would find applications in other parts of the developing world.

The programme, therefore, has the potential to serve as a flagship model for how to meet sustainable development and climate goals simultaneously. And this is exactly the kind of initiative that the government should be emphasizing in the global climate arena—one that puts sustainable development centre stage instead of focusing merely on "targets and timetables", as our recent constructive position has done.

Such an approach should also resonate with the rest of the developing world—representing three-quarters of the world's population—that needs to deal with urgent developmental challenges even as it struggles with the climate issue. The global climate negotiations have not paid enough attention to this issue. Industrialized countries, instead, have been fixated on how to bring "big" polluters such as India into the mitigation "targets and timetables" tent (regardless of their lack of historical contribution to climate change or their relative paucity of resources and capabilities). But reacting to this pressure cannot be the sole driver of our climate agenda. We instead must be proactive and ensure that the needs of the poor and the vulnerable are not forgotten in what is becoming a "gloves off" international negotiation.

India can, and must, change the technocratic nature of the international climate debate and bring people and sustainable development back into the centre. That is what real leadership is about.

Ambuj Sagar, IIT Delhi
Mint Dec 19, 2009

IIT D News

Congratulations

on being conferred as IEEE Fellows (Fellow Class of 2010):

★ Prof SK Koul, CARE
for contributions to analysis and design of microwave and millimeter wave components and circuits

★ Prof Bhim Singh, Electrical Engineering
for contributions to active power filters and multipulse AC-DC converters

Ethiopian students get taste of IIT experience

The Indian Institute of Technology (IIT), Delhi, for the very first time, is sharing its faculty resources with a university abroad. About 200 students of Adis Ababa University in Ethiopia are being taught by IIT, Delhi teachers in four postgraduate programmes. And intriguingly, it's all happening over a two-way audio-video link between the two institutions.

"We were approached by their country's ambassador last year. Though the university was interested in improving their technical education they did not have the faculty for it. So we were asked for help," said Professor Surendra Prasad, director, IIT, Delhi. Both the institutions have entered into a four-year agreement. To facilitate distance education a dedicated hotline or private line between IIT-D and Adis Ababa University has been set up. That apart, two delivery rooms have been equipped with video conferencing facility and recording of lectures.

About 46 faculty members across five departments of IIT-D have been roped in to deliver lectures to the Ethiopian students for four programmes — Construction technology and Management, Chemical Engineering, Electronics and Computer Engineering and Manufacturing Engineering.

"We are, however, only concerned with instruction. The students who complete these programmes will have their degrees awarded by their own university," said Professor M. Balakrishnan, dean, post graduate and research studies. IITs have, for a while, been discussing the possibility of tiding over faculty crunch by sharing faculty resources through virtual classrooms. This initiative, according to Prasad, could serve as a precursor to that experiment

The Hindustan Times, Aug 8, 2009

THE INKREDIBLES

EnNatura has developed offset printing ink from vegetable oils

● Ravi Teja Sharma

An innovation by a group of students at IIT-Delhi's Technology Business Incubation Unit is likely to leave an imprint on the world's green initiative. When everyone's problem is saving the earth, EnNatura has come up with a solution. It has developed offset printing ink using vegetable oils, which is completely bio-degradable, lending itself beautifully to recycling of paper. The global offset printing industry uses 1 million tonnes of petroleum products and emits 500,000 tonnes of volatile organic compounds every year. "I can see a company like this growing into a billion dollar global business," says Vivek Wadhwa of Duke University who studies entrepreneurs and took time to meet the founders Sidhartha Bhimania, Krishna Gopal Singh and Sandeep Mourya, during a recent visit to Delhi.

Each tonne of recycled paper can save 17 trees. But the biggest hurdle in paper recycling is the high cost of separating ink to obtain clean paper. EnNatura's ink gets removed easily during the de-inking process. "If recycling becomes cost-effective there is greater probability of paper coming back for recycling," says Singh.

The patented technology is expected to find favour with corporate biggies who currently use non-biodegradable ink and reams of paper to make brochures, advertising, packaging and other applications. "For them, this is also the cheapest way to acquire a green tag," says Bhimania, who is the company's CEO. He claims that using their ink

Bhimania(L), Mourya & Singh's innovation will help save a billion dollars and a million trees

reduces printing costs by a third.

What's more, printing presses need to be cleaned after every 5,000 impressions to rid them of excess ink. Traditionally, for every kilogram of ink, printers use 0.6 kilogram of expensive and polluting hydrocarbon washers with volatile organic compounds. Some try to cut cost by using a cheaper alternative—kerosene. EnNatura's ink can be washed away using a water and surfactant solution, which costs very little. Printers can also sell waste paper at a higher cost since they give the recycler inkfree waste. A press uses two tonnes of paper everyday of which 10% goes waste.

Their innovation has already started attracting investors. Even before fully commercialising the ink, EnNatura has raised funds from Navam Capital and the ministry of Science and Technology under the Technopreneur Promotion Programme (TePP).

Scientists decode deadly cancers

British scientists have cracked the genetic code of two of the most deadly cancers, a development described as a "transforming moment" in the effort to find a cure for the killer disease. Cambridge University researchers mapped the DNA mutations that lead to skin and lung cancers. The complete genetic codes of the two human cancers have been mapped for the first time, setting the stage for a

medical revolution in which every tumour can be targeted with personalised therapy.

Mint, Dec 18, 2009

Faculty Profile

Prof Maithili Sharan

Born in 1953 Maithili Sharan earned his BSc and MSc (Maths) degrees from Rajasthan University Jaipur. He received his Ph D degree from IIT Delhi in the multidisciplinary area of Physiological Fluid Dynamics under the supervision of Prof MP Singh IIT Delhi, Prof JP Kernevez, Compiegne, France and Prof (Mrs) K. Khetarpal AIIMS Delhi. He was trained in computational techniques as a Research Trainee for two years (1979-81) at University of Technology Compiegne (France) and worked (1986-87) as Post Doctoral Fellow with Prof AS Popel, Department of Biomedical Engineering, The Johns Hopkins School of Medicine Baltimore (USA) where he was trained in the modeling of oxygen transport in the brain micro-circulation. He joined as Lecturer in the Centre for Atmospheric Sciences IIT Delhi in the year 1982, worked in various capacities and currently he is the Professor since 1995.

Research Contributions

Maithili Sharan has immense R&D work to his credit. Research contributions have been made in the multi-disciplinary field of Biomedical and Environmental Engineering especially in Environmental, Physiological and Computational Fluid Mechanics. Innovative mathematical models have been developed for gas transport in pulmonary and systemic circulations; oxygen and carbon dioxide dissociation curves; oxygen transport in brain microcirculation; transport of oxygen in arterioles and venules; and carbon monoxide uptake and its disposal in human blood. Through these models, a strong foundation has been laid for the understanding of physiological processes underlying gas transport. In the process, some new mathematical and computational techniques which have the potential of wide applicability have also been developed. Most of the models developed in these studies have been duly validated with the help of appropriate available experimental data/ clinical information.

Significant contribution has also been made in the formulation of mathematical models for the coupling of diffusion-reactions in artificially active membranes. The model has been used as an example to study the phenomenon of bifurcation, multiple steady states associated with the nonlinearities and the control of bifurcation. An algorithm has been evolved to compute all the branches of solutions including bifurcation and limit points.

Innovative contributions have been made in the development of mathematical models for the dispersion of air pollutants released from a near source in low/weak wind conditions. The proposed models have been duly validated with the low wind diffusion experiments conducted at IIT Delhi (India), NOAA, Idaho (USA), Hanford (USA), EPRI Kincaid (USA) and Copenhagen (Denmark). An inversion technique has been proposed to retrieve the source of a tracer with an application to synthetic satellite measurements. The contributions in the boundary layer led in understanding the underlying physics in weak wind nocturnal boundary layer (NBL) supported with the measurements at Delhi, Jodhpur (India), Anand (India) and Kincaid (USA).

Significant contributions have been made to simulate/ explain numerically the dispersion of MIC during the infamous Bhopal leak. The coupled atmospheric boundary layer model and a Lagrangian particle model has been used to simulate some major features of the Bhopal gas accident. For the first time, a simple approach within the framework of Lagrangian particle dispersion model has been formulated to deal with gas vapors which are marginally affected by gravity and are also subject to entrainment.

Over the years, Prof Sharan has taught various courses related to Mathematics and Atmospheric Sciences and mentored several students including 8 Ph D students. He has authored over 90 research papers in peer-reviewed journals and is the member of Editorial Board of various International and National Journals: Boundary Layer Meteorology (2002-) Springer, Atmospheric Environment (2005-) Elsevier; Proc of Indian National Science Academy (2006-) etc. He edited the special issues on Advances in Atmospheric and Oceanic Processes of the journal Proceedings of Indian National Science Academy 2003 and also edited jointly with Prof S Raman (ii) Weather and Climate Part I & II (2005) and Atmospheric and Oceanic Mesoscale processes (2007), of the journal Pure and Applied Geophysics Birkhauser and (iii) Mesoscale Processes and Natural Hazards (2007) Journal of Natural Hazards Springer.

Distinctions

Prof. Sharan was the Head of the Centre for Atmospheric Sciences from 2004-2007. He is widely travelled. Over the years, he has carried out collaborative research with the Scientists from University of Technology Compiegne (France); Ecole Nationale Des Ponts et Chaussees Paris (France); Johns Hopkins Univ, Baltimore (USA); Univ of Alabama, Huntsville (USA); North Carolina State University, Raleigh (USA); National Institute for Research in Environment,Tsukuba (JAPAN); Univ of California, Livermore (USA) etc.

Prof. Sharan received **INSA Young Scientist Award** in 1984 and was elected to the **Fellowship of INSA** in 1995. He is also a Fellow of the Indian National Academy of Engineering and the **National Academy of Sciences**, India. Among the several honours and prizes that he received were the **SS Bhatnagar Prize** in Mathematical sciences (1992), **Meghnad Saha Award** in Theoretical Sciences (2004), besides being the Elected member of "**Johns Hopkins Society of Scholars**" Johns Hopkins University, Baltimore, Maryland USA (2005).

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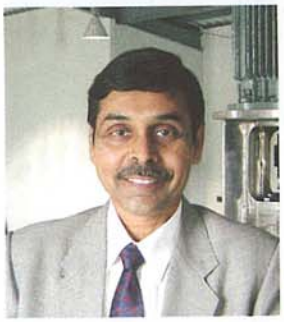


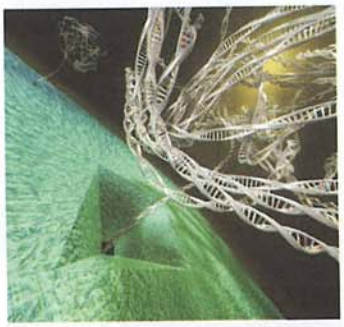
Prof Virendra Swarup Bisaria

Prof Virendra Swarup Bisaria joined IIT-Delhi in 1974 in Department of Biochemical Engineering and Biotechnology (formerly known as Biochemical Engineering Research Centre) and became Professor in 1995. He obtained PG Diploma in Microbiology and Biotechnology from Osaka University in 1974 and Ph D from IIT-Delhi in 1978 for his work on mechanism of cellulose hydrolysis, a topic which is of crucial significance in the present day world-wide efforts in realizing the conversion of renewable lignocellulosic materials to biofuels (ethanol) and other bioproducts. He has been Vice-Chairman, Joint Entrance Examination (1993-1995), Head of the department (1996-1999), Associate Dean and then Dean, Industrial Research and Development (2003-2005 and 2005-2008 respectively) at the institute.

Prof Bisaria's main research interests include (a) Lignocellulose Bioconversion with special reference to enzymatic cellulose hydrolysis, regulation of cellulase and xylanase biosynthesis, application of cellulase and xylanase enzymes in various industries and simultaneous bioconversion of cellulosic hydrolyzates containing mainly glucose and xylose to ethanol, (b) Production of therapeutic compounds by plant cell technology, and (c) Production of bioinoculants and development of their formulations for enhanced crop productivity. Over the years, his research efforts have been supported by various funding agencies such as Department of Biotechnology, Department of Science and Technology, MHRD, and Indo –Swiss Collaboration in Biotechnology. He has guided 13 Ph D and 40 M Tech projects. Currently 4 Ph D and 2 M Tech students are registered with him. He has published about 72 original research papers in peer-reviewed international journals, 10 reviews as book chapters, and presented about 80 invited papers in national or international conferences. He also holds two patents and another two have been filed.

Prof Bisaria has been a consultant to Genencor International Inc., South San Francisco, Tetragon Chemie Ltd., Bangalore, International Panacea Ltd., New Delhi, Biocon India Ltd, Bangalore, and Biotech International Ltd., New Delhi. He is also a Promoter Director of a start-up company M/s Carepro Biotechnologies (P) Ltd. which was established as a technology business incubator unit (TBIU) two years ago at IIT-Delhi under the aegis of FITT to develop technologies suitable for application in agriculture, industry and environmental bioremediation.

Prof Bisaria has worked at several reputed international institutes to further his research activities. He had been a researcher at Institute of Biotechnology, Swiss Federal Institute of Technology, Zurich, Switzerland, and Institute of Biotechnology, Nuclear Research Centre, Julich, Germany. At Gray Freshwater Biological Institute, University of Minnesota, USA , he worked on lignin biodegradation as a DBT Overseas Associate. He was a senior researcher at Institute of Biotechnology, University of Cambridge, England on UNDP fellowship. He was invited as a visiting professor by International Centre for Biotechnology, Osaka University, Osaka, Japan to participate in research and take part in teaching activities of Osaka University. Last year (2008) he spent his sabbatical at Department of Chemical Science and Engineering, Kobe University, Kobe, Japan as Visiting Professor, where he took part in research activities concerning synthesis of bioproducts from renewable resources. He is currently a member of the Advisory Board of a large research project entitled "Innovative Bioproduction" of Kobe University, Japan.



Prof Bisaria is associated with several national and international committees and societies in the field of biochemical engineering and biotechnology. He is an editor of Journal of Bioscience and Bioengineering (JBB), and a member of the Editorial Board of Journal of Chemical Technology and Biotechnology (JCTB). He is a reviewer of manuscripts submitted for publication in Journals like Biotechnology and Bioengineering, Critical Reviews in Biotechnology, Journal of Bioscience and Bioengineering, Journal of Chemical Technology and Biotechnology, Applied Biochemistry and Biotechnology, Biochemical Engineering Journal, Bioresource Technology, Process Biochemistry, Plant Cell, Tissue & Organ Culture, Pure and Applied Chemistry etc. He is on Expert Committees for formulation and evaluation of academic programmes in Biotechnology of a few national universities. He was a member of the International Scientific Committee of the prestigious 13th International Biotechnology Symposium (IBS 2008). He is currently a member of a few national and international scientific professional societies, including that of the newly established Asian Federation of Biotechnology as one of its founding members. In 2008, the Korean Society for Biotechnology and Bioengineering (KSBB), Korea conferred on him Research Exchange Award for his significant contribution towards promoting research amongst Asian countries.

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Technology Showcase

Counterfeit Protection Machine

As it is true of nearly every market, product piracy and the "gray-market" trade have become a serious economic problem. Recent developments in photographic and computer technology, as well as printing devices, have made the production of counterfeit money relatively easy, thereby increasing the potential threat.

A method and apparatus has been developed to generate labelled objects (or simply labels) that are printed or embossed on paper, plastic, metallic foils etc. that are used to identify, describe, mark or annotate valuable objects such as printed documents (such as passports, driver's license), supplies (such as printer cartridges, strips of medicinal tablets or capsules) or equipment (such as integrated circuits, electric motor), cartons or containers used to house/transport valuable supplies or equipment, that are possibly subject to fraudulent creation, duplication or otherwise misrepresentation. We made the combined use of multiple technologies to generate machine able to read and verify label.

Application:

- In preventing counterfeit currency notes.
- In Pharmaceutical Industry to ensure that counterfeit drugs are not marketed.
- Passports, ID cards, visas, holograms, shares, titles, permits, passes, vouchers, stamps, cheques, labels, Degree certificates and anything that constitutes a security document can be thoroughly analyzed.
- For preventing Software/Hardware counterfeiting.

Novel Clinical Kit to estimate iron overload in humans

Iron overload is excess of iron in the body. Excess iron in vital organs, increases the risk for liver disease (cirrhosis, cancer), heart attack or heart failure, diabetes mellitus, osteoporosis, osteoarthritis, metabolic syndrome, hypothyroidism, hypogonadism, numerous symptoms and in some cases premature death. Iron mismanagement resulting in overload can accelerate such neurodegenerative diseases as Alzheimer's, early-onset of Parkinson's, Huntington's, epilepsy and multiple sclerosis. NTBI is a labile and potentially toxic form of serum iron associated with imbalanced iron metabolism and transfusional overload.

The presence of NTBI (non-transferrin bound iron) in circulation is a pathological manifestation. Patients suffering from thalassemia and hemolytic anemias usually suffer from iron overload as a result of repeated blood transfusions. At present there is no generally accepted routine clinical assay for the accurate quantification of NTBI. The institute has developed a novel clinical method for measuring excess iron in blood serum, which remains unbound to iron carrier protein, transferrin. This is particularly relevant to thalassemia patients. The method would be applicable to diagnosis and monitoring of any disease which leads to iron overload in the body like hemochromatosis, and myeloid cancer. The main advantage of this method is that it is a direct method of measuring non-transferrin bound iron using optical properties of molecules of biological origin.

Technologies Transferred (July-Dec.'09)

S.No.	Name of the company	Name of the technology	P.I.		
1	Swaraj Herbal Plants Pvt. Ltd., Barabanki, U.P.	An apparatus decortication of oil fruits / seeds for separation of shell from kernel	Prof.	S. N. Naik	CRDT
2	Vacuum Equipment Co., Noida, U.P.	Novel RF Magnatron Holder	Prof.	Sudhir Chandra	CARE

New IPR cases (July–December 2009)

S.No.	Title of the Invention	P.I. / Deptt.		
1	4x4 Optical Switch for Fault Tolerant routing of Data / Communication	Prof.	Devi Chadha *et al*	DEE
2	Process for generating magnetically controlled ball end smart abrasive laden shape for finishing of 3D intricate shaped surface	Dr.	Sunil Jha *et al*	DME
3	Novel Clinical Kit to estimate iron overload in humans	Dr.	Nivedita Karmakar *et al*	CBME
4	Locking System for Hinge	Prof.	Anoop Chawla *et al*	DME
5	Hinge Joint System	Prof.	Anoop Chawla *et al*	DME
6	A cryptographic method for creation of labels affixed to valuable objects that are impossible to fraudulently create or duplicate but provide for easy authentication and integrity checks	Prof.	B. N. Jain *et al*	CSE
7	Cryogenic applications to reduce tool wear in Electric Discharge Machining process	Dr.	P. M. Pandey *et al*	DME
8	An apparatus for measuring Fabric Hand Value	Dr.	Apurba Das *et al*	DTT
9	Technology to create three dimensional objects	Dr.	Niloy Mitra *et al*	DEE
10	Protein folding *in vivo* for over expressed proteins in Escherichia Coli	Prof.	M. N. Gupta *et al*	Chy.
11	Scooter shaped toilet seat for children	Dr.	Amitoj Singh *et al*	IDDC
12	A set of access control structures for allowing wheel chair access while restricting a motorbike	Dr.	Amitoj Singh *et al*	IDDC
13	Waterless and Odour Preventing Urinal Trap	Dr.	V. M. Cheriar *et al*	RDAT
14	A thermostable Phytase as animal Feed / Food Supplement	Prof.	M. N. Gupta *et al*	Chy.
15	Method for decolorization of the textile industry effluent using combination of chemical and laccase / mediator treatment	Prof.	T. R. Sreekrishnan *et al*	DBEB
16	Bodystorming simulator for Kyphosis condition	Dr.	Amitoj Singh *et al*	IDDC

A Few Commercializable Ideas / Technologies Available For Transfer

Pharma /Health care related technology

1. A novel process for production of stable silver nanogel for antimicrobial action in drug release implants.
2. A process and composition for controlled oral delivery of insulin.
3. An interpenetrating network based novel hydrogel towards controlled drug delivery for special use in Oncology and Osteoporosis.
4. A novel high yield and high purity process for the production of human interferon alpha 2b in Pichia Pastoris.
5. Method for specific integration of T7 RNA polymerase gene in the chromosome of corynebacteria and the resultant corynebaterial reservoir for protein synthesis.
6. Generation of therapeutic proteins particularly Urokinase in Hollow Fiber Bioreactor.
7. An intracellular process for controlling Protein folding and unfolding for significant efficacy in protein synthesis
8. A Novel Clinical Kit to estimate iron overloads in blood sera for diagnosis of diseases viz. thalessemia, myocardial infarction etc.

Agricultural/Veterinary related Technology

1. An efficient process for decolorization of textile industry effluents using combination of chemical and ultra-filtration techniques.
2. A botanical pesticide composition for effective action against pests and nematodes.
3. A novel bioreactor design for scaled-up production of bio-pesticides from hairy roots of *Azadirachta Indica*
4. A system medium for production of chemohetrophic plant growth promoting factor for fertilizers.
5. A process of mercury bioremediation by using mercury accumulating recyclable/harvestable new strain of microorganism.
6. A novel strain for the production of highly pure, thermostable poly-1-lactic acid (PPLA) fibres.
7. A high yielding, high quality animal Feed/Food Supplement by using a novel thermostable phytase producing microorganism.

Professional Development Programmes, July–December, 2009

S.No.	Title	Faculty Coordinator
1	Two day workshop on 'Fuel Cell Technology and Hydrogen Energy', July 23-24, 2009	Prof. D K Sharma, CES
2	Certificate Course on Intellectual Property Rights & Intellectual Property Services; July 13-18, 2009	Prof. S. K. Jain, DMS
3	Short course on "Advanced Sensing Technology for Civil Engineers"; July 15 – 17, 2009	Dr. Suresh Bhalla, Civil Engg.
4	Seminar on "Simulation and Modeling in Process Industry" (Refineries & Petrochemicals Focus) June 9- 13, 2009	Dr. Munawar A. Shaik and Prof. S. Basu, Chemical Engg.
5	Multiphase Reactor Engineering for the Process Industry; December 9-11, 2009	Dr. Shantanu Roy, Chem. Engg.
6	Short-term training programme on "Bioinformatics and Computational Biology; 23 August – 21 November , 2009	Prof. B. Jayaram, Chemistry
7	Advisory Workshop on Enhancing Capabilities of North India Ocean Storm Surges (IITD Model upgrade); July 14-17, 2009	Prof. S. K. Dube, CAS Prof. A. D. Rao, CAS
8	Roughness parameters and their significance in engine cylinder bore honing; 18th August, 2009	Dr. R. K. Pandey, ITMMEC
9	IT Security & Ethical Hacking; August 24 – September 25, 2009	Prof. S. K. Gupta, CSE
10	Personality Development Program at Bharti School, IITD; August to December 2009	Prof. Subrat Kar, EED
11	Scheduling of Batch and Continuous Process Operations (for ABB, Bangalore); September 10-11, 2009	Dr. Munawar A. Shaik, Chemical Engg.
12	Training on Strom Surge Prediction for WMO; September 28 – October 10, 2009	Prof. S. K. Dube, CAS Prof. A. D. Rao, CAS
13	Technology demonstration/exhibition for Telecom Centre of Excellence (Telecom India 2009); December 3-5, 2009)	Prof. Subrat Kar
14	Global Internship Program in Engineering Design and Innovation; August to December 2009	Prof. Subrat Kar, DEE
15	International Course on Transportation Planning, Road Safety & Biomechanics; December 4-11, 2009	Prof. Dinesh Mohan, TRIPP
16	FED Fundamentals of Engineering Design; December 15 -16, 2009	Prof. L. K. Das, IDDC Dr. Savita Goel, CSC

Few Forthcoming Programmes

1	Short course on "Next Generation Networks" at IHC, New Delhi; January 9-10, 2010	Prof. Subrat Kar, EE
2	CPCB-Training Programme on "Environmental Monitoring and Latest Trends and Guidelines for Environmental Impact Assessment Studies" January 15 – 17, 2010	Dr. A. K. Nema, CE
3	Certificate Course on Intellectual Property Rights & Intellectual Property Services; January 11-16, 2010	Prof. S. K. Jain, DMS
4	Short course on "Computer Aided Design of Electrical Machines with Power Electronics Applications; January 28-30, 2010	Prof. S. S. Murthy, EE
5	Security Vulnerabilities in current Communications & Networks Technologies; January18 to 4 Feb., 2010	Prof. S. D. Joshi, EE Dr. Brejesh Lall, EE
6	Short course on Autonomous Underwater Acoustic Surveillance; January 29-31, 2010	Prof. R. Bahl, CARE Prof. Arun Kumar, CARE
7	One day workshop on "Emerging Role of Biotechnology in Industries"; February 26, 2010	Prof. D. K. Sharma, CES

Some R & D Projects, July - December '09

S.No.	Title	PI, Deptt./Centre
1	Effect of a Methaplus on Production of biogas under representative Indian condition	Dr V.K. Vijay, Rural
2	Is carbon trapping (CO_2 sequestration) possible at low temperature through electrochemical conversion of CO_2 and H_2O to methanol and other organic compounds?	Prof. S Basu, Chemical
3	Development of RF Components and setting up of a RF Laboratory	Prof. S K Koul, CARE
4	UWB RF Board Testing and Evaluation	Prof. Ranjan Bose, Elec.
5	Technical Opinion about Rough Ophthalmic Glass Blank (Photochrom)	Prof. BP Pal, Physics
6	Advice and assistance in developing long-term monitoring techniques using underwater acoustic technology	Prof. R Bahl, CARE
7	User-centred Reasoning and Acquisition System	Prof. KK Biswas, CSE
8	Potential of Fuel Cell Technology in India	Prof S Basu, Chemical
9	Occupant Protection on Railway Rolling Stock – Simulation, Modelling Techniques and Usage of Dummies	Prof Anoop Chawla, Mechanical
10	Recovery of heat and water by condensation of steam from Decolourizer (Line-II) & Dryer (Line-I) (Phase-II)	Prof. PMV Subbarao, Mechanical
11	Development of Technology for Commercial Scale Manufacturing of AMPS	Prof. Veena Choudhary, Polymer
12	Dynamic Characterization of the humerous, scapula and clavicle bones of the shoulder complex	Prof Anoop Chawla, Mechanical
13	Linking Water and Agriculture in River Basins : Impacts of climate changes	Prof AK Gosain, Civil
14	Analysis and Characterisation of anti-vibration mounts	Prof A K Darpe, Mechanical
15	Beautification and Renovation of park in Sector-95 (c/o Column Plaza in Park), Noida	Prof AK Jain, Civil
16	Technology Transfer Project "High Pressure Bio Gas (Gobar Gas) Enrichment and Bottling System	Dr VK Vijay, Rural
17	Studies and analysis of friction composites	Prof Jayashree Bijwe, ITMMEC
18	Study of failed pads of Hydrodynamic Thrust Pad Bearing	Dr RK Pandey, ITMMEC
19	Determination of Elastic-Plastic Toughness in Piping Joints & Bends and Evaluation of their suitability for Engg Applications	Prof RK Pandey, Appl. Mechanics
20	Radioactive Particle Tracking (RPT) in Bio-Reactor Pilot Plant	Dr. Shantanu Roy, Chemical
21	Evaluation of CTOD Toughness in weld joint of APT steel and insurance of failure safety using fracture mechanics approach	Prof RK Pandey, Appl. Mechanics
22	Solubilization of Proteases from Bacillus Licheniformis	Prof MN Gupta, Chemistry
23	Immobilized Lipase for Fatty Acid Ethyl Ester (FAEE) Synthesis	Prof MN Gupta, Chemistry
24	EU funded International Consortium Project "High Noon: Adaptation to Changing Water Resources Availability in Northern India with Himalayan Glacier Retreat and Changing Monsoon Pattern"	Prof AK Gosain, Civil
25	Modeling, Analysis and Feasibility study of using Ammonia – Water Mixture as Working Fluid in Boiling Water Reactor with Nuclear Fuels & Nuclear Waste	Prof. PMV Subbarao, Mechanical
26	Analysis and Design of Centrifugal Ammonia Water Absorption Heat Pump	Prof. PMV Subbarao, Mechanical
27	Validation of Herbal Technologies	Prof SN Naik, Rural
28	Animal dung / alternative feed material based captive power generation on decentralized mode and Biogas enrichment for Rural Application at Shri Krishna Goshala, Jaleda Distt. Baran, Rajasthan	Dr VK Vijay, Rural
29	Analysis & Simulation of HWAT System	Prof MR Ravi, Mechanical
30	CFD Analysis of a 5000L Milk Cooling Tank	Prof MR Ravi, Mechanical

Conferences / Workshops

The **Third International Conference on Pattern Recognition & Machine Intelligence (PReMI'09)** was held from Dec. 16-20, 2009 at IIT Delhi with FITT providing the necessary administrative / organisational support. The primary goal of the conference was to present state-of-the-art scientific results, encourage academic and industrial interaction, and promote collaborative research activities, in Pattern Recognition, Machine Intelligence and related fields, involving scientists, engineers, professionals, researchers and students from India and abroad. The conference is held every two years to make it an ideal platform for people to share their views and experiences in the said areas.

The **Twelfth International Conference on Rough Sets, Fuzzy Sets, Data Mining and Granular Computing RSFDGrC'2009** was held from Dec. 15-18, 2009 at IIT Delhi under the aegis of FITT. RSFDGrC investigates the meeting points among the four major areas outlined in its title, with respect to foundations and applications. This year's **RSFDGrC** was co-organized with **PReMI'09** that provided additional means for multi-faceted interaction of both scientists and practitioners. The conference saw participants and experts from several countries that included : China, Japan, Poland, Canada, USA, Egypt and others.

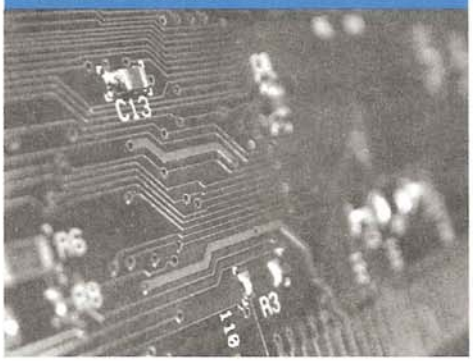
FITT enabled the organisation of symposium **RadTech India 2009** from Nov. 1-4, 2009 at Delhi. The purpose of the symposium was to bring together academia, suppliers and user groups to promote knowledge, build relationship and to promote the developments on all aspects of Ultra violet and electron beam curable coatings related to the paints and coating industry. Ultra violet light and electron beam curing are considered green technologies.

Conference included : technical paper presentations, practical end user sessions, exhibits and short courses in Polymer Chemistry, UV/EB technology and advanced UV/EB Curing.

Under the S&T Collaboration Agreement between Governments of India and Canada a **Workshop On Electricity Generation Using Renewable Energy** was held from Oct. 9-10, 2009 at IIT Delhi under the aegis of FITT. The workshop which was organized as a Partnership Development Activity, brainstormed on the subject to evolve partnership between professionals of both countries and to pursue further joint activities on Research, Development and Deployment. The main focus was on Grid fed and Off Grid (decentralized) power generation using Renewable sources such as Wind, Small Hydro, Bio and Solar Energy. The workshop aimed to identify projects on renewable energy such as wind, small hydro, solar and bio – areas of interest to both the countries.

Industry Academia Meet: The Student Perspective

Under the aegis of FITT and with active support of IRD, Technocracy - a student forum at IIT Delhi organised an Industry Academia Meet : The Student Perspective on 7th Nov., 2009. The meet enabled several industry representatives and students to discuss issues related to industry – academia collaboration in projects where student intervention can be of value. The primary objective of Technocracy is towards boosting innovations from the students and provide them creative opportunities in application oriented research in topical areas.



Some of the participants during The Third International Conference on Pattern Recognition & Machine Intelligence (PReMI'09).

FITT extends following supports under approved Government Schemes:

Entrepreneurial and Managerial Development (MSME)
to nurture / promote technology / knowledge - based innovative ventures through financial / incubation support (www.msme.gov.in)

Innovation Support – under TePP (DSIR)
to enable innovators to become technology entrepreneurs through financial support / mentoring – *upto Rs 15 / 45 lakh* (www.dsir.org)

Commercialization Support – under TREMAP (TIFAC)
to facilitate commercialization of innovative technologies / products / processes through refinement, patenting, packaging and marketing. (www.tifac.org.in)

New Corporate Members of FITT

1. Dabur Research Centre, Sahibabad
2. KEE-GAD Biogen Pvt. Ltd., New Delhi
3. Mechartes Researchers Pvt. Ltd., New Delhi
4. Schneider Electric India, New Delhi

FITT – Corporate Membership

FITT invites the industry / industry associations / R&D organisations and financial institutions to become corporate members of FITT at a nominal fee.

A corporate member client can participate in technology transfer and joint R&D programme of the Institute on a priority basis with FITT providing the interface.

For more information please contact us at parthab@fitt.iitd.ernet.in

Membership Form can be mailed on request or can be downloaded from www.fitt-iitd.org

Prof George Foster of Stanford University addressing the participants at the Seminar "Growing from Millions to Billions & Internationalization Strategies" which was co-organized by FITT, TiE – Delhi Chapter and IIT Delhi Alumni Association on Nov. 11, 2009 at Vishwakarma Bhavan, IIT Delhi

Professional Candidate Registration Programme

IIT Delhi understands that a part-time M.Tech. education requires a high intensity commitment of 3 years and a Ph.D. programme even more involvement. Unfortunately, not everyone has the time for making such a long term and involved commitment. To facilitate focused educational need, the Institute now offers to the professionals a choice to choose and attend a course from over 300 courses offered each semester. For the first time, it is now possible to get the feel and benefit of IIT Delhi education with just an application from showing interest in a regular course at IIT Delhi (subject to acceptance by the Dept/Centre). Course fees range from Rs. 15,000/- to Rs. 20,000/- (industry professionals) and Rs.6000/- to Rs.8000/- (academic/government personnel) for a 42- hour lecture course spread over a semester of 16 weeks. In the case of a few select courses, on-site course delivery using the two way video link systems is under planned implementation.

For details please contact :
parthab@fitt.iitd.ernet.in , uttam@fitt.iitd.ernet.in

Few Start-up companies currently resident at the TBIU (IIT Delhi)

M/s Care-pro Biotechnologies Pvt Ltd
Fermentation based biomolecules
(www.careprobio.com)

M/s Sunurja Renewable Energy
- Design and Development of renewable energy solutions
(www.sunurja.com)

M/s Innovative Transport Solutions
- Scientific and technical solutions for traffic & transport systems & development of models for sustainable transport for cities (http://itrans.co.in)

M/s FarosTechnologies
- Development of simulator sub components, simulators and providing simulation services (www.farosindia.com)

M/s Global Motortech
- Technology based products and services in Motor Design and analysis software

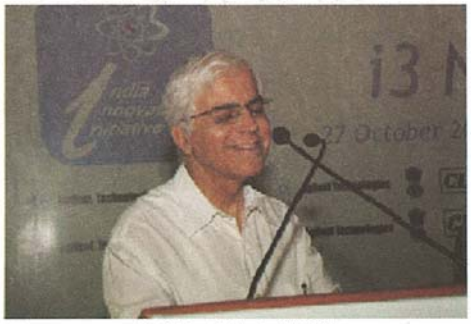
M/s Gram Vanni Gommunity
– Building Innovative models of media delivery for rural areas of India (http://gramvaani.org)

M/s Advantage Organic Naturals
– Development ofa process for making garments with wellness properties (www.advantagenature.com)

M/s HTECH Hands Talk Technologies
- An optical 3D pointing mechanism and ergonomically enhanced touchpads (www.handstalk.in)

India Innovation Initiative – i3

On Oct 27, 2009, IIT Delhi hosted the i3 National Fair "India Innovation Initiative – i3" - a joint effort of CII & DST along with Agilent to launch a nation-wide innovation competition for all innovators above the age group of 18+. i3 aimed to capture innovative ideas from the Indian innovators that included students, innovators from R&D Institutes, Industry professionals and individual innovators, entrepreneurs, grassroots innovators etc.



Prof S Prasad, Director IIT Delhi

Exhibition Stalls

FITT Team

Chairman, Governing Council	Prof. Surendra Prasad
Managing Director	Dr. Anil Wali
Executive Consultants	Shri K.K. Roy, Shri Partha Bhattacharya, Shri Mohit Mahajan
Consultant	Shri Akhilesh Gupta
Support Staff	Mrs. Seema Lamba, Shri Raj Kumar Mehta, Shri Viswaroop Bhattacharya, Shri Jagdev Singh, Shri Uttam Aswal, Shri Mahendra K. Rajoriya

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